II.—*The Progress of Vertebrate Palæontology in Canada.*

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The dawn of vertebrate palæontology in Canada may be said to have begun when Sir William E. Logan, in 1841, discovered amphibian footprints in the Lower Coal Measures at Horton bluff, Nova Scotia. It may be naturally asked—What progress has been made in the science of vertebrate palæontology since that time, and what is the present state of our knowledge of the vertebrates that inhabited the northern half of this continent, living on the land, in the lakes and rivers, or in the adjacent seas, during past geological ages? It is with the object of reviewing briefly the progress of Canadian vertebrate palæontology during this period of over sixty years that the present paper is written.

The discovery by Sir William Logan of footprints at Horton bluff in 1841 was the first proof of the existence of Carboniferous air-breathing vertebrates. In a paper on the coal-fields of Pennsylvania and Nova Scotia, read by him before the Geological Society of London, shortly after, mention is made of the finding of these tracks, an abstract of the paper appearing in the Proceedings of the Society in 1842.[1]

Sir J. William Dawson, in his "Synopsis of the Air-breathing Animals of the Palæozoic in Canada, up to 1894," refers to the leading part taken by our eastern provinces in some of the earlier discoveries, but it may be said that whatever credit is due in this regard to eastern Canada is the result, in a great measure, of the untiring energy and industry of Sir William Dawson himself. To him belongs the credit of having made the "first discovery of the osseous remains of any Palæozoic land vertebrate in America,"[2] when in 1850 he found the type of *Baphetes planiceps* at the Albion mines, Pictou. Sir William Dawson's contributions to vertebrate palæontology have been principally confined to the description of numerous species of Carboniferous Stegocephalia. Much of his time was devoted to palæobotany, as is evinced by his numerous writings on the fossil flora of this country published at frequent intervals during his long life. In his "Acadian Geology" will be found the results of years of arduous work, devoted to the eluci-

[1] Proc. Geol. Soc., London, Vol. III., pt. II., p. 707.

[2] Synopsis of the Air-breathing Animals of the Palæozoic in Canada, up to 1894. Transactions Royal Society of Canada for 1894, vol. xii., section iv., p. 71, 1895.

dation of the geology of the maritime provinces, and begun when the science of geology may be said to have been still in its infancy.

In the early fifties Dr. C. T. Jackson made known to us some of the fishes of the Lower Carboniferous of New Brunswick. To Sir Richard Owen we are indebted for the description of *Baphetes planiceps* and two other species of Stegocephalia from the Coal Measures of Nova Scotia.

Bathygnathus borealis, from the Triassic of Prince Edward island, one of the earliest of the Theropoda and the only known dinosaur from eastern Canada was described by Dr. Joseph Leidy in 1854.

Sir William Dawson's first edition of "Acadian Geology" appeared in 1855 and was followed in later years, from 1859 on, by numerous papers on the fishes and amphibians of the Carboniferous rocks.

The large vertebræ from the Coal Measures of Nova Scotia, discovered by Professor Marsh and named by him in 1862 *Eosaurus acadianus,* made known the existence of a Carboniferous Stegocephalian of large size. These remains were thought by Professor Marsh to represent an Ichthyopterygian reptile, but they have since been referred to the Labyrinthodontia with uncertainty as to their family relationship.

Professor E. Ray Lankester contributed in 1870 to our knowledge of the Lower Devonian Cephalaspids, having for his subject the remarkable form *Cephalaspis dawsoni,* from Gaspé, named after its discoverer Sir William Dawson.

Vertebrate palæontology in this country owes much to Professor E. D. Cope, who, when he could ill afford the time, was willing to give to us, in the cause of science, the benefit of his extensive knowledge of the vertebrata. His memoir on the fauna of the Oligocene beds of the Cypress hills was an important addition to the vertebrate palæontology of this continent.

Dr. J. F. Whiteaves has, between the years 1880 and 1889, in a number of papers, placed before us the results of his studies of the rich fish-faunas of Campbellton, N.B., and Scaumenac bay, Que. In two of these papers, read before this Society, the well-preserved specimens of *Bothriolepis canadensis* and the Upper Devonian Crossopterygian *Eusthenopteron foordi* are described and figured.

Dr. G. F. Matthew was the fortunate discoverer in 1886, in rocks of supposed Niagara age in New Brunswick, of the Ostracoderm *Cyathaspis acadica.* These remains, first described in 1886, and more fully characterized in a number of papers of later date, represent a form of vertebrate, the oldest yet discovered in Canada as regards its geological age. If the views of some authorities be accepted it may be

regarded as the most primitive example of vertebrate life known to us in this country.

Dr. A. Smith Woodward, in two papers published in the Geological Magazine in 1892, adds much to our knowledge of the Devonian fishes of Scaumenac bay and Campbellton, and Dr. R. H. Traquair has also described new or little known forms from these same localities.

In association with Professor H. F. Osborn, the writer in 1902 reported on the vertebrate fauna of the Belly River series of the North West Territory, the publication taking the form of a joint memoir. Professor Osborn, in a manner as disinterested as that of Professor Cope, and equally laudable, devoted time, when under the pressure of other work, to the consideration of the general geological and palæontological relations of the fossils which the writer had the pleasure of describing. This fauna includes fishes, a batrachian, reptiles and mammals, the majority of which were new to science.

After having glanced at the main facts relating to the results of those who have contributed most to our knowledge of the fossil vertebrata of the Dominion, let us pass to a consideration of the faunas, as they are known to us at present, of the different geological horizons.

1. SILURIAN FAUNA.—In rocks of Silurian age there are only two representatives of the highest subkingdom, viz.: *Cyathaspis acadica,* an Ostracoderm from New Brunswick, belonging to the order Heterostraci, which includes the simplest forms of the subclass, and *Dendrodus, arisaigensis,* a crossopterygian Teleostome from a slightly higher horizon in Nova Scotia. The former is the only Silurian Pteraspid known from Canada, a species of another genus, *Palæaspis elliptica,* occurring in the Upper Silurian of Pennsylvania. *Dendrodus arisaigensis* is based on a well-preserved tooth, from the Upper Arisaig series (Lower Helderberg) at McDonald's brook, near Arisaig, N.S., collected by Mr. T. C. Weston in 1869.

2. LOWER DEVONIAN FAUNA.—Passing to the Lower Devonian, the efforts of collectors have here been more liberally rewarded. Through the writings of Lankester, Whiteaves, A. S. Woodward and Traquair, the number of known species from these rocks is now greatly increased, in comparison with the paucity of the recorded species from the Upper Silurian, the majority of the forms coming from the celebrated beds at Campbellton, N.B. Three species of Cephalaspids are notable, *Cephalaspis campbelltonensis,* of which the cranial buckler, the only part preserved, is of large size, *C. dawsoni,* from Gaspé, remarkable in many ways, but especially in the great breadth of the head shield as compared with the smallness of the trunk, and *C. jexi,* differing in several particulars from both of the above species. In the class Pisces,

seven genera are represented by seven species. *Protodus jexi* and *Doliodus problematicus* are Pleuracanthids from Campbellton. Of the Diplacanthidæ we have *Climatius latispinosus,* also from Campbellton, and of the Acanthodidæ there are *Acanthodes semistriatus* and *Cheiracanthus costellatus,* from the same locality. The Dipnoi are represented by a single species, *Phlyctænaspis acadica,* an Arthrodire generically distinct from Coccosteus, with which it was originally classed. Woodward has drawn attention to the presence in this species of a pair of hollow, lateral, fixed spines, a feature worthy of special notice. Another species of this order, *Macropetalichthys sullivanti,* is questionably represented by small fragments of plates from the Corniferous of Ontario. Of the Teleostomi a single Crossopterygian is indicated by part of an "inter-mandibular crest," from the Corniferous of Ontario, which has been identified with Newberry's *Onychodus sigmoides.* Under the designation Ichthyodorulites come *Machæracanthus peracutus, M. sulcatus* and *Gyracanthus incurvus* from Ontario, Gaspé and New Brunswick respectively.

3. Upper Devonian fauna.—The fauna of the Upper Devonian differs materially from that of the Lower Devonian by the introduction of many new forms. The order Osteostraci is represented by three species, the order Antiarchi by the very characteristic Upper Devonian genus *Bothriolepis.* The Elasmobranchs include Acanthodian fishes of the families of Diplacanthidæ and Acanthodidæ. In *Ptychodus* and *Rhynchodus* we have genera of Chimæroids. The Dipnoan fishes are represented by the genus *Scaumenacia* of the Sirenoidei, and the genera *Coccosteus, Aspidicthys* and *Dinichthys* of the order Arthrodira. *Holoptychius, Eusthenopteron* and *Onychodus* are Crossopterygian genera. An advance is made by the introduction of the Actinopterygian genus Cheirolepis.

Comparing the Upper Devonian fauna with that of the Lower Devonian we find the Ostracoderms augmented by the order Antiarchi. The early forms of the Ichthyotomi mentioned as occurring in the Lower Devonian have no Upper Devonian representatives. Also Chimæroid, Sirenoid and Actinopterygian fishes are added to the list.

Cephalaspis laticeps and *Euphanerops longævus are both from* Scaumenac bay, Que., the latter being the only known genus and species of the family of Euphaneropidæ. We have the sole representative of the Antiarchi in *Bothriolepis canadensis.* The type of this particularly interesting genus is *B. ornata* from the Upper Devonian of Russia, described by Eichwald in 1840. Of the nine species known from England, Scotland, Russia, Canada and the United States, *B. canadensis* appears to come nearest to *B. ornata* and *B. hydrophila,* Agassiz,

described in 1844 from Scotland. The Canadian species is interesting on account of its having clearly indicated oral appendages, described by Whiteaves and also by A. S. Woodward. This genus differs from Pterichthys principally in the proportions of the plates, the direction of the sensory canals and the relatively longer lateral appendages which are supposed to be modified and highly specialized head spines.

As in the Lower Devonian, the Diplacanthidæ and Acanthodidæ are present, the former represented by the typical genus; the species are *Diplacanthus striatus, D. horridus, Acanthodes affinis* and *A. concinnus,* all four from Scaumenac bay. The Chimæroid genera *Ptyctodus* and *Rhynchodus* are from the Upper Devonian of Manitoba, the former also occurring in rocks of the same age in Ontario. The Dipnoans are made conspicuous in this fauna by the presence of four species belonging to the four genera, *Scaumenacia, Coccosteus, Aspidicthys* and *Dinichthys. Scaumenacia curta* from Scaumenac bay is a Sirenoid of the family of Phaneropleuridæ. The Arthrodiran lung-fishes *Coccosteus canadensis* from Scaumenac bay, *Aspidicthys notabilis* from Ontario and Manitoba, and *Dinichthys canadensis* from the same provinces, were probably worthy representatives of this extinct and highly specialized order. *Holoptychius, Eusthenopteron, Onychodus* and *Cheirolepis,* Teleostomatous fishes, complete the list of the known Devonian genera of this country. Of the Crossopterygians *Holoptychius quebecensis* and *Eusthenopteron foordi* are from Scaumenac bay, and an undetermined species of Onychodus is from the Cuboides zone of the Devonian of Manitoba. The Actinopterygian, *Cheirolepis canadensis* of the suborder Chondrostei still further accentuates the richness of the fish-fauna of Scaumenac bay.

The well-known *Eusthenopteron foordi* exemplifies in an admirable manner a modified "archipterygial" type of fin structure in the pectorals. In the type specimen in the museum of the Geological Survey, the relation of the unfused radial supports, in the unpaired fins, to the basals which connect directly with the axial skeleton, is particularly well shown. Dr. Whiteaves's descriptions supplemented by the results of Dr. A. S. Woodward's study of additional material from the type locality, and critical observations on the fin structure generally, by Professor Bashford Dean,[1] have made this species one of the best known of the Devonian Crossopterygians.

The Carboniferous rocks of eastern Canada have yielded a highly important vertebrate fauna comprising a variety of fishes and a wealth

[1] Fishes, living and fossil. An outline of their forms and probable relationships, by Bashford Dean, New York, 1895.

of species of Amphibians, Stegocephalians for the most part belonging to the suborders Microsauria and Labyrinthodontia. The majority of these fossils were collected by Sir William Dawson, whose writings on the air-breathers of this period have made the Coal Measures of Nova Scotia famous as a palæontological collecting ground.

4. LOWER CARBONIFEROUS FAUNA.—In the Lower Carboniferous we have a forecast only of the terrestrial life of the Upper Carboniferous in the tracks of Amphibians preserved in the rocks of Nova Scotia. An Elasmobranch or Chimæroid fish is indicated by a spine from Cape Breton island. Both of the great orders Crossopterygii and Actinopterygii are represented, the first by a single genus and species of the family of Rhizodontidæ, the second by three Palæoniscid genera.

The ichthyodorulite *Gyracanthus magnificus* is a spine of large size from Cape Breton to be seen in the Provincial Museum of Nova Scotia at Halifax. *Strepsodus hardingi* was named and figured by Dawson in 1868, but with little description; lately Dr. O. P. Hay, of the American Museum of Natural History, New York, has more fully characterized the species, his observations being limited to the scales.

Of the Chondrosteans (Ganoids) we have *Rhadinichthys alberti, R. cairnsii, R. modulus, Elonichthys browni* and *Acrolepis? hortonensis,* the first four from Albert county, New Brunswick, the last one from Horton bluff, Nova Scotia. The tracks having the names *Hylopus hardingi, H. logani* and *Palæosauropus antiquior* are all from Nova Scotia. Dr. G. F. Matthew has, in a paper, read before this Society at its last annual meeting, and entitled "An attempt to classify Palæozoic batrachian footprints," aimed at reducing to some degree of order the confusion in which he has found the "generic" grouping of the tracks of Carboniferous age in Canada and the United States. The classification suggested by Dr. Matthew is based upon the number of the toe-marks preserved. Dr. R. S. Lull of Amherst, Mass., has also been working along somewhat similar lines, having devoted some time to the study of the footprints of dinosaurs in the Triassic rocks of the Connecticut valley[1] with most interesting and important results.

5. MILLSTONE GRIT FOOTPRINTS.—In the Millstone Grit the only indication of vertebrate life so far discovered in Canada is the well-preserved impressions of footprints primarily called *Sauropus unguifer.* A slab having large and particularly distinct footmarks of this "species" was collected by Sir Sandford Fleming, who presented the track itself

[1] Fossil footprints of the Jura-Trias of North America, by Richard Swann Lull, Ph.D. Memoirs Boston Society Natural History, vol. 5, p. 461, April, 1904.

to the museum of Queen's University, Kingston, Ont., and the natural cast in the overlying layer of rock to the Geological Survey.

6. UPPER CARBONIFEROUS FAUNA.—The fish-fauna of the Upper Carboniferous rocks is small numerically compared with the number of Amphibians recorded. The remains of the latter as well as those of the fish are principally from the South Joggins, Nova Scotia.

Elasmobranchs of the order Ichthyotomi are represented by the Pleuracanthids *Dittodus acinaces* and *D. penetrans,* the descriptions of which are based on teeth from Pictou, N.S. Other forms founded on Selachian teeth are *Ctenoptychius cristatus* from the South Joggins and Psammodus sp? from Pictou. *Gyracanthus duplicatus* is a very perfectly preserved ichthyodorulite from the South Joggins. The Dipnoans include the Dipterid species *Conchodus plicatus* from the same locality. The Teleostomes, Crossopterygians of the suborder Rhapidistia are *Rhizodus lancifer, Strepsodus dawsoni* and *Parabatrachus maxillaris,* from Horton and Pictou, from Pictou, and from Cape Breton island respectively. Sir William Dawson assigned teeth and scales from Pictou, with some doubt to Newberry's species *Megalichthys (Rhiziodus) lancifer* from the Coal Measures of Ohio. Dr. Hay, in his "Description of some vertebrates of the Carboniferous Age," bases a new species, *Strepsodus dawsoni,* on the Pictou scales, as he is of the opinion that they are quite different from those of Ohio, suggesting for the teeth the retention of the name under which they are referred to in the "Acadian Geology," although not certain that they are not those of an Amphibian. *Parabatrachus maxillaris* (*Megalichthys hibberti*), with which *Psammodus bretonensis,* Whiteaves, according to Hay, is synonymous, belongs to the Osteolepidæ and concludes the list of fishes from the Coal Measures.

The class Amphibia, as here referred to, is understood to include the two subclasses Stegocephalia, Cope, 1868, and Batrachia, Brogniart, 1800. The Stegocephalia are further subdivided into (I) Lepospondyli, Zittel, (II) Temnospondyli, Zittel, and (III) Labyrinthodontia, Owen. The Lepospondyli include the suborders: 1, Branchiosauria, Fritsch, 2, Microsauria, Dawson, and 3, Aistopoda, Miall. Dr. Hans Gadow[1] has recently placed the Microsauria definitely in the class Reptilia with ordinal rank (Microsauri) in the subclass Prosauria.

An undetermined species of *Sparodus* is so far the only representative of the Branchiosauria from the Coal Measures of Nova Scotia. Of the Microsauria the ten species included in the genera *Hylonomus, Smilerpeton, Hylerpeton, Fritschia* and *Amblyodon* are all from the South Joggins. The Labyrinthodontia still further increase the number

[1] Amphibia and Reptiles, by Hans Gadow, London, 1901.

of Stegocephalians from Nova Scotia; of these in the family of Dendrerpetontidæ are *Dendrerpeton acadianum, D. oweni, Baphetes minor, B. planiceps* and *Platystegos loricatum,* all from the South Joggins except *B. planiceps,* which is from Pictou. As regards *Eosaurus acadianus* from the South Joggins, described by Marsh in 1862, from vertebræ only, doubt exists as to its exact position in the zoological scale. Lydekker suggests that it may belong to the Anthracosauridæ. Marsh described the vertebræ as those of a new Enaliosaurian.

The various tracks of this age from Nova Scotia, grouped under the name Ichnites, were probably, in some cases at least, made by the Stegocephalians above mentioned.

7. TRIASSIC DINOSAUR.—The only vertebrate fossil collected from the Triassic of this country consists of the anterior end of the right ramus of the lower jaw, in which seven trenchant teeth are preserved, of a carnivorous dinosaur from Prince Edward island, described by Leidy in 1854 under the name *Bathygnathus borealis;* this is the earliest evidence we have of dinosaurian life in this country. The specimen was found by Mr. D. McLeod, of New London, on the north shore of the island, and sold by him to the Academy of Natural Sciences of Philadelphia in whose museum it is now on exhibition. *B. borealis* is placed by Marsh in the family of Anchisauridæ; it may have been responsible with *Anchisaurus* and other allied forms, for the numerous tracks of the Triassic sandstone of the Connecticut valley, which are now regarded as having been made by dinosaurs and not by birds, as formerly supposed. For full particulars as to the form of teeth, etc., of this species the reader is referred to Leidy's admirable description to be found in the Journal of the Academy of Natural Sciences of Philadelphia. As Sir William Dawson has remarked, this very interesting fossil greatly aids in establishing the age of the red sandstones of Prince Edward island.

The dinosaur above mentioned affords us a very meagre glimpse of the vertebrate life of earliest Mesozoic times. Of the known varied aquatic and terrestrial vertebrate life of the Jurassic and earlier Cretaceous periods we have no evidence whatever in Canada, principally for the reason that a systematic search for fossils in the rocks of the formations representing Jurassic and early Cretaceous times has not as yet been instituted. Our lack of information is largely the result of lack of effort to secure the same.

The closure of this immense gap in our partial knowledge of the vertebrate life of the northern half of this continent is reached with the finding of fish remains in the Colorado formation in Manitoba, mentioned under the next heading.

8. FAUNA OF THE CRETACEOUS. NIOBRARA-BENTON (COLORADO FORMATION).—The fish remains, from the Niobrara-Benton of the Cretaceous of Manitoba, represent in all four species of different genera. *Lamna manitobensis,* a Selachian of the suborder Asterospondyli, is known only from detached teeth. The second species, *Ptychodus parvulus,* also a Selachian, but of the suborder Tectospondyli, and belonging to the family of Myliobatidæ (eagle rays), is founded on a single tooth. The two remaining species are Teleostomes, one *Enchodus shumardi,* described by Leidy from the Cretaceous of Nebraska, is represented by portions of the jaws with teeth, the other *Cladocyclus occidentalis,* Leidy, also a Nebraskan Cretaceous species, is recorded on the evidence of detached cycloid scales. *E. shumardi* and *C. occidentalis* are both Actinopterygians, the former of the suborder Isospondyli, the latter belonging to the Percesoces.

9. FAUNA OF THE CRETACEOUS. BELLY RIVER SERIES.—The next fauna to be considered, that of the Belly River series, includes fishes, a batrachian, reptiles and mammals, and has a greater diversity of forms and a larger number of species than any of the preceding ones.

This fauna is decidedly archaic in some of its features and progressive in others, forming a connecting link between the known faunas of the upper Jurassic and the uppermost Cretaceous, and helps to reduce the gap in the geological records of the land inhabitants of early Cretaceous times.

Most of the fossils included in this fauna were obtained by the writer in 1897, 1898 and 1901 in the Red Deer river district in Alberta, and are described in part II of volume III (quarto) of Contributions to Canadian Palæontology.

Among the fishes we have representatives of Elasmobranchs, Ganoids and Teleosts. We are able to record the occurrence of only one Amphibian, a Urodele species of the Batrachia. The synapsidan reptiles include plesiosaurs, and turtles of the three suborders Pleurodira, Cryptodira and Trionychia. Those of the Diapsida are, a species of the order Choristodera, Dinosauria of the two suborders Theropoda and Orthopoda, Squamata, Lacertilia and Crocodilia. Two mammals are an interesting feature of the fauna.

The Selachian *Myledaphus bipartitus,* placed with the Myliobatidæ is known only from separate teeth. Cope's description was based on teeth from Montana, the genus being doubtfully referred to the Rays. Of the "ganoid" *Actinopterygii* there are two species, one, *Acipenser albertensis* belonging to the Chondrostei, and founded on a keeled and ornamented shield, the other, *Lepidosteus occidentalis,* of the suborder Aëtheospondyli was described originally by Leidy from separate scales.

The Teleost *Rhineastes eruciferus* is known only from fragments of cranial bones. *Diphyodus longirostris,* whose relationships are uncertain, is of interest; it is hoped that additional material may soon throw light on its affinities.

The batrachian species, *Scapherpeton tectum,* is the only fossil representative of the subclass that we have. Cope was of the opinion that the genus was most probably referable to the Urodela.

In this series of rocks the remains of the Reptilia present a variety of forms of land and fresh-water groups of unusual interest. The plesiosaur *Cimoliasaurus magnus,* a marine type, is known originally from the Cretaceous of New Jersey. There are in all seven genera of turtles. The Pleurodira (fresh-water tortoises) are *Compsemys ? victus, Baëna hatcheri* and *B. antiqua,* Cretaceous representatives of the Jurassic family of Pleurosternidæ, a decidedly archaic feature of this fauna. The Cryptodires are of the two families of Adocidæ and Chelydridæ Of the Adocidæ (swamp turtles) are *Adocus lineolatus,* known from fragments of the shell having a very distinctive sculpture, and *Basilemys variolosus* (Cope's *Compsemys variolosus*) a turtle of large size with a roughly sculptured shell, of which the plastron is massive and reaches a length of nearly three feet. The Chelydroid species, *Neurankylus eximius* is peculiar in having a ninth costal bone to the carapace. The river turtles, Trionychia, are represented by one species of the family of Plastomenidæ, *Plastomenus costatus,* and two of the Trionychidæ, viz.: *Trionyx foveatus* and *T. vagans,* with a third not as yet determined. *T. foveatus* and *T. vagans,* previous to the expeditions to the Red Deer river were known only from shell fragments, but the material now in our possession has afforded us data for the reconstruction of almost the entire shell in each case. A well-preserved carapace (lacking only the nuchal plate) and the larger bones of two or three plastra, of *T. foveatus* are included in the collections from Alberta. As regards *T. vagans,* a complete carapace was obtained in the same region, and as there is little doubt that the species *Plastomenus coalescens,* Cope, from the Belly River series in Assiniboia, is based on the greater part of the hyoplastral and hypoplastral bones of *T. vagans,* the plastron of this species also is fairly well known.

Vertebræ referable to Cope's species *Champsosaurus annectens,* and described by the writer in 1902, are from the Belly River series of Alberta. In his memoir on "The Reptilian subclasses Diapsida and Synapsida and the early history of the Diaptosauria,"[1] Professor Osborn

[1] Memoirs of the American Museum of Natural History, Vol. I., 1903; and "Reclassification of the Reptilia," American Naturalist, vol. xxxviii., p. 93, February, 1904.

places the order Choristodera with equal rank to the Rhynchocephalia in his subdivisions of the new superorder Diaptosauria, considering it as a "sharply defined division of the Diaptosauria owing to its remarkable parallelism with the Gavialoid Crocodilia." *Champsosaurus* and *Simædosaurus* are the only known genera of the order, the former ranging from the Belly River series up to the Lower Eocene.

Taking up the dinosaurs next in order, the forms from this horizon fall into the two subordinal divisions of Theropoda and Orthopoda, with few representatives of the first or carnivorous group, but with many of the second, herbivorous dinosaurs, of the families of Stegosauridæ, Ceratopsidæ and Trachodontidæ. The specialization noticeable in both these suborders, leading to the total extinction of the entire order at the close of the Cretaceous period is far advanced in the Ornithomimidæ and Ceratopsidæ. The Stegosauridæ are already on the wane, there being little evidence of their occurrence in rocks higher than those of the Belly River series.

Deinodon horridus and *Ornithomimus altus* are carnivores, the former classed with the Megalosauridæ, the latter with the family that takes its name from the type genus and species, *Ornithomimus velox*, from Colorado. *Deinodon horridus* is closely allied to the Jurassic *Megalosaurus* and also to its successor, *Dryptosaurus*, from the higher Edmonton series. Known principally from teeth, additional material and further study are necessary for a better understanding of its generic relationships. *Ornithomimus altus* is a cursorial type with great grasping power in the manus, and is larger and shows greater specialization than its supposed ancestor *Ornitholestes hermanni*, a lightly built compsognathoid dinosaur recently described by Osborn from a nearly perfect skeleton from the Como beds (Upper Jurassic) of Wyoming. Among the characteristics of *O. altus* may be mentioned the straightness of the terminal phalanges of the pes, the great curvature and lateral compression of those of the manus, the elongation and crowding together of the metatarsals and the remarkable development of the postzygapophyses of the caudal vertebræ, which have lost their neural spines.

Palæoscincus asper and *P. costatus*, known from teeth, have been doubtfully referred to the Stegosauria. *Stereocephalus tutus* is a very heavily armoured Stegosaur of large size, with coössified plates protecting the head, and transverse rows of postcranial keeled ossicles. On this protective armour *Stereocephalus* no doubt relied in a great measure for immunity from the attacks of its agile carnivorous contemporaries.

The Ceratopsids *Monoclonius belli, M. canadensis* and *M. dawsoni* are ancestral types of the much larger forms of *Triceratops* and *Torosaurus* from the Laramie. *Stegoceras* is a new type to which reference

will be made later. *Monoclonius belli,* apparently nearly related to, and about one-third the size of *Torosaurus gladius,* Marsh, is known only from the coalesced parietals of the posterior crest in which are fontanelles of enormous size. *M. canadensis,* founded on parts of the skull, and vertebræ, has double fanged teeth, small supraorbital horns and a squamosal of triangular shape, scalloped on the outer edge, resembling somewhat the same bone in *Triceratops* and *Sterrholophus. M. dawsoni* has a large nasal horn and a broad saddle-shaped posterior crest in which are fontanelles or fossæ of large size, and is probably closely related to the Montana form *M. crassus.* The Montana species *Monoclonius crassus, M. recurvicornis, M. sphenocerus* and *M. fissus,* and those of the Belly River series, *M. belli, M. canadensis* and *M. dawsoni* constitute a particularly interesting and important group concerning which little is as yet known, the members of which, however, are smaller and apparently more primitive than the Laramie Ceratopsia. Professor Osborn is of the opinion that "it is not at all improbable that the horned dinosaurs will prove to be diphyletic, one line with persistent open fossæ leading from *Monoclonius* to *Torosaurus,* the other leading to *Triceratops* with closed fossæ." *Stegoceras validus* is based on portions of the skull from the median line of the head with indications on the upper surface of the presence of an unpaired horn. These parts were supposed to be prenasal, but, as pointed out by Nopcsa,[1] they probably represent the frontal and nasal elements of the skull. In *Stegoceras* we have an entirely new type, a unicorn dinosaur remarkable in that it bore a horn springing from the fronto-nasal region, recalling a somewhat similar development in the mammals *Aceratherium incisivum* and *Elasmotherium sibiricum.*

With the consideration of the *Trachodontidæ* (duck-billed dinosaurs) we reach a group of unarmed, bipedal, in many respects highly specialized Predentata, of which the Belly River series species are *Trachodon altidens, T. marginatus, T. selwyni* and *Cionodon stenopsis.* The mode of succession of the teeth in these herbivorous forms is one of the most interesting characteristics of the group. *T. altidens,* as its name implies, is distinguished from the other species by its long, narrow teeth, with distinctive border sculpture. A well-preserved maxilla represents this species and indicates an animal of small size. *T. marginatus,* known from excellent examples of the jaws with teeth, and the principal bones of the skeleton, reached a much larger size than *T. altidens,* but was itself far surpassed in bulk by *T. selwyni,* whose femur is nearly twice the size of that of *Iguanodon mantelli* of the

[1] "Ueber Stegoceras und Stereocephalus" von Franz Baron Nopcsa, jun., Centralblatt für Mineralogie, etc. No. 8, 1903. Stuttgart.

Upper Jurassic (Wealden) of England. The differences to be found in the shape and marginal sculpture of the teeth afford some of the most reliable data by which these species may be distinguished. *Cionoden stenopsis,* described by Cope from this horizon in Assiniboia, is very imperfectly known from small fragments of the jaw. Although, in his original description, Cope mentions that parts of teeth were preserved with the jaw-fragments, no trace of the former are now with the type material in the museum of the Geological Survey.

Troödon formosus has been provisionally referred to the Lacertilia; it is known from teeth alone. Belonging also to the Squamata, of the suborder *Eusuchia,* are the two crocodiles *Crocodilus humilus,* named from numerous teeth, and *Bottosaurus perrugosus,* of which the lower jaw and the brain case are now known. This completes the list of reptiles.

The earliest mammalian remains, and the only Cretaceous ones, so far collected in this country, have been named *Ptilodus primævus* and *Boreodon matutinus,* and are from the Red Deer river. *P. primævus* is a multituberculate mammal more primitive than the Laramie Plagiaulacids, and is the earliest known species of the genus. The writer succeeded in obtaining a tolerably complete right mandibular ramus, in which are preserved the fourth premolar and the first molar. The teeth present characters that seem to indicate an approach to the Laramie Cretaceous genus *Meniscoëssus. Boreodon* is founded on a single tooth having a well-developed cingulum and two roots. Mr. Hatcher, of the Carnegie Museum, Pittsburgh, was fortunate enough during the summer of 1903 to find, in rocks of this horizon, a mandibular ramus, which he considers to belong to this species. He is of the opinion that the animal will prove to be a marsupial. A description of this additional material would be of interest.

As regards the fauna of the Belly River series as a whole it is decidedly archaic in character as compared with that of the Laramie, it includes specialized types that have survived from Jurassic times and groups in stages of evolution more primitive than their Laramie representatives. Attention is called to the absence of Sauropoda, a group almost confined to the Jurassic.

10. CRETACEOUS FAUNA. NANAIMO GROUP.—The Nanaimo group of the Cretaceous as developed in Vancouver island, has yielded as yet few vertebrate fossils. A tooth of the Selachian, *Lamna appendiculata* of the suborder *Asterospondyli,* is from this horizon. Asterospondylic vertebræ thought to belong to the Carchariidæ, as well as vertebræ of a Hemibranch of the family of Dercetidæ, also occur in these rocks.

11. CRETACEOUS. VERTEBRATE REMAINS FROM THE FORT PIERRE GROUP.—The same paucity of vertebrate remains is to be recorded from the Fort Pierre group of the North West Territory. The remains so far collected are of Selachii and consist of a tooth and a pectoral fin from localities in Saskatchewan and Assiniboia.

Without doubt our knowledge of the vertebrate faunas of the Nanaimo and Fort Pierre groups could be greatly extended by a moderate amount of systematic collecting, and the same may be said of the faunas of the different geological horizons throughout this country generally. The few fish remains so far obtained from the two Cretaceous groups just mentioned have been found by local collectors at odd times, or by officers of this Survey (other than palæontologists), who, with their time fully occupied with exploratory and purely stratigraphical work, have been quite unable to afford the time necessary for even a hurried search for fossils in the most promising localities.

12. CRETACEOUS. VERTEBRATE REMAINS FROM THE EDMONTON SERIES.—The Edmonton series, constituting the highest beds of the Cretaceous system in the western plains, has furnished its quota of dinosaurian remains in the shape of excellently preserved crania, with other parts of the skeleton, of the large carnivore *Dryptosaurus incrassatus* from the Red Deer river in Alberta. These remains, first described by Cope in 1892, form the subject of an illustrated memoir by the writer[1] now in the press. This dinosaur, with an estimated length of about thirty-three feet, and a length of head, from actual measurement, of over three feet, was the largest of the Theropoda and combined strength with a capability of rapid motion. It formed a proper culmination to an important section of a race that had played its part in the life history of this earth, and was destined not to survive the close of the Cretaceous epoch. *D. incrassatus,* from the west and *D. aquilunguis* from the Cretaceous of New Jersey, belong to the family of Megalosauridæ, and are the best known species of the genus.

13. DINOSAURIAN VERTEBRA FROM MESOZOIC BEDS.—A cervical vertebra of a dinosaur described by Professor A. L. Adams in 1875 under the name *Arctosaurus osborni,* was obtained many years previously by Captain Sherrard Osborn from beds of Mesozoic age at Rendezvous mountain at the north end of Bathurst island in 70° 36′ north latitude. The exact age of the beds is uncertain, but it is interesting to know that remains of a dinosaur have been found at the northernmost limits of Canada. *Arctosaurus osborni,* the only species of the genus, is re-

[1] Geol. Surv. of Canada, Contr. to Can. Palæon, Vol. III. (quarto), part III., "On Dryptosaurus incrassatus (Cope), from the Edmonton series of the North West Territory."

garded by Lydekker as a Theropodous dinosaur allied to the Anchisauridæ.

In his description of the above vertebra Lydekker remarks that "the especial interest of the specimen is the evidence which it affords as to the path by which the generic types of dinosaurs common to the old and new world may have passed from one hemisphere to the other." The type specimen is preserved in the museum of Science and Art, Dublin.

14. TERTIARY BIRD.—The only fossil bird, known from this country, older than the Pleistocene, was described by Cope in 1894, from the upper part of a tarsometatarsus obtained by Dr. G. M. Dawson at Carmanah point, Vancouver island, in a bed of indurated clay of Tertiary age. For the specimen Cope proposed the name *Cyphornis magnus,* the probable affinity of the genus being regarded as with the order Steganopodes. According to Cope, the characters of *Cyphornis* indicate the age of the bed to be Eocene or Oligocene. Also according to the same author "the presumed affinity with the Steganopodes indicates natatory habits, and probable capacity for flight. Should this power have been developed in *Cyphornis magnus,* it will have been much the largest bird of flight thus far known."

15. THE OLIGOCENE FAUNA.—The vertebrate life of Oligocene times is revealed to us in the 1883-84 collections of Messrs. R. G. McConnell and T. C. Weston from the Cypress hills, Assiniboia, described by Professor Cope. The fauna consists of fishes, turtles and mammals, the last, as might be expected, greatly preponderating, as with the Eocene began that dominance of the Mammalia which has continued to the present day.

The fishes are Actinopterygians, Protospondyli, the dominant fishes of the Jurassic period and Nematognathi, the Siluroid fishes. The former are represented by two species of the family of Amiidæ, *Amia macrospondyla* and *A. whiteavesiana,* each known from a single vertebra, the latter by three species of the Siluridæ, *Rhineastes rhœas, Amiurus cancellatus* and *A. maconnelli,* also described from vertebræ.

The turtles *Stylemys nebrascensis* and *Trionyx leucopotamicus* are represented by shell fragments. The former species is a Cryptodire belonging to the Testudinidæ, the latter a river turtle of the family of Trionychidæ. It is desirable that better material be secured of these interesting forms.

The mammals of this period belong to the orders Ungulata, Ancylopoda, Rodentia and Carnivora, with a number of species of Perissodactyles and Artiodactyles among the Ungulates.

Considering first the Perissodactyla or odd-toed hoofed animals, the horses are represented by *Mesohippus westoni,* the titanotheres by

three species of *Megacerops* and one of *Symborodon,* the hyracodonts by one species of *Hyracodon,* and the rhinoceroses by two species of *Aceratherium.*

Mesohippus westoni is known from teeth of primitive character, and is named after Mr. T. C. Weston, to whom the Survey is indebted for so many years of faithful service as a collector. *Megacerops angustigenis* is based on numerous specimens of upper and lower jaws with teeth with which were associated as probably belonging to the same species certain bones of the skull and limbs affording additional information.

The fossil remains from the Cypress hills that Cope identified with *Menodus americanus,* Leidy and *M. proutii,* Owen, Norwood and Evans are, in the light of recent research, probably referable to *Megacerops coloradensis,* Leidy. The results of the exhaustive studies of the Titanotheres made by Professor Osborn of late years are to be found in his papers entitled "The Cranial Evolution of Titanotherium,"[1] 1896, and "The Four Phyla of Oligocene Titanotheres,"[2] 1902. They form a solid basis for future research, and with them a proper understanding of the group is rendered possible, and a welcome release offered from the almost hopeless confusion into which the literature relating to these mammals had fallen, a confusion arising principally from a multiplicity of synonymous terms. *M. selwynianus* is a third species, named in honour of Dr. Alfred R. C. Selwyn, under whose able direction the Geological Survey of Canada made rapid and substantial progress during many years. *Menodus syceras,* Cope, is regarded by Osborn as probably identical with *Symborodon acer,* Cope. The material on which *M. syceras* was based consists of pairs of coössified nasal bones that exhibit characters such as are found in the corresponding bones of *S. acer.*

The ancient rhinoceroses from this region are *Aceratherium occidentale* (Leidy) represented by a fragment of a right mandibular ramus, and *A. mite* (syn. *A. pumilum,* Cope in part).

The type specimen of *A. (Cœnopus) pumilum,* Cope, consisting of the anterior end of a jaw holding deciduous teeth, has been shown by Osborn[1] to belong not to an Acerathere but to an Hyracodon, viz.: *Hyracodon nebrascense,* Leidy. The cotype of *A. pumilum,* which is of necessity now to be regarded as the type, establishes, according to the same authority, the identity of *A. pumilum* with *A. mite,* Cope, of the Symborodon or Titanotherium beds of north-western Colorado.

[1] Bulletin. American Museum of Natural History, vol. viii., article ix., p. 91.

[2] *Ibid,* vol. xvi., article viii., p. 91.

[1] Memoirs of the American Museum of Natural History, vol. I., part III., "The Extinct Rhinoceroses, by Henry Fairfield Osborn, New York, 1898.

Among the Artiodactyla we have representatives of the Suidæ, Agriochœridæ and Camelidæ. The highly specialized pig-like animals of large size of the genus *Elotherium* are known from a number of species from the Oligocene and Miocene beds of the western United States. *E. coarctatum* is a species from Assiniboia considered of interest on account of the primitive character of its teeth; it was established on a left mandibular ramus. Remains of the Agriochœridæ probably better known as the Oreodontidæ, of which the typical genera were termed ruminating hogs by Leidy, are scarce in the Cypress hills collections. The presence of the genus *Oreodon* is doubtfully indicated by a lower first premolar. Of the genus *Leptomeryx,* which, with closely allied forms, resembles the Cervidæ of the Pliocene, there are three species, *L. esulcatus, L. mammifer* and *L. semicinctus,* the first two of which are also recorded from the Titanotherium beds of Montana by Dr. W. D. Matthew.[2] *Hypertragulus transversus* of the family of Camelidæ is characterized from two upper molar teeth. This genus as well as *Leptomeryx* is placed by some authors with the Tragulidæ.

The order Ancylopoda includes primitive Ungulates having a curious assemblage of characters, among which may be mentioned as most striking the ungulate teeth and skull and the unguiculate terminal phalanges. *Chalicotherium* has been referred to by Osborn as an unguiculate perissodactyl. It is represented in our west by the Cypress hills species *C. bilobatum,* described by Cope from part of the jaw of an adult individual.

To the Leporidæ, hares and rabbits, belongs the Oligocene species *Palæolagus turgidus,* previously known from the White River beds of Dakota and Colorado. This, the only rodent from the Cypress hills district, is represented by mandibular rami.

There is evidence of one species only of the Carnivora, viz.: *Hemipsalodon grandis* of the family of Hyænodontidæ. Of it Cope remarks in his description of the species that "it was the largest flesh-eater of the epoch of the White River beds, and the size of its canine teeth proves it to have been a dangerous animal," also that "the jaw from which it is known is more robust than that of any existing carnivore."

A perusal of the Oligocene faunal list will convince any reader of the great variety of ancient and interesting forms of mammals that inhabited our western country during this early Tertiary time. The collections in our possession clearly show that the Cypress hills district may be regarded as probably the most promising collecting ground for fossil mammalian remains in Canada, and that with the aid of modern

[2] Bulletin, American Museum of Natural History, "The Fauna of the Titanotherium Beds at Pipestone Springs, Montana," vol. xix., article vi., p. 197, 1903.

field methods the results to be obtained from a systematic exploration of the beds of this district would be of the greatest possible value from a palæontological and general geological standpoint.

Before turning our attention to the life of Pleistocene times, the next to be considered, as no vertebrate fossils have been collected from rocks of Miocene and Pliocene age in Canada, it is necessary to mention certain fishes from British Columbian Tertiary beds that have been assigned with some doubt to the Oligocene.

16. TERTIARY FISHES.—The fishes referred to above are Plectospondyli of the family of Cyprinidæ belonging to the genus *Amyzon*. There are two species, the first *A. brevipinne* from the Similkimeen river, British Columbia, the second an undetermined species of the same genus from the Horse Fly river of the same province.

17. FAUNA OF THE PLEISTOCENE.—In the Pleistocene we come to forms the majority of which now exist. The several species of fishes found in the Leda clay of the St. Lawrence and Ottawa valleys are well-known living forms common in the Gulf of St. Lawrence and along the Atlantic coast. The only remains of birds are some undetermined bones that were obtained many years ago from the Leda clay at Montreal, and an impression of a small feather beautifully preserved in a nodule collected from the same deposit at Green's creek near Ottawa in 1881. *Delphinapterus leucas* (*Beluga catadon*), the white whale, white porpoise or beluga, is an Arctic species that at present occurs as far south as the Gulf of St. Lawrence, finding its way up the river of that name past Murray Bay; it is more abundant on the north than on the south shore of this river. The remains of this species have been found in the Pleistocene at Jacquet river, N.B., and at Rivière du Loup (en bas), Montreal and Cornwall. *Megaptera boöps* (*M. longimana*), the humpback whale, exists now in all seas. Some of the bones of a skeleton of this species were found in 1882 in a Pleistocene gravel deposit near Smith falls, Ontario. The Mastodon (Mammut) and Mammoth, judging from the wide distribution and number of their remains, must have been plentiful over a very large portion of this country, the range of the Mastodon extending from the east to what is now Manitoba, that of the Mammoth reaching eastward from the Pacific almost across the continent. Remains of one-toed horses have not been found in Canada, although so well-known from the Pleistocene of various parts of the United States, including Alaska. Marsh regarded the North American continent as the true home of the horse. It still existed here in the early part of the Quaternary period, and may have been a contemporary of prehistoric man. We know, however, that the native races at the advent of the white man to this continent knew nothing of the horse. There are few records of the finding of

bones of *Cervus canadensis* in the Pleistocene. Logan in his 1863 report (Geol. Surv. of Canada, p. 914) mentions the occurrence of the horns of this species near Hamilton, Ontario, associated with the jaw of a beaver, and in the same deposit, but a few feet lower, the remains of a mammoth. Tyrrell in his "Mammalia of Canada,"[1] points out that "the name 'Wapiti' was applied to this species by Richardson, who was apparently under the erroneous impression that the Indians knew it by this name. The Indian name '*Wapitik*' belongs, however, to the Mountain Goat and not to the *Waskesew*.[2] The former means 'white deer' (both the mountain sheep and mountain goat being considered as deer) and it would therefore only apply to the white Mountain Goat" (*Aplocerus montanus*). Dr. G. M. Dawson mentions in his Annual Report for 1898, the finding of part of the skull of a musk-ox (*Ovibos moschatus*) near Edmonton, Alberta, in the "Saskatchewan gravels" from which also a few miles above Edmonton a tooth of *Elephas primigenius* was obtained. Lydekker, in his Catalogue of the Fossil Mammalia in the British Museum, pt. II, states that a portion of a skull of the musk-ox was discovered in the Pleistocene of the Upper Porcupine river, Yukon. The remains of *Bison crassicornis* are recorded by Whiteaves from the Klondyke district, and by Lydekker from the Porcupine river. The latter's reference to the species is made under the name *Bos bonasus* (Linn.) var. *priscus* (Bojanus) a form that in the opinion of some authorities is not distinct from *B. crassicornis*, Richardson. The finding of a jaw of *Castor canadensis*, the American beaver, near Hamilton, Ontario, has been already referred to. Numerous remains of *Phoca grælandica*, the Greenland seal, also known as the Harp and Saddle-backed seal, have been found in the Leda clay at Montreal, Hull and Ottawa. For more detailed information regarding some of the above species from the Pleistocene the reader is referred to Sir William Dawson's well-known work "The Canadian Ice Age," published in Montreal in 1893.

In the two following lists the vertebrate species known from Canada are enumerated (1) according to their geological age in ascending order, (2) according to their position in the zoological scale passing from the lowest forms up to the highest. An attempt has been made to make the lists as complete as possible, and dates and localities are added. The dates given in the second list refer to the time of publication of the original descriptions of species based on specimens from Canada or to the identification of Canadian specimens with previously

[1] "The Mammalia of Canada," Proceedings of the Canadian Institute, third series, vol. vi., p. 66, 1889.

[2] *Wa-was-ka-sioo* is the Cree name for *Cervus canadensis*.

described species from the United States or elsewhere. Following the faunal lists is a short bibliography containing the more important references to the vertebrate species of Canada.

Summarizing the species in their several classes we have the following result:—

	No. of species.	
AGNATHA ..	8	
PISCES ..	72	
AMPHIBIA	39	(*of which* 21 *are tracks.*)
REPTILIA	35	
AVES..	3	
MAMMALIA ..	28	
Total	185	

From this it is seen that the fishes far outnumber the other forms; the reptiles come second and the mammals third. As most of the tracks were probably made by the amphibians the latter may be supposed to number about eighteen.

Or grouping the various species according to their geological age, thus:—

	No. of species.	
SILURIAN	2	
LOWER DEVONIAN ..	16	
UPPER DEVONIAN	17	
LOWER CARBONIFEROUS	11	(*of which* 4 *are tracks.*)
CARBONIFEROUS. MILLSTONE GRIT	1	*Track*
CARBONIFEROUS. COAL MEASURES	42	(*of which* 16 *are tracks.*)
TRIASSIC	1	
CRETACEOUS. NIOBRARA-BENTON..	4	
CRETACEOUS. BELLY RIVER ..	39	
CRETACEOUS. NANAIMO..	3	
CRETACEOUS. FORT PIERRE.... ..	2	
CRETACEOUS. EDMONTON	1	
MESOZOIC.....	1	
TERTIARY	1	
OLIGOCENE	25	
TERTIARY (? OLIGOCENE)..	2	
PLEISTOCENE	17	

we find that the faunas of the Lower and Upper Devonian, the Upper Carboniferous, the Belly River and Oligocene rocks are greater, in the number of their contained species, than those of the other horizons (with the exception of the Pleistocene), a result partly to be accounted for by the fact that special attention has been given at various times to these rocks as exposed at Campbellton, Scaumenac bay, the Joggins,

Red Deer river and the Cypress hills in an endeavour to obtain collections as representative as possible of their fossil vertebrate remains. This result is, however, an excellent example of the advantage to be derived from careful palæontological field work and systematic collecting.

It may certainly be said that we have so far made fair progress in the vertebrate palæontology of this country if we take into consideration, the very limited number of those who have devoted any time to the study of the fossil vertebrata of the Dominion, and how few have been the attempts made to secure a really representative collection of the vertebrate remains of any particular series of beds.

If we consider the magnificent results attained by the various institutions of some countries and the extensive collections exhibited in their museums, knowing that, throughout the Dominion generally, but particularly in the west, equally good results are forthcoming if proper means are taken to secure them, then we should realize the fact that as yet we have only made a beginning.

SPECIES ARRANGED ACCORDING TO THEIR GEOLOGICAL AGE.

SILURIAN.

Class AGNATHA.

Cyathaspis acadica (Matthew). Nerepis hills, King's county, New Brunswick. Thought to be of Niagara age.

Class PISCES.

Dendrodus arisaigensis, Whiteaves. Upper Arisaig series, McDonald brook, near Arisaig, Nova Scotia. (Lower Helderberg group.)

LOWER DEVONIAN.

Class AGNATHA.

Cephalaspis campbelltonensis, Whiteaves. Campbellton, New Brunswick.

Cephalaspis sp. Campbellton, New Brunswick.

Cephalaspis dawsoni, Lankester. Gaspé, Quebec.

Cephalaspis jexi, Traquair. Campbellton, New Brunswick.

Class PISCES.

Protodus jexi, A. S. Woodward. Campbellton, New Brunswick.

Doliodus problematicus (A. S. Woodward). Campbellton, New Brunswick.

Climatius latispinosus (Whiteaves). Campbellton, New Brunswick.

Spine of ? Acanthodian fish (*Homacanthus gracilis*, Whiteaves). Campbellton, New Brunswick.

Acanthodes semistriatus, A. S. Woodward. Campbellton, New Brunswick.

Cheiracanthus costellatus (Traquair). Campbellton. New Brunswick.

Machæracanthus peracutus, Newberry. Corniferous formation, Ontario.

Machæracanthus sulcatus, Newberry. Corniferous formation, Ontario; and Lower Devonian, Gaspé, Quebec.

Gyracanthus incurvus, Traquair. Campbellton, New Brunswick.

Phlyctænaspis acadica (Whiteaves). Campbellton, New Brunswick.

? *Macropetalichthys sullivanti*, Newberry. Corniferous formation of Ontario; and Mettagemi river, Ontario, in rocks of apparently the same age.

Onychodus sigmoides, Newberry. Corniferous formation. Ontario.

UPPER DEVONIAN.

Class AGNATHA.

Cephalaspis laticeps, Traquair. Scaumenac bay, Quebec.

Euphanerops longævus, A. S. Woodward. Scaumenac bay, Quebec.

Bothriolepis canadensis, Whiteaves. Scaumenac bay, Quebec.

Class PISCES.

Diplacanthus striatus, Agassiz. Scaumenac bay, Quebec.

Diplacanthus horridus, A. S. Woodward. Scaumenac bay. Quebec.

Acanthodes affinis, Whiteaves. Scaumenac bay, Quebec.

Acanthodes concinnus, Whiteaves. Scaumenac bay, Quebec.

Ptyctodus calceolus, Newberry and Worthen. Cuboides zone of the Devonian of Manitoba; and Hamilton formation of Ontario.

Rhynchodus sp. undt. Cuboides zone of the Devonian of Manitoba.

Scaumenacia curta (Whiteaves). Scaumenac bay, Quebec.

Coccosteus canadensis, A. S. Woodward. Scaumenac bay. Quebec.

Aspidicthys ? notabilis, Whiteaves. Cuboides zone of the Devonian of Manitoba; and Hamilton formation of Ontario.

Dinichthys canadensis, Whiteaves. Cuboides zone of the Devonian of Manitoba.

Holoptychius quebecensis (Whiteaves). Scaumenac bay, Quebec.

Eusthenopteron foordi, Whiteaves. Scaumenac bay, Quebec.

Onychodus sp. undt. Cuboides zone of the Devonian of Manitoba.

Cheirolepis canadensis, Whiteaves. Scaumenac bay, Quebec.

LOWER CARBONIFEROUS.

Class PISCES.

Gyracanthus magnificus, Dawson. Cape Breton island, Nova Scotia.

Strepsodus hardingi (Dawson). Horton bluff and Pictou, Nova Scotia.

Rhadinichthys alberti (Jackson). Hillsborough, Albert county, New Brunswick.

Rhadinichthys cairnsii (Jackson). Hillsborough, Albert county, New Brunswick.

Rhadinichthys modulus (Dawson). Hillsborough, Albert county, New Brunswick.
Elonichthys browni (Jackson). Hillsborough, Albert county, New Brunswick.
Acrolepis ? hortonensis, Dawson. Horton bluff, Nova Scotia.

ICHNITES.

Hylopus hardingi, Dawson. Parrsboro', Nova Scotia.
Hylopus logani, Dawson. Horton bluff, Nova Scotia.
Palæosauropus antiquior (Dawson). Parrsboro', Nova Scotia.
Megapezia pineoi, Matthew. Parrsboro', Nova Scotia.

CARBONIFEROUS. MILLSTONE GRIT.

ICHNITES.

Pseudobradypus (*Sauropus*) *unguifer* (Dawson). Fillimore's quarry, Cumberland county, Nova Scotia.

CARBONIFEROUS. COAL MEASURES.

Class PISCES.

Dittodus acinaces (Dawson). Pictou, Nova Scotia.
Dittodus penetrans (Dawson). Pictou, Nova Scotia.
Ctenoptychius cristatus, Dawson. South Joggins, Nova Scotia.
Psammodus sp. ? Pictou, Nova Scotia.
Gyracanthus duplicatus, Dawson. South Joggins, Nova Scotia.
Conchodus plicatus, Dawson. South Joggins, Nova Scotia.
Rhizodus lancifer ? Newberry. Horton bluff and Pictou, Nova Scotia.
Strepsodus dawsoni, Hay. Pictou, Nova Scotia.
Parabatrachus maxillaris (Agassiz). Cape Breton island, Nova Scotia.

Class AMPHIBIA.

Sparodus sp. undt. South Joggins, Nova Scotia.
Hylonemus latidens, Dawson. South Joggins. Nova Scotia.
Hylonemus lyelli, Dawson. South Joggins, Nova Scotia.
Hylonemus multidens, Dawson. South Joggins, Nova Scotia.
Hylonemus wymani, Dawson. South Joggins, Nova Scotia.
Smilerpeton aciedentatum, Dawson. South Joggins. Nova Scotia.
Hylerpeton dawsoni, Owen. South Joggins, Nova Scotia.
Hylerpeton intermedium, Dawson. South Joggins, Nova Scotia.
Hylerpeton longidentatum, Dawson. South Joggins, Nova Scotia.
Fritschia curtidentata, Dawson. South Joggins, Nova Scotia.
Amblyodon problematicus, Dawson. South Joggins, Nova Scotia.
Dendrerpeton acadianum, Owen. South Joggins, Nova Scotia.
Dendrerpeton oweni, Dawson. South Joggins, Nova Scotia.
Baphetes minor, Dawson. South Joggins, Nova Scotia.
Baphetes planiceps, Owen. Pictou, Nova Scotia.
Platystegos loricatum, Dawson. South Joggins, Nova Scotia.
Eosaurus acadianus, Marsh. South Joggins, Nova Scotia.

ICHNITES.

Asperipes avipes, Matthew. South Joggins, Nova Scotia.
Asperipes sp. South Joggins, Nova Scotia.
Asperipes (*Hylopus*) *caudifer* (Dawson). South Joggins, Nova Scotia.
Ornithoides (*Hylopus ?*) *trifidus* (Dawson). South Joggins, Nova Scotia.
Hylopus minor, Dawson. South Joggins, Nova Scotia.
Hylopus sp. undt. South Joggins, Nova Scotia.
Hylopus ? sp. South Joggins, Nova Scotia.
Baropezia (*Sauropus*) *sydnensis* (Dawson). Sydney, Cape Breton island, Nova Scotia.
Baropezia sp. Sydney, Cape Breton island, Nova Scotia.
Thenaropus ? macnaughtoni, Matthew. South Joggins, Nova Scotia.
Barillopus unguifer, Matthew. South Joggins, Nova Scotia.
Barillopus sp. South Joggins, Nova Scotia.
Barillopus sp. South Joggins, Nova Scotia.
Dromillopus celer, Matthew. South Joggins, Nova Scotia.
Cursipes dawsoni, Matthew. South Joggins, Nova Scotia.
Cursipes sp. South Joggins, Nova Scotia.

TRIASSIC.

Class REPTILIA.

Bathygnathus borealis, Leidy. Prince Edward island.

CRETACEOUS. NIOBRARA-BENTON (COLORADO FORMATION).

Class PISCES.

Lamna manitobensis, Whiteaves. Rolling river, Manitoba.
Ptychodus parvulus, Whiteaves. Swan river, Manitoba.
Enchodus shumardi, Leidy. Rolling river, Manitoba.
Cladocyclus occidentalis, Leidy. Rolling river and other localities in Manitoba.

CRETACEOUS. BELLY RIVER SERIES.

Class PISCES.

Myledaphus bipartitus, Cope. Alberta.
Acipenser albertensis, Lambe. Alberta.
Lepidosteus occidentalis (*Leidy*). Alberta.
Lepidosteus (*Clastes*) sp. Assiniboia.
Rhineastes eruciferus (Cope). Alberta.
Diphyodus longirostris, Lambe. Alberta.

Class AMPHIBIA.

Scapherpeton tectum, Cope. Alberta.

Class REPTILIA.

Cimoliasaurus magnus, Leidy. Alberta.
Compsemys ? victus, Cope. Assiniboia.
Baëna hatcheri, Hay. Alberta.
Baëna antiqua. Lambe. Alberta.
Adocus lineolatus, Cope. Alberta.
Basilemys variolosus (Cope). Alberta and Assiniboia.
Neurankylus eximius. Lambe. Alberta.
Plastomenus costatus, Cope. Assiniboia.
Trionyx foveatus, Leidy. Alberta.
Trionyx vagans, Cope. Assiniboia and Alberta.
Trionyx sp. Assiniboia.
Champsosaurus annectens, Cope. Alberta.
Deinodon horridus, Leidy. Alberta.
Deinodon explanatus (Cope). Alberta.
Ornithomimus altus, Lambe. Alberta.
Palæoscincus asper, Lambe. Alberta.
Palæoscincus costatus, Leidy. Alberta.
Stereocephalus tutus, Lambe. Alberta.
Monoclonius belli, Lambe. Alberta.
Monoclonius canadensis, Lambe. Alberta.
Monoclonius dawsoni, Lambe, Alberta.
Stegoceras validus, Lambe. Alberta.
Trachodon altidens, Lambe. Alberta.
Trachodon marginatus, Lambe, Alberta.
Trachodon selwyni, Lambe. Alberta.
? *Trachodon* ? sp. Assiniboia.
Cionodon stenopsis, Cope. Assiniboia.
Troödon formosus, Leidy. Alberta.
Crocodilus humilis, Leidy. Alberta.
Bottosaurus perrugosus, Cope, Alberta.

Class MAMMALIA.

Ptilodus primævus, Lambe. Alberta.
Boreodon matutinus, Lambe. Alberta.

CRETACEOUS. NANAIMO GROUP.

Class PISCES.

Lamna appendiculata (Agassiz). Near Wellington, Vancouver island, British Columbia.
Asterospondylic vertebræ. Puntledge or Comox river, Vancouver island, British Columbia.
Vertebræ of a teleost. Hornby island (off Vancouver island), British Columbia.

CRETACEOUS. FORT PIERRE GROUP.

Class PISCES.

Selachian tooth. Battle river, Saskatchewan.
Pectoral fin of a large Selachian. Sounding creek, Assiniboia.

CRETACEOUS. EDMONTON SERIES.

Class REPTILIA.

Dryptosaurus incrassatus (Cope). Alberta.

MESOZOIC.

Class REPTILIA.

Arctosaurus osborni, Adams. Bathurst island, District of Franklin.

TERTIARY.

Class AVES

Cyphornis magnus, Cope. Carmanah point, Strait of Juan de Fuca, Vancouver island, British Columbia. (According to Cope, "not older than Eocene nor later than Oligocene.")

OLIGOCENE (or LOWER MIOCENE).

Class PISCES.

Amia macrospondyla, Cope. Cypress hills, Assiniboia.
Amia whiteavesiana, Cope. Cypress hills, Assiniboia.
Rhineastes rhæas, Cope. Cypress hills, Assiniboia.
? *Rhineastes*, Cope. (vertebræ). Cypress hills, Assiniboia.
Amiurus cancellatus, Cope. Cypress hills, Assiniboia.
Amiurus maconnelli, Cope. Cypress hills, Assiniboia.

Class REPTILIA.

? *Stylemys nebrascensis*, Leidy. Cypress hills, Assiniboia.
Trionyx leucopotamicus, Cope. Cypress hills, Assiniboia.

Class MAMMALIA.

Mesohippus westoni (Cope). Cypress hills, Assiniboia.
Megacerops angustigenis (Cope). Cypress hills, Assiniboia.
Megacerops coloradensis ? Leidy. Cypress hills, Assiniboia.
Megacerops selwynianus (Cope). Cypress hills, Assiniboia.
? *Symborodon acer*, Cope. Cypress hills, Assiniboia.
Hyracodon nebrascensis, Leidy. Cypress hills, Assiniboia.
Aceratherium mite, Cope. Cypress hills, Assiniboia.
Aceratherium occidentale (Leidy). Cypress hills, Assiniboia.
Elotherium coarctatum, Cope. Cypress hills, Assiniboia.
? *Oreodon*, Leidy. Cypress hills, Assiniboia.
Leptomeryx esulcatus, Cope, Cypress hills, Assiniboia.
Leptomeryx mammifer, Cope. Cypress hills, Assiniboia.
Leptomeryx semicinctus, Cope. Cypress hills, Assiniboia.
Hypertragulus transversus, Cope. Cypress hills, Assiniboia.
Chalicotherium bilobatum, Cope. Cypress hills, Assiniboia.
Palæolagus turgidus, Cope. Cypress hills, Assiniboia.
Hemipsalodon grandis, Cope. Cypress hills, Assiniboia.

TERTIARY (? OLIGOCENE).

Class PISCES

Amyzon brevipinne, Cope. North fork of Similkimeen river, British Columbia.
Amyzon sp. Horse Fly river, British Columbia.

PLEISTOCENE.

Class PISCES

Salmo salar ? Linn. Common Atlantic salmon. Goose river, north shore of St. Lawrence river, Quebec.
Mallotus villosus (Müller). Capelin. Green's creek (Leda clay). near Ottawa, Ontario.
Osmerus mordax (Mitchill). American smelt. Green's creek (Leda clay), near Ottawa, Ontario.
Artediellus uncinatus (Reinhardt). Sculpin. Near Green's creek (Leda clay), near Ottawa, Ontario.
Cyclopterus lumpus, Linn. Lumpfish; Lump Sucker. Green's creek (Leda clay), near Ottawa, Ontario.
Gasterosteus bispinosus, Walbaum. Common eastern stickleback. Green's creek (Leda clay), near Ottawa, Ontario.

Class AVES.

Feathers. Green's creek (Leda clay), near Ottawa, Ontario.
Bones: not determined. Leda clay, Montreal, Quebec.

Class MAMMALIA.

Delphinapterus leucas, Pallas. White whale. Jacquet river, New Brunswick; and St. Lawrence valley.
Megaptera boöps (Linn.). Humpback whale. Smith falls, Ontario.
Mastodon americanus (Cuvier). Cape Breton island; region south of James bay; southern Ontario; and Manitoba.
Elephas primigenius, Blumenback. Region round Hudson bay; southern Ontario; Alberta; British Columbia; and Yukon. A tooth from near Edmonton, Alberta, has been referred to *E. columbi*,[1] Falconer, as well as to *E. primigenius*, the former species being considered by some authorities as a variety of the latter rather than as a distinct species.
Cervus canadensis, Erxleben. Near Hamilton, Ontario.
Ovibos moschatus (Zimmermann). Musk-ox. Alberta; and Yukon (Upper Porcupine river).
Bison crassicornis, Richardson. Klondyke, and Upper Porcupine river, Yukon.
Castor canadensis, Kuhl. American beaver. Near Hamilton, Ontario.
Phoca grœnlandica (Müller). Greenland seal; Harp seal. Leda clay, Montreal, Hull, and Ottawa.

[1] Dr. Robert Bell, in his admirable paper "On the occurrence of Mammoth and Mastodon remains around Hudson Bay," (Bull. Geol. Soc. Am., vol. 9, p. 369. 1898), mentions this tooth as apparently belonging to *E. columbi*.

SPECIES ARRANGED ZOOLOGICALLY.

CLASS AGNATHA.

SUBCLASS OSTRACODERMI.

ORDER HETEROSTRACI.

PTERASPIDÆ

48—52. Cyathaspis acadica (Matthew). 1886. Silurian. New Brunswick.

ORDER OSTEOSTRACI.

CEPHALASPIDÆ.

73. Cephalaspis campbelltonensis, Whiteaves. 1881. Lower Devonian. New Brunswick.

85. Cephalaspis sp. 1892. Lower Devonian. New Brunswick.

39. Cephalaspis dawsoni, Lankester. 1870. Lower Devonian. Gaspé, Quebec.

67. Cephalaspis jexi, Traquair. 1893. Lower Devonian. Campbellton, New Brunswick.

66. Cephalaspis laticeps, Traquair. 1890. Upper Devonian. Scaumenac bay, Quebec.

EUPHANEROPIDÆ.

87. Euphaneropus longævus, A. S. Woodward. 1900. Upper Devonian. Scaumenac bay, Quebec.

ORDER ANTIARCHI.

ASTEROLEPIDÆ.

69. Bothriolepis canadensis, Whiteaves. 1880. Upper Devonian. Scaumenac bay, Quebec.

CLASS PISCES.

SUBCLASS ELASMOBRANCHII.

ORDER ICHTHYOTOMI.

PLEURACANTHIDÆ.

17. Dittodus acinaces (Dawson). 1860. Carboniferous, Coal Measures. Nova Scotia.

17. Dittodus penetrans (Dawson). 1860. Carboniferous, Coal Measures. Nova Scotia.

85. Protodus jexi, A. S. Woodward. 1892. Lower Devonian. New Brunswick.

85, 67. Doliodus problematicus (A. S. Woodward). 1892. Lower Devonian. New Brunswick.

ORDER ACANTHODII.

DIPLACANTHIDÆ.

70. Diplacanthus striatus, Agassiz. 1844. Upper Devonian. Scaumenac bay, Quebec.

86. Diplacanthus horridus, A. S. Woodward. 1892. Upper Devonian. Scaumenac bay, Quebec.

73. 77. 85. Climatius latispinosus (Whiteaves). 1881. Lower Devonian, New Brunswick.

73. 77. 88. Spine of ? Acanthodian fish (Homacanthus gracilis, Whiteaves. 1889). Lower Devonian. New Brunswick.

ACANTHODIDÆ.

76. Acanthodes affinis, Whiteaves. 1887. Upper Devonian. Scaumenac bay, Quebec.

76. Acanthodes concinnus, Whiteaves. 1887. Upper Devonian. Scaumenac bay. Quebec.

85. Acanthodes semistriatus, A. S. Woodward. 1892. Lower Devonian. New Brunswick.

Cheiracanthus costellatus (Traquair). 1884. Lower Devonian. New Brunswick.

ORDER SELACHII.

SUBORDER ASTEROSPONDYLI.

LAMNIDÆ.

83. Lamna appendiculata (Agassiz). 1843. Cretaceous. Nanaimo group. Vancouver island.

79. Lamna manitobensis, Whiteaves. 1889. Cretaceous. Niobrara-Benton. Manitoba.

83. Asterospondylic vertebræ, of which one is thought to belong to the *Carchariidæ*. 1903. Cretaceous, Nanaimo group. Vancouver island.

79. Selachian tooth. 1889. Cretaceous, Fort Pierre group. Saskatchewan.

79. Pectoral fin of a large Selachian. 1889. Cretaceous, Fort Pierre group. Assiniboia.

SUBORDER TECTOSPONDYLI.

PETALODONTIDÆ.

20. Ctenoptychius cristatus, Dawson. 1868. Carboniferous, Coal Measures. Nova Scotia.

PSAMMODONTIDÆ.

20. Psammodus sp. ? 1868. Carboniferous, Coal Measures. Nova Scotia.

MYLIOBATIDÆ.

79. Ptychodus parvulus, Whiteaves. 1889. Cretaceous, Niobrara-Benton. Manitoba.

36. Myledaphus bipartitus, Cope. 1876. (The position of this genus, doubtfully referred by Cope to the Rays, is uncertain.) Cretaceous, Belly River series, Alberta.

SUBCLASS HOLOCEPHALI.

ORDER CHIMÆROIDEI.

PTYCTODONTIDÆ.

80. Ptyctodus calceolus, Newberry and Wortheu. 1866. Upper Devonian. Manitoba and Ontario.

80. Rhynchodus sp. undt. 1892. Upper Devonian, Manitoba.

ICHTHYODORULITES.

Machæracanthus peracutus, Newberry. 1857. Devonian (Corniferous). Ontario.

39. Machæracanthus sulcatus, Newberry. 1857. Devonian (Corniferous), Ontario; and Lower Devonian, Gaspé, Quebec.

20. Gyracanthus duplicatus, Dawson. 1868. Carboniferous, Coal Measures. Nova Scotia.

66. Gyracanthus incurvus, Traquair. 1890. Lower Devonian. New Brunswick.

20. Gyracanthus magnificus, Dawson. 1868. Lower Carboniferous. Cape Breton island.

SUBCLASS DIPNOI.

ORDER SIRENOIDEI.

DIPTERIDÆ.

20. Conchodus plicatus, Dawson. 1868. Carboniferous, Coal Measures. Nova Scotia.

PHANEROPLEURIDÆ.

71. 68. Scaumenacia curta (Whiteaves). 1881. Upper Devonian. Scaumenac bay, Quebec.

ORDER ARTHRODIRA.

86. 68. Coccosteus canadensis, A. S. Woodward. 1892. Upper Devonian. Scaumenac bay, Quebec.

73. 66. Phlyctænaspis acadica (Whiteaves). 1881. Lower Devonian. New Brunswick.

80. Aspidicthys ? notabilis, Whiteaves. 1892. Upper Devonian. Manitoba and Ontario.

80. Dinichthys canadensis, Whiteaves. 1892. Upper Devonian. Manitoba.

78. ? Macropetalichthys sullivanti, Newberry. 1857. Devonian (Corniferous). Ontario.

SUBCLASS TELEOSTOMI.

ORDER CROSSOPTERYGII.

SUBORDER RHIPIDISTIA.

HOLOPTYCHIIDÆ.

77. 68. 88. Holoptychius quebecensis (Whiteaves). 1889. Upper Devonian. Scaumenac bay, Quebec.

81. Dendrodus arisaigensis, Whiteaves. 1898. Silurian. Nova Scotia.

RHIZODONTIDÆ.

19. Rhizodus lancifer ? Newberry. 1856. Carboniferous, Coal Measures. Nova Scotia.

31. Strepsodus dawsoni, Hay. 1900. Carboniferous, Coal Measures. Nova Scotia.

20. 31. Strepsodus hardingi (Dawson). 1868. Lower Carboniferous. Nova Scotia.

68. 70. Eusthenopteron foordi, Whiteaves. 1881. Upper Devonian. Scaumenac bay, Quebec.

OSTEOLEPIDÆ.

72. 73. Parabatrachus maxillaris (Agassiz). 1843. Carboniferous, Coal Measures. Cape Breton island.

ONYCHODONTIDÆ.

Onychodus sigmoides, Newberry. 1857. Devonian (Corniferous). Ontario.

80. Onychodus sp. undt. 1892. Upper Devonian. Manitoba.

ORDER ACTINOPTERYGII.

SUBORDER CHONDROSTEI.

PALÆONISCIDÆ.

71. Cheirolepis canadensis, Whiteaves. 1881. Upper Devonian. Scaumenac bay, Quebec.

33. Rhadinichthys alberti (Jackson). 1851. Lower Carboniferous. New Brunswick.

33. Rhadinichthys cairnsii (Jackson) . 1851. Lower Carboniferous. New Brunswick.

26. Rhadinichthys modulus (Dawson). 1877. Lower Carboniferous. New Brunswick.

33. Elonichthys browni (Jackson). 1851. Lower Carboniferous. New Brunswick.

20. Acrolepis ? hortonensis, Dawson. 1868. Lower Carboniferous. New Brunswick.

ACIPENSERIDÆ.

36. Acipenser albertensis, Lambe. 1902. Cretaceous, Belly River series. Alberta.

SUBORDER PROTOSPONDYLI.

AMIIDÆ.

10. Amia macrospondyla, Cope. 1891. Oligocene. Assiniboia.

10. Amia whiteavesiana, Cope. 1891. Oligocene. Assiniboia.

SUBORDER AËTHEOSPONDYLI.

LEPIDOSTEIDÆ.

36. Lepidosteus occidentalis (Leidy). 1856. Cretaceous, Belly River series. Alberta.

3. 4. Lepidosteus (Clastes) sp. 1875. Cretaceous, Belly River series. Assiniboia.

SUBORDER ISOSPONDYLI.

SALMONIDÆ.

29. Salmo salar ? Linn. 1758. Pleistocene. Quebec.

ARGENTINIDÆ.

41. Mallotus villosus (Müller). 1777. Pleistocene. Ontario.
29. Osmerus mordax (Mitchill). 1815. Pleistocene. Ontario.

ENCHODONTIDÆ.

79. Enchodus shumardi, Leidy. 1856. Cretaceous, Niobrara-Benton. Manitoba.

SUBORDER PLECTOSPONDYLI.

CYPRINIDÆ.

12. Amyzon brevipinne, Cope. 1893. Tertiary (? Oligocene). British Columbia.
Amyzon sp. Tertiary (? Oligocene). British Columbia.

SUBORDER NEMATOGNATHI.

SILURIDÆ.

36. Rhineastes eruciferus (Cope). 1876. Cretaceous, Belly River series. Alberta.
10. Rhineastes rhæas, Cope. 1891. Oligocene. Assiniboia.
10. ? Rhineastes, Cope. 1872. Oligocene. Assiniboia. (Vertebræ).
10. Amiurus cancellatus, Cope. 1891. Oligocene. Assiniboia.
10 Amiurus maconnelli, Cope. 1891. Oligocene. Assiniboia.

SUBORDER PERCESOCES.

MUGILIDÆ.

79. Cladocyclus occidentalis, Leidy. 1856. Cretaceous, Niobrara-Benton. Manitoba.

SUBORDER PERCOMORPHI.

COTTIDÆ.

29. Artediellus uncinatus (Reinhardt). 1833. Pleistocene. Ontario.

CYCLOPTERIDÆ.

29. Cyclopterus lumpus, Linn. 1788. Pleistocene. Ontario.

SUBORDER HEMIBRANCHII.

GASTEROSTEIDÆ.

29. Gasterosteus bispinosus, Walbaum. 1792. Pleistocene. Ontario.
83. Vertebræ of a Hemibranch. 1903. Cretaceous, Nanaimo group. Vancouver island.

OF UNCERTAIN POSITION.

36. Diphiodus longirostris, Lambe. 1902. Cretaceous. Belly River series. Alberta.

CLASS AMPHIBIA.

SUBCLASS STEGOCEPHALIA.

ORDER LEPOSPONDYLI.

SUBORDER BRANCHIOSAURIA.

PROTRITONIDÆ.

27. Sparodus sp. undt. 1882. Carboniferous, Coal Measures. Nova Scotia.

SUBORDER MICROSAURIA.

HYLONOMIDÆ.

27. Hylonomus latidens, Dawson. 1882. Carboniferous, Coal Measures. Nova Scotia.

16. Hylonomus lyelli, Dawson. 1859. Carboniferous, Coal Measures. Nova Scotia.

27. Hylonomus multidens, Dawson. 1882. Carboniferous, Coal Measures. Nova Scotia.

16. Hylonomus wymani, Dawson. 1859. Carboniferous, Coal Measures. Nova Scotia.

16. Smilerpeton aciededentatum, Dawson. 1859. Carboniferous, Coal Measures. Nova Scotia.

65. Hylerpeton dawsoni, Owen. 1862. Carboniferous. Coal Measures. Nova Scotia.

30. Hylerpeton intermedium, Dawson. 1895. Carboniferous, Coal Measures. Nova Scotia.

25. Hylerpeton longidentatum, Dawson. 1876. Carboniferous. Coal Measures. Nova Scotia.

25. Fritschia curtidentata, Dawson. 1876. Carboniferous, Coal Measures. Nova Scotia.

27. Amblyodon problematicus, Dawson. 1882. (A lepospondylous genus of uncertain position.) Carboniferous. Coal Measures. Nova Scotia.

ORDER LABYRINTHODONTIA.

DENDRERPETONTIDÆ.

63. Dendrerpeton acadianum, Owen. 1853. Carboniferous, Coal Measures. Nova Scotia.

18. Dendrerpeton oweni, Dawson. 1863. Carboniferous, Coal Measures. Nova Scotia.

21. Baphetes minor, Dawson. 1869. Carboniferous, Coal Measures. Nova Scotia.

64. Baphetes planiceps, Owen. 1853. Carboniferous, Coal Measures. Nova Scotia.

30. Platystegos loricatum, Dawson. 1895. Carboniferous, Coal Measures. Nova Scotia.

ANTHRACOSAURIDÆ.

45 Eosaurus acadianus, Marsh. 1862. (Position uncertain.) Carboniferous, Coal Measures. Nova Scotia.

SUBCLASS BATRACHIA.

ORDER URODELA (CAUDATA).

36. Scapherpeton tectum, Cope. 1876. Cretaceous, Belly River series. Alberta.

ICHNITES.

54. Asperipes avipes, Matthew. 1903. Carboniferous, Coal Measures. Nova Scotia.

54. Asperipes sp. 1903. Carboniferous, Coal Measures. Nova Scotia.

18. 27. 54. 55. Asperipes (Hylopus) caudifer (Dawson). (1863) 1882. Carboniferous, Coal Measures. Nova Scotia.

30. 54. Ornithoides (Hylopus ?) trifidus (Dawson). 1895. Carboniferous, Coal Measures. Nova Scotia.

18. 27. 55. Hylopus hardingi, Dawson. (1863) 1882. Lower Carboniferous. Nova Scotia.

18. 27. 55. Hylopus logani, Dawson. (1863) 1882. Lower Carboniferous. Nova Scotia.

30. Hylopus minor, Dawson. 1895. Carboniferous, Coal Measures. Nova Scotia.

30. Hylopus sp. undt. 1895. Carboniferous, Coal Measures. Nova Scotia.

30. Hylopus ? sp. 1895. Carboniferous. Coal Measures. Nova Scotia.

27. Palæosauropus antiquior (Dawson). 1882. Lower Carboniferous. Nova Scotia.

20. 54. Baropezia (Sauropus) sydnensis (Dawson). 1868. Carboniferous, Coal Measures. Cape Breton island, Nova Scotia.

54. Baropezia sp. 1903. Carboniferous, Coal Measures. Cape Breton island, Nova Scotia.

54. Megapezia pineoi, Matthew. 1903. Lower Carboniferous. Nova Scotia.

24. 54. 55. Pseudobradypus (Sauropus) unguifer (Dawson). 1872. Carboniferous, Millstone Grit. Nova Scotia.

53. 55. Thenaropus ? macnaughtoni, Matthew. 1903. Carboniferous, Coal Measures. Nova Scotia.

53. 54. 55. Barillopus unguifer, Matthew. 1903. Carboniferous. Coal Measures. Nova Scotia.

54. Barillopus sp. 1903. Carboniferous, Coal Measures. Nova Scotia.

54. Barillopus sp. 1903. Carboniferous, Coal Measures. Nova Scotia.

53 55. Dromillopus celer, Matthew. 1903. Carboniferous Coal Measures. Nova Scotia.

54. Cursipes dawsoni, Matthew. 1903. Carboniferous, Coal Measures. Nova Scotia.

54. Cursipes sp. 1903. Carboniferous, Coal Measures. Nova Scotia.

CLASS REPTILIA.

SUBCLASS SYNAPSIDA.

ORDER SAUROPTERYGIA.

PLESIOSAURIDÆ.

30. Cimoliasaurus magnus, Leidy. 1851. Cretaceous, Belly River series. Alberta.

ORDER CHELONIA.

SUBORDER PLEURODIRA.

PLEUROSTERNIDÆ.

3. 4. Compsemys ? victus, Leidy. 1856. Cretaceous, Belly River series, Assiniboia.

36. Baëna hatcheri, Hay. 1901. Cretaceous, Belly River series. Alberta.

36. Baëna antiqua, Lambe. 1902. Cretaceous, Belly River series. Alberta.

SUBORDER CRYPTODIRA.

ADOCIDÆ.

36 Adocus lineolatus, Cope. 1874. Cretaceous, Belly River series. Alberta.

3. 4. 34. 36. Basilemys variolosus (Cope). 1876. Cretaceous, Belly River series. Alberta.

CHELYDRIDÆ.

36 Neurankylus eximius, Lambe. 1902. Cretaceous, Belly River series. Alberta.

TESTUDINIDÆ.

10. ? Stylemys nebrascensis, Leidy. 1851. Oligocene. Assiniboia.

SUBORDER TRIONYCHIA.

PLASTOMENIDÆ.

3 4. Plastomenus costatus, Cope. 1875. Cretaceous, Belly river series Assiniboia

TRIONYCHIDÆ.

35. 36. Trionyx foveatus, Leidy. 1856. Cretaceous, Belly River series. Alberta.

10. Trionyx leucopotamicus, Cope. 1891. Oligocene. Assiniboia.

3. 4. 35. 36. Trionyx vagans, Cope. 1874. Cretaceous, Belly River series. Assiniboia and Alberta.

3. 4. Trionyx sp. 1875. Cretaceous, Belly River series. Assiniboia.

SUBCLASS DIAPSIDA.

ORDER CHORISTODERA.

CHAMPSOSAURIDÆ.

36. Champsosaurus annectens, Cope. 1876. Cretaceous, Belly River series. Alberta.

ORDER DINOSAURIA.

SUBORDER THEROPODA.

ANCHISAURIDÆ.

40. Bathygnathus borealis, Leidy. 1854. Triassic. Prince Edward island.

Arctosaurus osborni, Adams. 1875. Mesozoic. Bathurst island, District of Franklin.

MEGALOSAURIDÆ.

36. Deinodon horridus, Leidy. 1856. Cretaceous, Belly River series. Alberta.

36. Deinodon explanatus (Cope). 1876. Cretaceous, Belly River series. Alberta.

11. 36. 37. Dryptosaurus incrassatus (Cope). 1876. Cretaceous. Edmonton series. Alberta.

ORNITHOMIMIDÆ.

36. 38. Ornithomimus altus, Lambe. 1902. Cretaceous, Belly River series, Alberta.

SUBORDER ORTHOPODA.

STEGOSAURIDÆ.

36. Palæoscincus asper, Lambe. 1902. Cretaceous, Belly River series. Alberta.

36. Palæoscincus costatus, Leidy. 1856. Cretaceous, Belly River series, Alberta.

36. 57. Stereocephalus tutus, Lambe. 1902. Cretaceous, Belly River series, Alberta.

CERATOPSIDÆ.

36. Monoclonius belli, Lambe. 1902. Cretaceous, Belly River series. Alberta.

36. Monoclonius canadensis, Lambe. 1902. Cretaceous, Belly River series, Alberta.

36. Monoclonius dawsoni, Lambe. 1902. Cretaceous, Belly River series, Alberta.

36. 57. Stegoceras validus, Lambe. 1902. Cretaceous, Belly River series. Alberta.

TRACHODONTIDÆ.

36. Trachodon altidens, Lambe, 1902. Cretaceous, Belly River series. Alberta.

36. Trachodon marginatus, Lambe. 1902. Cretaceous, Belly River series. Alberta.

36. Trachodon selwyni, Lambe. 1902. Cretaceous, Belly River series. Alberta.

3. 4. ? Trachodon ? sp. 1875. Cretaceous, Belly River series. Assiniboia.

3. 4. Cionodon stenopsis, Cope. 1875. Cretaceous, Belly River series. Assiniboia.

ORDER SQUAMATA.

SUBORDER LACERTILIA.

36. Troödon formosus, Leidy. 1856. Provisionally referred to the *Lacertilia*. Cretaceous, Belly River series. Alberta.

ORDER CROCODILIA.

SUBORDER EUSUCHIA.

CROCODILIDÆ.

36. Crocodilus humilis, Leidy. 1856. Cretaceous, Belly River series. Alberta.

36. Bottosaurus perrugosus, Cope. 1874. Cretaceous, Belly River series. Alberta.

CLASS AVES.

SUBCLASS ORNITHURÆ.

SUBORDER EUORNITHES.

ORDER STEGANOPODES.

PELECANIDÆ.

13. Cyphornis magnus. Cope. 1894. Tertiary. Vancouver island. (Position of genus uncertain.)

ADDITIONAL REMAINS OF BIRDS.

29. Feathers. 1881. Pleistocene. Ontario.

41. Bones. 1863. Pleistocene. Quebec.

CLASS MAMMALIA.

SUBCLASS PROTOTHERIA.

ORDER MULTITUBERCULATA.

PLAGIAULACIDÆ.

36. Ptilodus primævus, Lambe. 1902. Cretaceous, Belly River series. Alberta.

SUBCLASS EUTHERIA.

ORDER CETACEA.

SUBORDER ODONTOCETI.

DELPHINIDÆ.

28. Delphinapterus leucas (Pallas). 1776. (Beluga catodon.) Pleistocene. New Brunswick and St. Lawrence river valley.

SUBORDER MYSTACOCETI.

BALÆNIDÆ.

28. Megaptera boöps (Linn.). 1758. (M. longimana.) Pleistocene. Ontario.

ORDER UNGULATA.

SUBORDER PROBOSCIDEA.

ELEPHANTIDÆ.

15. Mastodon americanus (Cuvier). 1798. Pleistocene. Cape Breton island; region south of James bay; southern Ontario; and Manitoba.

11. 14. Elephas primigenius, Blumenbach. 1803. Pleistocene. Region round Hudson Bay; southern Ontario; Alberta; British Columbia; Yukon.

SUBORDER PERISSODACTYLA.

EQUIDÆ.

8. 10. Mesohippus westoni (Cope). 1891. Oligocene. Assiniboia.

TITANOTHERIIDÆ (BRONTOTHERIIDÆ).

7. 8. 10. Megacerops angustigenis (Cope). 1886. Oligocene. Assiniboia.

10. Megacerops coloradensis? Leidy. 1870. (M. americanus, M. proutii.) Oligocene. Assiniboia.

9. 10. Megacerops selwynianus (Cope). 1889. Oligocene. Assiniboia.

9. 10. ? Symborodon acer, Cope. 1873. (S. syceras.) Oligocene. Assiniboia.

HYRACODONTIDÆ.

Hyracodon nebrascensis, Leidy. 1850. (Type of Aceratherium pumilum, Cope). Oligocene. Assiniboia.

RHINOCEROTIDÆ.

6. 7. 8. 10. Aceratherium mite, Cope. 1874. (Cænopus pumilus). Oligocene. Assiniboia.

10. Aceratherium occidentale (Leidy). 1851. Oligocene. Assiniboia.

SUBORDER ARTIODACTYLA.

SUIDÆ.

8. 9. 10. Elotherium coarctatum, Cope. 1889. Oligocene. Assiniboia.

AGRIOCHŒRIDÆ.

7. 8. ? Oreodon, Leidy. 1851. Oligocene. Assiniboia.

8. 10. Leptomeryx esulcatus, Cope. 1889. Oligocene. Assiniboia.

6. 7. 8. 10. Leptomeryx mammifer, Cope. 1886. Oligocene. Assiniboia.

8. 10. Leptomeryx semicinctus, Cope. 1889. Oligocene. Assiniboia.

CAMELIDÆ.

8. 10. Hypertragulus transversus, Cope. 1889. Oligocene. Assiniboia.

CERVIDÆ.

41. Cervus canadensis, Erxleben. 1777. Pleistocene. Ontario.

BOVIDÆ.

14. Ovibos moschatus (Zimmermann). 1780. Pleistocene, Alberta and British Columbia.

42. 84. Bison crassicornis, Richardson. 1854. Pleistocene. Yukon.

ORDER ANCYLOPODA.

CHALICOTHERIIDÆ.

8. 10. Chalicotherium bilobatum, Cope. 1889. Oligocene. Assiniboia.

ORDER GLIRES (RODENTIA).

SUBORDER SIMPLICIDENTATA.

CASTORIDÆ.

41. Castor canadensis, Kuhl. 1820. Pleistocene. Ontario.

SUBORDER DUPLICIDENTATA.

LEPORIDÆ.

8. 10. Palæolagus turgidus, Cope. 1873. Oligocene. Assiniboia.

ORDER CARNIVORA.

SUBORDER CREODONTA.

HYÆNODONTIDÆ.

6. 7. 8. 10. Hemipsalodon grandis, Cope. 1885. Oligocene. Assiniboia.

SUBORDER PINNIPEDIA.

PHOCIDÆ.

41. 29. Phoca grœnlandica (Müller). 1776. Pleistocene. Quebec and Ontario.

OF UNCERTAIN POSITION.

36. Boreodon matutinus, Lambe. 1902. Cretaceous, Belly River series. Alberta. According to Hatcher, probably referable to the Marsupialia.

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