A guide to the exhibition galleries of the Department of Geology and Palaeontology in the British Museum (Natural History) / [Henry Woodward].

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A GUIDE

TO THE

EXHIBITION GALLERIES

OF THE DEPARTMENT OF

GEOLOGY AND PALÆONTOLOGY.

IN THE

BRITISH MUSEUM (NATURAL HISTORY),

CROMWELL ROAD, LONDON, S.W.

(Fifth Edition.)

Under Revision.

PRINTED BY ORDER OF THE TRUSTEES,

1888.

[Price Fourpence.]

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TO THE

EXHIBITION GALLERIES

OF THE DEPARTMENT OF

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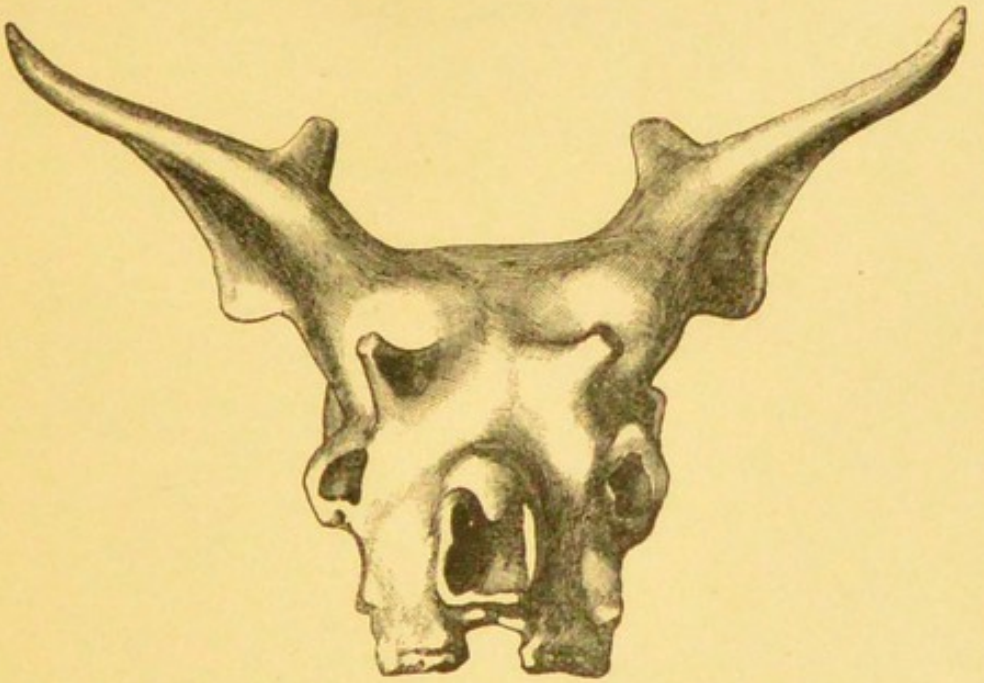

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PRINTED BY HARRISON AND SONS,
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PREFACE.

THE First Edition of this Guide was issued, without illustrations, on the 19th April, 1881. The Second Edition appeared in 1882, illustrated with thirty-one wood engravings. A Third Edition, slightly altered, appeared in 1884. Of these three editions altogether 11,234 copies have been sold. The present edition has been almost wholly re-written, and many fresh illustrations have been added. This had become the more needful as many new cases had been introduced into the Galleries, the whole Mammalian series re-arranged and re-mounted, and a very large number of specimens added to the collection. A new plan of the Galleries has been inserted and an index added.

HENRY WOODWARD.

Department of Geology,
April, 1886.

NOTICE.—The present issue (September, 1888) is a reprint of the 1886 Edition, save that the Wall and Pier-cases of the South-East Gallery and Pavilion have been renumbered in consequence of six new pier-cases having been added.

The Skeletons of *Dinoceras mirabile*, Marsh, and of *Mylodon gracilis*, have been added to these Galleries this year, 1888. —H.W.

TABLE OF STRATIFIED ROCKS.

Periods.	SYSTEMS.	FORMATIONS.
CAINOZOIC. Quaternary.	**PLEISTOCENE** (250 ft.)	Peat, Alluvium, Loess Valley Gravels, Brickearths Cave-deposits Raised Beaches Boulder Clay and Gravels
CAINOZOIC. Tertiary.	**PLIOCENE** (100 ft.)	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 } (Nummulitic Beds) London Tertiaries }
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 Keuper Muschelkalk Bunter
PRIMARY, OR PALÆOZOIC.	**PERMIAN or DYAS** (500 to 3,000 ft.)	Red Sandstone, Marl } Zechstein Magnesian Limestone, &c. } 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.)	Old Red Sandstone (Upper) } Devonian Old Red Sandstone (Lower) }
	SILURIAN (3,000 to 5,000 ft.)	Ludlow Wenlock Beds Llandovery
	ORDOVICIAN (5,000 to 8,000 ft.)	Bala and Caradoc Group Llandeilo Group Arenig and Skiddaw Group
	CAMBRIAN (20,000 to 30,000 ft.)	Tremadoc Slates Lingula Beds Menevian Beds Longmynd Group
	EOZOIC—ARCHÆAN (30,000 ft.)	Pebidian and Dimetian Huronian and Laurentian

LIFE-PERIODS.

Range of Invertebrata and Plants in time
Range of Fishes in time.
Range of 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 still 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 distribution, and the physical conditions under which they were formed.

Palæontology deals with the remains of ancient life found in the various layers, and strives, by comparison with the living fauna and flora, to restore the successive life-forms which have passed away, and to trace by those relics 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 a guide-book like the present a treatise on the science, but merely to explain that the specimens in the Galleries are arranged according to their zoological classes, orders, and families (so far as these can be ascertained); and under each is placed its name, geological position, and the locality whence it was derived. In the Invertebrata and Plants also each class is 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 also a reference given to the place of publication.

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

The plan, facing p. 108, will serve to show the general arrangement of the cases and their contents. The small table of strata, p. 10, is given to show the range in time of the great groups of Mammals, Birds, Reptiles, Amphibia, and Fishes.

H. W.

GUIDE TO THE DEPARTMENT

OF

GEOLOGY AND PALÆONTOLOGY.

SOUTH-EAST GALLERY.

Vertebrate Animals.*

Class 1.—MAMMALIA.

Gallery No. 1, on Plan.

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. 10.) Earlier traces of such higher class of animals are comparatively rare; but are met with in the Eocene formation, and a very few remains of almost the lowest order (Marsupialia), extremely small in size, occur in rocks of Secondary age.‡

See Table-case, No. 14, Pavilion.

No. 2, on Plan.

Many of these animals are extinct, but a very large number belong to forms closely related to the existing terrestrial orders —such as the cat-tribe (lion and tiger), the dog, wolf, the

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

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

‡ The skull of a small mammal, named by Sir Richard Owen *Tritylodon longævus*, from the Trias, of Basuto-land, South Africa: *Microlestes Moorei*, Owen (represented by teeth only), from the Rhætic beds of Somerset, and *M. antiquus* from the Trias of Germany. *Dromatherium*, from North America. Other species (small but more numerous), from the Great Oolite (Stonesfield) and the Purbeck beds of England and America.

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 Amazons, 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 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, &c., 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.

Sub-class 1.—Monodelphia.

Order I.—PRIMATES.

Primitive Man.

Table-case, No. 1.

Man.—In the first Table-case are placed various human remains from Kent's Cavern; from the Gower Caves; from alluvium near Tilbury, in the Thames valley; from a turbary, or peat deposit, near Lewes; from Bruniquel, in France; from Mulhausen; and from Brazil; casts of the Engis and Neanderthal skulls. Examples of barbed harpoons made of reindeer-antler; bone needles; worked horns and bones; from Kent's Cavern, and from Bruniquel; also an incised figure of a horse, cut on an antler of Reindeer, from Neschers in the Auvergne; together with numerous stone implements from various British and Foreign localities, illustrative of Prehistoric Man.

Pier-case, No. 2.

Human Skeleton from Guadaloupe.

In the Pier-case 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. 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.

Sub-order 1.—Anthropoidea.

Table-case, No. 1.

Monkeys.

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; *Hylobates* in the Miocene of Switzerland; *Oreopithecus* in Italy; and *Mesopithecus* at Pikermi, near Athens. *Palæopithecus*, *Semnopithecus*, *Macacus* and *Cynocephalus* have

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

† From Greek: *platus*, broad; *rhines*, nostrils; because the nostrils open on the surface of the face, the nasal bones being very small and inconspicuous.

Monkeys. Table-case, No. 1.

been found in the Lower Pliocene deposits of the Siwalik Hills, India. A single tooth, referred by Prof. Owen to *Macacus pliocænus*, was obtained from the Brick-earth of Grays, Essex. *Macacus* has also been found in the Pliocene of 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.

Lemurs. Table-case, No. 1.

The Lemurs are represented by *Adapis* from the Eocene of Hordwell and the Older Tertiaries of France; also by *Necrolemur* from the Eocene of Bach and Salmandingen.

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

Sub-order 1.—Fissipedia.

Pier-case, No. 3, Table-case, No. 2. South side. Carnivora: Lion, Tiger, Hyæna, &c.

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 tigers" (*Machærodus*) remarkable for the enormous development of their canine teeth, and also for their wide geographical distribution. Their remains have been met with in Kent's Cavern, Torquay, in Cresswell 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 *Machærodus* is now quite extinct.

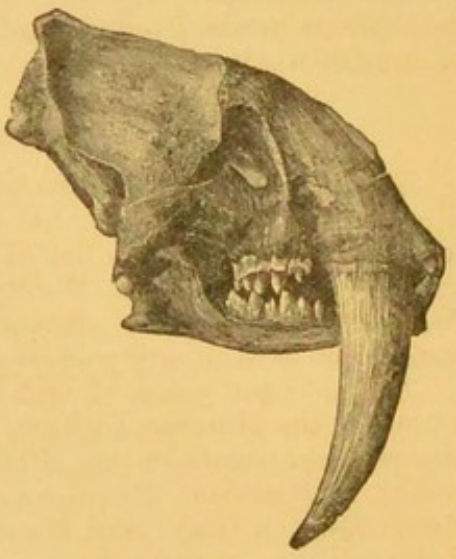


Fig. 1.—Skull of the "Great Sabre-toothed Tiger." *Machærodus*; from the Newer Tertiary deposits of South America.

Pier-case, No. 4.

Another lost form, whose remains have also been obtained from the alluvial deposits of Buenos Ayres, is the *Arctotherium*, an animal nearly related to the bears.

Remains of *Hyænodon*, *Pterodon*, &c., from the Lower Tertiaries of France, are placed in this Table-case. **Table-case, No. 2.**

Here are also the remains of other early representatives of the Carnivora, the *Amphicyon*, *Simocyon*, *Dinocyon*, and *Cynodictis*, together with other Miocene types; also of the glutton, badger, otter, marten, and weasel; the Grizzly Bear (*Ursus horribilis*), 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. **Pier-case, No. 2.** **Bears.** **Table-case, No. 3.** **Pier-case, No. 4.**

Sub-order 2.—Pinnipedia (Fin-footed).

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. **Seals and Walrus.** **Table-case, No. 3.**

Order III.—INSECTIVORA (Moles, Shrew-Mice, Hedgehogs).

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 *Microchœrus*, 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, &c. **Hedgehogs, Moles, and Shrews.** **North side, Table-case, No. 24.**

Order IV.—CHIROPTERA (Bats).

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 Sansan and Mayence. *Phyllorhina*, a genus of large horse-shoe bats found in tropical **Bats.** **Table-case, No. 24.**

Bats.
Table-case, No. 24.

regions in the Old World and in Australia, has been discovered in the Upper Eocene of Caylux, France. *Rhinolophus* is found in Kent's Hole, Torquay. The Vampire bat (*Phyllostoma*) is found fossil in the caves of Brazil.

Order V.—DERMOPTERA.

"Flying Lemurs."

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

Order VI.—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.

Of the forty genera of Rodentia which have been found in a fossil state, twelve extend back in time as far as the Eocene Tertiary formation, but many of them belong to types of animals which abound at the present day.

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.
Table-case, No. 24.

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

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

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

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

* See Recent Mammalian Gallery, West side, first floor, Case 27; and Osteological Gallery, second floor, Case 8, division A.

† 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. In Scandinavia Beavers survived down to 1844.

Pleistocene deposits of the valley of the Lea, near London, in the Cambridgeshire fens, and elsewhere. It is still living in the River Kola and other Russian and Siberian rivers, in the Kurile Islands, and in North America. **Gallery No. 1. North side, Table case, No. 24.**

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. **The Great Extinct Beaver.**

Remains of a gigantic dormouse (*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 fossil in the cavern deposits of Minas Geraes, Brazil. **Gigantic Dormouse.** **Cœlogenys.**

Sub-order 2.—Duplicidentata.

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

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. **Lagomys.**

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

Order VII.—UNGULATA (Hooped Animals).

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

Sub-order 1.—Proboscidea (Elephants).

Animals furnished with a long flexible trunk-like snout or proboscis. **Elephants.**

The cases on the North side of this Gallery are nearly entirely devoted to the exhibition of probably 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 animals have no *canine* **Pier-cases, 29 to 39.**

Elephants.

teeth, and in this character they resemble the Rodentia (rats and rabbits); the molars or grinding teeth are few in number, but large and complex.

The teeth of the elephant and mastodon differ from those of other orders of animals, by 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.

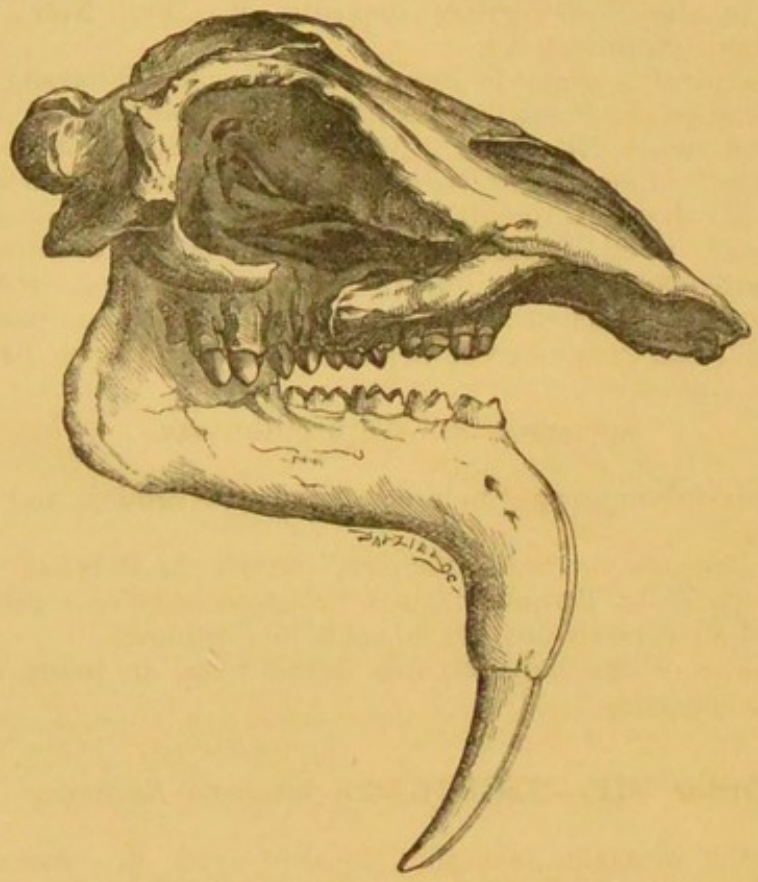


Fig. 2.—Skull and lower Jaw of *Dinotherium giganteum* (Kaup), from the Upper Miocene of Eppelsheim, Hesse-Darmstadt.

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

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. 3 and 6). These tusks were provided with persistent pulp-cavities (analogous to the front teeth of the rat and the rabbit), and continued to grow as long as the animal lived. In one species, *Mastodon angustidens*, they were partly coated with enamel. They had also three deciduous or milk-molars, and

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

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

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.

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 species related to the elephants, this order is reversed, there being two tusk-like

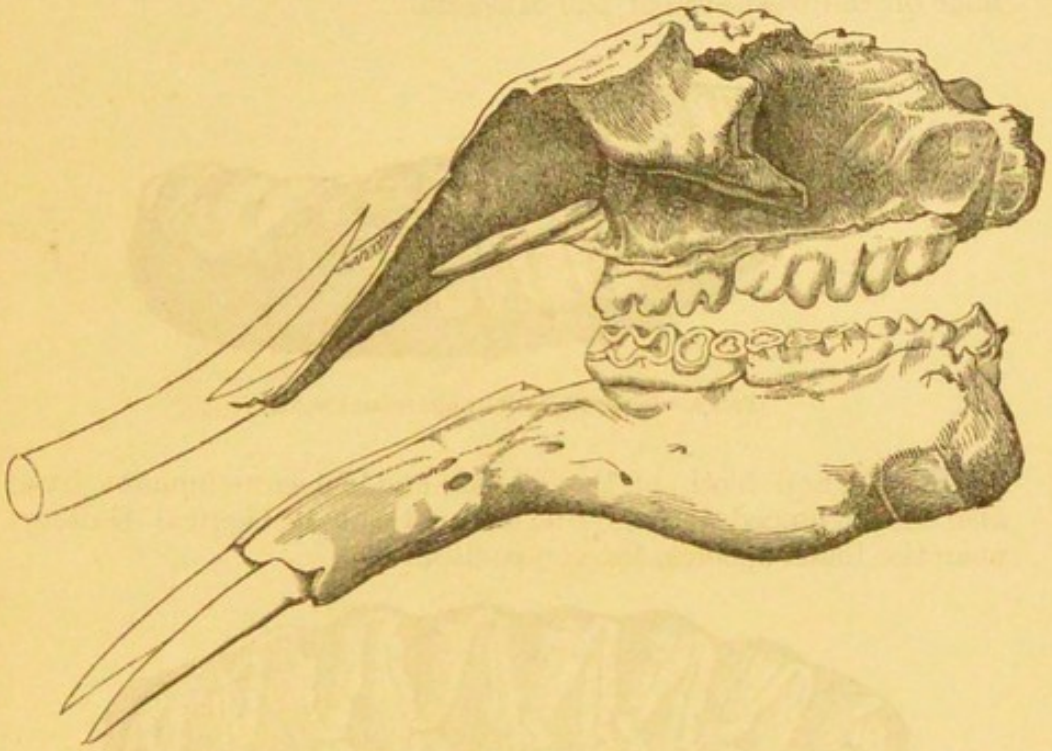


Fig. 3.—Skull and lower Jaw of *Mastodon longirostris* (Kaup), showing tusks in both upper and lower Jaw, from the Upper Miocene, Eppelsheim, Germany. (*See* Pier-case 37.)

incisors in the *lower jaw*, and none in the upper (*see* Fig. 2, p. 20).

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.*

Only two living species of elephants are known; one, the Asiatic elephant, confined to the forests of India, Ceylon,

* 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.

Elephants.

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. 4 and 5).

A fine series of the skeletons of modern Indian and African elephants, together with detached skulls of both species, may be seen in the Recent Osteological Gallery upon the second floor on the west side of the Museum.

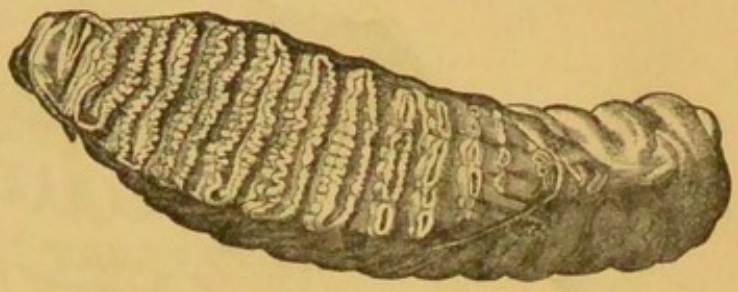


Fig. 4.—Lower Molar of living Indian Elephant.

North side, Pier-case, No. 30.

Skulls and teeth of the Indian and African elephant have also been placed in the Pier-case of the Geological Gallery, near the fossil species, for comparison.

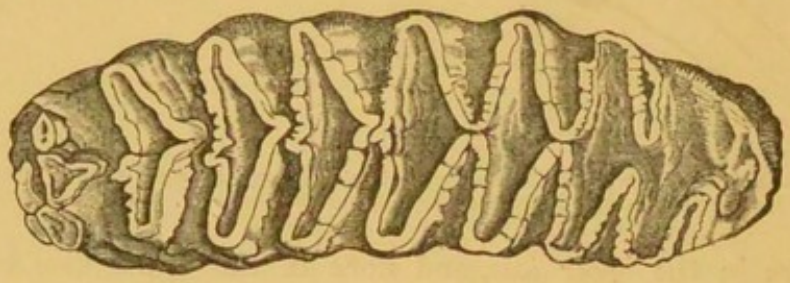


Fig. 5.—Upper Molar of living African Elephant.

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—the plates varying in number and in pattern in the different species. Thus the African elephant has fewer enamelled plates in each tooth, and these on the grinding surface are worn down to a lozenge-shaped pattern (Fig. 5); the Indian elephant having many plates, closely folded together and finely crimped at their edges (Fig. 4). The teeth of the larger number of fossil elephants resemble those of existing species, but in some of the earlier forms they 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. **Mastodon.**

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 Trilophodons the ridges are but three in number, the Tetralophodons having four, **Table-case, No. 23.**

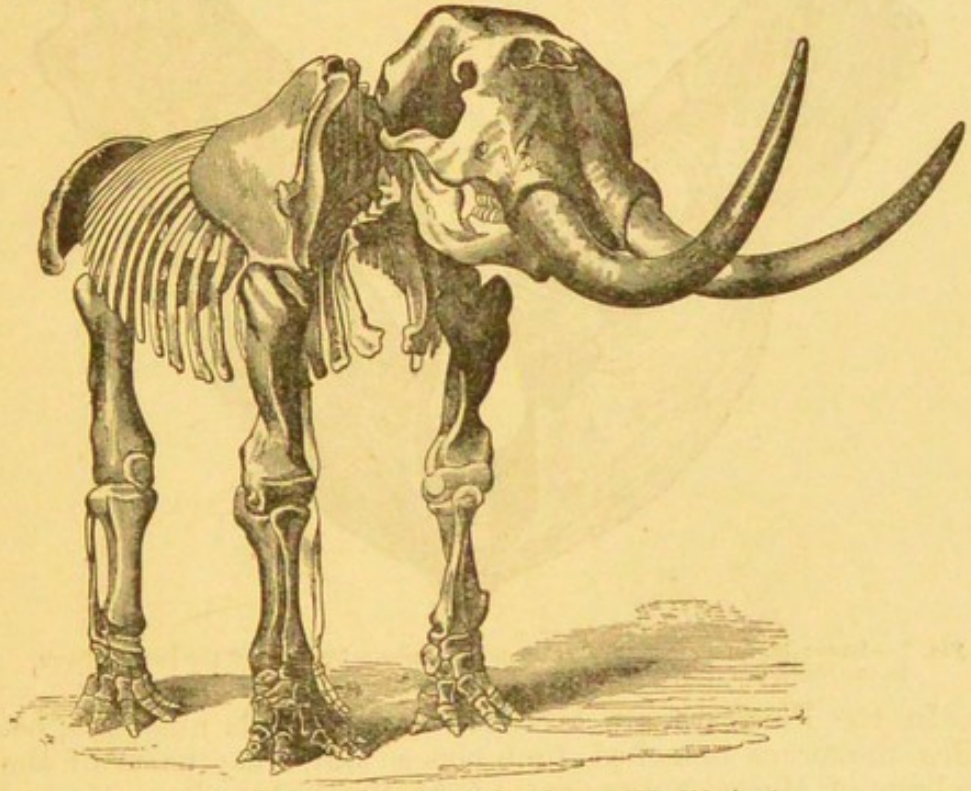


Fig. 6.—Skeleton of *Mastodon Americanus* (*M. Ohioticus*). **Stand A.**

The series of Proboscidean remains commences with those of the *Dinotherium*, a hoofed quadruped, supposed to have been intermediate between the Tapir and the *Mastodon*, the most perfect remains of which have been found in the Miocene Tertiary formation of Epplesheim, Hesse-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, are placed in a separate case in this gallery. (*See* p. 20, Fig. 2.) **North side, Wall-case, No. 39.** **Glass-case B.**

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

Mastodon. Stand A.

The entire skeleton of the *Mastodon* from Benton Co., Missouri, 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 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.

Glass-case C. Wall-case, No. 39.

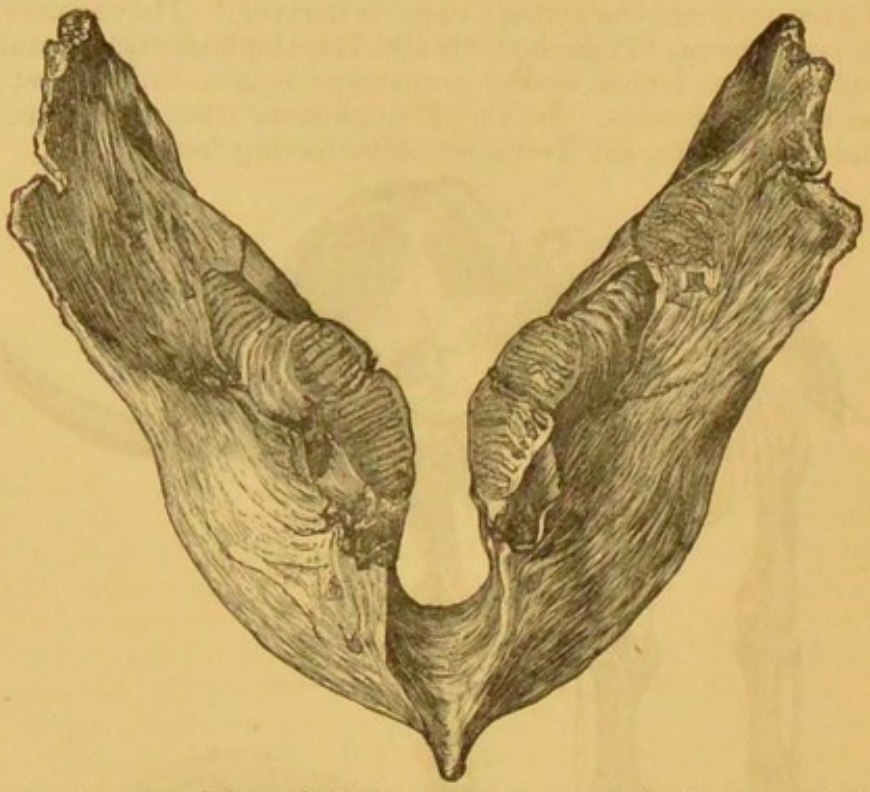


Fig. 7.—Lower Jaw of Mammoth, *Elephas primigenius*. Dredged off the Dogger Bank, in the North Sea, 1837.‡ (The original specimen is exhibited in Pier-case 32.)

Pier-case, No. 38. North side.

In the Pier-case are arranged fifteen 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.

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

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

‡ 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.*

Mastodon. Pier-case, No. 37.

The next Pier-case is occupied with remains of *Mastodon longirostris* from Eppelsheim, in Hesse-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, India. Of these there are some very perfect remains, including about eight heads. 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. 3, p. 21.

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.

Geographical Range of the Mastodon & Elephant.

The Mastodons have been found over an area extending from England through France, Germany, Switzerland, Italy, to Armenia, India, and Ava; they occur also both in North and South America. There are thirteen 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.

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 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 in the valley of the Thames near London, from the Dogger Bank, and the coast of Norfolk. 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.

Hair of the Mammoth: Pier-case, No. 31.

Fossil Ivory from Siberia

Pier-case No. 32. Table-case, No. 18.

Many of these remains may be seen in the Pier-cases, and in the centre of the Gallery floor are placed the fine skull, tusks, and lower jaw of the Ilford Mammoth. 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

Pier-cases, Nos. 32 to 36.

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

Elephas ganesa.

elephants, has also yielded abundant evidence of numerous extinct species of this animal. The skull and tusks of *Elephas ganesa* (probably one of the largest of all the fossil elephants), from the Siwalik Hills in India, and exhibited next the Ilford Mammoth in the centre of the Gallery, has tusks which measure 10 feet 6 inches in length.* (Presented by General Sir William Erskine Baker, K.C.B.)

Separate stand, D.

Thirteen extinct species of elephants, seven of which are from India, and three found fossil in this country, are represented in the cases.

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

Pier-case No. 33 contains some British remains of the *Elephas antiquus*; the rest of the case, and also of Pier-cases Nos. 28, 29, and 30, are entirely devoted to the great collection of elephant-remains from the Siwalik Hills (Older Pliocene) of 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 series 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 the late Professor A. Leith Adams, M.D., F.R.S. These Maltese elephants, which

* 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 Pier-case No. 30.)

Pigmy Elephants from Malta.

by the form of their grinders are related to the living African elephant (Fig. 5), 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 race or 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, and thence they extend into Arabia, Syria, and Palestine. No fossil remains have, as yet, been discovered of these peculiar little mammals.

Sub-order 3.—**Amblypoda.**

Coryphodon. Pier-case, No. 20.

Here are placed the remains of the *Coryphodon*, from the Lower Eocene of Harwich, Essex; and from Dulwich, near London; also plaster-casts of teeth and bones of the same animal from the Eocene lignites of Soissons in France.

Several species have been described as occurring in the Eocene of North America.

Coryphodon was the largest of the early Eocene Ungulates; and the relative smallness of its brain, and the five-toed feet, which resemble in structure those of the *Dinocerata*, indicate some affinity to that group, which it also preceded.

Sub-order 4.—**Dinocerata.***

Dinocerata. Pier-case, No. 20.

This division contains a most remarkable group of huge extinct herbivorous mammals discovered in the Eocene Tertiary strata of Wyoming, North America, by Professor O. C. Marsh, M.A., F.G.S., in 1870.

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.

* *See* glazed case M.M. with complete skeleton of *Dinoceras mirabile*, Marsh, in centre of Gallery, near Pier-case No. 20; just added (September, 1888.) Presented by Professor O. C. Marsh, M.A., LL.D., F.G.S.

Dinoceras.
Pier-case, No. 20.

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.

Three genera are enumerated by Marsh, namely—*Dinoceras*,

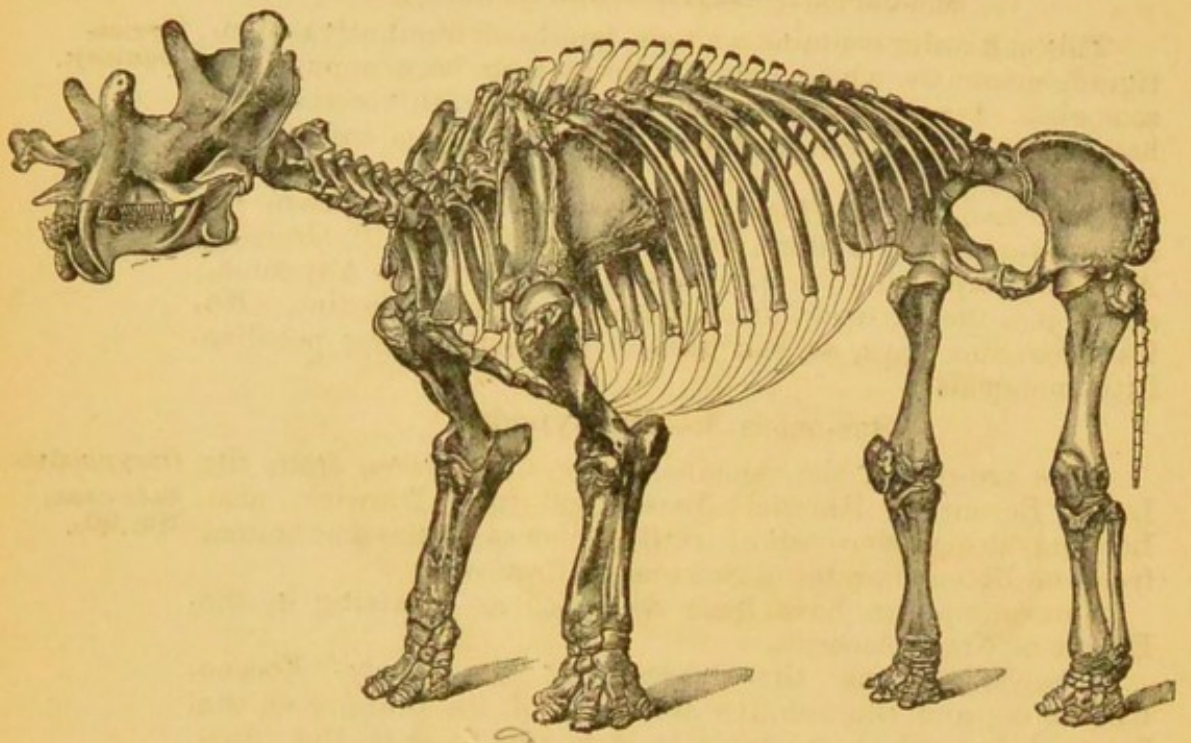


FIG. 8.—Restoration of *Tinoceras ingens*, Marsh. One-thirtieth natural size. Eocene Tertiary lake-basin, Wyoming, North America.

Marsh, with seven species; *Tinoceras*, Marsh (*see* woodcut, Fig. 8), with seventeen species; and *Uintatherium*, Leidy, with five species.

Pier-case, No. 20. South-side.

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.

A fine series of 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, 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.

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. **Pier-case, No. 20.**

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.

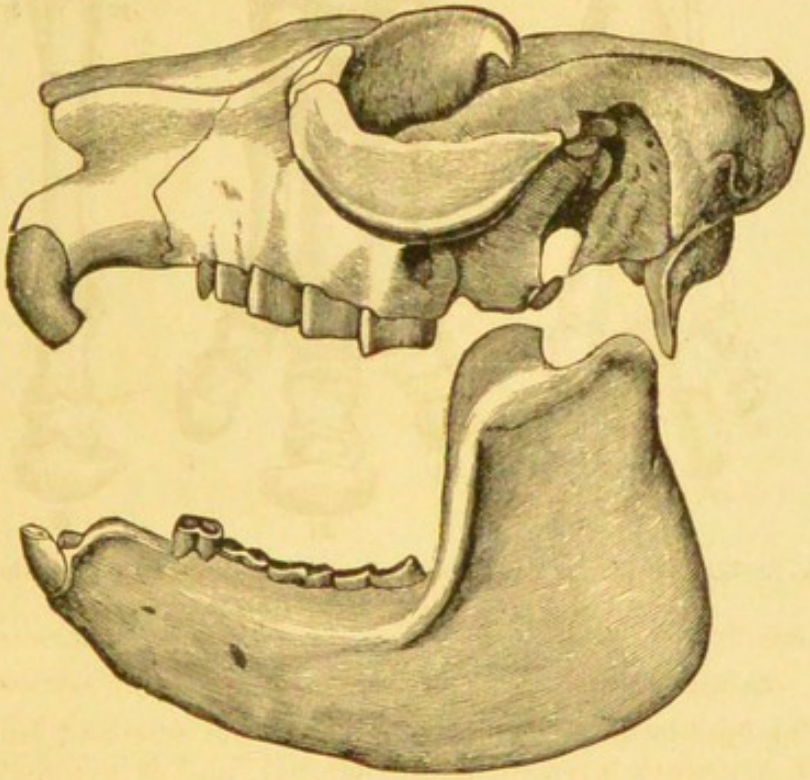


Fig. 9.—Skull and lower jaw of *Typotherium cristatum* (⅛ nat. size).

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*.

Nesodon, another Tertiary genus, discovered in South America, has been provisionally referred to this sub-order. An upper and lower jaw of the smallest species (*Nesodon ovinus*,

Owen)*, from the S.W. Coast of Patagonia, is preserved in the collection. They were brought home by Admiral Sir B. J. Sulivan, K.C.B.

SUB-ORDER 7.—**Perissodactyla** (uneven-toed Ungulates).

Ungulata. Perissodactyla.

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.

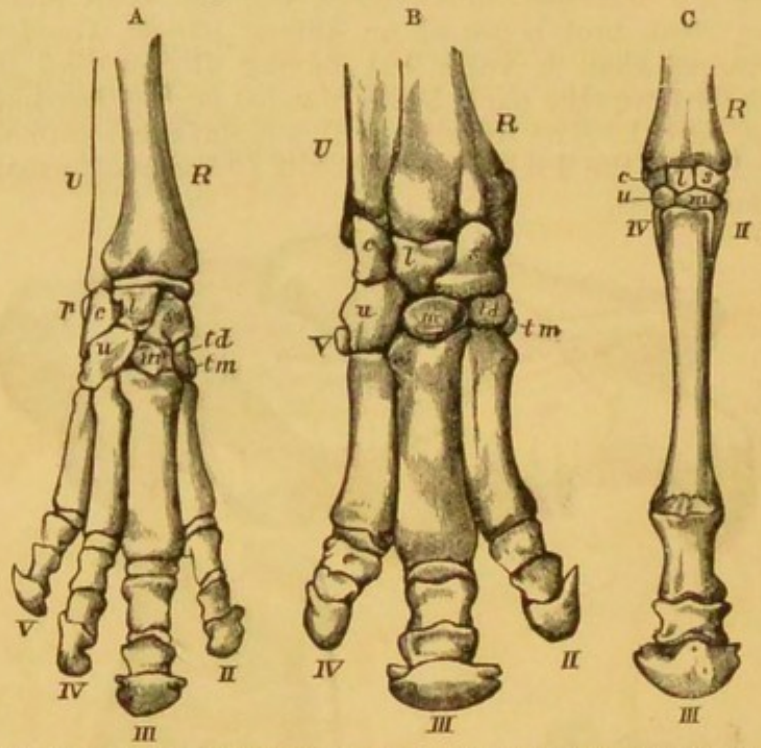


FIG. 10.—Examples of modifications of the bones in the Perissodactyle Fore-foot (after Prof. Flower).†

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.

Uneven-toed Ungulata.

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* woodcut, Fig. 10.)

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

† Reproduced by permission from Prof. Flower's Osteology of the Mammalia, p. 295, third Edition, 1885.

Family MACRAUCHENIIDÆ.—In this case is placed a ramus of the mandible and portions of limb-bones of *Macrauchenia patachonica*, 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.*

Macrauchenia.
Pier-case, No. 8.

Originally supposed to have been allied to the Llama, though much larger, it is now known to be a Perissodactyle Ungulate, but of a peculiar specialized form, its true affinities being still undecided.

It possessed a camel-like neck, teeth that ally it to the Rhinoceroses and Palæotheres, and it had three toes upon each foot.

Family CHALICOTHERIIDÆ.—Nearly allied to the Rhinoceroses is the genus *Chalicotherium*, consisting of several species with a wide geographical range, their remains having been found in India, China, Greece, France, and Germany.

Chalicotherium.
Table-case, No. 4.

They occur in Tertiary deposits, ranging in time from the Miocene to the Pliocene periods.

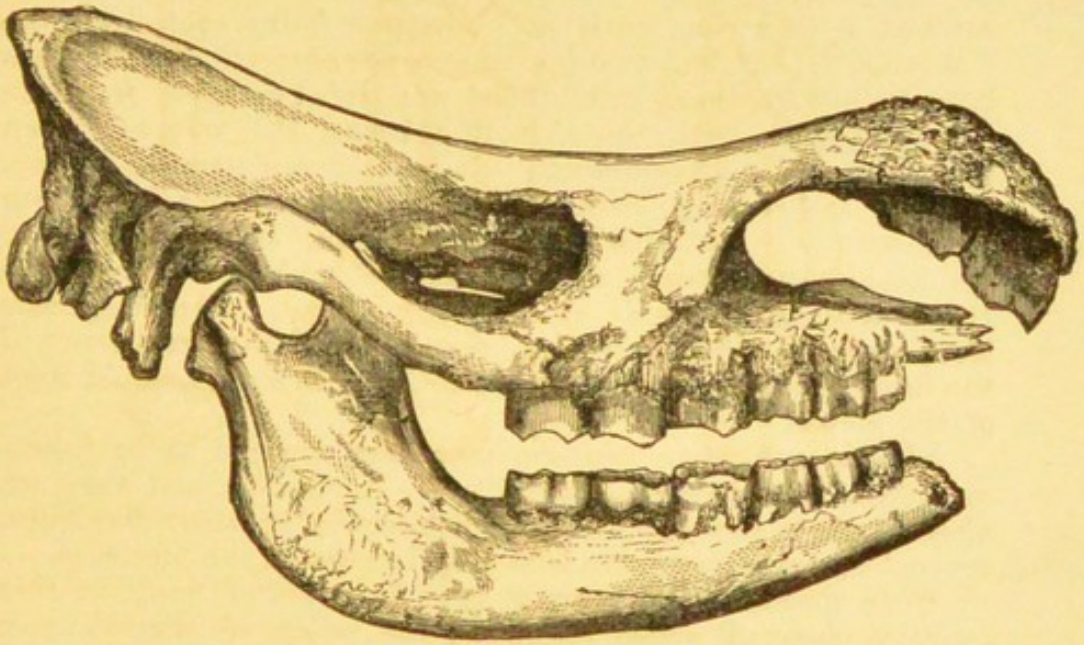


FIG. 11.—Skull and lower Jaw of *Rhinoceros leptorhinus* (Owen), from the Pleistocene Brick-earth of the Thames Valley, at Ilford, Essex. (*See* Pier-case, No. 6.)

Family RHINOCEROTIDÆ.—The Rhinoceroses occupy Pier-cases Nos. 6, 7, and 8, and Table-case No. 4. There is only a single living genus, which includes five or six known species; five genera have been described from fossil remains, but probably many of these might well be referred to Rhinoceros also.

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

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

The Rhinoceros.

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; they have no canine teeth, but there are usually incisor teeth in both jaws;* they have generally one or two horns, 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 (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 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 the fossil remains of the genus, published in a curious old tract of the period.†

Pier-case, No. 6.

Skulls and other remains have been dredged up by fishermen from the "Dogger Bank," in the North Sea, and they are also found in the gravels and brick-earths in many localities, several fine examples of which 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

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

The Rhinoceros.

interesting series of remains, including a nearly perfect skull, which shows the bony septum of the nares (*see* Fig. 11), 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. 7, 8.

Remains of several species of rhinoceros have been found in strata of Middle and Newer Tertiary age all over the Old World, and one species (*e.g.*, *R. occidentalis*) has been found in the Upper Miocene beds of Dakota, North America.

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

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

Cadurcotherium: Hyracodon: Homalodontotherium.

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; and the *Homalodontotherium*, from South America. Of the last genus only the jaws and teeth are known, and its true affinities are still uncertain. Here also is placed a cast of the skull and teeth of the *Elasmotherium*, from the Pleistocene deposits of Novousenk, Government of Samara, Russia.*

Elasmotherium.

Table-case, No. 4.

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, Hesse-Darmstadt; from the Val d'Arno, &c.

Palæotheriidæ.

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

Family Palæotheriidæ.—In the next cases are arranged a good series of the 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,

* The original is preserved in the Museum of the Imperial Academy of Sciences, St. Petersburg.

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 (*P. annectans*) 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.

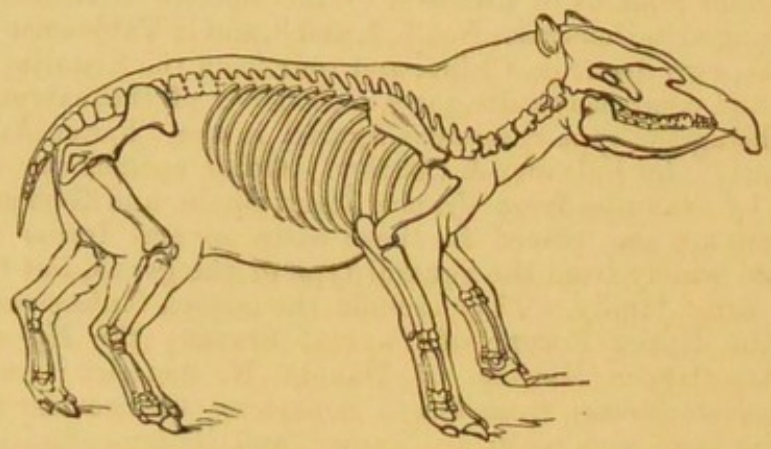


Fig. 12.—Palæotherium, Eocene, Montmartre (restored. *See* Pier-case No. 9).

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 a transitional form connecting the *Palæotheriidæ* with the *Equidæ*, and as an early ancestor of the Horse. 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.

Lophiodon.

The *Lophiodon* is an extinct genus nearly approaching in the structure of its teeth to the tapir and rhinoceros. Like the tapir, the lower true molars have simple transverse ridges, but the premolars are more or less longitudinally tuberculated, and

in this respect it differs from its near ally, the *Palæotherium*, in which the whole series of the lower molars are longitudinally bi-crescentic in form. It had also, like the tapir, which it preceded in geological time, four toes on the fore-feet and three on the hind-feet. **Lophiodon. Table-case, No. 5.**

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 $\frac{3}{3} \times 2 = 40$.

Closely allied to the *Lophiodon* and preceding genera, but later in geological time, is the Tapir (*Tapirus*), differing from the Eocene forms, principally, by the resemblance of the last three premolars to the true molars. Fossil remains of the tapir were first discovered in the Upper Miocene at Eppelsheim, Hesse-Darmstadt. **Tapir. Pier-case, No. 9.**

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 Table-case, No 5. 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.

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

Hyracotherium was a small animal, about the size of a hare, principally known by its dentition.‡ **Pier-case, No. 9.**

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 deposit in the Suffolk Crag.

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*. **Pliolophus.**

* 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.

‡ Prof. Cope believes the American *Orohippus* to be identical with *Hyracotherium*.

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 $\frac{3}{3} \times 2 = 44$.

Horses.

Family EQUIDÆ (Horses).—In all modern horses the digits are reduced to a single perfect toe on each foot. (Fig. 10, C.p. 30); 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. 13, giving four examples, of the *Perissodactyle* foot, after Marsh.)

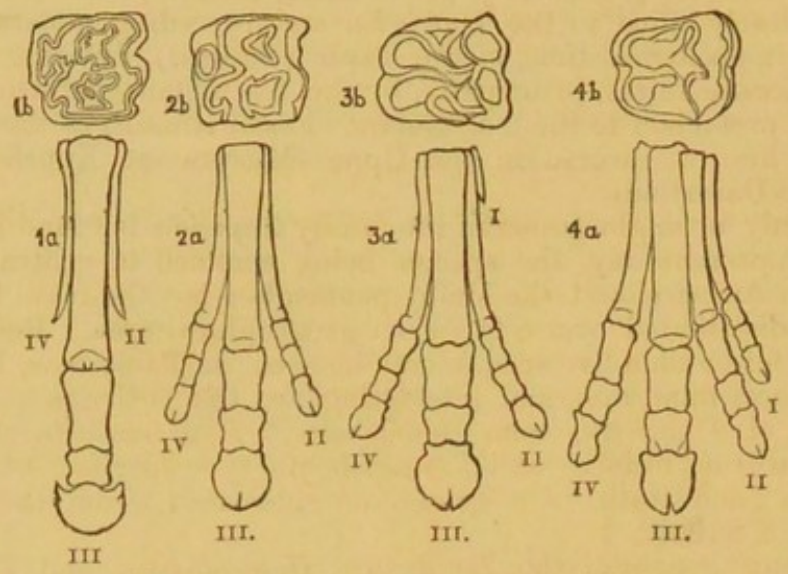


FIG. 13.—Genealogy of the Horse (*Equus caballus*).

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.

Pier-case, No. 10.

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.

Ancestry of the Horse.

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.

The three-toed and most immediate ancestor of the horse (*Hipparion*, Fig. 13, 2), occurs fossil in the Pliocene deposits

Hipparion, and Equus.

of the Siwalik Hills in India; in China and at Maragha, Persia; at Pikermi, in Greece; in France and Germany; and in the Red Crag of Suffolk.

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 the Post Tertiary 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.*

Sub-order 8.—**Artiodactyla** (Even-toed Ungulates).

This well-defined group is traceable from early Eocene

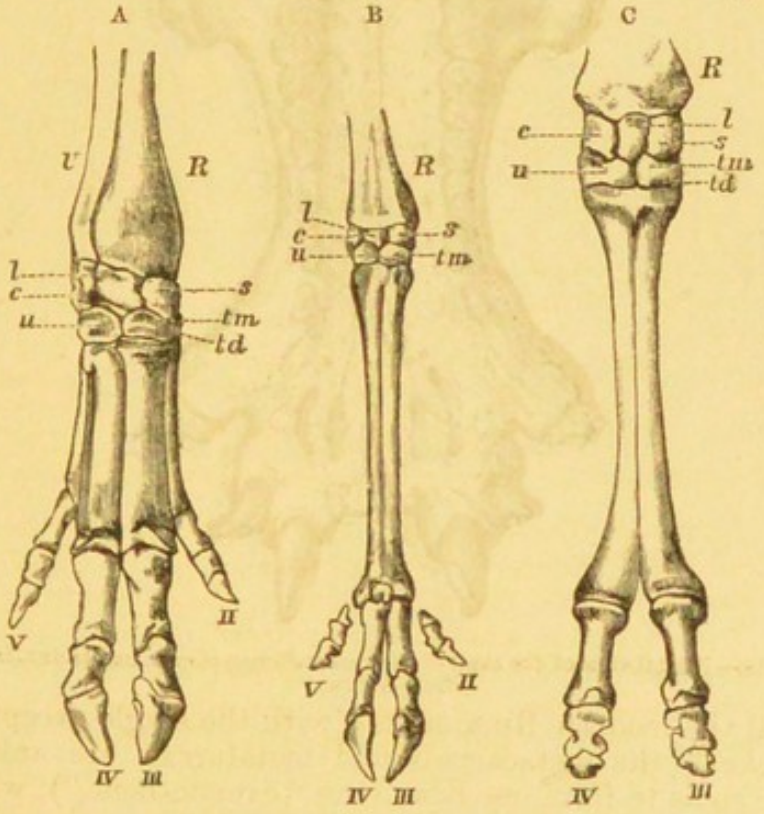


Fig. 14.—Examples of modifications of the bones in the Artiodactle Fore-foot (after Prof. Flower).

A, Pig, ½ nat. size. B, Deer, $\frac{1}{7}$ nat. size. C, Camel, ⅛ nat. size.
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, or digits, present in each foot.
[Reproduced, by permission, from Prof. Flower's Introduction to the "Osteology of the Mammalia," 3rd edition, 1885, p. 297.]

* O. C. Marsh.

Artiodactyla, Bunodonta.

times. They are characterised by having the third and fourth digits in both fore and hind feet almost equally developed, and their ungual phalanges flattened on their inner or contiguous surfaces, so that each is not symmetrical in itself, but when 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.

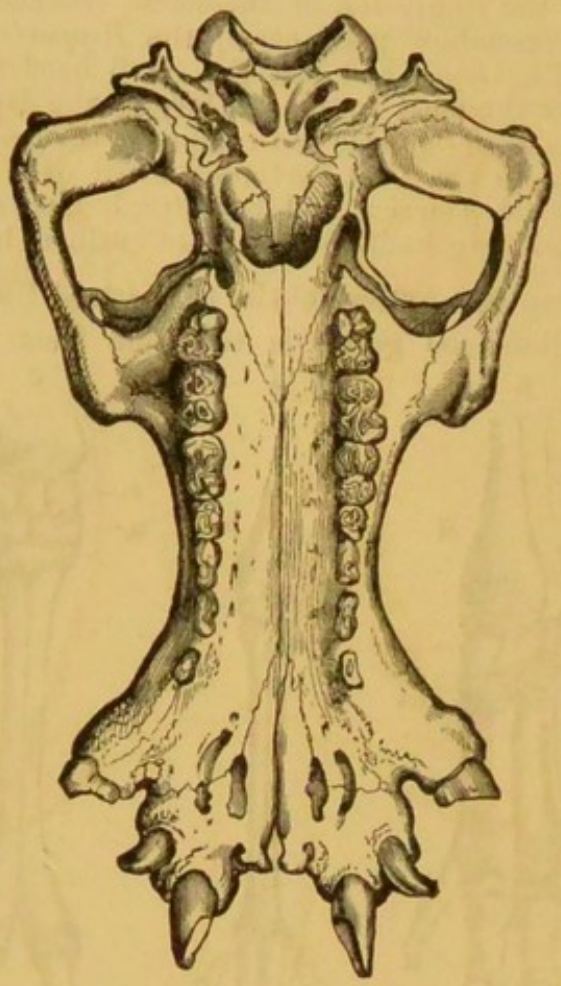


FIG. 15.—Palatal view of the skull of the recent *Hippopotamus amphibius*, Linn., from Africa.

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 are never ankylosed together. The Artiodactyla are readily divided into two very distinct groups: firstly, the Non-ruminants, which have been named the BUNODONTA,* embracing

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

the hippopotamus and the pigs; and secondly, all the true Ruminants—animals which chew the cud—these are named SELENODONTA,* and embrace the deer, antelopes, oxen, &c. **Hippopotamus.**

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 this country, in the southern parts of Europe, and in India. **Pier-cases, No. 11, 12. Table-case, No. 6.**

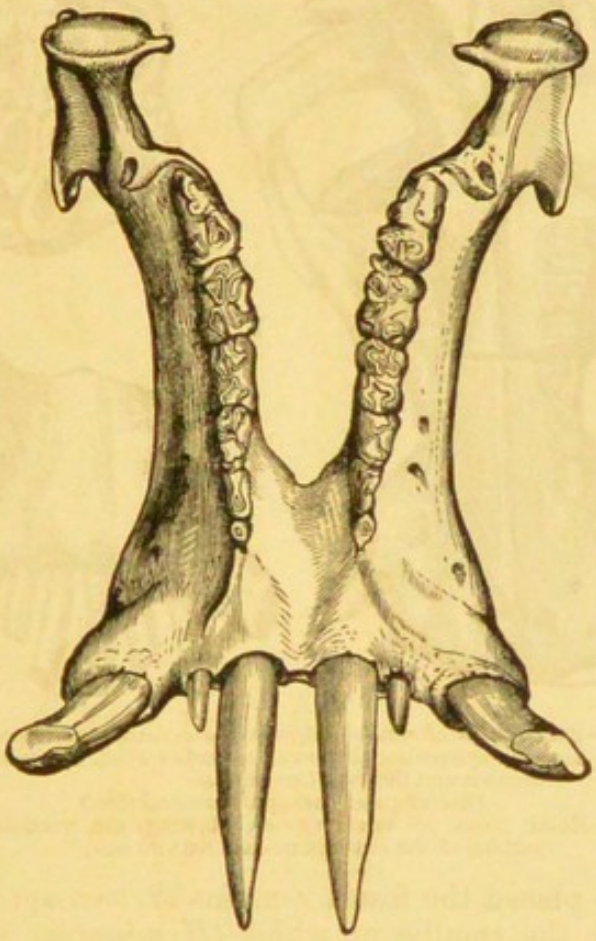


FIG. 16.—Lower jaw of *Hippopotamus amphibius*, Linn., Recent, Africa (seen from above).

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.

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

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

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 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.

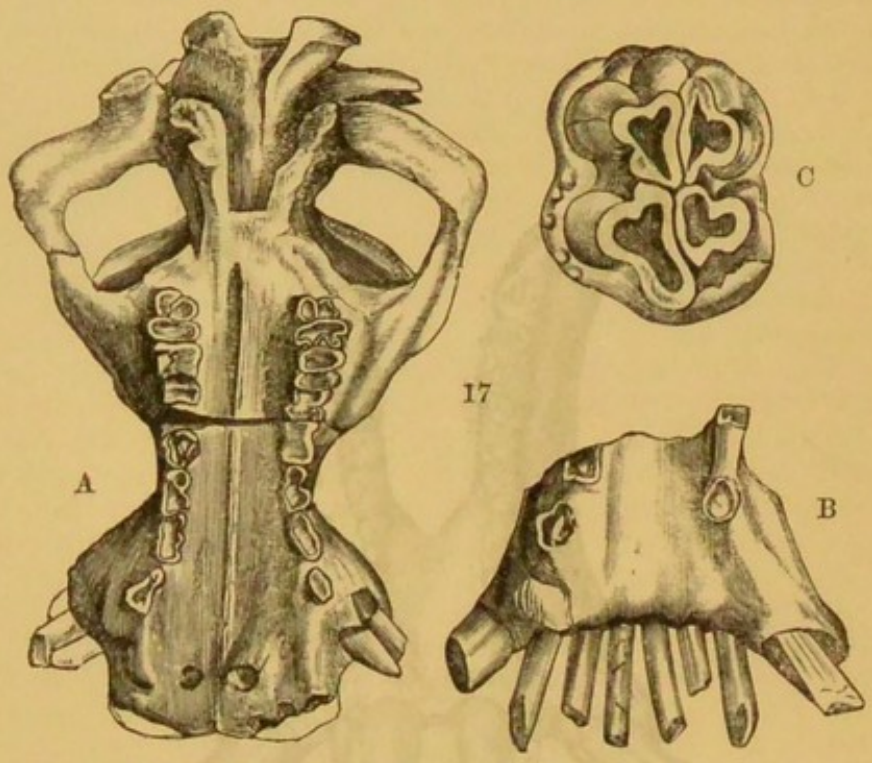


Fig. 17 A.—Palatal view of skull of *Hippopotamus sivalensis*, Falconer and Cautley.
,, B.—Front or symphisial portion of lower jaw of *H. sivalensis*, showing the six incisors and the tusk-like canines.
(Both figures one-eighth natural size.)
,, C.—Molar teeth of same species, showing the worn-down double trefoil pattern of the crown (one-half natural size).

Table-case, No. 6.

Pier-case, No. 11

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.)

Former Geographical range of the Hippopotamus.

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.

Table-case, No. 6.

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 Hesse-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 of simpler structure. Its remains have been found in the Middle Miocene at L'Isle-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 digits not being united by ankylosis.

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.

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 at Ronzon, near Puy-en-Velay, France. Its remains have also been found in the Hempstead beds of the Isle of Wight. *Chœropotamus* was also a denizen of this country. Sir Richard Owen has described* a nearly perfect

Elotherium. Chœropotamus.

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

Chæropotamus.
Table-case, No. 7.

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.

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, Hesse-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, *A. (Hyopotamus) Gresslyi*, are found in the Upper Eocene beds at 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* 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, and *Oreodon* in the Miocene of the White River, Dakota.

Hyopotamus.
Merycopotamus.
Oreodon.

Table-case, No. 8.

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

Anoplotherium.

The best known, by description and figures, of these extinct animals is the *Anoplotherium*,† thus named because it was the only animal then known 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.

Xiphodon.
Dichodon.
Dichobunus.
Cænotherium.

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; *Cænotherium*, a genus of small animals about the size of hares and rabbits, whose remains are preserved in the greatest abundance and perfection in freshwater deposits of Lower Miocene age at Cournon and Sauvetat (Puy-de-Dome), and Allier, and also in the Upper

* Hence the name "Coal-beast."

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

Cænotherium. Table-case, No. 8. Gelocus Lophiomeryx and Chæromeryx.

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 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 *Chæromeryx* in the Siwalik Hills, India.

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 camel, 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 (except in the camels); 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.

Camels. Pier-case, No. 13.

Tylopoda* (Camelidæ).—The camels and llamas form a somewhat aberrant group of Ruminants, 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.

Llamas.

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.

Palauchenia.

Tragulidæ. Dorcatherium, &c. Table-case, No. 8.

Tragulidæ (Chevrotains).—The extinct fossil genera, *Prodremotherium*, and *Bachitherium*, from the Upper Eocene of Caylux, and the *Dorcatherium*, from Eppelsheim in Hesse-Darmstadt, Sansan in France, and the Siwalik Hills in India, are probably early ancestors of the *Tragulina*, 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 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

* Pad-footed animals.

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.

Section.—Pecora or Cotylophora.—Bovidæ.

Horns of the Bovidæ, or Ox-tribe.

In the first division are placed all those animals with curved or straight "horns," having a central bony process—or 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 (Flower). These are all included under the term Bovidæ, embracing all the horned-Ruminants, such as the Oxen, Sheep, Antelopes, &c.

Pier-cases, Nos. 16 to 19.

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.

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

Pier-case, No. 18.

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 Ox, *Bos primigenius*, from the Brick-earth of Ilford, from Walton and Clacton, Essex; and from peat-deposits and Turbaries in Kirkcudbright-

* Oss. Foss. Darmstadt pt. 5, pl. xxiii. A.

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

shire, Scotland, &c. Also jaws and other remains of *Bos longifrons* believed to be the immediate ancestor of our existing small Welsh and Scottish cattle. They are only found in peat-bogs, Turbaries, and superficial deposits of comparatively recent date, also in prehistoric tumuli, kitchen-middens, &c. **The Great Ox.**

In this case are placed the remains of an animal of singular interest to the palæontologist, the "Musk-sheep" (*Ovibos moschatus*), which was once 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 **Pier-case, No. 16.** **The Musk-sheep.**

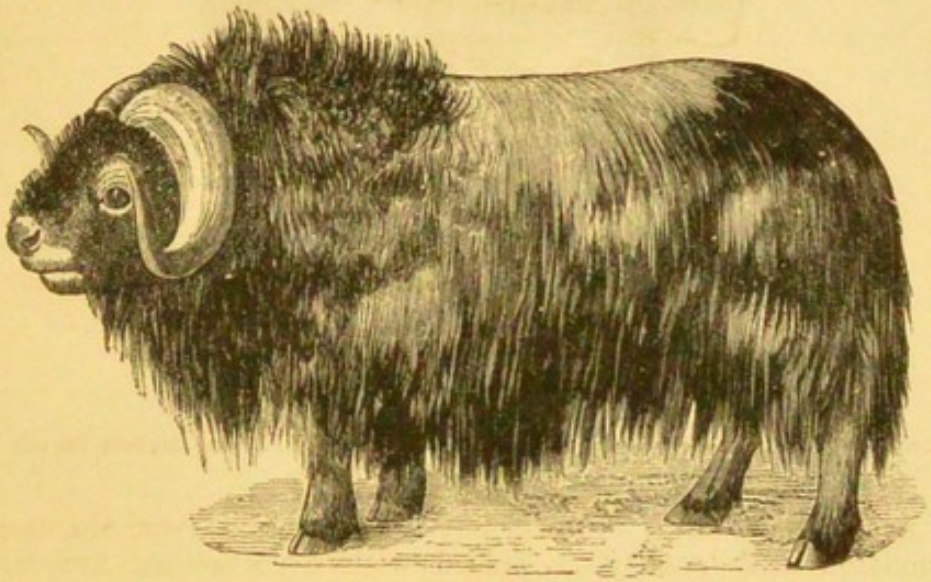


Fig. 19.—The Musk-sheep (*Ovibos moschatus*).
Still found living as far north as North Grinnell-Land, Lat. 82° 27′.

Bank in the North Sea, and found in the Caves of Dordogne in France.

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

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 Pliocene deposits of the Siwalik Hills, India. It possessed 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.

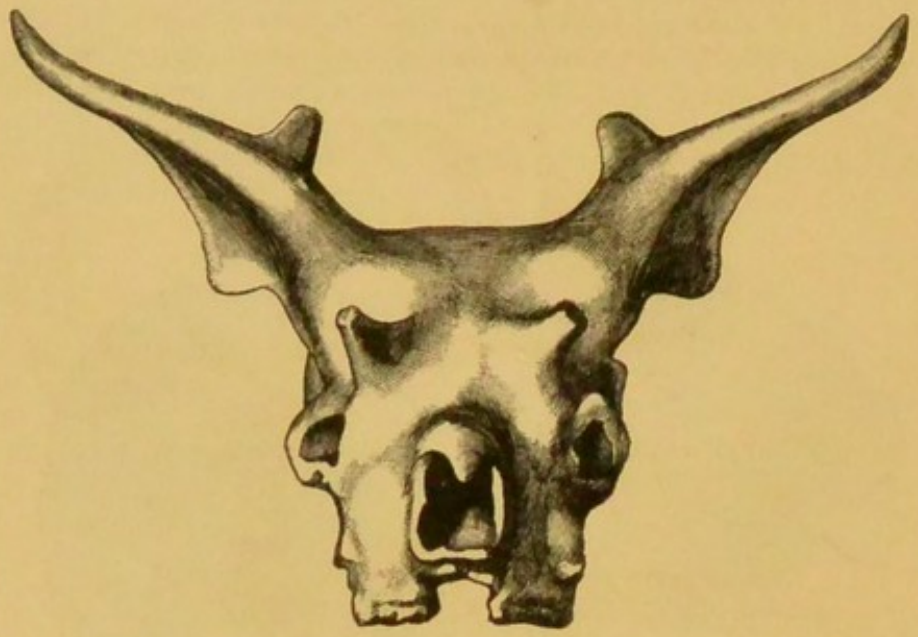


Fig. 20.—Skull of *Sivatherium giganteum*, from the Lower Pliocene deposits, Siwalik Hills, India (the horns restored).

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 provisionally 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 Cervidæ (Deer-tribe).

Cervidæ, Deer-tribe.

To the second division belong the *Cervidæ* or Deer-tribe. These 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 state they remain permanently in the Giraffe, but in the

Antlers of Deer.

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."*—(*Flower.*)

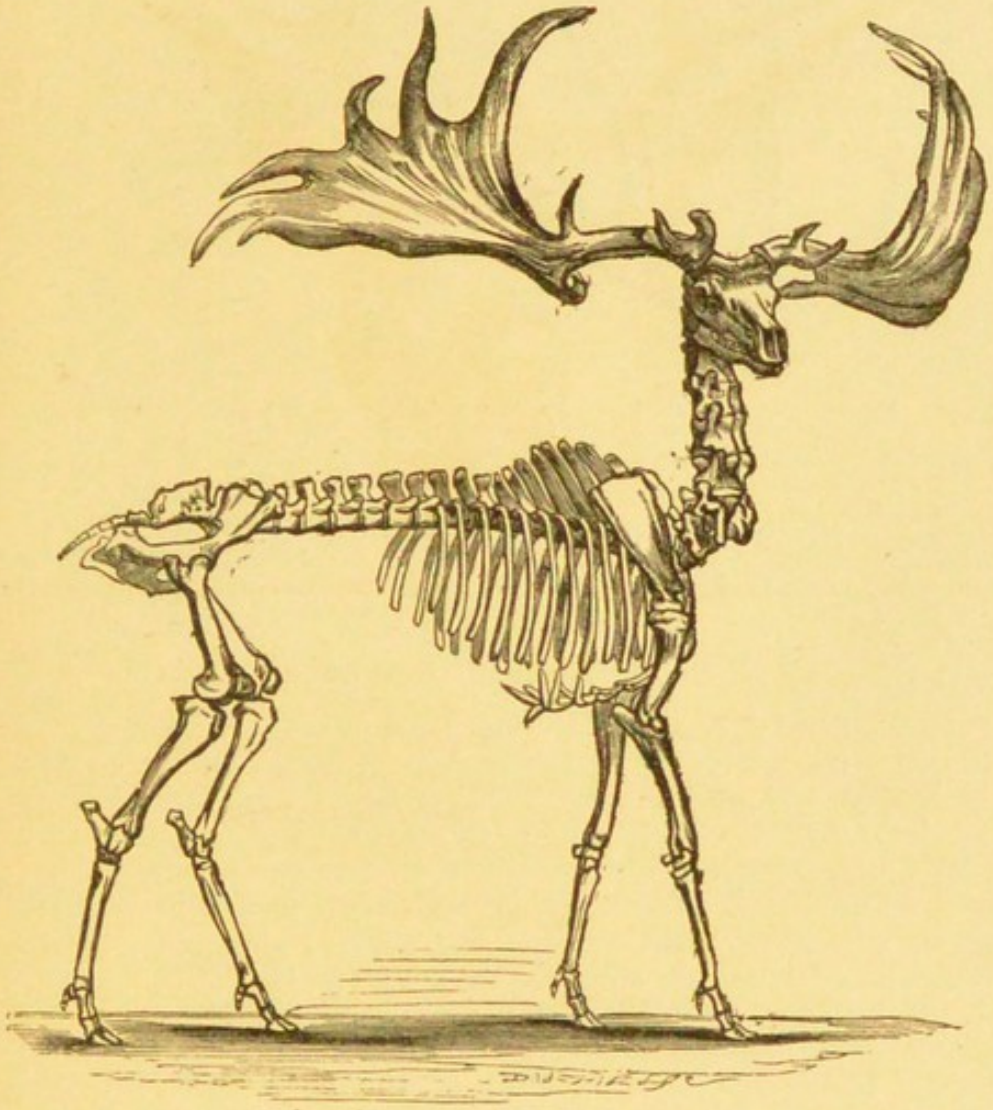


Fig. 21.—The Gigantic Irish Deer *Cervus (Megaceros) giganteus*, from shell-marl beneath the peat, Ireland.

* The antlers of the deer tribe are shed and renewed annually, increasing in size with age, a new "snag" or tine marking each year, being added to the new antler. The horns of the oxen are never renewed, but last as long as the animal lives.

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 wall-cases, and affixed to the columns on either side of the central avenue.

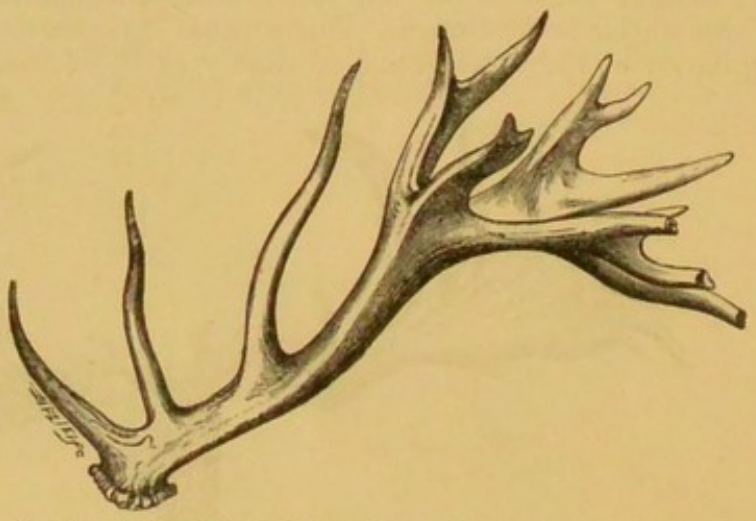


Fig. 22.—Antler of the Red-deer, *Cervus elaphus* (one of a pair), from the bed of the River Boyne at Drogheda, Ireland. Exhibited on one of the columns on the south side.*

Gigantic Irish Deer.

Stands K. L. M.

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," from its remains having been met with in considerable numbers, in Ireland, and often in very remarkable 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* Fig. 21.) The true elk (*Alces machlis*) and the reindeer (*Rangifer tarandus*) were also denizens of our island in Pleistocene times. 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 lime-

The elk.

The reindeer.

* 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.

† Heads and antlers of several others are placed on the tops of the adjacent wall-cases. The crowns of some of these are of even greater breadth.

stone rocks in England. The broken skulls, with the bases of antlers attached, may also be seen from the cave of Bruniquel, and a fine entire antler embedded in stalagmite from Brixham Cave near Torquay.

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

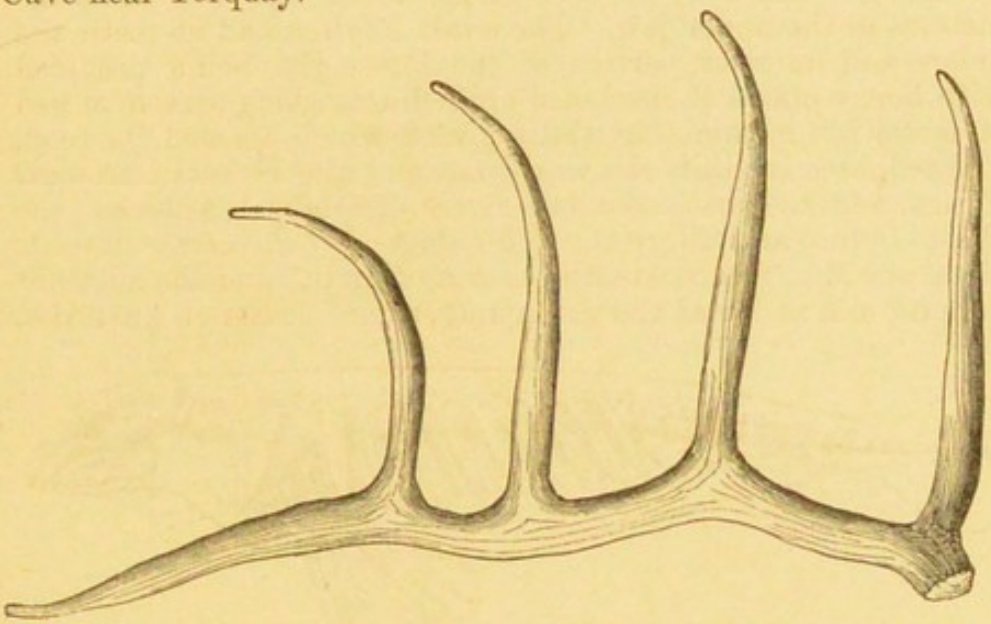


Fig. 23.—An Antler of the fifth year of *Cervus tetraceros*, Boyd-Dawkins, from the Pliocene of Peyrolles, France (see Pier-case No. 15).

Several extinct forms of Deer, some equalling the gigantic 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 bones, from deposits of Miocene and Pliocene age in Darmstadt, France, and Italy, and also from India, are arranged in the Pier and Table-cases.

Cervus verticornis.

Pier-case, No. 21.

Cervus tetraceros.

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

Sirenia.

Pier-case, No. 21.

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.

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 they can turn the head from side to side, which the Cetacea cannot do.

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

Sirenia, Manatee, & Rhytina. Pier-case, No. 21.

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; 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.

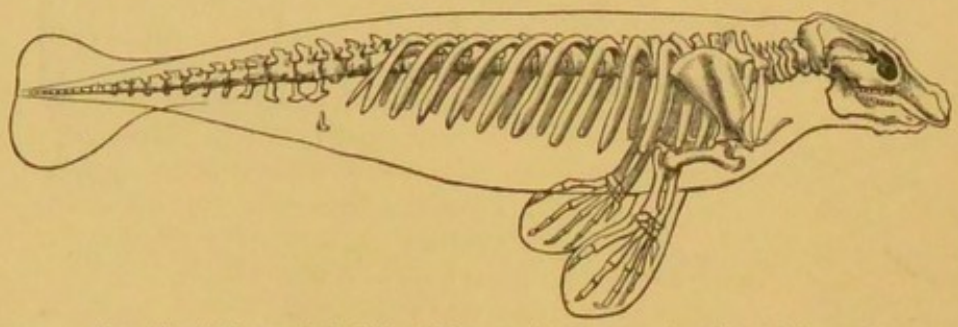


Fig. 24.—Skeleton of the living "Manatee" (*Manatus Americanus*), from the River Amazon.

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 Island, 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 35 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.*

* Mr. William Carruthers, F.R.S., F.G.S., informs me that 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. He adds:—"When I went to see the Coniferous trees at Monterey, California (1884), I was surprised at the magnitude and quantity of the *Fuci* and *Laminariæ* thrown up on the coast."—H.W.

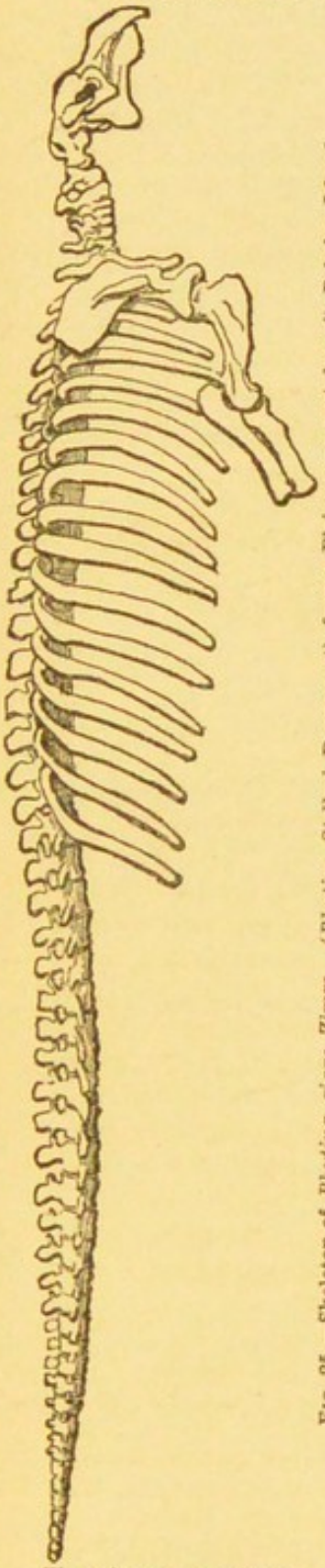


Fig. 25.—Skeleton of *Rhytina gigas*, Zimm. (*Rhytina Stelleri*, Desmarest), from a Pleistocene peat-deposit, Behring Island. (Length of original specimen, 19 feet 6 inches.)

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 sea-weed which surround the coast. **Skeleton of Rhytina. Stand N.**

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, infested by numerous parasites.

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, Steller records, 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. **Stand N.** **Pier-case, No. 21.**

Its bones are obtained from peat deposits on Behring's Island, from 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 14 genera and 30 species are

Fossil Sirenia. Pier-case, No. 21.

recorded,* 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 Schinzii*, from the Miocene of Hesse-Darmstadt, of which a cast of the entire skeleton and a large series of separate bones are exhibited. The cast of a nearly perfect skull of *Felsinotherium*, 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, near Cairo, with recent skulls of the African Manatee and the Australian Dugong placed for comparison with the fossil forms.

Order IX.—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, and these are not divided externally 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.

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 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 *Ziphiinæ*, *Hyperoodon*, *Ziphius*, *Mesoplodon*, and the *Delphinidæ*.

Wall-case, No. 22. Zeuglodon.

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 premolars on each side, or 36 in all. The molar teeth have laterally compressed crowns, with serrated edges and two distinct fangs. It differs from all other Cetacea in the fact that

* One species is recorded from the Pleistocene, eight are from the Pliocene, 15 from the Miocene, and four from the Eocene.

† The true "whale-bone" of commerce.

some of the teeth have vertical successors. Plaster casts of skulls of two other extinct Cetaceans—*Squalodon*, from the Miocene of Bavaria, and *Rhizoprion*, from the Miocene of Central France, are also exhibited. **Squalodon. Pier-case, No. 21.**

In the table case is placed a series of the rostral bones of *Ziphiinæ* and the ear bones (*Cetotolithes*) of true whales from the Suffolk Crag. **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 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. 22.** **Wall-case, No. 28.**

THE PAVILION (No. 2 on Plan).

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

In Glass-case (Q), near the centre window at the east end of the Pavilion, is placed the cast of the skull and lower jaw, neck-vertebræ, fore and hind limbs, 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 of 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. **Glass-case Q. Glyptodon.** **See Wall-case, No. 26.**

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

These large extinct species differed from the modern Armadillos in having no bands, or joints, in their coat of mail, which enable the living species, when attacked, to contract the body into the form of a ball. 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 allied but much smaller genus is the *Hoplophorus*, of which a nearly entire carapace and tail-sheath, partly restored, may be seen in the wall-case. **Hoplophorus.**

The banded and jointed Armadillo is represented by the extinct genus *Chlamydotherium*, detached plates of the carapace **Wall-case, No. 26, and Table-case, No. 13a.**

Wall-case, No. 26.

and bones having been found in abundance in the caves of Minas Geraes, Brazil. It is supposed to be allied to the little "Mole Armadillo," *Chlamydophorus*.

On the stand, in the centre of the Pavilion, is placed the cast of the entire skeleton of the great extinct "Ground-Sloth"

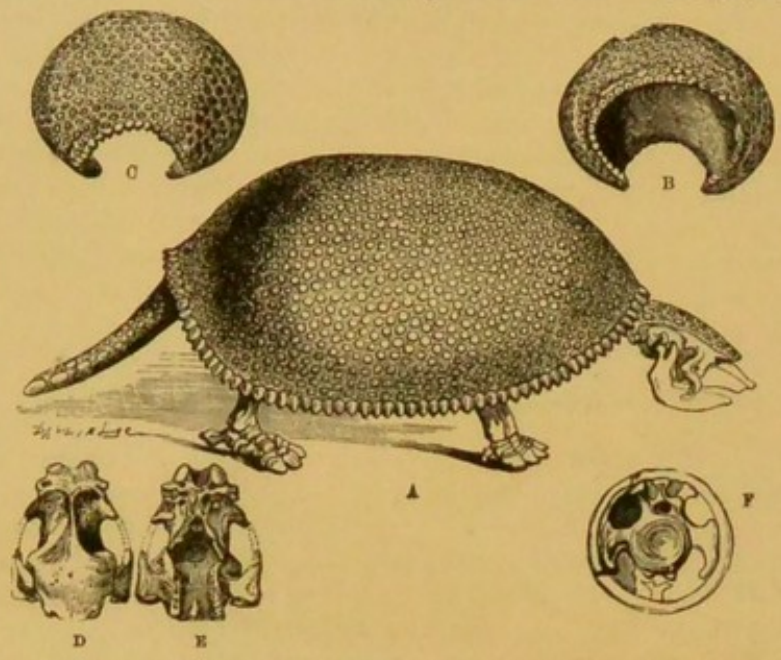


FIG. 26.—Extinct Gigantic Armadillo (*Glyptodon clavipes*) from South America.
A, View of entire animal. B, Front end of carapace. C, Back view of same. D and E, Upper and under side of skull. F, Section of tail showing caudal vertebræ inside the bony sheath.

Megatherium. Stand O.

(*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 flexible forearms and the large claws with which its fore-feet 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.

Wall-case, No. 26. Great Ground-Sloth.

The jaws are destitute of teeth in front, but there are indications that the snout was elongated, and more or less flexible, whilst the fore-part of the lower jaw is much prolonged and grooved (*see* woodcut, Fig. 27 *d*, *infra*) 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 similar diet 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.

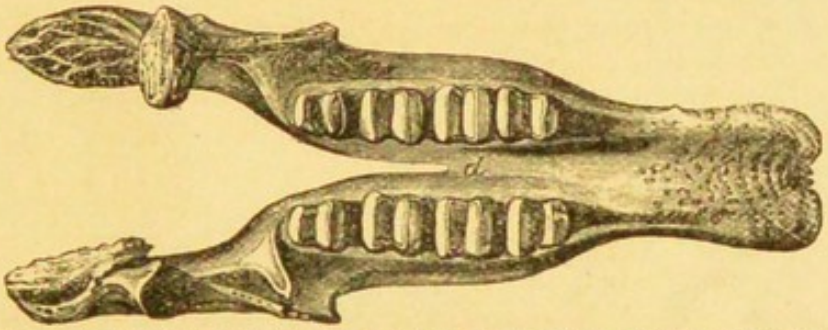


Fig. 27.—Lower Jaw of *Megatherium americanum*, showing the chisel-shaped Molar teeth.

Wall-case, No. 26. Mylodon.

Remains of other allied animals, namely, the *Mylodon*, the *Scelidotherium*, and the *Megalonyx*, may be seen in the Wall-case adjoining.

Although so much larger in bulk than their modern representative, these huge extinct vegetarians of the New World all belong to one family, being classed with the "Great Ant-eaters" in the order Edentata (or toothless animals), but the Ant-eaters are the only ones in the class that have no teeth, the others having teeth in the sides of their jaws, but none in front.

At the time when these animals lived in the vast wooded regions through which the upper waters of the Parana and Uruguay flowed, the lowlands, which now form the extensive "pampas," or grassy plains, of the La Plata, were probably submerged estuarine, or delta areas, over which these great rivers annually deposited the fine sediment which they brought down, together with the bodies of *Megatheria*, *Mylodons*, *Glyptodons*, &c., drowned during floods in the upper valleys where they had their habitat. Hundreds of the fossil remains of these huge herbivora have been met with in this pampas formation exposed in the beds of the sluggish rivers which now traverse these plains.

Mylodon. Case O.O.

An almost perfect skeleton of *Mylodon gracilis* has just been completed and placed upon the floor of the Pavilion in a separate glazed case. (September, 1888.)

Sub-class II.—**Didelphia.**

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

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.

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

Here are placed the remains of those large extinct animals belonging to the class Marsupialia—so called because some of them (*e.g.*, the Kangaroos) were furnished with a *marsupium* or pouch in which to carry their young after birth until they were able to care for themselves.

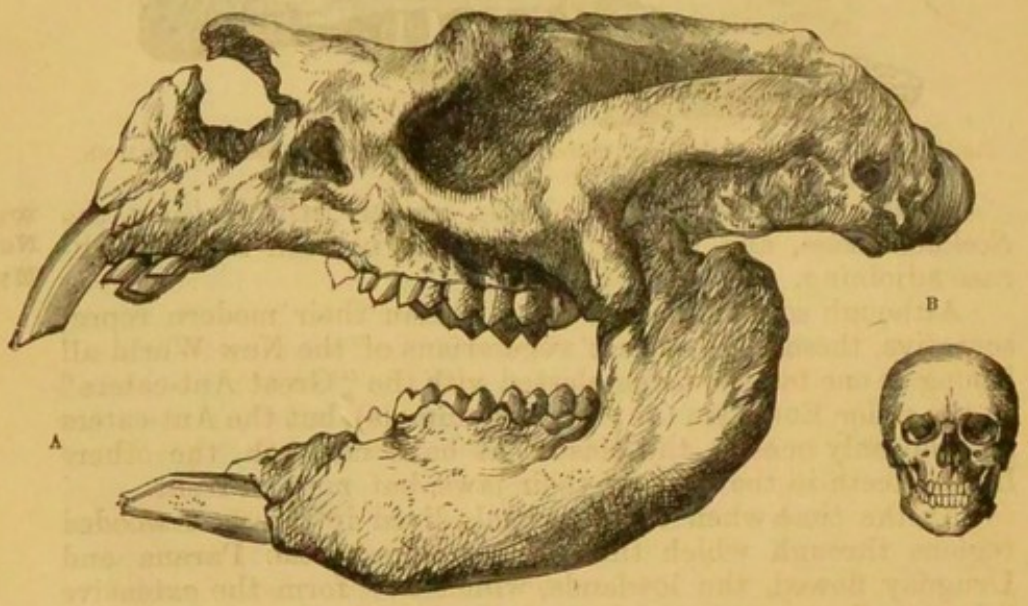


Fig. 28.—(A.) Skull and lower jaw of gigantic extinct Kangaroo (*Diprotodon australis*), from the Newer Tertiary Deposits, Australia.
(B.) A human skull placed beside it to show comparative size.
(Wall-case, No. 21.)

Diprotodon. Wall-case, No. 27.

The largest of this ancient family is called *Diprotodon* (Owen); the skull alone measures three feet in length, being six times as large as the great red kangaroo (*Macropus rufus*), the largest existing Marsupial. The fore-limbs were longer, and the hind-

limbs shorter, in proportion than in the living kangaroo, and its skeleton was altogether more robust. **Wall-case, No. 27.**

Another allied and extinct genus, but smaller than *Diprotodon*, was the *Nototherium*; it is distinguished from the former by the remarkable form of the skull, which is shorter and relatively broader, and the incisor teeth also differ in form, and were not so largely developed. **Nototherium.**

Of the Wombat family only three species are known living; they are of burrowing habits, and confined to Tasmania and the continent of Australia: the extinct forms varied in size from that of a marmot to a tapir. The largest of these are named *Phascolomys magnus* and *P. gigas*. The extinct forms belonging to the *Macropodidæ*, or true Kangaroos, but exceeding in size any of the living species, are the genera *Palorchestes*, *Procoptodon*, *Protemnodon*, and *Sthenurus*. **Table-cases, Nos. 15, 15a. Wombats.** **Table-cases, Nos. 14, 15.**

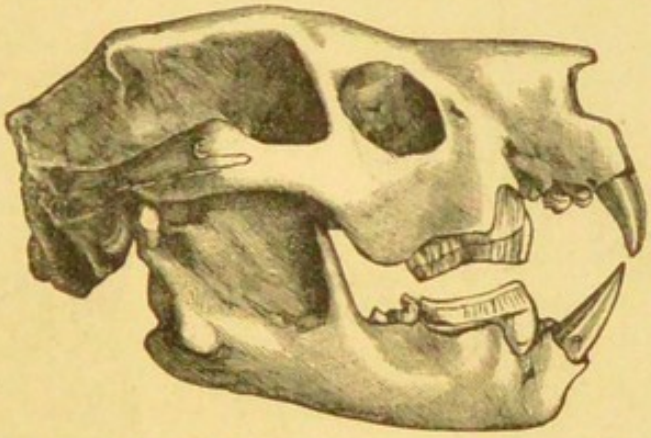


Fig. 29.—Skull and lower jaw, of an extinct Marsupial Carnivore (*Thylacoleo carnifex*), from the Newer Tertiary Deposits, Australia.

All these animals were herbivorous, subsisting on grass and roots; but one form, remarkably modified from the rest, yet nevertheless of the same marsupial class, is supposed by Sir Richard Owen to have been a true carnivore, and to have preyed upon these old giant kangaroos and wombats. It has been named by him *Thylacoleo carnifex*. **Thylacoleo. Table-case, No. 14.**

Nearly all the indigenous animals found in Australia, both in the past and also at the present day, had peculiar modifications of their skeletons characteristic of the class *Marsupialia*, and none are found out of that region of the globe save a single small family called "Opossums," or *Didelphidæ*, found in America. These little animals, with a small banded ant-eater (*Myrmecobius*); the Bandicoot (*Perameles*); with the larger Tasmanian devil (*Sarcophilus*); and the Tasmanian wolf (*Thylacinus*); are either insect-eaters, or prey upon animals smaller than themselves.

Most of the remarkable series of remains from Australia were obtained from caves, from lacustrine and river deposits on

Marsupialia.

Darling Downs, Queensland, associated with estuarine shells of the genus *Melania*, and from the Wellington Caves, New South Wales.

Table-case, No. 14a.

Earliest Mammal.

The earliest appearance of mammals at present known is in the Trias formation. Beds of this age have yielded the detached teeth of a small Marsupial (*Microlestes antiquus*) from near Stuttgart, Germany; a lower jaw of another (*Dromatherium sylvestre*) was found by Emmons in North Carolina; and a skull (named *Tritylodon longævus*, by Owen) has recently been obtained from Basutoland, South Africa. A specimen of *Polymastodon taoensis*, Cope, from the lower Eocene of New Mexico, offers, in its dentition, an interesting comparison with the *Tritylodon*, of Owen, from South Africa.

Tritylodon, Trias.

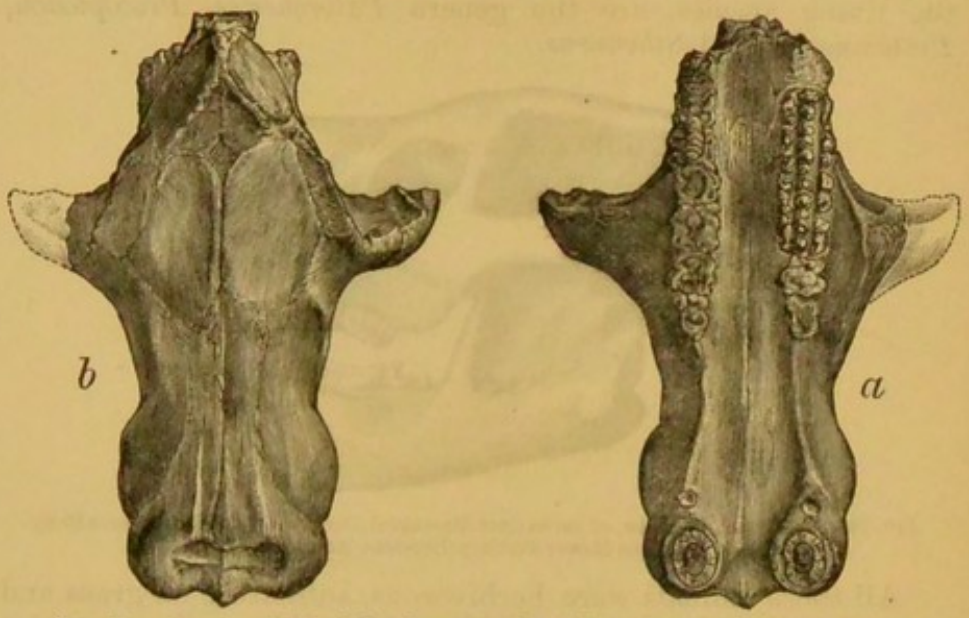


Fig. 30.—Cranium of *Tritylodon longævus*, Owen Trias, Basuto-land, South Africa. *a*=palatal view of skull, showing the dentition; *b*=view of the upper surface of the skull, ⅓ nat. size.

Microlestes.

Detached teeth of a small mammal were found by the late Mr. C. Moore in the Rhætic beds at Frome, Somerset, and named *Microlestes Moorei*, by Owen.

Phascolotherium, etc. Great Oolite.

Again, in the Great Oolite, of Stonesfield, near Oxford, the jaws of several small mammals were discovered and named *Amphitherium*, *Phascolotherium*, and *Stereognathus*.

Purbeck Mammals.

Lastly, Mr. S. H. Beckles, F.R.S., obtained a series of Mammalian remains from the Freshwater Limestone of Purbeck, Dorset, mostly consisting of lower jaws, which Sir Richard Owen has determined to belong to no fewer than fourteen genera and twenty-seven species, many of which did not exceed in size a rat or a mouse. These are all arranged in the Table-case with other small mammals from the Tertiaries of France and from the caves of Brazil, &c.

Table-case, No. 14.

Fig. 31.—Lower Jaw and Teeth (natural size) of *Triconodon mordax*, Upper Oolite, Purbeck, Dorset.

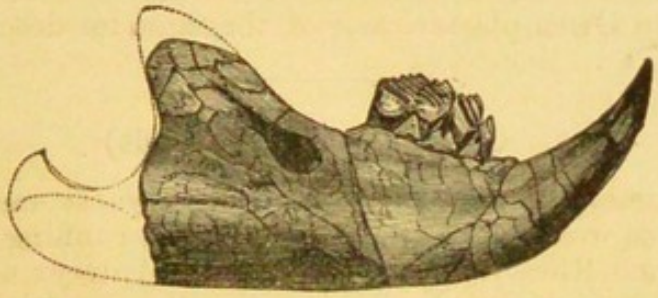


Fig. 32.—Lower Jaw and Teeth of *Plagiaulax Becclesii* (twice natural size), Upper Oolite, Purbeck, Dorset.

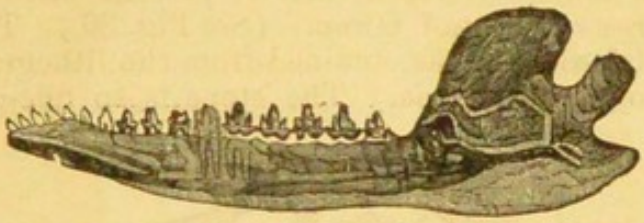


Fig. 33.—Lower Jaw and Teeth of *Amphitherium Prevostii* (twice natural size), Great Oolite, Stonesfield, Oxfordshire.

(Natural Size.)

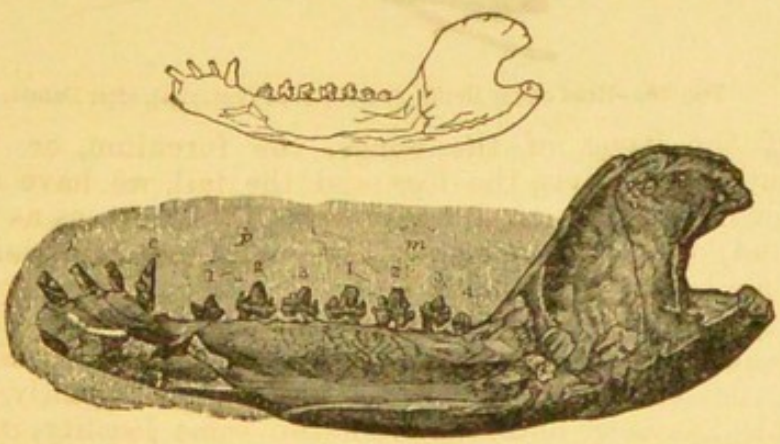


Fig. 34.—Lower Jaw and Teeth of *Phascolotherium Bucklandi*, from the Great Oolite, Stonesfield, Oxfordshire.

Sub-class III.—Ornithodelphia.

Order XII.—MONOTREMATA.

Table-case, No. 14a.

Echidna.

Remains of *Echidna* had been 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.

Class 2.—AVES (Birds).

Pavilion, Table-case, No. 13.

Oldest Bird known.

The Archæopteryx.

It had generally been considered that the most ancient type of birds known was 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,—especially so if the bird-like tracks met with on the Triassic sandstone slabs of the Connecticut Valley, in America, were made by a feathered biped—but the oldest fossil bird at present discovered is the *Archæopteryx macrura* of Owen. (*See* Fig. 36.) This remarkable long-tailed bird was obtained from the lithographic stone* of Solenhofen, in Bavaria. The stone is so fine-grained that

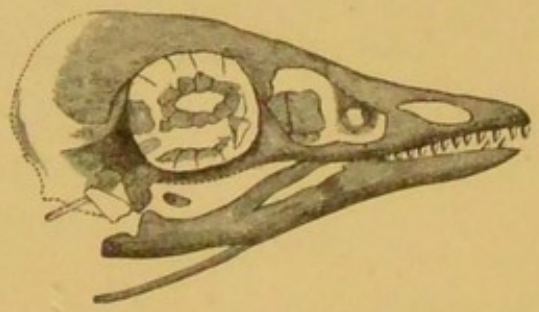


Fig. 35.—Head of the Berlin *Archæopteryx* (nat. size), after Dames.

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. Quite recently another example has been obtained from the same locality, in which the head is very well preserved; this specimen is in the Berlin

* The equivalent in age of the Kimmeridge clay of England.

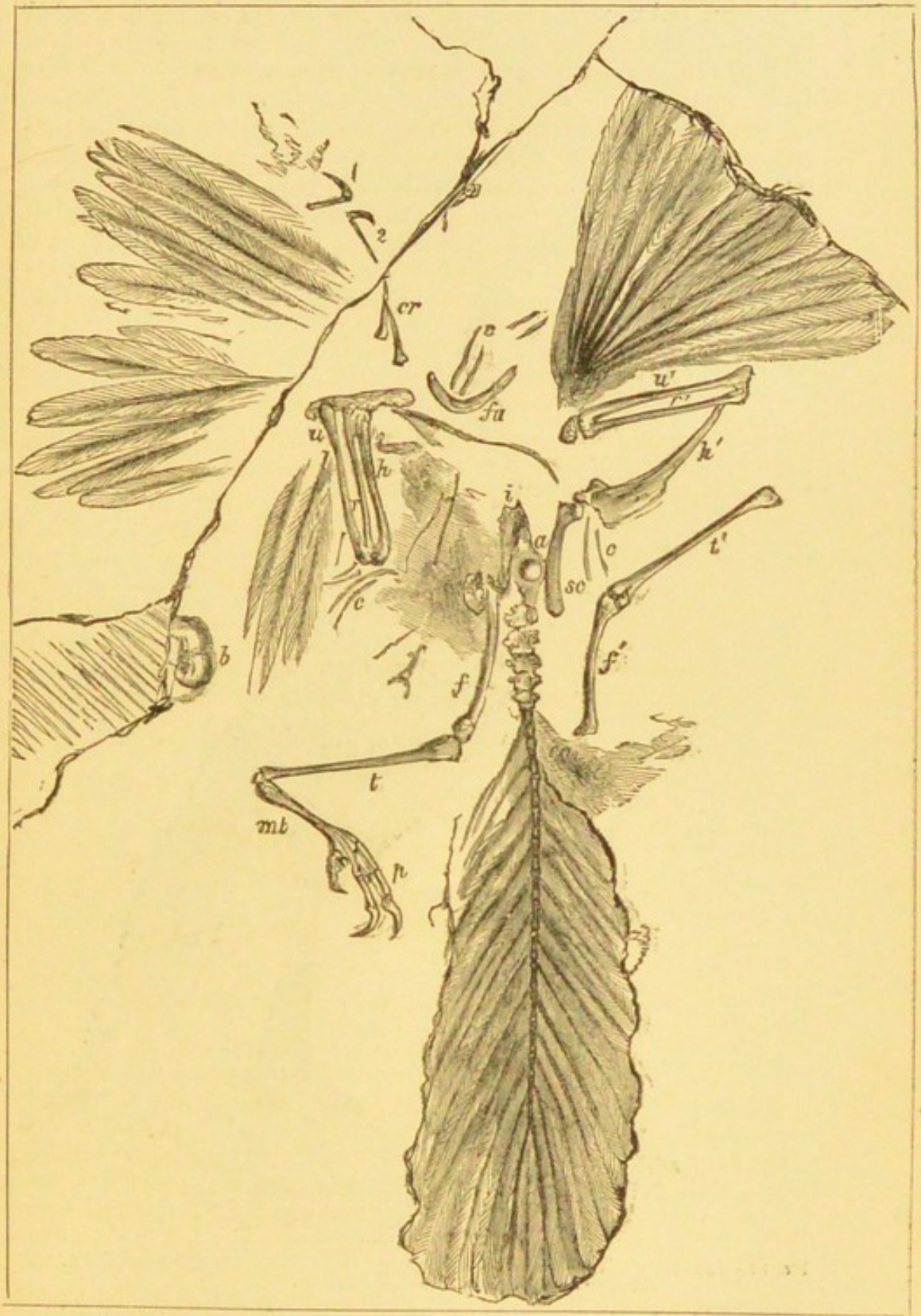


FIG. 36.—The Long-tailed Fossil Bird (*Archæopteryx macrura*, Owen), from the Lithographic Stone, Solenhofen, Bavaria. About one-fourth natural size.
(*See* Table-case, No. 13, in the Pavilion.)

The Berlin Archæopteryx.

Museum. An engraving of the Berlin specimen, presented by Prof. Dames of Berlin, is exhibited near the window. Further examination 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. 35, p. 60.)

FIG. 37.—Skeleton of *Hesperornis regalis*, Marsh, restored; about one-tenth natural size. (From the Cretaceous of Kansas, N. America.)

Here is also exhibited some fragmentary bones of another bird named *Palæornis Cliftii*, from the Wealden formation of Tilgate

Forest, and 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 shoulder of the wing, remains as a rudimentary bone. Its legs and feet were very powerful and admirably adapted for swimming. The teeth of *Hesperornis* were numerous and implanted in grooves, but the 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 Professor O. C. Marsh, F.G.S., by whom the series of casts were presented. 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.

Hesperornis.

Table-case, No. 13.

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

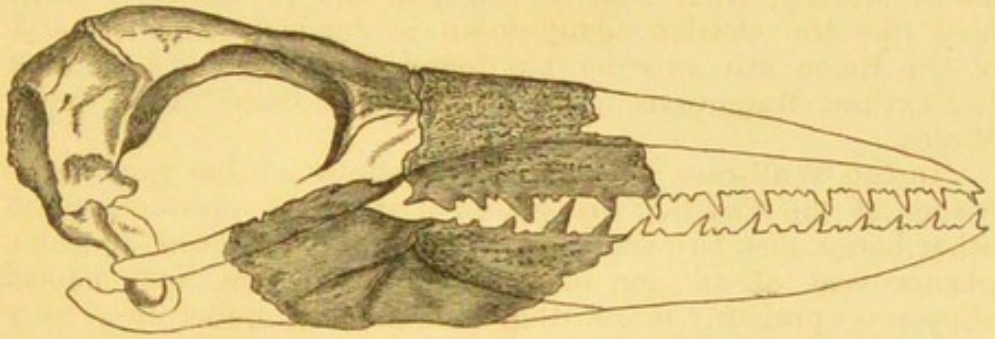


FIG. 38.—Skull of *Odontopteryx toliapicus* (Owen), a bird from the London Clay of Sheppey, with serrated mandibles; probably a fish-eating bird, like the Merganser.

One of these, *Dasornis londiniensis*, represented by a single imperfect skull, was as large as an ostrich, and probably closely related to that bird. 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. 38). There are also remains of a Vulture (*Lithornis vulturinus*), and of *Halcyornis toliapicus*, a little bird, probably allied to the kingfisher.

Dasornis, Argillornis, etc.

Here are placed the casts of the femur and tibia of *Gastornis parisiensis*, from the Lower Eocene of Meudon, 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, as well as to the RATITÆ.

Gastornis.

Gastornis Klaasseni.

* Proc. Zool. Soc., May 5th, 1885.

Table-case, No. 13.

The list of Eocene Tertiary birds is completed by the remains of *Palæortyx Hofmanni*, from the Eocene of Montmartre, Paris.

The remains of birds are rather more numerous in the Miocene and Newer Tertiary deposits, though seldom abundant.

The Ostrich in India.

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, and impressions of feathers from Oeningen and from the Brown Coal of Bonn, on the Rhine. But the largest assemblage of Miocene birds is from Allier, in France, from which some sixty-nine species have been obtained and described by Professor A. Milne Edwards.

Harpagornis.

Here are placed casts of the bones of a huge Eagle *(Harpagornis Moorii)*, from New Zealand; of the *Dromornis*, a large bird, like the Ostrich, found fossil in Australia, and remains of the Emeu, still existing, but found associated with those of the extinct Marsupials in the Wellington Caves, New South Wales.

Dromornis.

Table-case, No. 13.

Wall-case, No. 25.

In the Wall-case between the windows at the South-east corner of the Pavilion are placed a tibia and plaster casts of other bones, also two entire eggs, many broken pieces, and one plaster cast of an egg, of an extinct wingless bird, named *Æpyornis* (probably larger than an Ostrich), found in a very modern formation in the Island of Madagascar. One of the eggs of this bird measures 3 feet in its longest circumference and 2 feet 6 inches in girth, and its liquid contents equal a little more than two gallons. They are much larger in size than the eggs of the *Dinornis*, which are exhibited in the case on the South side of this room. In the same case may be seen bones of the Dodo *(Didus ineptus)* from the Isle of Mauritius, and a mounted skeleton of the great Auk *(Alca impennis)* from Funk Island; both these birds having become extinct in recent times.

Æpyornis, Dodo, and Great Auk.

Table case, No. 13a.

In Table-case, No. 13*a*, are remains of a gigantic goose *(Cnemiornis)* and of a land Coot or Rail *(Notornis)*, which, though rare, still exists in the island. Also of *Aptornis*, an extinct genus allied to the *Rallidæ*, and represented in the collection by many perfect bones of two species.

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

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

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 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

The "Moa," or Dinornis.

Glass-case R.

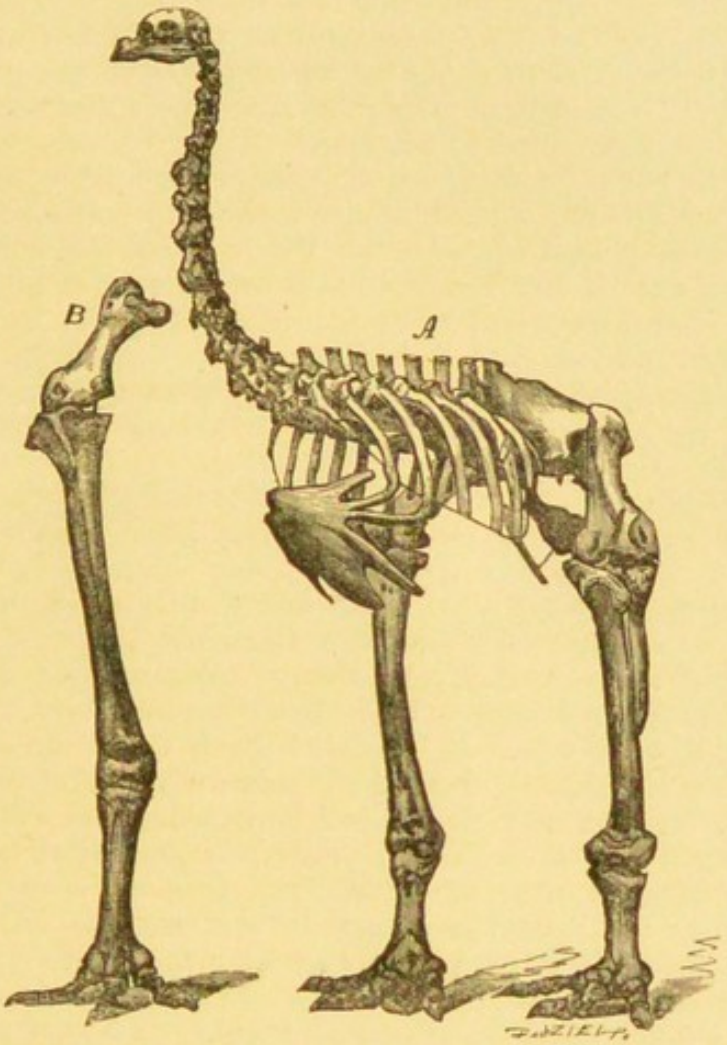


Fig. 39.—A, Skeleton of the "Elephant-footed Moa," *Dinornis elephantopus* (Owen), from New Zealand. B, Leg-bones of *Dinornis giganteus* (Owen), one of the largest of the extinct Wingless Birds of New Zealand.

like the modern Ostrich, whilst others were short and very stout-limbed, as in the specimen of *Dinornis elephantopus*, which was undoubtedly a bird of great strength, but very heavy-footed. (*See* Skeleton, Fig. 39.) *D. crassus* was also very robust of limb.

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 a little before these Islands were thrice visited by Captain Cook, 1769-1778. Their charred

The Moa, or Dinornis.

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" (*Dinornis didinus*), 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 also be seen *in situ*, the sclerotic plates of the eyes, and the sheaths of the claws. One foot also shows the hind-claw of the bird still attached to the foot.

Glass-cases R. and S.

Three nearly entire skeletons of *Dinornis* are placed in cases, *D. elephantopus* (Fig. 39), 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 (*D. parvus* only 3 feet) species of the Moa family. Here are also placed casts of the leg-bones, and the actual bones of other individuals, giving evidence of still more gigantic wingless birds from New Zealand.

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 Ostrich-like birds.*

In Africa we have the living African Ostrich which once extended through Arabia and Persia, into India, where its fossil remains have been found in the Siwalik Hills. In Madagascar has been found the *Æpyornis* fossil. 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 *Dinornis* (represented by 18 species), the *Mionornis* (2 species), the *Palapteryx* (2 species), the *Eurypteryx* (2 species), *all extinct;* and the living *Apteryx.*

REPTILIAN GALLERY.* Class 3.—REPTILIA.

Reptilian Gallery. Wall-case, No. 1.

Quitting the Mammalian Gallery, near its eastern end, we pass by the East Corridor (No. 3, on Plan), into the Reptilian Gallery (No. 4), which runs parallel with the former on its northern side.

This Gallery is devoted to the exhibition of the remains of fossil Reptilia, a class which includes the Tortoises and Turtles, Snakes, Lizards, Crocodiles, and a large number of extinct forms, the exact zoological position of many of which we can only judge by analogy. Like the Mammalia, the Reptilian class lived both on land and in the water; some being evidently fitted for terrestrial locomotion by their well-developed legs; others, as shown by their paddle-shaped limb-bones, must have passed their entire existence in the water. One group, now extinct, possessed, like the Bats and the Birds, the power of flight.

Order I.—PTEROSAURIA (Winged-Lizards).

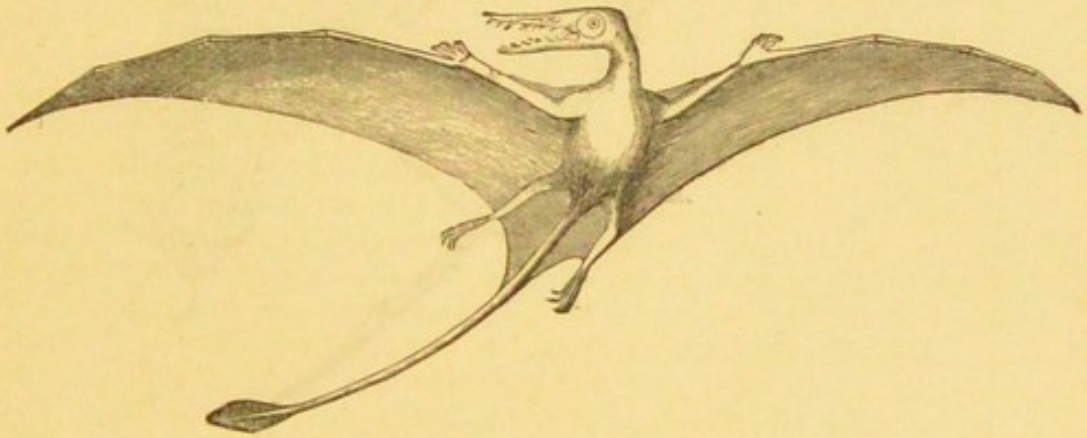


Fig. 40.—Restoration of *Rhamphorhynchus phyllurus* (Marsh), one-seventh natural size, from the Lithographic Stone, Solenhofen, Bavaria.

Pterodactyles. Wall-case, No. 1, Table-cases, Nos. 1 and 2.

In Wall-case No. 1, and in Table-cases Nos. 1 and 2, are placed the fossil remains of this last-named group of "Flying Lizards," or Pterodactyles. These animals had the centra of the vertebræ hollow in front; they possessed a broad *sternum* or "breast-bone," with a median ridge or keel, similar to that of birds; the jaws were usually armed with teeth fixed in sockets. The fore-limb had a short humerus, a long radius and ulna, and one of the fingers of the hand was enormously elongated to give support to the wing-membrane (*patagium*), which was attached to the sides of the body, arm, and the long finger, and also to the hind-limb and tail. The other fingers of the hand were free and furnished with claws. The wing-membrane appears

* Marked No. 4, on Plan facing p. 108.

Flying Lizards.

Wall-case, No. 1.

to have resembled that of the Bat, being destitute of feathers. The caudal series of vertebræ in some genera (as in *Rhamphorhynchus*) was greatly elongated and stiffened with slender ossified fibres (*see* Fig. 42). The bones were pneumatic (*i.e.*, filled with large air-cavities), the walls of the bones being very

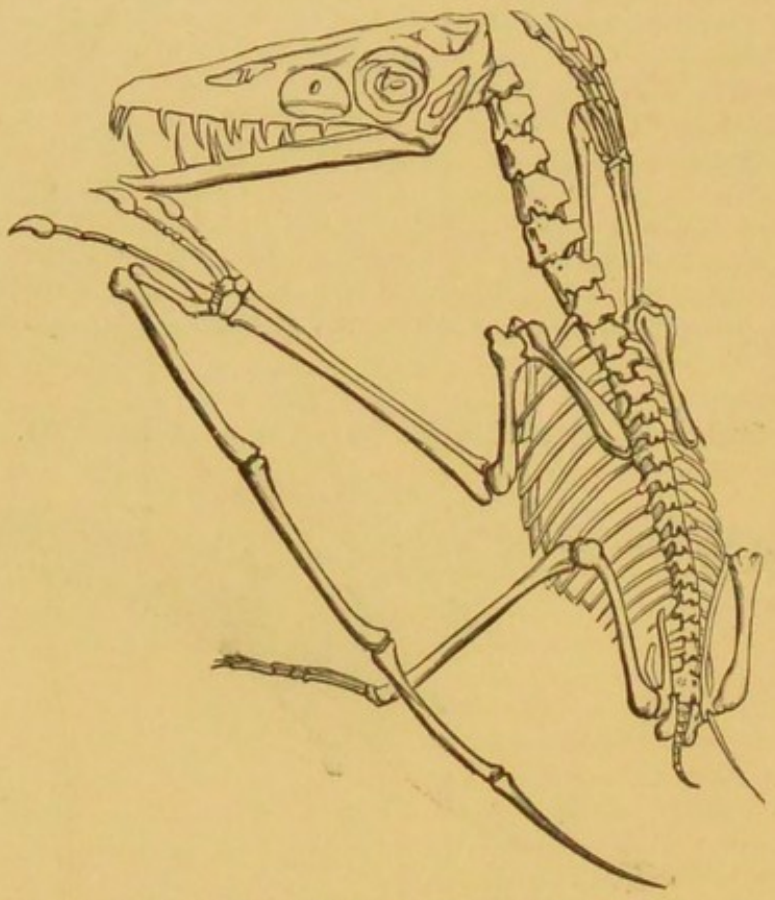


Fig. 41.—Skeleton of Flying Lizard (*Pterodactylus crassirostris*), from the Lithographic Stone, Solenhofen, Bavaria.

thin, and their substance very hard and compact, thus combining strength with lightness.

Numerous remains of nearly perfect Pterodactyles, both with long and short tails, and varying greatly in size, have been obtained from the Solenhofen Limestone in Bavaria—others occur in the Great Oolite at Stonesfield, near Oxford; and in the Lias formation, Lyme Regis, Dorset. The most remarkable of these English examples is the *Dimorphodon macronyx* from the Lias of Lyme, which had a large head, the jaws armed with lancet-shaped teeth, a long tail, and well-developed wings. The skull was 8 inches in length, and the expanse of the wings about 4 feet. (*See* Fig. 42.)

Dimorphodon.

Wall-case, No. 1.

Many remains have been discovered by Prof. Marsh in the Chalk of North America. One singular form, named by him

Pteranodon, had no teeth in its jaws, which were a yard in length, sharp-edged and pointed, and were probably encased in a horny sheath like the beak of a stork or heron.

The Flying Lizards of the Chalk and Greensand attained even a larger size—but their remains are all very fragmentary. For example, some detached vertebræ of the neck of one species have been found in the Cambridge Greensand, measuring 2 inches in length, and portions of humeri 3 inches broad. Such bones give evidence of a flying lizard having probably an expanse of wings of from 18 to 20 feet. The Pterodactyles of the Chalk of Kent were nearly, if not quite, as large. The smallest species was not larger than a sparrow. These singular flying reptiles do not appear to have lived longer than the period of time represented by the deposition of the strata from the Lias formation to the Chalk, their remains being confined to rocks of the Secondary, or Mesozoic age. They are now entirely extinct.

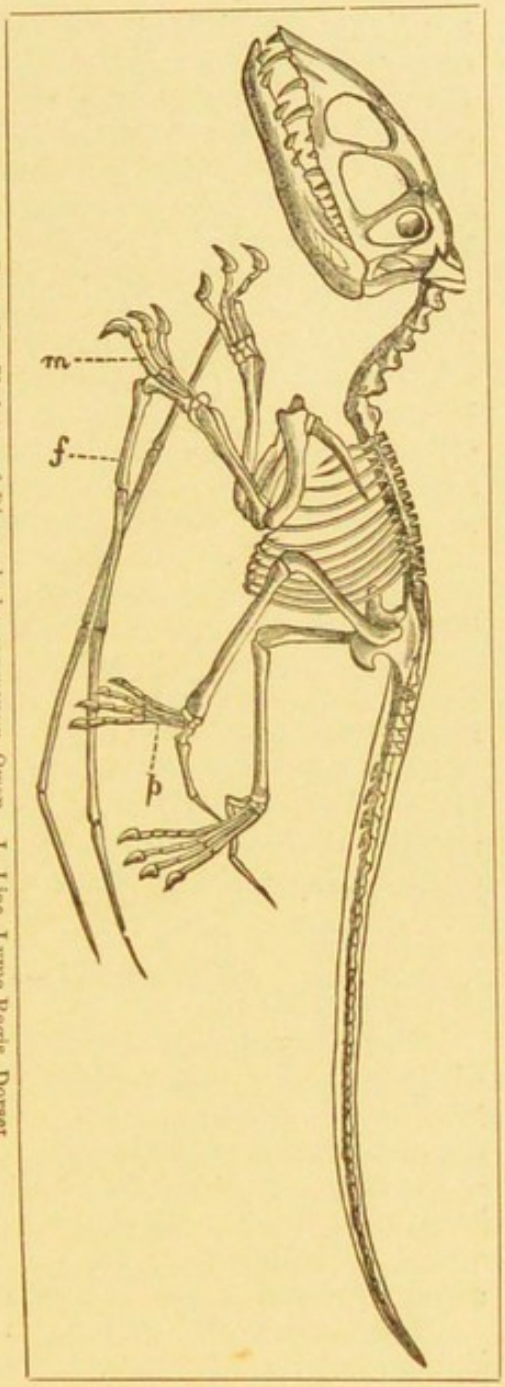


Fig. 42.—Skeleton of *Dimorphodon macronyx*, Owen. L. Lias, Lyme Regis, Dorset. *m* = manus; *f* = wing-finger; *p* = foot.

Order II.—CROCODILIA. (Crocodiles.)

Crocodiles. Wall-case, No. 2, and Table-cases, Nos. 2 to 7.

The Crocodilia (which are placed in Wall-case No. 2, and in Table-cases Nos. 2–7) have the body covered with a thick layer of oblong bony plates or scutes, pitted on the surface, and covered with a horny substance. They have a single row of teeth in distinct sockets, which are continually being renewed from below; the joints of the backbone of these reptiles

Crocodiles. Wall-case, No. 2. are either cup-shaped or concave at both ends, as in *Teleosaurus*; or concave in front and convex behind, as in the Crocodile from Sheppey and in all living Crocodiles. Professor Owen has constituted two groups, based on these modifications of the backbone. Of the earliest of these Crocodilian reptiles one is named *Belodon*, having long and pointed slightly-curved teeth, longitudinally grooved, and with elongated jaws like the modern Gharials; the other, named *Stagonolepis*, resembled the existing Caimans, but with an elongated skull like the Gharials; the body was covered by bony scutes. Both these reptiles are from the Trias, the former from Stuttgart, Germany; the latter from Elgin, Scotland. In the Oolitic and Liassic series the old type of long and slender-jawed Teleosaurs and Steneosaurs with strong bony scutes was abundantly represented.

Pelagosaurus. Glazed-case X. A coloured reproduction of the entire skeleton of the *Pelagosaurus typus*, from the Lias of Curcy, Normandy, prepared by Professor E. Deslongschamps, is placed in a glazed case between Table-cases Nos. 10 and 11, and marked x on plan.

Table-case, No. 4. From the Purbeck beds of Dorset we have a true Crocodilian, the *Goniopholis*; and a dwarf species, *Theriosuchus pusillus*, Owen (Table-case No. 4).

Table-cases, Nos. 2-7. A large Crocodile has been obtained from the Eocene Tertiary of the Isle of Wight, and from Hordwell, Hampshire; and remains of many species of Crocodiles and Gharials, from the Tertiary rocks of India, may be seen in the wall-case.

Order III.—DINOSAURIA.

Wall-cases, Nos. 3—7, and Table-cases, Nos. 7-10. The Dinosauria, Land-Reptiles.—This remarkable group of huge terrestrial reptiles is quite extinct. Some of them had bony dorsal plates and long and formidable spines (as *Acanthopholis*, *Polacanthus*, *Hylæosaurus*, &c.), others were without such defences. Most of these animals had flat or biconcave centra to their vertebræ, the anterior (cervical) vertebræ had hollow cups behind. Two pairs of limbs were always present, furnished with strong-clawed digits.

They were probably to some extent amphibious in their habits, but their limbs were well fitted for progression on the land.

Prof. Marsh has provisionally sub-divided the group into the following sub-orders, namely:—

Sub-order 1.—Sauropoda (Lizard-footed).

Wall-case, No. 3. The members of this group of Dinosaurs were all herbivorous, and included some of the largest forms hitherto discovered, by far the hugest being the American genus *Atlan-*

tosaurus, from the Jurassic of Colorado. Although no entire skeleton has been found, it is supposed to have attained a length of over 80 ft., and a height of 30 ft., as from the structure and relative proportions of the fore and hind limbs, it is assumed that these huge reptiles walked in an erect, or a semi-erect position, on their hind-feet. A plaster-cast of a thigh-bone (femur) shown in this case is 6 ft. 3 in. long.

Atlantosaurus. Wall-case, No. 3.

The *Cetiosaurus*, or "Whale-Lizard," thus named by Sir Richard Owen, from some resemblance in the form and structure of the posterior vertebræ to those of a whale (it must be borne in mind that the Cetiosaurs have really *no affinities* to the whales in any way whatever, save in name!) is another genus of these huge Saurians, whose remains are found in our own island, and of which three species are recorded, the earliest in geological time being the *C. longus* (Owen). Of this species a large portion of a skeleton of the same animal was discovered in 1870, in the Great Oolite at Enslow Bridge, near Oxford, and is preserved in the University Museum; but plaster-casts of the large bones of the extremities are placed in the case. The femur is 5½ ft. long, and the humerus 4 ft. 3 inches. The anterior vertebræ are large, with cup and ball articulations, they have large cavities in the centra, and are buttressed like those of *Ornithopsis*, an allied genus. A huge arm-bone (humerus) nearly 5 ft. long, from the Kimmeridge Clay, near Weymouth, has been referred to this genus, under the name of *C. humerocristatus*; it is at present the only evidence of the species known. *C. brevis*, from the Wealden of Sussex and the Isle of Wight, is represented by caudal and dorsal vertebræ, &c., including the original specimens from Dr. Mantell's collection, upon which the genus was founded.

Cetiosaurus, or "Whale Lizard."

Here are exhibited a series of vertebræ and other remains of a huge Dinosaur, named *Ornithopsis eucamerotus*, by Hulke, obtained from the Wealden formation, Brixton, Isle of Wight.

Ornithopsis. Wall-case, No. 3.

Ornithopsis was remarkable for the extreme lightness in construction of the bones of its neck and back, combined with great strength. A single dorsal vertebra had a centrum 10 inches long, and 25 inches in circumference at the front or convex end, whilst it measured in height to the summit of the dorsal spine 25 inches; and in breadth across the transverse processes 19 inches. A single centrum of one of the cervical or neck vertebræ measures 32 inches in length.

The centrum of each vertebra is composed of highly cellular bony tissue (like the frontal portion of the skull of the elephant), and has a large cavity on each side.* The dorsal and

* This cellular structure disappears as we reach the posterior vertebræ of the sacral and caudal series, which are solid and destitute of the cavities characteristic of the thoracic and cervical vertebræ.

Ornithopsis. Wall-case, No. 3. cervical vertebræ are opisthocœlous (*i.e.*, hollow behind, and convex in front), and each had articulations for a double-headed rib. The spinous processes are convex, and greatly developed, being rendered at the same time both extremely light and strong by struts and buttresses and thin sheets of bone, with large and deep recesses between.

Brontosaurus. The discovery of the entire remains of a huge Dinosaur in America, which when alive was nearly, or quite, fifty feet in length, named by Prof. Marsh, *Brontosaurus*, with dorsal vertebræ constructed upon the same type as *Ornithopsis*, fully confirms the accuracy of the conclusions arrived at by Prof. Seeley and Mr. Hulke as to the affinities of the latter animal.

Pelorosaurus. The *Pelorosaurus*, another large land Saurian of the Wealden period, is referred to this sub-order. It equalled, and probably exceeded, in size the largest Iguanodons, and is represented in the collection by several dorsal and caudal vertebræ, a sacrum, bones of the anterior extremities, and parts of the skeleton, all differing in form from the corresponding bones of the Iguanodon, the vertebræ being relatively much broader and also shorter in the long axis of the body. The humerus exhibited is 52 ins. long, and has a large medullary cavity indicative of terrestrial habits. The head and long bones of the hinder limbs are unknown.

Sub-order II.—**Stegosauria** (plated-Lizards).

Scelidosaurus, Case Y, on Plan. A large plated Dinosaur has been discovered in a tolerably perfect state, and is placed in a glazed case in the centre of the Reptile gallery.

It is from the Lower Lias of Lyme Regis, Dorset, and is a fairly complete skeleton of an herbivorous Dinosaur about 12 feet in length, closely allied by its dentition to *Iguanodon*, and described by Sir Richard Owen as *Scelidosaurus Harrisoni*. This reptile was armed with lateral rows of thick bony scutes or spines on each side, which extended along the tail also. There is also considerable disparity between the fore and hind-limbs, as in so many other Dinosaurs. There are four functional toes and one rudimentary one on the hind foot; the fore-foot is not well preserved and the number of digits cannot consequently be clearly made out in the hand.

Hylæosaurus. The long dermal spines of *Hylæosaurus*, another armed Dinosaur from the Wealden, were arranged in a single row along the central line of the back.

Polacanthus. Wall-case, No. 4. Table-case, No. 7. The *Polacanthus*, or many-spined Dinosaur, from the Wealden formation near Brixton, Isle of Wight, appears, as regards its dermal covering, to have been one of the most heavily-armed of these old dragons. Its body was protected by a series of long, laterally-compressed, and more or less acutely triangular osseous spines, and also by numerous plain and keeled

scutes; whilst the pelvic region was covered by a large shield or carapace of thick bone firmly united to the vertebræ and ribs, like the carapace in a turtle. The tail was also protected by strong bony dermal scutes. **Polacanthus. Wall-case, No. 4.**

Many of the limb-bones and vertebræ of the back and tail were found associated with the spines, but no remains of the neck or head.

The bases of the spines are broad and asymmetrical, showing that they were arranged in one or more rows on either side of the central line of the back. The largest of these spines exhibited measures in its longest diameter about ten inches and in height thirteen inches.

A smaller Dinosaur, named *Acanthopholis*, found in the Lower Chalk of Dover, was also armed with spines, but only a few fragmentary remains of it are preserved in the collection. **Acanthopholis. Table-case, No. 7.**

In this sub-order are also provisionally placed the remains of a large Dinosaur from the Kimmeridge Clay of Swindon, Wilts, described by Sir Richard Owen in his Monograph on the Fossil Reptilia of the Mesozoic Formations (Palæontographical Society's Volume for 1875), under the name of *Omosaurus armatus*. The series comprises, in an immense block, the iliac bones of either side with the entire sacrum, retaining the normal form and position, an ischium, a femur, several dorsal and caudal vertebræ projecting in bold relief from the background of grey stone, forming a magnificent fossil group unique of its kind. **Omosaurus. Wall-case, No. 4.**

In addition to the bones above mentioned (which are all imbedded in one block 6′ 0″ × 7′ 6″), a large dermal spine, several centra and processes of many vertebræ and chevron-bones, an entire humerus, ulna and radius with carpal and metacarpal bones, all parts of the same fore-limbs; also a complete ischium and pubis, and six caudal vertebræ, were found lying in the clay around the larger mass.

The femur measures more than 4 feet, and the humerus is nearly 3 ft. in length and enormously broad. The head and neck are unfortunately wanting, but there is little doubt that nearly the entire animal might have been obtained had some competent person been present in the pit when the remains were first observed.

Sub-order III.—**Ornithopoda** (Bird-footed).

We are mainly indebted to the researches of Prof. Huxley and Mr. J. W. Hulke for a knowledge of *Hypsilophodon Foxii*, a small Dinosaur from the Wealden, about 4 feet in length. The animal has four large and powerful digits to the hind **Hypsilophodon. Table-case, No. 9.**

foot, and a small rudimentary fifth outer toe; an extremely small fore foot, with four digits and a fifth rudimentary one. The sharp-pointed and curved ungual phalanges indicate that it was probably arboreal and rock-climbing in its habits. The sides of the crowns of the teeth are finely-serrated, and repeat in miniature the serrations of the crown of the teeth of *Iguanodon*. *Hypsilophodon* was destitute of any dermal armour. Remains of parts of several individuals have been met with at Brixton, in the Isle of Wight.

Hypsilophodon.

Small Glass-case, y.

"Mantell's *Iguanodon*."—This is one of the largest of the great extinct land-reptiles, some of which certainly rivalled the elephant in bulk.* The femur (thigh bone) alone measured 4 to 5 feet in length. The fore-limbs were very short, so that it is almost certain that it did not make use of them constantly for progression on the ground, but could readily raise itself into an upright position, the weight of its body being counter-balanced by its long and ponderous tail, although it was far too bulky to progress after the manner of a kangaroo. The slab

Iguanodon Mantelli.

Wall-cases, Nos. 5 and 6, and Table-case No. 8.

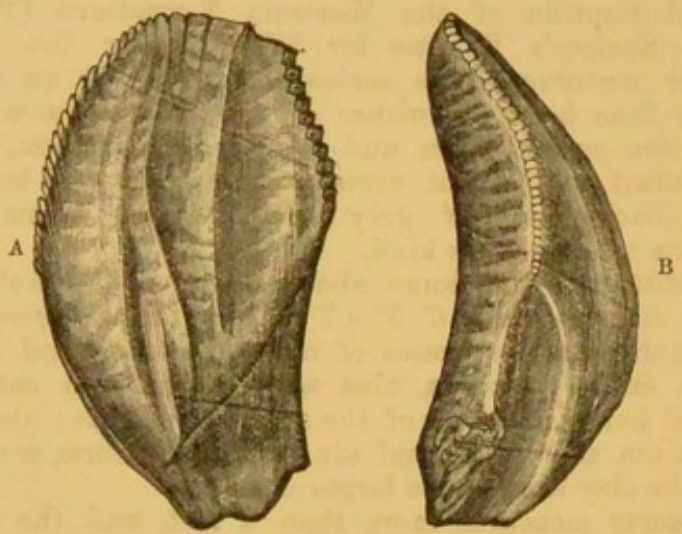


Fig. 43.—A, Outer view; B, Profile of Tooth of *Iguanodon* (natural size), Wealden, Isle of Wight.

in the centre of Case 6 contains a great portion of the skeleton of a young individual of *Iguanodon Mantelli* from Bensted's Kentish Rag quarry at Maidstone, in which the disproportion of the fore and hind limb is well shown. It will be seen that the bones of the arm and fore-arm (humerus, and radius and ulna) are barely half the length of the thigh and shin bone (femur and tibia). This difference between the leg and arm seems to have been a marked feature in a large number of

* As many as twenty-four of these huge reptiles were recently obtained from the Wealden of Belgium, and three or four almost complete skeletons have been put together in the Brussels Museum, proving it to have been more than 30 feet in length.

Dinosaurs, as may be well seen in *Compsognathus* and many others.

The restored skeletons of *Iguanodon* exhibited in the Brussels Museum also show this disproportion very clearly.

The *Iguanodon* was a vegetarian in its diet, as is proved by its teeth, which correspond with those of the living and vegetable-feeding *Iguana* of S. America.

Iguanodo
Wall-case
No. 6.

Their fossil teeth are not unfrequently found worn down at the crown, like the molar teeth of the herbivorous mammalia at the present day. They were implanted in distinct sockets, and a succession of teeth always growing up from beneath replaced the worn-down stumps. The teeth are curved and leaf-shaped in form, and the edges are elegantly serrated, a character peculiar to all the vegetable-feeding Dinosaurs, such as *Acanthopholis*, *Scelidosaurus*, and the South African genera, *Anthodon* and *Pareiasaurus*. (*See* Woodcut, Fig. 43.)

Table-cas
No. 8.

The genus *Orthomerus* (Seeley), an Iguanodont and a species of *Megalosaurus*, from the Upper Chalk of Maestricht, appear as far as yet known to be the most recent, and probably the last, representatives in Europe in geological time of the great group of terrestrial Dinosaurs. Both species are founded upon a few long bones of limbs in the collection, and assuming them to have belonged to fully adult animals, their small proportions, when compared with those of their predecessors, probably indicated degeneration in an expiring race.

Table-cas
No. 9.

Sub-order IV.—**Theropoda** (Beast-footed).

Numerous other fine Dinosaurian remains are to be seen in the collection, but as we do not know the teeth of many of these huge reptiles, we cannot speak positively as to their habits. It is certain, however, that, from the Trias to the Chalk, two groups have existed, one having a carnivorous dentition, and the other being herbivorous. *Teratosaurus* of the Trias of Stuttgart, *Megalosaurus* and *Compsognathus* of the Oolitic and Wealden strata were all carnivores. The actual counterpart and casts of the maxilla and premaxilla and a portion of the ramus of the lower jaw of *Megalosaurus* from the Inferior Oolite, Sherborne, Dorset, may be seen in the Wall-case. But of *Polacanthus*, *Omosaurus* *Hylæosaurus*, and *Cetiosaurus* * we have no direct

Teratosau
rus.
Megalosa
rus.
Table-cas
No. 10.
Wall-case
No. 4.

* A single detached tooth has been found in the same quarry at Enslow Bridge, near Oxford, from which the bones of *Cetiosaurus* were obtained; it is like that of Iguanodon.

dental evidence. No doubt, as amongst the Mammalia at the present day, the majority were vegetable feeders, and the minority were predaceous in habit. The Cretaceous genus *Lælaps* was, in America, the representative of the carnivorous *Megalosaurus* of our Secondary rocks.

Lælaps.

Megalosaurus.

Many species of *Lælaps* have been identified, and a series of plaster-casts of bones of *Lælaps aquilunguis* are shown in the case.

Wall-case, No. 7.

Sub-order V.—**Cœlurĭa** (Hollow-tailed).

This sub-order is not represented in the collection.

Sub-order VI.—**Compsognatha** (Slender jaws).

Compsognathus.

Table-case, No. 10.

The skeleton of a small Dinosaurian reptile, of which a beautiful cast may be seen in Table-case No. 10, the original being preserved at Munich, named *Compsognathus longipes*, has been found entire in the lithographic stone of Solenhofen. From the relative proportions of its limbs we cannot but conclude that it must have "hopped (like a Jerboa), or walked in an erect or semi-erect position, after the manner of a bird, to which its long neck, slight head, and small anterior limbs must have given it an extraordinary resemblance." (Huxley.)

Sub-order VII.—**Hallopoda** (Leaping-foot).

This sub-order is not represented in the collection.

Wall-case, No. 7, and Table-case, No. 10.

Dinosaurs of uncertain affinities :—

In Wall-case No. 7, and Table-case No. 10, are placed the remains of several genera of Dinosaurs whose exact affinities are not defined. They include *Tapinocephalus*, *Pareiasaurus*, and *Anthodon*, from the Triassic deposits of South Africa; *Bothriospondylus*, from the Kimmeridge Clay; *Streptospondylus* and *Poikilopleuron*, from the Wealden; and *Thecospondylus*, only known by a natural cast of the neural cavity of an entire sacrum, having only a few fragments of the bone adherent to it. It was discovered in the Hastings sand (Wealden), near Tunbridge Wells.

Pareiasaurus serridens was obtained by Mr. Bain from the reptiliferous Triassic sandstone near the Winterberg, Cape of

Good Hope. The teeth are close-set, in an alveolar groove; they resemble those of the *Iguanodon* in their mode of implantation, and those of the *Scelidosaurus* in their close arrangement and nearly uniform wear. The degree of abrasion indicates, as in the Iguanodon, that they were applied to the mastication of vegetable substances. Pareiasaurus. Wall-case, No. 7.

Fifteen or sixteen teeth are closely set on each side of both the upper and lower jaws. As in man, there is no diastema in the dental series, no one tooth is longer than the rest. But there is still greater uniformity in the teeth of this ancient Saurian. There is absolutely no character by which to separate the incisors, or canines, or false or true molars. All the teeth are equally worn, and show by their abraded border that they have taken an equal share in the pounding as well as the cropping of the vegetable food upon which it subsisted (Owen).

The animal measures fully nine feet in length, and the shape of its skull and jaws are remarkably like those of the Batrachia.

Tapinocephalus is represented by an imperfect portion of skull, also several entire limb-bones and vertebræ.

Order IV.—ANOMODONTIA.

Sub-order I.—Theriodontia (Beast-toothed).

The Theriodontia form a remarkable group of carnivorous reptiles, first described and thus named by Sir Richard Owen* in reference to the form and order of arrangement of the teeth bearing a greater resemblance to the dentition of the Mammalia than any other group of the class Reptilia, for, as in the carnivorous mammals, the incisors are separated from the molars by well-developed canines; and the canines of the lower jaw crossed those of the upper in front. In many of the genera the upper canines are long and trenchant, and the incisors large and close together (*Lycosaurus*, *Ælurosaurus*, etc.), the molars, as a rule, being smaller than the incisors. In most reptiles, living and extinct, the teeth that are worn away by use, or otherwise lost, are replaced by others that are constantly forming in the jaws; but there is no evidence of preceding teeth, like the milk teeth in mammals, nor of successional teeth, in the jaws of the Theriodonts. From this negative evidence Sir Richard Owen assumes them to have been "Monophyodont" reptiles, having but one set of teeth, which were permanent during life. He has described eleven genera, varying in the size and form of the skull and teeth. The specimens exhibited have all been obtained from rocks of Triassic age in South Africa, and are all type specimens of the species figured and described in the work already quoted. Theriodontia. Table-case, No. 11.

* "Catalogue of the Foss. Rept. of S. Africa," 4to, Lond. 1876.

Sub-order II.—**Dicynodontia** (Double Dog-toothed).

Dicynodon.

Wall-case, No. 7.

In Wall-case No. 7 is arranged a further series of S. African reptilia belonging to the sub-order Dicynodontia, such as *Dicynodon*, &c.

The Dicynodonts* are a very peculiar family of reptiles from the Trias of South Africa. The skull is massive and remarkable in form, and is furnished with a single pair of huge sharp-pointed tusks growing downwards, one from each side of the upper jaw, like the tusks in the Walrus. No other kind of teeth were developed in these singular animals; but the premaxillaries were confluent and sharp-edged, and formed with the lower jaw a beak-like mouth, probably sheathed in horn like the Turtles and Tortoises. Several species have been described from South Africa and India, and quite recently (1885) remains of the genus have been discovered in the reptiliferous sandstone of Elgin, Scotland.

Table-case, No. 11.

The genus *Ptychognathus* is nearly related to *Dicynodon*.

Sub-order III.—**Rhynchocephalia** (Beak-headed Lizards).

Rhyncho-saurus.

Under the name of *Rhynchosaurus articeps*, Prof. (now Sir Richard) Owen described and figured, in 1842, a very interesting reptile from the fine-grained white Triassic sandstone of the Grinsill quarries near Shrewsbury (Trans. Cambridge Phil. Soc., vol. vii., part iii., p. 355, pl. 5 and 6).

Wall-case, No. 7.

The vertebræ are biconcave, but whilst in some characters of the processes they resemble recent lizards, in others they present characters like those of the Dinosauria.

Table-case, No. 12.

The skull presents the form of a four-sided pyramid compressed laterally; it is also remarkable for the beak-like prolongation of the premaxillaries, which are pointed and recurved, and must have been encased in a horny sheath, like the mandible of a bird of prey.

It had also, like the still existing New Zealand lizard *Sphenodon* (*Hatteria*), to which it is closely allied, two rows of minute acrodont teeth, united to a sharp edge of the maxillary and palatine bones respectively, between which the teeth of the lower jaw fit in a longitudinal groove. This character was unknown until quite recently, when a skull in the collection, having the mandibles in natural position, was skilfully developed from the matrix, and revealed the fact, which is here for the first time recorded. The biconcave form of the vertebræ, sternal and abdominal ribs, and general characters of the limbs, also show the near affinity of this ancient extinct land-lizard to its living representative.

* The genus, *Dicynodon*, is so called from δις, two, and κυνοδος, canine tooth, from the two tusk-like canines in the upper jaw.

Another form, but of much larger proportions, named by Prof. Huxley, *Hyperodapedon*, has been obtained from the Triassic sandstone of Elgin, Morayshire, Scotland, having the same compressed broadly triangular form of skull, with the orbits directed upwards and the premaxillaries prolonged into a sharp re curved beak, like *Rhynchosaurus*, which must have been encased in a similar horny sheath. **Hyperodapedon. Table-case, No. 12.**

The dentition is very peculiar, for, unlike the *Rhynchosaurus*, the maxillary and palatine bones were provided with several rows of well-developed low conical teeth closely set, and so arranged posteriorly as to form a deep longitudinal groove between two or more rows of teeth on each side for the reception of the marginal teeth of the mandible; these teeth are small and closely arranged, and wear by attrition with the upper teeth into a sharp cutting edge. There is also present on the inner side of the mandible a series of large and obtuse teeth.

The fine specimen of *Hyperodapedon Gordoni* exhibited from Elgin shows the head, neck, and body region, and some of the limb-bones in fair preservation, but the whole of the caudal region is absent. It was a terrestrial reptile, and attained a length of six or seven feet, and does not appear to have been armed with scutes or spines, but there are traces of wrinkled (skin) markings on the slab near the vertebræ.

A much larger species, named *Hyperodapedon Huxleyi*, is from the Triassic deposits of Maledi, India, of which a good series of the jaws is exhibited. It is computed to have attained a length of 17 ft.

Two other sub-orders, from the Trias of South Africa, have been proposed by Sir Richard Owen, namely:—

Sub-order IV.—**Cryptodontia** (Concealed tooth).

Comprising the genera *Oudenodon*, *Theriognathus*, and *Kistecephalus*.

Sub-order V.—**Endothiodontia.**

Genus *Endothiodon*.

Sub-order VI.—**Placodontia** (Plate-toothed).

The genus *Placodus*, from the Muschelkalk of Germany, offers a remarkable modification in its dentition not usually met with in the reptilian class, but of which the class of fishes affords numerous examples. The skull is as broad as it is long, the greatest breadth being behind, whence the sides converge to an obtuse muzzle. Owen says, the temporal fossæ are the widest and the zygomatic arches the strongest in the reptilian class, **Placodus. Table-case, No. 12.**

Placodus. Table-case, No. 12.

and the lower jaw presents a similar strong development of the coronoid process. This powerful action of the jaws for biting and grinding relate to the form and size of the teeth, which resemble paving-stones, and were evidently adapted to crack and bruise shells of Mollusca, Crustacea, and perhaps Echini also.

The upper jaw contains a double series of these teeth, an outer, or maxillary series, and an internal or palatal series; but the under jaw has only a single row of teeth.

Although now admitted to be a reptile, the true affinities of this remarkable genus are at present unknown. Formerly it was classed by Münster and Agassiz as one of the Pycnodont fishes.

Order V.—ICHTHYOSAURIA (Fish-Lizards).

Wall-case, No. 14, Table-cases, Nos. 13 and 14.

These great marine reptiles had very short necks (*see* Woodcut, Fig. 44), probably not visible at all externally; the vertebræ were numerous and deeply biconcave; the skull had very large orbits, and the eyes were surrounded by a ring of broad bony (sclerotic) plates. The jaws were elongated, and armed with powerful teeth implanted in grooves. The hand and foot are modified into fin-like organs, composed of short polygonal bones, arranged in five closely approximated rows, with supernumerary rows of marginal ossicles added.

The largest entire *Ichthyosaurus* is from Lyme Regis, and measures 22 feet in length and 8 feet across the expanded paddles; but detached heads and parts of skeletons prove that they often attained a far larger size than this.

In some of the Ichthyosaurs the jaws are prolonged into a long and slender rostrum; others have short and robust heads, and jaws armed with large teeth. A most perfect example of the long and slender-jawed form of *Ichthyosaurus tenuirostris*, from the Lower Lias of Street, Somerset, has recently been presented (1884) by Alfred Gillett, Esq., of Street.

These old marine lizards must have exercised the same repressive action over the teeming animal population of the old Liassic seas that the sharks do in our seas at the present day. They existed during the long period of geological time represented by the several formations extending from the Rhætic to the Chalk inclusive (*see* Table of Stratified Rocks, p. 10), but they occur in the greatest abundance, both as regards individuals and species, and also in the most perfect preservation, in the Lias formation. Nearly entire skeletons of both young and adult animals have been obtained from beds of this age with but few of the bones displaced, as may be seen by many specimens in the Wall-case.

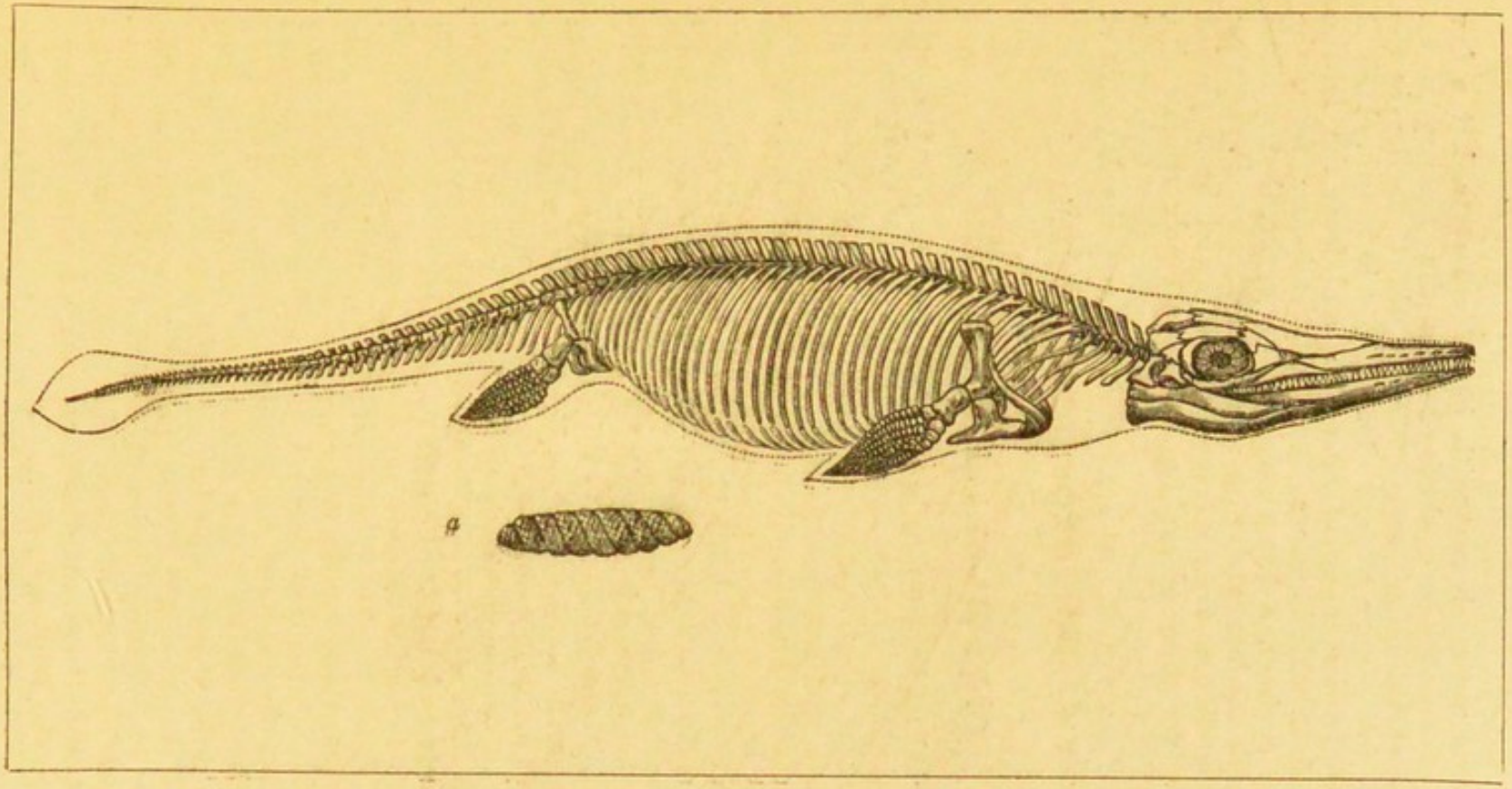


FIG. 44.—Skeleton of the Short-necked Marine Fish-Lizard (*Ichthyosaurus*), from the Lias of Lyme Regis, Dorset.

a represents one of the fossil coprolites of these saurians.

Order VI.—OPHIDIA (Serpents).

Serpents.
Table-case, No. 15.

Serpents are rarely met with in a fossil state, but a few such remains have been obtained from the Tertiary rocks. The earliest Ophidian* represented in the Collection is the

Palæophis.

Palæophis toliapicus, a serpent about 12 feet in length, obtained from the London Clay of Sheppey; and from the Middle Eocene of Bracklesham we have a still larger form, the *Palæophis typhæus*, a boa-constrictor-like snake, that attained a length of 20 feet, and also a smaller species, *P. porcatus*; whilst the Upper Eocene sands of Hordwell have yielded numerous vertebræ of snakes, but of a much smaller size,

Paleryx.

namely, the *Paleryx rhombifer* and *P. depressus*. Others are recorded from the Miocene of Œningen and the Lignites of Bonn-on-the-Rhine, and are exhibited in this case.

Order VII.—LACERTILIA (Lizards).

Lizards.
Protorosaurus.

The earliest known member of the large group of Lacertian reptiles is the *Protorosaurus Speneri*, from the Permian "Copper-slates" of Thuringia. Though capable of progression on land, it was evidently of aquatic habits, feeding upon the *Palæoniscidæ* and other fishes, which abounded in the seas of that period.

Wall-case, No. 8, and Table-cases, 15 and 16.

From the Trias of Elgin in Scotland, we have the very small Lacertian, the *Leptopleurus (Telerpeton)*, not exceeding seven inches in length.

The *Saurosternon* is a small form of Triassic lizard, from the reptiliferous sandstones of South Africa.†

From the deposits of Oolitic age we have the *Homœosaurus*, a genus of small lizards from the lithographic stone of Solen-

Macellodus.

hofen: the *Macellodus* and *Saurillus*, mostly known by jaws and teeth from the Purbeck beds of Swanage, Dorset; and also the *Echinodon*, a larger form, probably of aquatic habits. The

Echinodon.

teeth were flat, broadly pointed, and the upper edges strongly serrated, hence the name "prickly-tooth." A more formidable saurian from the same deposit is the *Nuthetes destructor*, allied

Nuthetes.

to the Monitors. The teeth are flat, recurved, and finely serrated on their anterior and posterior margins, like miniature teeth of *Megalosaurus*, which they resemble. From the Chalk of

Dolichosaurus.

Sussex and Kent have been obtained the *Coniosaurus*, and the snake-like lizard *Dolichosaurus longicollis*.

Here are placed the remains of the great aquatic lizard-like

Mosasaurus.

reptile which once inhabited the shores of the sea in which the uppermost Chalk, or Maestricht beds, were deposited, and

* M. Sauvage has described Ophidian Vertebræ from the Chalk of France.
† Its exact zoological position seems to be still a matter of some uncertainty.

known as the *Mosasaurus*, whose powerful jaws, armed with great grooved, recurved, conical teeth, have been obtained from St. Peter's Mount, near Maestricht, and (under the name of *Leiodon*) from the Chalk of Norfolk and Kent. Remains of over forty species of this tribe have been found in the Cretaceous rocks of New Jersey, Kansas, &c., in North America. One of these, the *Mosasaurus princeps*, is computed to have been 75 to 80 feet long. The body was covered with small overlapping bony plates. The paddles, which were four in number, each with five digits, had a remarkable resemblance to the "flippers" of a whale.

Mosasaurus.
Wall-case, No. 8.

Here are exhibited the *Pleurosaurus*, and the *Geosaurus*, from the lithographic stone (Upper Oolite) of Solenhofen, Bavaria. Baron Cuvier inferred, from the form and structure of its skull, that *Geosaurus* held an intermediate place between the crocodiles and the monitors, but was more nearly related to the latter. The orbits are large and the eyes were protected by bony sclerotic plates, like those of *Ichthyosaurus*. It had numerous, large, compressed, and slightly recurved teeth, and the vertebræ are constricted and biconcave. It probably attained a length of ten or twelve feet. The original specimens from Monheim, first described and figured by Sœmmering in 1816, as a gigantic lizard *(Lacerta gigantea)* are exhibited in the case.

Geosaurus.

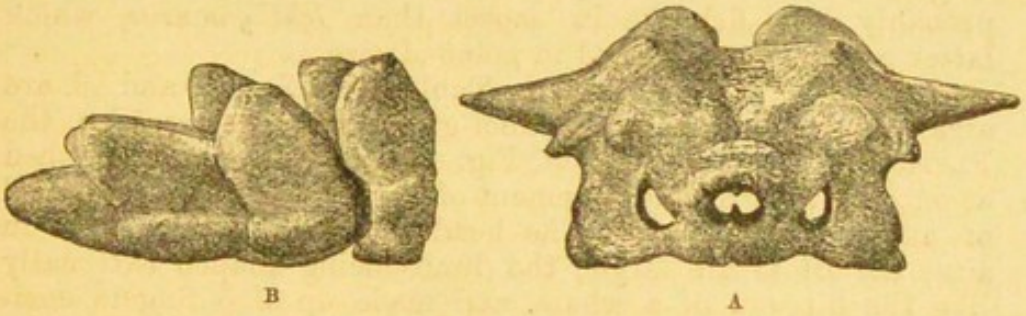


FIG. 45.—A, The Skull, and B, the Tail-sheath, of the great Horned Lizard (*Megalania prisca*, Owen) from the Newer Tertiary deposits of Australia.

Next to these are placed the remains of a great extinct land-lizard (*Megalania prisca*, Owen)* from Australia, 14 feet, or even more, in length, with nine horn-like prominences on its skull, which measured 1 foot 10½ inches in breadth. The skull, at first glance, looks like that of some flat-headed form of Ox; but the bones are altogether dissimilar, and the jaws are without teeth. It was probably a vegetable feeder, like its pigmy living representative (*Moloch horridus*), also from Australia, which has horny dermal prominences on its head, but the entire length of this little lizard is only seven inches.

Megalania.
Wall-case, No. 12.

* Now referred by Professor Huxley to the Chelonia. Will be transferred to that order in the New Edition, now in the press.—H. W.

Table-cases, Nos. 15 and 16.

Other remains were sent over in 1880, showing that it possessed a tail encased in a horny sheath (*see* Fig. 45, B), so like the armour-plated tail of the great extinct non-banded Armadillo *(Glyptodon)* from South America, that had the tail arrived before the head and vertebræ had been received, it might well have been cited to prove the former existence of the *Glyptodon* in Australia. (See *Phil. Trans.* 1858, 1880, and 1881.) Still further evidence of probably another genus of horned-lizard has been obtained from a coral sandstone formation on Lord Howe Island, 1,000 miles from the coast of Australia, whence the first specimens were obtained. Other fossil remains of Lacertilia occupy Table cases Nos. 15 and 16.

Order VIII.—PLESIOSAURIA.

Pliosaurus. Wall-cases, Nos. 9 and 10, and Table-cases, Nos. 17, 18, and 19.

In Wall-cases Nos. 9 and 10, and in Table-case No. 17, are placed the remains of one of our largest marine reptiles, the *Pliosaurus*, from the Kimmeridge Clay, near Ely, and also from Dorsetshire. We have no entire skeleton of this animal, but the cast of a swimming-paddle (the original of which is preserved in the Dorchester Museum) measured 7 feet in length; its jaw was 6 feet long, and one of its teeth was 15 inches in length. It had a shorter neck than the *Plesiosaurus*, but was probably less fish-like in aspect than *Ichthyosaurus*, which latter reptile it outrivalled in point of size.

Plesiosaurus. Wall-case, No. 13, and Table-cases, Nos. 17, 18, and 19.

In Wall-case No. 13, and in Table-cases Nos. 17 and 18, are arranged examples of the extinct group of marine reptiles, the PLESIOSAURIA. (*See* Woodcut, Fig. 46.) They are distinguished at once by the great development of the neck, which is composed of numerous vertebræ. The head is comparatively small in size; the orbits are large; the limbs being shaped externally like the flippers of a whale, and made up of 5 fingers, composed of numerous phalanges. The jaws were armed with many simple pointed teeth inserted in distinct sockets. The most complete examples are the *Plesiosaurus Hawkinsii*, the *Pl. robustus*, the *Pl. laticeps*, *Pl. macrocephalus*, all in Case No. 13; and the cast of the great *Pl. Cramptoni*, fixed on the wall of the East Corridor (No. 3 on Plan), leading to the S.E. gallery, which is 22′ 0″ in length and 14′ 0″ in breadth, measuring across its expanded paddles.

Most of these old marine lizards, both the long and the short-necked forms, were obtained from the Lias of Street, Somersetshire, Lyme Regis, Dorsetshire, Barrow-on-Soar, Leicestershire, and Whitby in Yorkshire; in fact, their geological and geographical distribution seems to have been almost identical.

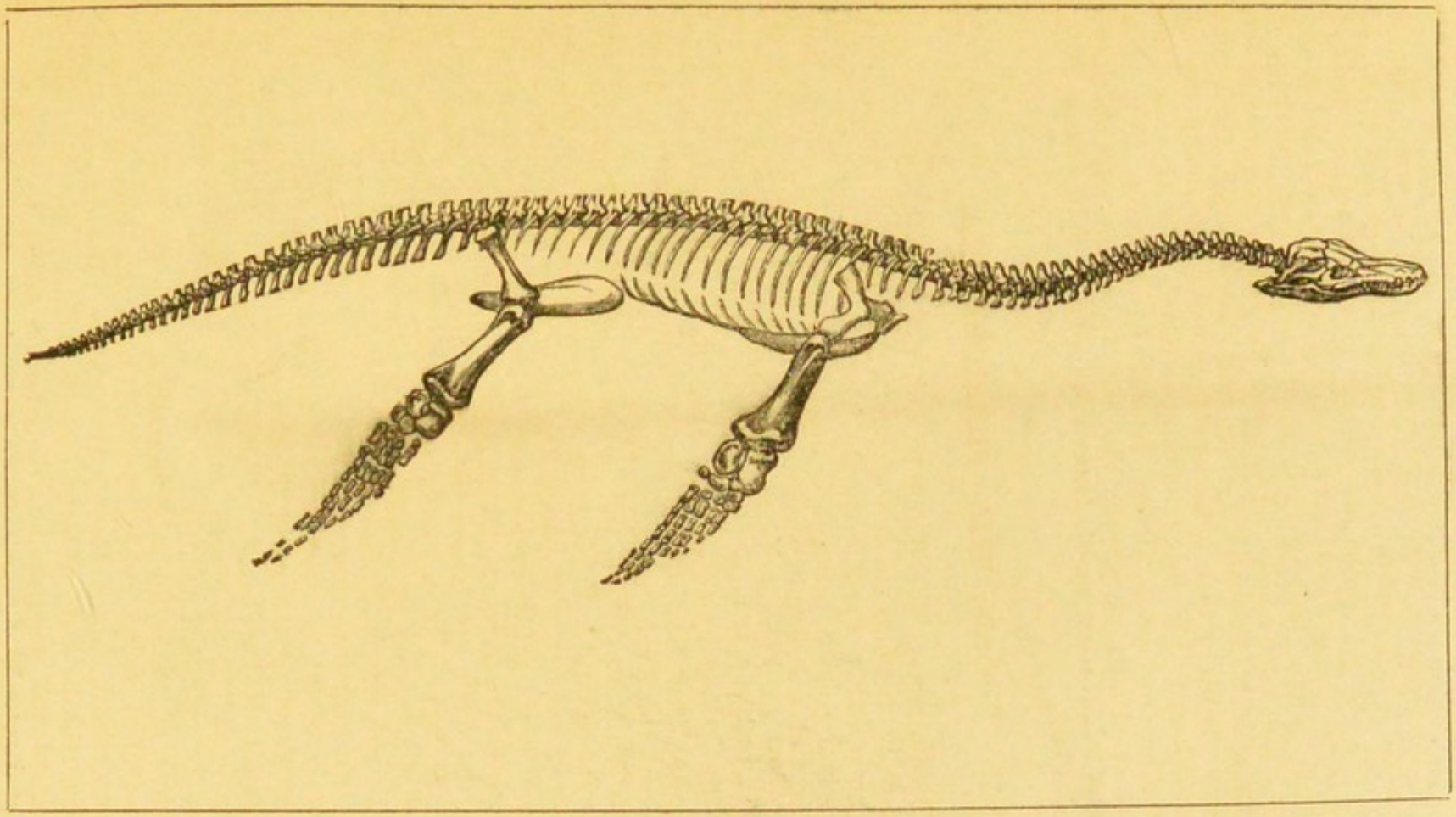


FIG. 46.—Skeleton of the Long-necked Sea-Lizard (*Plesiosaurus*), from the Lias of Lyme Regis, Dorset.

Neusticosaurus.

Table-case, No. 19.

In Table-case No. 19 are placed two nearly entire skeletons of a small but very remarkable amphibious reptile, named *Neusticosaurus pusillus*, from the Trias near Stuttgart, Germany; having affinities with both the terrestrial and marine lizards. In the long neck and form of the fore-limb this reptile approaches *Plesiosaurus;* in the hind-limb it presents affinities with the earliest of the fossil Crocodiles.

Order IX.—CHELONIA (Tortoises and Turtles).

Tortoises and Turtles.

The Chelonia are exhibited in two wall-cases and three table-cases placed in the West Corridor (No. 5 on Plan), which connects the Mammalian with the Reptilian Galleries.

Wall-cases, Nos. 11 & 12, and Table-cases, Nos. 20, 21, and 22.

Here are placed the fossil remains of the order Chelonia, including the Tortoises and Turtles, a group of reptiles in which the backbone and ribs are immovable, being combined with the external coat of bony plates, closely connected by interlocking sutures, enclosing the entire body of the animal. This box-like envelope is covered with leathery skin or horny plates; one kind of which is called "tortoise-shell," and is made into combs, &c. The bones of the skull (except the lower jaw and the hyoid bones) are also consolidated. They have no teeth, but the jaws being encased in a horny beak, the sharp edges serve instead for dividing the food.

The Chelonians are found living at the present day on land, in fresh water, and in the sea; they are all oviparous, depositing their eggs in the sand, to be hatched by the warmth of the sun. Some recent Turtles' eggs from Ascension, cemented together and fossilized in shell-sand by deposition of lime (produced through the rapid evaporation of the sea-water by the sun's heat), are exhibited in Wall-case, No. 12.

See Wall-case No. 12.

Some of the old gigantic land-tortoises (of which a few only survive) inhabited Mauritius, the Seychelles, and other islands of the Indian Ocean and the Galapagos Islands in the Pacific. Like the Dodo, they have been gradually exterminated by the hand of man. The largest of the fossil forms (a restored cast of which is placed on a stand at the west-end of the Reptile Gallery, and marked Z, on Plan), is the *Colossochelys atlas* from the Siwalik Hills of India. The detached fragments (*vouchers* for the size and form of this great carapace) are placed in the Wall-case. These old land-tortoises, so remarkable for the magnitude they attained, had extremely long necks and small heads; they were all vegetable-feeders.

Chelonia. West Corridor, No. 5 on Plan.

See Wall-case, No. 11.

Several smaller species of Chelonians are also exhibited from the same Indian locality. **Turtles.**

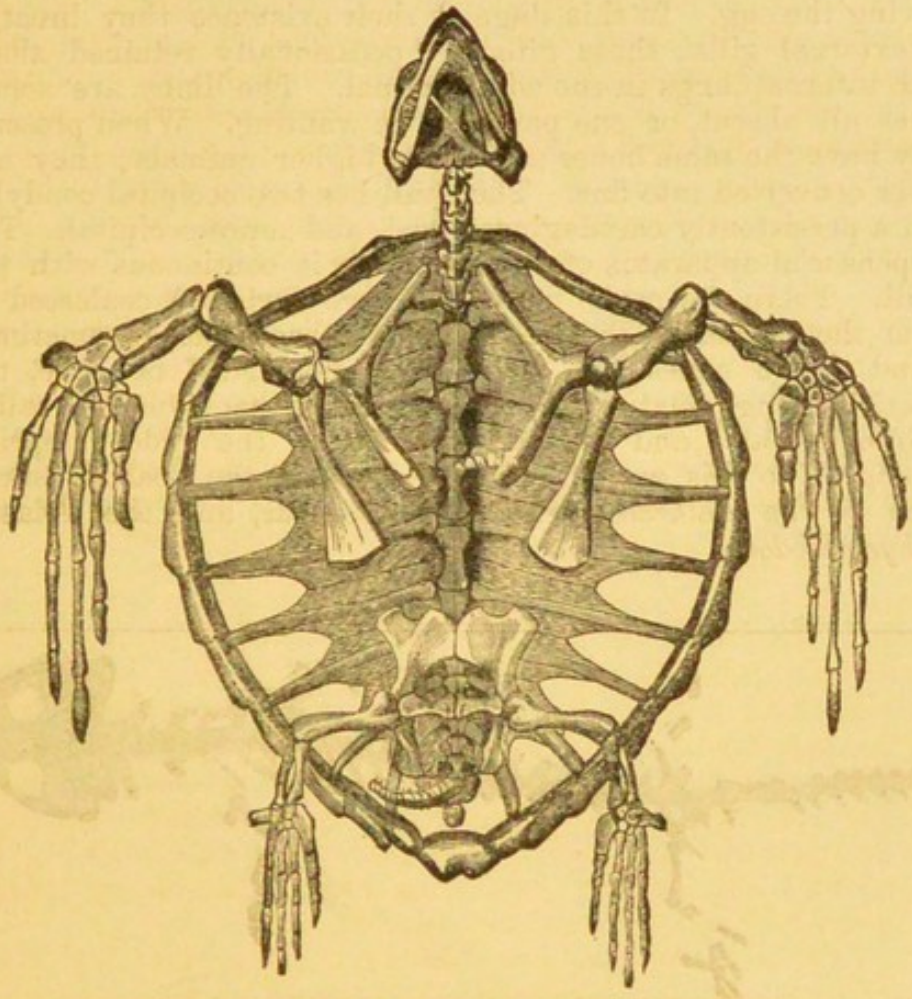


Fig. 47.—Skeleton of the Logger-head Turtle.

Here are placed the remains of the great *Chelone Hoffmanni*, from the Chalk of Maestricht. The *Chelone gigas*, whose head and some other parts may be seen and compared, is from the London Clay of Sheppey, and represents an even larger animal. These were true marine turtles, related to the "Logger-head" Turtle of the present day. (Fig. 47.) **Chelone gigas.** **Wall-case, No. 12.**

One small species of *Emys*, or Marsh Tortoise, was formerly an inhabitant of this country, and its remains occur in the Pleistocene deposits at Mundesley, and at East Wretham Fen, in Norfolk (*see* Table-case, No. 20). **Table-cases, Nos. 20, 21 and 22.**

The oldest Chelonian known is the *Chelytherium*, from the Triassic sandstones, Stuttgart.

Class 4.—AMPHIBIA.

In Wall-case No. 11, and in Table-cases Nos. 23 and 24, are placed the fossil Amphibia (Frogs, Toads, Newts, and Sala- **Table-cases, 23 and 24.**

Amphibia. Gallery, No. 4. Table-cases, Nos. 23 and 24. West Corridor, No. 5. Wall-case, No. 11.

manders). These animals are distinguished from true reptiles by the fact that the young undergo certain metamorphoses after leaving the egg. In this stage of their existence they breathe by external gills: these gills are occasionally retained along with internal lungs in the adult animal. The limbs are sometimes all absent, or one pair may be wanting. When present, they have the same bones as in the higher animals; they are never converted into fins. The skull has two occipital condyles and a persistently cartilaginous basi- and supra-occipital. The suspensorial apparatus of the mandible is continuous with the skull. There are never more than two vertebræ coalesced to form the sacrum. The centrum of the backbone is sometimes found to be unossified, forming a mere ring of bone, the interior being gelatinous. This form of backbone is called "Notochordal," and is characteristic of the oldest reptilia belonging to this group met with fossil in the Coal Measures, such as the *Anthracosaurus*, *Archægosaurus*, and the Triassic *Labyrinthodon*.

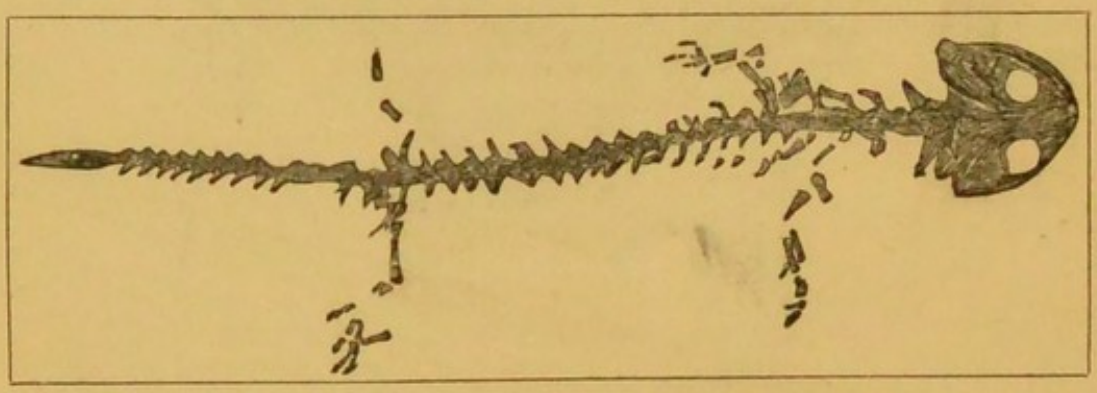


Fig. 48.—The great Fossil Salamander from Œningen (*Cryptobranchus homo-diluvii-testis*), Scheuchzer, sp.

Loxomma. Wall-case, No. 11.

In Wall-case 11 is placed a very beautifully preserved skull of a Labyrinthodont Reptile from the Coal Measures of Shropshire, referred to *Loxomma Allmanni*, Huxley. The specimen is preserved uncrushed and shows the natural contour of the skull and lower jaw, admirably preserved in clay-ironstone. It was presented by George Maw, Esq., F.L.S., F.G.S.

Giant Salamander. Wall-case, No. 11.

The Salamanders are represented by the great fossil form from the Miocene of Œningen (*see* Wall-case 11), which, when first discovered, in 1726, was described by Scheuchzer as "*homo-diluvii-testis*," the man who witnessed the Deluge!

Batrachia. Table-case, No. 24.

The tail-less *Batrachia*, or frogs and toads (Table-case 24), have been found fossil in the same freshwater deposit, and also in the Brown Coal of Bonn-on-the-Rhine.

GALLERIES RUNNING NORTH FROM THE REPTILIAN GALLERY.

There are seven Galleries running at right angles to the Reptilian Gallery (see Plan facing p. 108), about 140 feet in length; three of which are forty feet in breadth, and four are of half that width. The first narrow gallery is occupied by the General Library.

Class V.—PISCES (Fishes).*

Fossil Fishes. Gallery No. 6 on Plan.

The first wide Gallery (No. 6, on Plan), is devoted to the exhibition of the Fossil Fishes, and contains thirty-two Table-cases, and about 260 feet linear of Wall-cases.

Here are exhibited the finest collection of Fossil Fishes ever brought together in any museum. This class was always well represented, but it has lately received two splendid additions by the acquisition of the famous collection of the Earl of Enniskillen, from Florence Court, Ireland; and that of the late Sir Philip de Malpas Grey-Egerton, Bart., M.P. (Trustee of the British Museum), of Oulton Park, Tarporley, Cheshire; both obtained in 1882.

Order I.—CHONDROPTERYGII.

Wall-cases, Nos. 1, 2, and 3.

Wall-cases Nos. 1, 2, and 3 are entirely occupied with the Plagiostomatous fishes (sharks and rays); the specimens exhibited comprise a very large series of "Ichthyodorulites" (fish spines); followed by the *Hybodontidæ* and *Cestraciontidæ*.

The "Ichthyodorulites" include spines of *Gyracanthus*, and *Ctenacanthus*, from the Upper and Lower Carboniferous, and *Oracanthus*, &c., from the Carboniferous limestone. To these succeeds a fine series of remains of heads with teeth, spines, and the "shagreen" skin of *Hybodus* and *Acrodus*, from the Lias of Lyme Regis. Many of these show also the curious recurved dermal spines, named *Sphenonchus* by Agassiz, who constituted a distinct genus for their reception. There are two on each side of the head, one near the posterior border of the orbit, and the second a little further backward. They are not analogous to the single central clasper on the fore part of the head of the male chimæra.

Wall-case No. 3 is devoted to the remaining Selachians, the most noteworthy of which are the new and undescribed species of sharks and rays, from the Cretaceous formation of the

* See also separate Illustrated "Guide to the Fossil Fishes."

Gallery, No. 6. Fossil Fishes. Wall-case, No. 3.

Lebanon, and the specimens of *Rhinobatus maronita* from the same locality. This case also contains several specimens of the very singular fish named *Squaloraja polyspondyla*, from the Lias of Lyme Regis, and of *Spathobatis bugesiacus*, from the Kimmeridgian of Cirin, near Lyons.

Sharks and Rays.

The first nine Table-cases on the West side of Gallery A. are also devoted to the *Plagiostomata*, and *Holocephala*, comprising the *Carchariidæ*, *Lamnidæ*, *Notidanidæ*, *Hybodontidæ*, *Cestraciontidæ*, *Pleuracanthidæ*, *Myliobatidæ*, *Raiidæ*, *Torpedinidæ*, *Squatinidæ*, and the *Edaphodontidæ*, whose modern representatives, the sharks, rays, and chimæras, are most widely distributed in the seas of to-day.

There is great difficulty in obtaining satisfactory evidence for the correct determination of these cartilaginous fishes in a fossil state. Thus in the sharks we have only the spines, teeth, and shagreen left: all else has disappeared, save some few of the vertebræ in the Chalk and London Clay; the backbone of the earlier sharks appears to have been quite "notochordal." Even

Teeth and Spines of Sharks.

the spines and teeth are not always found in association in the same deposit, so that one cannot with certainty affirm that they belonged to the same fish. In many instances teeth and spines, originally placed in separate genera, have now been determined by correlation to belong to the same fish. Thus for example:—The spines named *Pleuracanthus*, from the Coal Measures, belong to the teeth called *Diplodus*, from the same beds. *Ctenacanthus* spines belong to *Cladodus* teeth in the Carboniferous limestone. Again, *Asteracanthus* spines found with *Strophodus* teeth are probably parts of the same fish; whilst *Leptacanthus* spines, found in the same matrix with Chimæroid jaws, in the Chalk, the Stonesfield Slate, the Solenhofen stone, and in the Lias, furnish conclusive evidence of their union in the same fish. There can be little doubt that *Myriacanthus* spines in like manner belonged to genera of fossil rays. The teeth and spines

Acrodus and Hybodus.

of both *Acrodus* and *Hybodus* have now each been found in their true association, so that we know certainly the forms belonging to each genus. Again, many forms of crushing teeth which had been made into distinct species, are now known to occur in the jaws of the same fish. Thus the teeth named *Strophodus magnus*, and others named *tenuis*, may be seen in the mandible of the same individual.

Carcharodon.

The wide distribution, both geographically and geologically, of the sharks is very remarkable. Teeth of the genus *Carcharodon* have been met with in Tertiary deposits in New Zealand, Jamaica, Carolina, Malta, Egypt, in the Antwerp and Suffolk Crags, and elsewhere: and several species of other genera are found common to the lower Tertiaries both of Europe, America, and Australia. Shark's teeth were also dredged up, in numerous localities, from the bed of the ocean

during the voyage of H.M.S. *Challenger*, so that teeth of sharks will form a marked feature in the deposits now in process of formation in the depths of the sea. **Gallery, No. 6. Fossil Fishes.**

Order II.—GANOIDEI.

In Wall-case No. 4 follow the Acanthodians, represented by *Cheiracanthus*, from the Lower Old Red Sandstone of Lethen Bar and Tynet Burn, and from the equivalent beds of Forfarshire. To these succeed the Placoderms *(Pterichthys, Coccosteus, Asterolepis)*, and in Table-case No. 35 are placed the *Cephalaspidæ (Cephalaspis, Scaphaspis, Pteraspis*, &c.), from the Scottish Old Red, and from Herefordshire. **Wall-case, No. 4.** **Table-case, No. 35.**

The *Dipnoi* (Wall-case 5, and Table-case 36) form a very peculiar sub-order of fishes, having a notochordal skeleton. To it belongs the living *Protopterus*, *Lepidosiren*, and *Ceratodus*. Teeth, indistinguishable in character from the modern *Ceratodus*, are abundant in the Trias, Rhætic and Oolitic formations (*see* Table-case 36). *Dipterus* occurs in the Devonian, *Ctenodus* in the Carboniferous. Several other genera are also represented (*see* Wall-case 5a).

In Wall-cases 5—15 are arranged the true fishes of the order Ganoidei. The first sub-order (Crossopterygidæ) occupies cases 5 to 7, and embraces the *Holoptychiidæ (Holoptychius, Glyptolepis)*; *Rhizodontidæ (Tristichopterus* and *Gyroptychius* from the Old Red Sandstone: and *Rhizodus* from the Lower Carboniferous of Scotland); the *Saurodipteridæ (Osteolepis* and *Diplopterus*, from the Old Red Sandstone, and *Megalichthys* from the Carboniferous); and lastly, the *Cœlacanthidæ*, remarkable for their long range in geological time *(Cœlacanthus* occurring in the Carboniferous, the Permian, and Upper Oolite, *Gyrosteus* in the Lias, and *Macropoma* in the Chalk). **Wall-cases, Nos. 5 to 15.**

Wall-case 8, and a portion of No. 7, contain remains of the second sub-order of Ganoids, the Acipenseroidei. These are represented by the true Sturgeons *(Acipenser)* from the London Clay of Sheppey; by *Chondrosteus* from the Lias, by the *Palæoniscidæ*, including *Chirolepis*, *Pygopterus*, *Acrolepis*, and *Oxygnathus*, from the Old Red Sandstone to the Lias inclusive, followed by the *Platysomidæ*, represented by the genus *Platysomus*. **Wall-case, No. 8.**

Wall-cases Nos. 9 to 14 comprise all the genera included in the great sub-order of the Lepidosteoidei (fishes with rhomboidal scales) represented by the genera *Eugnathus Lepidotus, Heterolepidotus, Dapedius, Pholidophorus, Semionotus, Aspidorhynchus, Gyrodus*, &c. **Wall-cases, Nos. 9 to 14.**

In Wall-case No. 15 are placed the fossil fishes of the sub-order Amioidei, represented by the genera *Caturus, Leptolepis, Thrissops*, &c. **Wall-case, No. 15.**

Order III.—TELEOSTEI.

Fishes.

Gallery, No. 6.

Wall-cases, Nos. 16 to 18.

The remaining wall-cases (Nos. 16—18) contain the order of TELEOSTEI (fishes with a well-developed, bony skeleton). The *Esocidæ* (the pike), *Clupeidæ* (the herrings), and *Salmonidæ* (the salmon and trout), including the genera *Esox*, *Clupea*, *Osmeroides*, with the *Percidæ* (or perches), *Perca*, *Smerdis*, &c.

Wall-cases, Nos. 17 and 18

Wall-cases Nos. 17 and 18 contain the Cretaceous, spiny-finned fishes of the genus *Beryx*, and the Eocene fishes from the Canton Glaris slates, of the genus *Anenchelum*, &c., together with the *Fistulariidæ* (pipe-fishes), the *Scombridæ* (mackerel family), and the curious thread-fin, *Gastronemus*, from Monte Bolca.

The table-cases follow the same arrangement as is observable in the wall-cases, varied only by the size and number of the specimens by which each family is represented.

This terminates the series of Vertebrate fossils, and in the next Gallery we commence with the INVERTEBRATA (animals without a backbone)—such as Cuttlefishes, Snails, Oysters, Insects, Crabs and Lobsters, Worms, Sea-urchins, Corals, &c.

INVERTEBRATE ANIMALS.

Sub-Kingdom 1.—MOLLUSCA (Soft-bodied animals).

Division A.—MOLLUSCA (proper).

CLASS 1.—Cephalopoda.

Mollusca. Cephalopoda.

Gallery, No. 7 on Plan.

In Narrow Gallery (No. 7 on Plan) are displayed the fossil CEPHALOPODA,* being the first section of the Invertebrate animals and the highest division of the Molluscan Class.

The animals of this class are all marine, and are provided with long feelers or tentacles (sometimes called feet) attached to the head around the mouth, whence the name Cephalopoda, or "head-footed," is derived. Here are placed the fossil representatives of the existing *Octopus*, and the Squids and Cuttle-fishes, the delicate Paper Nautilus and *Spirula*, also the Pearly Nautilus. These are divided into two great groups, the *Dibranchiata*, or two-gilled, and the *Tetrabranchiata*, or four-gilled Cephalopods.

The first of these includes the most active free-swimming forms to which all the living genera belong. One solitary form, a survivor of the second or Tetrabranchiate division, namely "the Pearly Nautilus," is still found living in the Indian Ocean.

Most of them have a delicate internal shell, often quite

* From κεφαλή, head, and πους, ποδος, a foot; hence "head-footed."

minute, or rudimentary, as in *Octopus*, or divided into chambers by septa or partitions, as in *Spirula*.

Gallery, No. 7 on Plan.

The delicate shells of *Spirulirostra*, *Beloptera*, &c., occur in the Miocene and Eocene Strata. Impressions of "Squids" showing the soft parts of the body, the arms, and the "ink-bag" are found in the Chalk of the Lebanon, Syria; the Oxford Clay of Wiltshire; the Solenhofen limestone of Bavaria; and the Lias of Lyme Regis, &c.

Cephalopoda.

The "Belemnite," so common a fossil in the Cretaceous and Oolitic rocks, is only the shelly extremity or "guard" (like the tip of a spear, or dart, without barbs), forming part of the internal shell of an extinct kind of Squid, or Cuttlefish, which, when perfect, had a chambered upper portion to its shell (called the *phragmocone*), and a pearly extension beyond (called the *pro-ostracum*). Some nearly perfect examples have been found in the Lias and Oxford Clay (*see* Wall-case). The arms were provided with hooklets as well as suckers for holding fast its prey, and each animal had an ink-bag that secreted an inky fluid (known as sepia, and used as a pigment by artists), which could be ejected into the water at pleasure, so as to conceal the animal's retreat by a cloud of inky blackness.

Belemnites.

Ink-bag of the Cuttle (Sepia).

They all had strong horny or shelly mandibles, resembling a parrot's beak; these are frequently met with in a fossil state.

Beaks of Cuttle-fishes.

By far the largest proportion of the fossil forms, however, belong to the Tetrabranchiate, or four-gilled division, represented at the present day by the "Pearly Nautilus" of the Indian Ocean. These were less active forms than the Squids and Cuttlefishes; and instead of having, like them, an internal shell, they had a strong external one with a pearly lining, in the large body-chamber of which the soft parts of the animal was enclosed. The rest of the shell is divided by septa or partitions into a series of chambers usually filled with fluid, through which a tube passes called the "siphuncle." These are merely the earlier and disused chambers of the animal's shell which had been inhabited when it was younger, and have been gradually closed off and abandoned as the increased growth of its soft parts required a larger habitation.

All the beautiful and varied forms of *Turrilites*, *Baculites*, *Ammonites*, *Ceratites*, *Goniatites*, *Orthoceratites*, &c., belong to this great division of the Cephalopoda.

Turrilites, Baculites, etc.

The shells of the Pearly Nautilus have been obtained in large numbers from the London Clay of Highgate, Hampstead, and the Isle of Sheppy. Beautiful examples of these and of the little *Nautilus* (*Aturia*) *zic-zac* may be seen in the Table and Wall-cases. The Ammonites in infinite variety of pattern occur from the close of the Cretaceous period to the base of the Secondary rocks; the *Ceratites* in the Trias, and the *Goniatites* in the Carboniferous formation, their variations in form and in

Gallery, No. 7.

ornament being only modifications of the shells of the same family.

Cephalopoda.

Orthoceras.

The older forms chiefly belong to the straight *Orthoceratites*, having shells like a Nautilus but uncurled and straightened out, or to curious forms, having various degrees of curvature in the shell, between the straight Orthoceras and the involute Nautilus and Ammonite. These variations are also found in many genera of Cephalopod Shells of the Chalk period. A fuller description of the contents of this Gallery will be given in a small separate Guide in preparation, which will be issued as soon as the cases are completely arranged.

Class 2.—**Pteropoda** (Wing-shells).

Pteropoda.

Gallery, No. 7 on Plan.

A single Table-case is devoted to this curious division of Mollusca, represented at the present day by small oceanic animals, whose entire life is passed in the open sea far away from any land, swimming by means of two wing-like appendages, one on each side of the head. The Pteropods had their representatives far back in past geological time.

In the Miocene beds of Bordeaux, Dax, Turin, Sicily, and in the Suffolk Crag, small delicate shells occur, like the existing genera—*Hyalea*, *Vaginella*, *Cuvieria;* whilst in the Carboniferous, Devonian, and Silurian many species are met with, as *Conularia*, *Hyolithes (Theca)*, &c., which attained a large size compared with the minute shells of living members of this class.

Gallery (No. 8 on Plan).—The second of the wide Galleries has thirty-two Table-cases, and Wall-cases corresponding with Gallery No. 6. In it are placed the remaining groups of the Mollusca, viz., the Gasteropoda, the Lamellibranchiata, and the Brachiopoda. It also contains the Polyzoa, the Insecta and Crustacea, the Annelida, and Echinodermata.

Class 3.—**Gasteropoda** (Snails, Whelks, &c.).

Class 4.—**Lamellibranchiata*** (Oysters, Cockles, &c.).

Mollusca.

Gallery, No. 8 on Plan.

Wall cases, Nos. 1 to 9. Table-cases Nos. 89 to 104.

The fossil shells of the above groups occupy the whole of the West or left side of this Gallery and a small portion of the East or right side. Wall-cases Nos. 1 to 9 contain the Foreign Mollusca, and Table-cases Nos. 89 to 104 the British specimens of the same group. The Gasteropods, or Univalves, are placed first in each case, and the Lamellibranchs, or Bivalves, follow them. The whole series is subordinately arranged in strati-

* Called also *Pelecypoda*, by Goldfuss (1820).

graphical order, commencing with the most recent deposits, such as the Peat, Raised-Beaches, Glacial deposits, and going back in time to the Silurian and Cambrian periods. **Mollusca. Gallery, No. 8 on Plan. West side.**

Attention is drawn to the fine series of Mollusca from the French, Italian, and English Tertiary strata, particularly to the beautiful collection of shells from the Eocene strata of the Paris Basin (Wall-cases Nos. 3 and 4), and the Miocene of Bordeaux (Wall-cases Nos. 1, 2, and 3), to our own Eocene shells from Highgate, Bracklesham, Barton, and the Isle of Wight (see Table-cases Nos. 100, 101). This Molluscan fauna of the South-east of England indicates the former existence of a much warmer climate in Britain than we now experience; for such genera as *Conus* and *Voluta*, then so abundant, do not now live on our coasts, but must be sought for in subtropical seas. **Wall-cases, Nos. 1, 2, 3, and 4. Table-cases, Nos. 100 and 101.**

A fine specimen of *Cerithium giganteum* from the Eocene of the Paris Basin is placed under a glass-case between Wall-cases 3 and 4. **Cerithium giganteum.**

On the West wall, between Wall-cases Nos. 6 and 7, is placed a fine slab of "Petworth Marble," entirely composed of the shells of a fresh-water snail *(Paludina)*. The elegant columns of the Temple Church, Fleet Street, are made of this marble from the Weald of Sussex. **Wall-cases, Nos. 6 and 7.**

In Wall-cases Nos. 5 and 6 are placed the curious shells called *Hippurites*, allied to the existing Chamas. They probably lived clustered in Coral-reefs like their modern representatives. They are seldom met with in the Cretaceous rocks of this country, but the "Hippurite limestone" is largely developed on the Continent, in France, Spain, and Italy; it also occurs in the East and West Indies. **Wall-cases, Nos. 5 and 6.**

Among the Oolitic and Cretaceous Mollusca may be noticed the shells of three genera, rarely obtained living in the seas of to-day, namely, *Pleurotomaria* (Table-case No. 93 and Wall-case No. 7), *Pholadomya* and *Trigonia* (Table-cases Nos. 92 to 98). Only four recent species of *Pleurotomaria*, represented by 13 specimens, have been obtained. As many as 1,156 species are recorded fossil, ranging from the Tertiaries to the Silurian formation, but mostly found in the Oolitic and older rocks. A single living species of *Pholadomya* is known from the West Indies; whilst *Trigonia* only occurs in the seas of Australia. **Table-case, No. 93. Wall-case, No. 7. Table-cases, Nos. 92 to 98.**

Division B.—Molluscoida.

Class 5.—**Brachiopoda** ("Lamp-shells," ex. *Terebratula*).

Gallery, No. 8. East side.

The British collection of Brachiopods, or "Lamp-shells," occupies Table-cases Nos. 85, 86, 87, and 88. The Tertiary, Cretaceous, Oolitic, Carboniferous, and Devonian forms being **Table-cases, Nos. 85, 86, 87, and 88.**

Gallery, No. 8 on plan, East side.

well represented, also those of the Upper and Lower Silurian strata.

Wall-cases, Nos. 10 and 11.

The foreign species occupy Wall-cases Nos. 10 and 11. The Brachiopoda were most carefully studied by the late Mr. Thomas Davidson, LL.D., F.R.S., who devoted his whole life to the illustration and description of this class of the Mollusca. Many of the specimens figured by him may be seen in the cases. In 1886 he bequeathed his entire collection to the Nation, and it is exhibited in Gallery No. 11.

Class 6.—**Polyzoa** (Sea-mats and horny Corallines).

Table-case, No. 84. Wall-case, No. 12.

These elegant organisms, so frequently found upon the sea-shore, and often confounded with sea-weeds (Algæ), are really the horny or calcareous composite habitations of numerous distinct but similar microscopic zoöids, each individual occupying a minute double-walled sac, in a common habitation, called a *cœnœcium*.

They are met with in great variety of form in the Coralline Crag of Suffolk, in the Miocene of Dax, Bordeaux, and Touraine, and more rarely in the Eocene beds of the London and Paris Basin.

Beautiful masses of *Fenestella* are found in the Permian or Magnesian Limestone of Durham, and in the Permo-Carboniferous rocks of Australia and Tasmania. The Polyzoa of the Carboniferous formation are also numerous and varied. The most singular of these is the *Archimedipora*, which has its *cœnœcium*, or *polyzoarium*, arranged around a central screw-like axis, giving it a most elegant geometrical form.

Sub-Kingdom 2.—Annulosa.

Division A.—Arthropoda (Jointed Animals).

Class 7.—**Insecta** (ex. Beetles, Flies, Bees, &c.).

„ 8.—**Myriapoda** (ex. Centipedes, Millipedes).

„ 9.—**Arachnida** (ex. Spiders, Scorpions, &c.).

Insects.

Insects, Myriapods, and Arachnida are very rare in the rock-formations of this country. They have, however, been met with in considerable numbers in the Eocene strata of Gurnet Bay, Isle of Wight, in the Purbeck Beds of Swanage, Dorset, in the Great Oolite of Stonesfield, the Lias of Warwickshire, the Coal Measures of Coalbrook-dale, and Scotland, &c. (see Table-case No. 84). They are more abundant in the Brown Coal of Bonn; in the Amber from the Miocene Beds of Samland on the Baltic; from Œningen, near Constance; and from the Litho-

See Table-case, No. 84.

graphic stone of Solenhofen, Bavaria. From the last-named locality beautiful Dragon-flies (*Libellulæ*) and numerous other genera have been obtained (see Wall-case No. 12).

Gallery, No. 8. Insects. See Wall-case, No. 12.

Class 10.—**Crustacea** (ex. Crabs and Lobsters).

Crustacea.

The Foreign Crustacea occupy Wall-cases Nos. 12, 13, and 14, and the British forms fill four-and-a-half of the adjoining Table-cases, Nos. 80 to 83. Those British specimens too large for the Table-cases are arranged on the top shelf of the Wall-cases. Attention is directed to Table-case No. 80, in which is exhibited a fine series of Trilobites from the Wenlock shale and limestone near Dudley. Many of these Silurian Crustaceans are remarkable for great beauty and variety of form, and exhibit in some instances (as in *Phacops*) the singular compound eyes, peculiar to the Arthropoda; and in *Encrinurus*, the eyes placed upon long eyestalks.

Wall-cases, Nos. 12, 13, and 14, Table-cases, Nos. 80 to 83. Table-case, No. 80.

The largest of the British Trilobites (*Paradoxides*) exceeds 2 feet in length (see Wall-case No. 14 B), whilst the nearly-allied genus *Pterygotus*, from the Old Red Sandstone of Forfarshire, measured fully 5 feet in length (see Wall-case 13).

See Wall-case, No. 14b. See Wall-case, No. 13.

Other specimens of this class are fixed on the Wall adjoining.

Division B.—Anarthropoda.

Class 11.—**Annelida** (ex. Earth-worms, Sand-worms, Tube-worms, &c.)

Sea-worms (Table-case No. 79 and Wall-case No. 15), being soft-bodied animals, are seldom preserved in a fossil state; but their existence is proved by the tracks, burrows, and worm-castings which they have left on the wet mud, and upon the ripple-marked sands of the old sea-shores, before these had become hardened into shales and sandstones; their microscopic teeth have also been found as fossils in the Lower Palæozoic rocks.* Some species form shelly tubes,† and these are frequently found in rocks both of Palæozoic and Secondary age.

Table-case, No. 79, and Wall-case, No. 15.

Sub-Kingdom 3.—Echinodermata (Spiny-skinned Animals).

Class 12. **Echinoidea** (Sea-urchins).
„ 13. **Asteroidea** (Star-fishes).
„ 14. **Ophiuroidea** (Brittle-stars).
„ 15. **Crinoidea** (Stone-lilies).
Class 16. **Cystoidea.**
„ 17. **Blastoidea.**
„ 18. **Holothuroidea.**

* See an account of these with figures by Dr. G. J. Hinde, F.G.S., Quart. Journ. Geol. Soc. Lond. 1879.

† These worms are called "Tubicolar Annelids," or Tube-worms.

Gallery, No. 8 on Plan, East side.

The animals grouped in this division are very different in appearance, but agree in having their soft parts enclosed within a more or less solid calcareous covering, composed of numerous plates, disposed usually in a distinctly radial arrangement.

Echinoidea, Sea-Urchins.

1. This radial structure is particularly observable in the Sea-urchins *(Echinoidea)*, whose tests, of marvellous beauty and variety of form, are, when living, covered with rows of moveable spines, which serve as defences, and aid the ambulacral tubes or suckers in locomotion. The spines, which are calcareous, vary greatly in length and form, being often very minute, but sometimes of great thickness, or of extraordinary length. Many examples of these are exhibited. Some of the largest of the fossil Sea-urchins, called *Clypeaster*, are from the quarries of Mokattam, near Cairo, whence the Nummulitic Stone, used in constructing the Pyramids, was quarried (Wall-case No. 15). The Echinoderms of our own Chalk and Oolite are placed in Table-cases Nos. 76-78.

Wall-case, No. 15. Table-cases, Nos. 76 to 78.

Star-fishes.

2. Of the Star-fishes the magnificent series of *Goniasters* and *Oreasters*, from the Chalk; the fine *Solaster Moretonis*, from the Great Oolite, with thirty-three arms; and the five-rayed *Stellaster Sharpii*, from the Northampton Ironstone, deserve special notice. (Table-case No. 75.)

Table-case, No. 75.

Brittle-stars.

3. The "Brittle-stars," such as *Ophioderma Egertoni*, from the Lias of Lyme Regis, and others of Silurian age, resemble those now found living on our own coasts.

Stone-lilies.

4. The Stone-Lilies (Crinoidea), so rare in our modern seas, were once exceedingly abundant in the Secondary and Palæozoic periods.

They were fixed during life to the sea-bottom by means of a flexible stalk. The body was of variable shape, but covered by calcareous plates, and surmounted by branched arms from five to ten in number.

Wall-case, No. 17. Table-case, No. 75. Wall-case, No. 16, and Table-case, No. 74.

The most striking objects of this group are the Lily-encrinites *(Entrochus liliiformis)*, from the Muschelkalk of Brunswick (Wall-case No. 17); the Pear-encrinite *(Apiocrinus Parkinsoni)*, from the Bradford Clay, of Wiltshire (Table-case No. 75); the beautiful *Pentacrinus Hiemeri*, from the Lias of Boll, Wurtemberg, and the *Extracrinus briareus* from Lyme Regis, Dorset (Wall-case No. 16 and Table-case No. 74).

Placed on the wall, near the case of Lias Pentacrinites, is a fine polished slab of "Entrochal or Encrinital marble," from Derbyshire, almost entirely composed of the broken stems of *Actinocrini* (Stone-lilies), from the Carboniferous limestone. The cases containing the older forms, from the Wenlock limestone (U. Silurian), near Dudley, are deserving of special notice; also the fine series of N. American Carboniferous and Silurian genera (Wall-cases Nos. 17 and 18).

Wall-cases, Nos. 17 and 18.

The curious and anomalous forms of *Cystoidea* and *Blastoidea*,

from the Carboniferous and Silurian rocks, are very well represented here. **Gallery, No. 8.**

5. The *Holothuroidea*, which have no hard test, properly so called, and in which the body is vermiform, have small plates and spicules scattered through the skin. Those of *Synapta* (shaped like microscopic anchors) and of *Chirodota* (like minute wheels) have been found by washing the decomposed shales of the Carboniferous limestone of the East of Scotland. **Holothuroidea; (sea-cucumbers).**

Narrow Gallery, No. 9 on Plan (*see* p. 108).—This is retained for study purposes, and contains also the Geological Library.

Gallery No. 10 on Plan.—This is the third of the wide Galleries, and contains upon its Western side:—

Sub-Kingdom 4.—Cœlenterata.

Class 19.—**Actinozoa** (Rayed Animals).

This group embraces the "Sea Anemones," the *Alcyonaria*, and the true corals. **Gallery, No. 10 on Plan, West side.**

The Sea Anemones have no hard parts or skeleton, and are therefore unknown in a fossil state, but they serve admirably to exemplify by their soft parts the structure of the coral-polype. **Corals.**

The cylindrical body of the Sea Anemone is tough, flexible, and elastic, with a sucker-like expansion at the base, by which it attaches itself to rocks, &c. The mouth is placed on the summit, and is encircled by numerous flexible retractile tentacles, resembling when expanded the petals of a flower.

The mouth leads directly into the stomach, which opens below into the general visceral cavity. The space surrounding the stomach is divided into a number of compartments by a series of radiating vertical partitions known as the "mesenteries," which take their rise from the inner surface of the body wall, and are attached to the external surface of the stomach; they are also continued downwards to the base of the visceral cavity, although less largely developed.

The spaces between the mesenteries are connected with the general visceral cavity beneath the stomach.

Division A.—Zoantharia-sclerobasica.*

In the *Alcyonaria* the polypes live together united by a common tissue (called the "cœnosarc"); each polype has eight **Alcyonaria.**

* *Sclerobasica* from *skleros*, hard, and *basis*, a pedestal: applied to a coral having a solid axis which is invested by the soft parts of the animal.

Gallery, No. 10. Corals. Table-cases, Nos. 1, 5, 6, 8 & 9, and Wall-cases, Nos. 1 to 6.

tentacles, and closely resembles in its structure a minute Sea Anemone. They are supported by an internal horny or calcareous skeleton or axis, secreted by the common flesh (or cœnosarc), and over which it is spread, like the bark enclosing the wood of a tree.

The "Red Coral" (*Corallium rubrum*), the *Isis*, the *Gorgonia*, and the *Tubipora* belong to this division; also the Palæozoic *Monticulipora* and *Heliolites*.

The Alcyonaria occupy a part of Table-cases Nos. 1, 5, 6, 8, and 9, and of Wall-cases Nos. 1–6.

Division B.—Zoantharia-sclerodermata.*

Wall-cases, Nos. 1 to 5. Table-cases, Nos. 1 to 8. A simple Coral.

In the true Corals the animal itself resembles a Sea Anemone, but instead of the polype being entirely composed of soft tissues, a deposit of solid calcareous matter is formed *within* the middle layer (or mesoderm) of the polype. Commencing at the base, it grows up and forms a more or less cup-shaped external wall or *theca* around the polype. From this wall are developed numerous perpendicular plates, the *septa*, which converge inwards; they correspond with the mesenteries. The number of septa and of the mesenteries and tentacles increases regularly with the age of the polype.

In addition to the *theca* and the *septa*, a column-like calcareous mass sometimes arises in the axis of the cup, and is known as the *columella*, and near it a circle of calcareous rods, called *pali*, which are separate from the *septa*. Furthermore, there are sometimes formed, between the lateral surfaces of the septa, interseptal rods or horizontal shelves (termed *dissepiments*). Of this nature also are the *synapticulæ* and *tabulæ*; the former are transverse calcareous bars, uniting the opposite faces of adjacent septa: the latter are highly developed dissepiments, and, like them, are as a rule horizontal; they often form transverse plates right across the visceral chamber. The *epitheca* is an additional calcareous investment, strengthening the external wall or *theca* of the polype. *Costæ* or ribs may also project from the outer wall of the cup. Within the calice or cup are placed the stomach and soft parts of the polype and the visceral chamber; below this the calice is sub-divided by the septa into a number of vertical compartments, called "the *interseptal loculi*."

The septa are not all of equal length; some, called *primary septa*, are wider than others, and may extend far enough to meet in the centre of the visceral chamber; others are less produced,

* "Hard-skinned Corals," that is to say polypes, which secrete a calcareous skeleton or corallum.

Gallery, No. 10.
Corals.
Wall-cases, Nos. 1 to 5, and Table-cases Nos. 1 to 8.

and are known as secondary and tertiary septa, according to their width.

The number of the septa varies greatly, but there are never less than six, and however great the number they will usually be found to correspond with some multiple of six in their arrangement.

Having briefly described a simple coral polype with its *theca*, or external wall, its *septa* corresponding to the mesenteries of the sea anemone, we can better understand an *aggregate coral*, built up by a large number of these simple polypes growing together and uniting their separate calcareous skeletons so as to form a compound corallum. The colony may consist of a number of individuals, all springing directly from one another, or they may be united by a common flesh or "cœnosarc." This cœnosarc secretes a common calcareous basis or tissue, which unites the several corallites together, called the *cœnenchyma*. Some coral polypes increase their mass by *lateral gemmation*, or budding from the sides; others from the base by root-like prolongations; or new individuals are developed by budding *within the cup* of the parent polype (known as *calicular gemmation*), as in the genera *Lonsdaleia*, *Goniophyllum*, &c.; whilst others increase by fission of the parent polypes themselves.

Compound Corals.

All the living *Zoantharia sclerodermata** inhabit the sea, and no doubt all the fossil corals were also marine. They attain their maximum development at the present day in the warmer seas of the globe, so that their abundant presence in any formation may be accepted as good evidence of the former existence of a warm temperature in the sea of that period. Two distinct types of corals exist at the present day, namely, those which inhabit tolerably deep water, and those which build the great masses of corals which are known as "coral-reefs." The deep-sea corals often attain, as individuals, considerable size; they also grow as compound masses, but never form those massive aggregations known as "reefs." This is because the separate corallites are not united by that lax cellular *cœnenchyma*† which enables the reef-building species to increase to an indefinitely large size. Deep-sea corals appear to have existed in all the great geological periods, from the Silurian upwards. The chief genera of this group now living are *Caryophyllia*, *Balanophyllia*, *Flabellum*, *Desmophyllum*, and *Sphenotrochus*, all simple forms; and *Lophohelia*, *Amphihelia*, *Dendrophyllia*, and *Astrangia*, compound forms.

* From σκληρός, *hard*, and δερμα, δερματος, *skin*: applied to the corallum which is formed within the tissues of the sclerodermic corals.

† From κοίνος, common εγχυμα, an infusion, or tissue; the common calcarareous tissue that unites together the various corallites of a compound corallum.

Gallery, No. 10.
Corals.
Wall-cases, Nos. 1 to 5, and Table-cases, Nos. 1 to 8.

The reef-building corals, when simple, are provided with special structures, which enable the polypes to grow rapidly. The great majority of the reef-builders are compound, the corallites being united by a loose cellular *cœnenchyma*. The chief genera of reef-building corals in Secondary, Tertiary, and Recent times belong to the families of the *Astræidæ*, *Poritidæ*, and *Madreporidæ*, though the *Oculinidæ* and *Fungidæ* also contribute to form reefs.

If coral-reefs existed in Palæozoic times, they were built up by Rugose corals. In Mesozoic times true reefs certainly existed at the close of the Trias, and especially in Oolitic times in Western Europe and England. In early Tertiary times vast reefs were formed in Central and Southern Europe, in Egypt, Syria, and Arabia, and in parts of India. (Nicholson.)

Three great divisions of the ZOANTHARIA-SCLERODERMATA are recognised, namely, the ZOANTHARIA-APOROSA, the ZOANTHARIA RUGOSA, and the ZOANTHARIA-PERFORATA.

The APOROSA are essentially a Secondary and Tertiary group. The RUGOSA are mainly confined to the Palæozoic period. The PERFORATA were largely represented in Palæozoic times, though certain families belong essentially to the Tertiary and Recent period.

The Actinozoa occupy Table-cases Nos. 1–9 and Wall-cases Nos. 1–6 along the western side of Gallery No. 10.

An interesting feature in the exhibited series of fossil corals consists in the introduction of a large series of transparent sections, mounted on glass and fixed at an inclination of about 45°, so as to give the observer a very good idea of the internal structure of the corallite in each genus.

A large number of the type specimens figured by MM. Edwards and Haime, W. Lonsdale, Prof. P. Martin Duncan, F.R.S., Prof. H. A. Nicholson, F.R.S.E., R. F. Tomes, F.G.S., R. Etheridge, F.R.S., R. Etheridge, junr., and A. H. Foord, are in the cases. Every figured specimen is indicated by a small green ticket.

CLASS 20.—**Hydrozoa.**

This division embraces the HYDROIDA, or Hydroid Polypes; the HYDROCORALLINÆ (Millepores, &c.), and the GRAPTOLITHINÆ (Graptolites). Many members of this class are unknown as fossil forms, having no hard structures which could be preserved. In the Hydrozoa the walls of the digestive sac are not separated from those of the general body-cavity (as we have seen is the case in the ACTINOZOA), the two coinciding with one another. The generative elements are developed in medusoid forms,

either free-swimming or attached permanently to the hydroid forms. **Gallery, No. 10. Table-case, No. 9.**

Under the HYDROIDA are placed the HYDRACTINIA from the Crag, in which deposit the calcareous skeleton is found encrusting shells; the large oval forms of *Loftusia* from Persia, the globular forms of *Parkeria* from the Greensand of England, and the genera *Syringosphæria* and *Stoliczkaria* from India.

In the HYDROCORALLINÆ are placed the Silurian genus *Labechia*, the Devonian and Silurian types of *Stromatopora*, and the Cretaceous and Tertiary *Millepora*.

The last division of the HYDROZOA contains the GRAPTOLITHINÆ, a remarkable Palæozoic group characterised by the possession of a compound polypary with a tubular chitinous covering enclosing the cœnosarc, and supporting numerous cup-like "cellules" or *hydrothecæ*, in each of which a polypite was placed. The polypites were united to the cœnosarc. The polypary itself, which was apparently free and unattached, was strengthened by a chitinous rod or fibre termed the solid axis, no doubt similar to that observed in the polyzoön *Rhabdopleura*. The Graptolites present a great variety in their form and in the arrangement of the *hydrothecæ* on the axis, some having but a single row of closely-placed "cellules" or *hydrothecæ* on each branch (hence called "monoprionidian Graptolites"), others having a row of cellules on each side of the branch (hence called "diprionidian"). These forms of Graptolites (*diprionidian*) are, with hardly an exception, confined to the Lower Silurian rocks, whilst the *monoprionidian* forms range from the base of the Silurian to the summit of the Upper Silurian series. **Graptolites.**

With the exception of the genus *Dictyograptus*, which survived to the Devonian, the Graptolites are confined to the Cambrian, the Lower Silurian (or Ordovician), and the Upper Silurian, or Silurian proper.

The families, genera, and even the individual species, of *Graptolites* are, according to Prof. Lapworth, remarkably characteristic of special zones in the Silurian, and that apparently over extremely wide areas of the earth's surface.

The exhibited series of this interesting and important group of Palæozoic Hydrozoa is placed in Table-case No. 10 and Wall-case No. 6. **Wall-case, No. 6. Table-case, No. 10.**

CLASS 21.—**Spongida** (Sponges).

The Sponges form the lowest group of cœlenterate animals. With the exception of one small division, the *Myxospongiæ*, whose structure is entirely composed of soft, fleshy substance, sponges secrete hard skeletons, either of horny, siliceous, or **Sponges.**

Gallery, No. 10. Fossil Sponges.

calcareous materials, and they have consequently been divided into *Ceratospongiæ*, *Silicispongiæ*, and *Calcispongiæ*. It is very doubtful if any of the Keratose, or horny sponges, similar to those in domestic use, have been preserved in the fossil state, and thus only sponges with silicified or calcareous skeletons are found in the rocks. The Silicispongiæ are by far the most important of these two divisions, their skeletons consist of minute spicules of silica of various forms, in some cases united together into a beautiful meshwork, in others the spicules are loosely held in position in the sarcode, and after the death of the sponge they are scattered over the sea-bottom. In this way beds of rock are, in some instances, nearly entirely formed of the minute detached spicules of these sponges.

Table-cases, Nos. 11–15.

Wall-cases, Nos. 7 and 8.

The Silicispongiæ are divided into four orders according to the form of their skeletal spicules:—(1) *Monactinellidæ*, in which the spicules have but a single axis; (2) *Tetractinellidæ*, in which the spicules have four rays or arms; (3) *Lithistidæ*, in which the spicules are four-rayed or irregular in form, and intimately interwoven together; and (4) *Hexactinellidæ*, in which the skeleton consists of spicules with six rays. As a rule, entire sponges of the two first-mentioned orders are rarely met with as fossils, though their detached spicules are very abundant, more particularly in the Upper Greensand and the Upper Chalk. The greater number of fossil sponges belong to the *Lithistidæ* and *Hexactinellidæ*.

With one or two exceptions fossil Calcisponges belong to the family of the *Pharetrones*. The spicules are mostly three or four-rayed, and they are united into a continuous fibrous network.

Fossil sponges are first met with in Cambrian strata, the earliest known genus, *Protospongia*, belongs to the Hexactinellidæ. In the Silurian rocks the Lithistidæ are represented by *Astylospongia* and *Aulocopium*; and the peculiar families of the *Receptaculitidæ* and the *Astræospongidæ* occur here and in the Devonian. Hexactinellid sponges, allied to the recent *Hyalonema*, were numerous in Carboniferous strata, and are principally represented by detached spicules and by bands of elongated spicules, which served to anchor the sponges in the mud.

With the exception of a small group of Calcisponges from the Triassic strata of St. Cassian, and from the Inferior Oolite of this country, fossil sponges are rarely met with until reaching the middle and upper Jura of Germany and Switzerland, in which the Lithistidæ and Hexactinellidæ are very abundant. Calcisponges are numerous in the Lower Greensand of Faringdon, Berkshire; and in the Upper Greensand of the South of England, Lithistid sponges are largely developed, as well as spicules of Tetractinellidæ and Monactinellidæ. Hexac-

tinellid sponges distinguish certain zones of the gray Chalk and the Chalk Marl, and in the Upper Chalk representatives of all the groups of siliceous sponges are present. It is probable that the silica of the flints in the Upper Chalk is derived from the skeletons of siliceous sponges; in many instances the flints are formed round the sponges, and when broken and their inner surfaces polished, the canals of the sponges are distinctly shown.

Gallery, No. 10. Fossil Sponges.

Sponges of Tertiary age are rare, and are represented by the minute borings of the genus *Cliona* in molluscan shells.

The Fossil Sponges occupy Table-cases Nos. 11–15, and Wall-cases Nos. 7 and 8.

The Fossil Sponges have been most carefully described, catalogued, and copiously illustrated by Dr. G. J. Hinde, F.G.S., and the work has been published by order of the Trustees.

Table-cases, Nos. 11 to 15, and Wall-cases, 7 & 8.

Sub-Kingdom 5.—Protozoa (First Life).

The animals placed in this division are extremely simple; they are generally of very minute size, and composed of an apparently structureless or but slightly differentiated jelly-like albuminoid substance, known as "sarcode"; they have no definite parts or segments, no distinct body-cavity, or nervous system, nor any definite alimentary apparatus.

They comprise all the simplest living organisms, such as the Infusorial Animalcules, the *Amœba*, *Foraminifera*, *Radiolaria*, &c.

The two last-named types have hard skeletons, and are consequently found as fossils.

Class 22.—**Radiolaria.**

The Radiolaria possess a siliceous skeleton, the parts of which are arranged in a more or less radiate manner. The soft sarcode, of which the animal's body is composed, forms a central mass, surrounded by a membranous capsule and an outer layer containing cell-like bodies, from which extend long filamentous ray-like threads of sarcode known as "pseudopodia."

The order includes *Polycystina*, *Acanthometrina*, *Thalassicollida*, and *Actinophryina*.

The Polycystina have been found on nearly every ocean floor both in high and low latitudes.

Their siliceous skeletons (of extreme microscopic minuteness) have accumulated until they have formed depositr of considerable thickness during the later geological epochs, and myriads of these exquisite microscopic forms may be obtained from many strata in Sicily; Greece; Oran, in Africa; Bermuda; Richmond, Virginia; and Barbadoes.

Class 23.—Foraminifera.

Foraminifera.

Gallery, No. 10. Wall-case, No. 9, and Table-case, No. 16.

The Foraminifera* have the body protected by a shell or test, composed of carbonate of lime, or it may consist of particles of sand cemented together, whilst others have a horny or chitinous covering.

The body may be simple or may repeat itself indefinitely by budding. The sarcode composing the animal's body gives out long thread-like pseudopodia, which often unite to form a continuous layer of sarcode outside the shell. The pseudopodia reach the exterior either by perforations in the walls of the shell or simply by an opening in the last chamber.

The Foraminifera are generally divided into two great primary divisions, namely, the Perforata and the Imperforata.

In the former the shell is perforated by more or less numerous pseudopodial foramina. In the latter the shell is *not* perforated, and may be arenaceous or "porcellanous."

The Imperforata include the *Miliolida* forms, which range from the Trias to the recent seas, and the *Lituolida*, which commence in the Carboniferous period. About 17 genera are represented."

Globigerina.

The Perforata include five families: the *Globigerinida*, so abundant in the Atlantic ooze, and also in the English Chalk, as to have led some writers to speculate on the Chalk-formation being identical with the modern deep-sea ooze in its mode of origin. The *Textulariidæ*, the *Rotalidæ*, and *Lagenidæ*, dating back to the Carboniferous and represented by many genera.

Fusulina.

Lastly, the great group of the Nummulitidæ, which in Carboniferous times built up vast masses of limestone in Russia, Central Europe, Armenia, India, China, Japan, and the United States, almost composed of *Fusulina:* and the *Nummulites*, which in Tertiary times played so conspicuous a part in building up the solid framework of the earth's crust, whether in Europe, Asia, or Africa.

Nummulites.

The great Nummulitic Limestone often attains many thousands of feet in thickness, and extends from the Alps to the Carpathians, and is in full force in North Africa, both in Morocco and Algeria. In Egypt it was largely quarried during the early dynasties for the building of the Pyramids.

It occurs also in Asia Minor and Persia; thence it stretches to India, and from the passes of Cabul to Eastern Bengal and the frontiers of China.

With this family is also included the much-disputed *Eozoön*, met with in the Lower Laurentian Limestones of Canada.

* The Foraminifera have been Catalogued by Professor T. Rupert Jones, F.R.S., and published by order of the Trustees.

Foraminifera. Wall-case, No. 9.

In Wall-case No. 9 is placed a series of models prepared by M. Alcide d'Orbigny, illustrative of the various forms of Foraminifera; also a set prepared by Drs. Reuss and Fritsch to illustrate Reuss's classification of this group.

Table-case, No. 16.

The British series of Foraminifera are arranged in Table-case No. 16 and the Foreign series in Wall-case No. 9.

PLANTÆ.

Gallery, No. 10.

Fossil Plants. Wall-cases, Nos. 10 to 18. Table-cases, Nos. 17 to 32.

Wall-cases Nos. 10–18 and Table-cases Nos. 17–32 are devoted to the exhibition of the Fossil plants, but as these are at present under arrangement it is only needful to say that the Tertiary plants commence in Wall-case No. 10 and in Table-case No. 17. To these succeed the Secondary and Palæozoic plants, the series terminating at the south end.

Glazed-cases, b, c, d, & e.

A fine opalized tree from Tasmania, a series of silicified woods from various localities, a large trunk of a tree from Purbeck Beds, Isle of Portland, and several Sigillaria stems from the Coal Measures are placed down the centre of this Gallery.

TYPE COLLECTIONS AND STRATIGRAPHICAL SERIES.

Gallery, No. 11. Type Collections.

Gallery No. 11.—This Gallery is now under arrangement; a portion of the cases along its Western side will be devoted to a special Stratigraphical collection, and on its Eastern side it will serve to continue the exhibited series of remains of Fossil Reptilia and a large series of *Ichnites*, or Footprints of Fossil Birds, Reptiles, &c., from various formations.

The Table-cases are appropriated to the type-collections of Dr. William Smith; of Sowerby, Gilbertson, Frederick Edwards, Searles V. Wood, Dr. Thos. Davidson, and others, illustrating S. V. Wood's Crag Mollusca; F. Edwards' Eocene Mollusca; Dr. Davidson's, Brachiopoda; the types of Sowerby's Mineral Conchology; Phillips's Carboniferous Fossils of Yorkshire; William Smith's "Strata Identified;" and some others.

HENRY WOODWARD.

EXPLANATION OF PLAN.

GEOLOGICAL GALLERIES.

List of large objects placed on stands and in separate glazed cases, distinguished on the Plan by a special letter.

A. The skeleton of *Mastodon americanus*, from Benton co., Missouri (partly restored).

B. Skull and lower jaw of *Dinotherium giganteum*, from the Miocene of Eppelsheim, Hesse-Darmstadt. (The lower jaw is a reproduction.)

C. Skull and lower jaw of *Mastodon Humboldti*, from Chile, in S. America.

D. Skull with tusks of *Elephas Ganesa*, from the Older Pliocene, Siwalik Hills, India.

E. Skull and lower jaw of "the Mammoth," *Elephas primigenius*, from the Pleistocene (Brickearth), Ilford, Essex.

F. Plaster-cast of skull of *Elephas namadicus*, Older Pliocene, Siwalik Hills, India.

G. A very large skull of *Elephas hysudricus*, from the Siwalik Hills, India (figured in the *Fauna Antiqua Sivalensis*, Pl. IV.)

H. Another skull of the same species placed so as to show the palate and the upper molar teeth, from the same locality (figured op. cit. Pl. V.).

I. Skull with horns (restored) of *Sivatherium giganteum*, from the Lower Pliocene, Siwalik Hills, India.

K. Skeleton, with antlers, of male of *Cervus giganteus*, from Peat-deposits (Pleistocene), Ireland.

L. Skeleton of a (hornless) female of same deer, also from Ireland.

M. Skeleton, with antlers, of another male from the Bog of Axe, Gorey, co. Wexford (from the collection of the Earl of Enniskillen).

M.M. Reproduction (natural size) of the entire skeleton of *Dinoceras mirabile*, Marsh, from the Eocene of Wyoming Territory, United States. Presented by Professor O. C. Marsh, M.A., F.G.S.

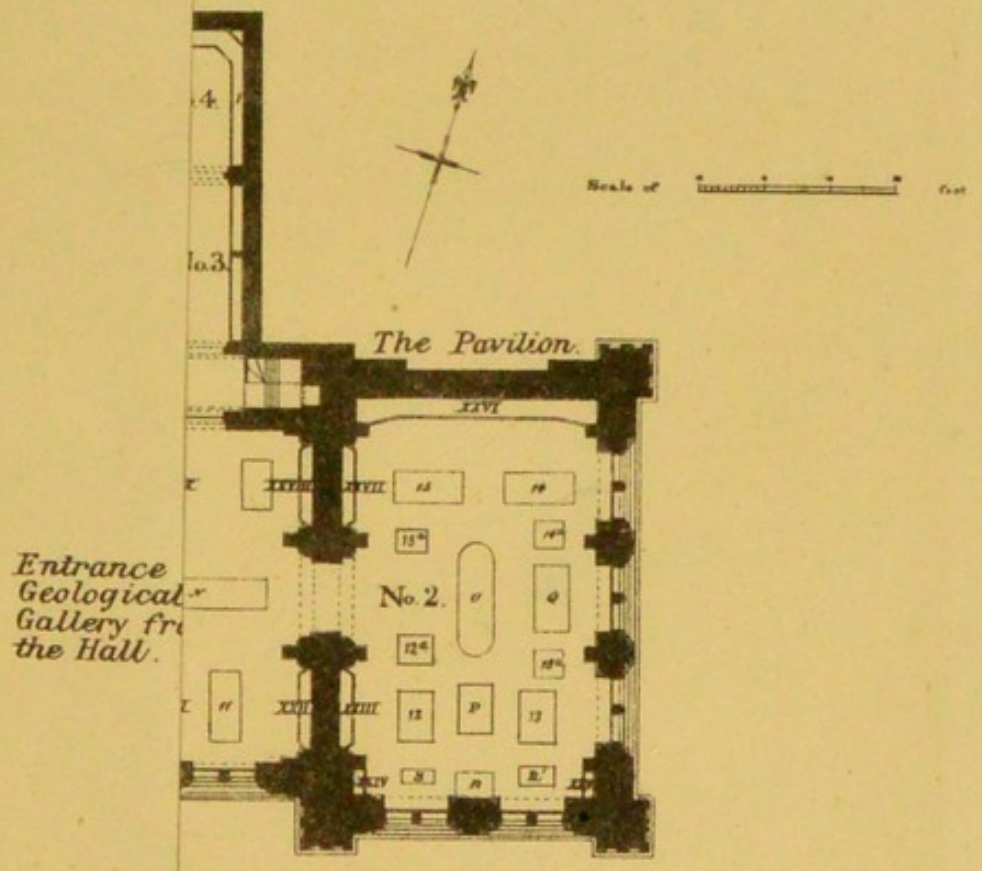
N. Skeleton of *Rhytina gigas*, "Steller's sea-cow," an extinct form of Sirenian, once common along the shores of Behring's and Copper Island, sea of Kamtschatka, seen alive by the Naturalist Steller so lately as 1741.

DEPARTMENT OF

GEOLOGY AND PALÆONTOLOGY

PLAN OF GALLERIES
EAST SIDE, GROUND FLOOR,
BRITISH MUSEUM,
(NATURAL HISTORY.)

No. 1. *S.E. Gallery—Fossil Mammalia.*
2. *Pavilion—Marsupialia, Edentata, Birds.*
3. *East Corridor—Reptilia.*
4. *Reptilian Gallery.*
5. *West Corridor—Reptilia.*
6. *Fossil Fishes.*
7. *Cephalopoda and Pteropoda.*
8. *Mollusca, Articulata, Echinodermata, etc.*
9. *Library and Workroom.* (*Private.*)
10. *Cœlenterata, Protozoa and Plants.*
11. *Type Collections & Stratigraphical Series.*



EXPLANA

O. Restoration of the skeleton
from the Pleistocene depos

O.O. An almost perfect skeleton
Buenos Ayres, South Ame

P. Skeleton of *Mylodon* (in cour

Q. Restored Cuirassoo and tail-s
jaw, and bones of the fore

R. Complete skeletons of *Dino*
casts of leg-bones of the

S. *Dinornis elephantopus*, the
footprints of same. New

T. Very large head of *Ichthyo*
Lyme Regis.

U. Another nearly complete
platyodon, from the Lias
Haden, Esq.

V. Reproduction of a large he
in the hall of the Geolo

W. Coloured cast of *Pleiosaur*
Lias (Alum Shale) of W
Science and Art Museu

X. Coloured cast of skeleton
separate. The original

Y. Nearly entire skeleton of
of Charmouth, Dorset.

y. Skeleton of *Hypsilophod*
Wight.

Z. Restored model of *Colosso*
Siwalik Hills, India.

a. Block of Limestone, fro
Portland.

b. Specimens of silicified w

c. Opalized or silicified tru
trudus). Discovered
Pliocene age, on the
Plains, New Norfolk
Commissioners for th

d. Portion of the silicifie
Kaup), from the Pu
Portland.

e. Portions of the stems
from the Coal Mea

O. Restoration of the skeleton of *Megatherium*, a gigantic Ground Sloth, from the Pleistocene deposits of Buenos Ayres, South America.

O.O. An almost perfect skeleton of *Mylodon gracilis* from the Pleistocene of Buenos Ayres, South America.

P. Skeleton of *Mylodon* (in course of erection but not yet completed).

Q. Restored Carapace and tail-sheath, of *Glyptodon* (with skull and lower jaw, and bones of the fore and hind limbs added).

R. Complete skeletons of *Dinornis maximus* and *Dinornis parvus*, with casts of leg-bones of the largest Moas known, from New Zealand.

S. *Dinornis elephantopus*, the elephant-footed "Moa," also impressions of footprints of same. New Zealand.

T. Very large head of *Ichthyosaurus* (much crushed), from the Lias of Lyme Regis.

U. Another nearly complete and well-preserved head of *Ichthyosaurus platyodon*, from the Lias of Lyme Regis. Presented by F. Seymour Haden, Esq.

V. Reproduction of a large head of *Ichthyosaurus*, the original preserved in the hall of the Geological Society, Burlington House.

W. Coloured cast of *Plesiosaurus Cramptoni*. The original is from the Lias (Alum Shale) of Whitby, Yorkshire; and is preserved in the Science and Art Museum, Dublin.

X. Coloured cast of skeleton of *Pelagosaurus typus*, with all the bones separate. The original from the Lias of Normandy.

Y. Nearly entire skeleton of *Scelidosaurus Harrisoni*, from the Lower Lias of Charmouth, Dorset.

y. Skeleton of *Hypsilophodon Foxii* from the Wealden, Brixton, Isle of Wight.

Z. Restored model of *Colossochelys atlas*, a gigantic land-tortoise, from the Siwalik Hills, India.

a. Block of Limestone, from the "Roach Bed," Portland Oolite, Isle of Portland.

b. Specimens of silicified and opalized woods, from various localities.

c. Opalized or silicified trunk of an extinct Coniferous Tree (*Spondyloxtrobus*). Discovered embedded in basaltic lava, probably of Pliocene age, on the estate of Richard Barker, Esq., Macquarie Plains, New Norfolk, Tasmania. Presented by the Tasmanian Commissioners for the 1851 Exhibition.

d. Portion of the silicified trunk of a Coniferous tree (Cedroxylon, Kaup), from the Purbeck Bed, top of the Portland Oolite, Isle of Portland.

e. Portions of the stems of Sigillaria and of a Lycopodiaceous Tree from the Coal Measures.

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