

CANADA  
DEPARTMENT OF MINES  
GEOLOGICAL SURVEY BRANCH

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PART IV.—THE VERTEBRATA OF THE OLIGOCENE OF THE CYPRESS  
HILLS, SASKATCHEWAN.

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This report on the Vertebrata of the Oligocene deposits of the Cypress hills forms the fourth part of volume III (quarto) of Contributions to Canadian Paleontology. Part I by Professor Edward D. Cope, on "The species from the Oligocene or Lower Miocene beds of the Cypress hills," published in 1891, is descriptive of specimens obtained during the years 1883, 1884, 1888 and 1889. The present part by Mr. Lawrence M. Lambe, is based on the collection made by him in 1904, and on the material of the earlier collections; it consists of 82 pages of letter press, illustrated by text figures and eight photographic plates.

P. W. BROCK,  
*Acting Director.*

DEPARTMENT OF MINES,  
GEOLOGICAL SURVEY BRANCH,  
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# GEOLOGICAL SURVEY OF CANADA

## THE VERTEBRATA OF THE OLIGOCENE OF THE CYPRESS HILLS, SASKATCHEWAN.

BY LAWRENCE M. LAMBE.

### INTRODUCTION

The discovery in 1883 by Mr. R. G. McConnell of this Survey, of Tertiary beds in the Cypress hills, of later age than any that had been found in the North West, was announced in Dr. A. R. C. Selwyn's Summary Report of the operations for that year.\* These beds capping the Cypress hills were assigned to the age of the Miocene by Mr. McConnell in his "Report on the Cypress hills, Wood mountain and adjacent country,"\*\* published in 1886. After giving a general statement of the physical features of the country, Mr. McConnell in his report, devotes himself (1) to a description of the geology in different sections of the district in turn, and (2) to an account of the deposits of the formations observed of the Cretaceous, Tertiary, and Quaternary periods. In the Cypress hills and vicinity the rocks seen were referred to the Miocene, Laramie and Fox-hill-Pierre formations, of which the last three are conformable, but the first lies unconformably on the Laramie, in places overlapping it and resting on the Fox-hill. The Miocene beds cap all the more elevated parts of the range of uplands extending in a direction a little north of east, from the west end of the Cypress hills to the east end of Swift-current Creek plateau; a distance of 140 miles. They have an average width of fifteen miles, and cover altogether an area of nearly 1,400 square miles."

The Cypress hills are divided into two unequal parts—of which the eastern one is much the larger—by the "Gap," a valley of erosion, running in a north and south direction. The Miocene deposits are best developed at the eastern end of the hills, where they attain a thickness of fully 500 feet, and consist of conglomerate, usually formed of quartz pebbles, cemented together by carbonate of lime, associated with beds of sandstone, sands, clays, and marls. West of the "Gap" the formation is represented only by a sheet of hard conglomerate, about 50 feet thick.

To quote from Mr. McConnell's report: "the conglomerate which forms such a marked feature of the Miocene deposits of the Cypress hills, is usually composed of quartzite pebbles cemented together by carbonate of lime, but also appears under a number of other forms. In some places the pebbles lie loosely in a matrix of coarse yellowish sand, and in others they are

\* Geol. and Nat. Hist. Survey of Canada, Report of Progress, 1882-83-84; Summary Report of the operations of the geological corps to 31st Dec, 1883 (published in Jan., 1884), p. 4.

\*\* Geol. and Nat. Hist. Survey of Canada, Annual Report (new series), vol. 1, 1886, (1886), part C.

consolidated by a ferruginous cement. Beds several feet thick also occasionally occur, which contain nothing but loose pebbles." "Beds of pebble conglomerate, though more frequent and larger near the base of the Miocene, are found at irregular intervals all through it, and are of all thicknesses, from a single layer of pebbles up to beds fully 50 feet thick. In many cases the formation consists of a single thick bed of this rock. Besides the pebble conglomerate, beds composed of angular pieces of clays enclosed in a matrix of hard sandstone, and forming a species of breccia, are occasionally found."

"The sands of the Miocene sometimes form hard beds, from one to two feet thick, but are usually only slightly indurated, and are nearly always affected by false bedding."

The above deposits are best seen in Bone coulée which runs almost due north and south about nine miles west of the eastern escarpment of the hills. In this coulée two streams have their origin within a few hundred yards of each other, the north fork of Swift-current creek flowing north-easterly, and Frenchman creek (Fairwell creek of Mr. McConnell's report) flowing in an opposite direction to the south.

It is in this main coulée and its tributaries, that the collections of vertebrate remains from this horizon of the Cypress hills have been principally made.

The first vertebrate fossils received from Bone coulée were obtained in 1883 by Mr. McConnell whilst engaged in his geological exploration of that year. Later in the same season Mr. T. C. Weston visited this locality, and secured a collection; but unfortunately all the specimens then obtained were lost by the sinking in Lake Superior of the steamer *Glenfinlas* on which the collection had been shipped for the east from Port Arthur. During the summer of 1884 Mr. Weston revisited the eastern end of the hills, and obtained many mammalian and other vertebrate remains typical of the Cypress Hills fauna. In 1888, and again in 1889, a short time was spent by Mr. Weston in adding to the collections already made in Bone coulée. In 1904 the writer spent some weeks in the eastern end of these hills making a supplementary collection of the vertebrate remains.

The fossils collected by Messrs. McConnell and Weston in 1883, were submitted to Professor Edward D. Cope, who published a preliminary list of the genera and species in the *American Naturalist*, 1885, vol. XIX, p. 163.\* The result of his subsequent study of the same material appeared in 1886 as an appendix to Mr. McConnell's report of 1886.\*\* Further contributions to the *American Naturalist* \*\*\* by the same distinguished paleontologist, followed in 1889, after Mr. Weston's collection of 1888 had also been placed in his hands for determination and description. Professor Cope's final report on all the material from the Cypress hills, including the specimens obtained by Mr. Weston in 1899, appeared in 1891 as part I \*\*\*\* of this volume.

\* The White River beds of Swift-current river, North West Territory.

\*\* Op. cit., part C, p. 79, appendix I. The Vertebrata of the Swift-current Creek region of the Cypress hills, by E. D. Cope.

\*\*\* 1889. *American Naturalist*, vol. XXIII, p. 151, The Vertebrata of the Swift-current river, II; and p. 628, Vertebrata of the Swift-current river, III.

\*\*\*\* The species from the Oligocene or Lower Miocene beds of the Cypress hills; *Geol. Survey of Canada, Contr. to Can. Paleont.*, vol. III (part 6), pt. I.

Cope, in his memoir of 1891, qualifies McConnell's assignment of the uppermost beds of the Cypress hills to the Miocene by describing them as of Oligocene or Lower Miocene age. Matthew would accord them a more definite horizon at the bottom of the Oligocene, and has expressed the opinion that they are probably of approximately the same age as the Titanotherium beds at Pipestone springs, Montana. This opinion appears to be borne out to some extent by the list of species from Pipestone springs, published by Dr. Matthew in 1903,\* and the collections from the Cypress hills, supplemented by the material secured in 1904. A provisional list by the writer, of the genera and species included in the collection of 1904, appeared in the Summary Report of this Department for that year.

That the Cypress Hills Oligocene deposits were the result of rapidly flowing water from the west is evident. The thick basal beds of rounded pebbles represent the work of a strong transporting force, such as would be supplied by a turbulent stream of considerable size carrying eastward material from the Rocky mountains. The sands show false bedding as a result of varying currents. With the accumulation of material eastward, and a consequent reduction of the transporting force, beds of finer material were deposited at a higher level, and probably on extensive areas of overflow.

Regarding the Cypress hills as an outlier of the Wood Mountain area, Mr. McConnell has pointed out that, the part of the country "now covered by the Cypress hills has been changed from a depression in Miocene times into the highest plateau on the plains, which is its present position, entirely by the arrest of denudation over its surface by the hard conglomerate beds which cover it, whilst the surrounding country, destitute of such protection, has been gradually lowered; and so affords an index of the amount of material removed from the neighbouring plain in the age intervening between the deposition of the Miocene and the glacial period." "The absence of any ridge connecting the Cypress hills with the mountains is somewhat surprising, as one would naturally suppose that near their source the pebble-beds would be thicker, and their constituents coarser and better able to resist erosion. This may be due, however, to the fact that the valley of the transporting stream must have been more contracted in its upper part than in the dilated portion in which the existing Miocene beds were deposited. In such a case, its narrow shingle floor would be gradually undermined, and as denudation proceeded would soon perish."

During his expedition of 1904, the writer examined the exposures of the Oligocene deposits along the eastern escarpment of the Cypress hills as well as on their southern slope in the vicinity of Frenchman (Whitemud) river as far west as Fairwell creek, also in the valley of this creek northward to Bone coulée, and for some miles along the upper reaches of the north fork of Swift-current creek. Few fossils were obtained along the eastern, and southern escarpments.

The greater part of the collection was made in Bone coulée and its numerous tributary coulées, and in its southern extension for a few miles along Fairwell creek. Here the grass-covered slopes are broken by numerous small and isolated weathered outcrops which at first do not appear very promising from a paleontological standpoint. A careful and close search, however, reveals an abundance of—for the most part—mammalian remains.

\* The fauna of the Titanotherium beds at Pipestone springs, Montana; Bulletin Amer. Mus. Nat. Hist., vol. XIX, article VI, 1903.

The most prolific beds are composed of a fine conglomerate that, on disintegration, freed the enclosed fossils. Associated beds of coarse sand, of a rich brown colour, also yielded some interesting remains. Very few fossils were found in the coarser conglomerates, and, might be expected, none at all in the beds of loose pebbles.

The generally fragmentary and dissociated nature of the remains at this locality detracts much from their value as definite horizon markers. Many of the specimens clearly show that they had been broken and often worn prior to being deposited in the beds where they were found. Some excellently preserved jaws with continuous series of teeth were obtained, and many separate and well preserved teeth, but bones of the feet were in cases dissociated.

Although the beds of the Cypress Hills deposits in question probably belong, in a general sense, to the horizon of the Titanotherium beds of Montana, some of their upper members may be synchronous with the Oreadon beds. Whether the time equivalent of the uppermost division of the Oligocene (Protoceras beds) is present at all is problematical. The fossils in the finer conglomeritic beds show in some cases evidence of having been transported from a distance, and on this account it is possible that a certain admixture of remains from slightly different horizons has taken place.

The Cypress Hills Oligocene faunal list has been considerably enlarged in the following pages by the addition of a number of new species, and species previously known but not recorded, hitherto, from this horizon in Canada. The majority of the additions to the fauna have been supplied by the collection of 1904, but a few forms are represented by specimens from the earlier collections, that apparently were not placed in Professor Cope's hands.

The species described as new, with those not recorded, hitherto, from this locality, belong to the three classes of fishes, reptiles, and mammals. New species of fishes of the families Amiidae and Lepidosteidae are described. Among the reptiles are two chelonians, of which one species is new; also lizards, snakes, and crocodiles representing the orders Squamata and Crocodylia, both of which are additional to the fauna. The mammals preponderate in number and variety and include a marsupial, ungulates, rodents, and carnivores. The artiodactyl genera *Ancodus*, *Anthracotherium*?, *Agriocherus*, and *Merycododon* are now recorded from the Cypress hills, as well as new species of horses, hyracodonts, rhinoceroses, and titanotheria. A new species of *Leptomeryx* is described. Further evidence of the presence of *Chalicotherium* an aenolophid, is given. The rodents include four families of which three, the *Ischyromyidae*, *Castoridae*, and? *Sciuridae*, are new to the list. Two known species of the cretaceous carnivores, three already described species of the *Canidae*, and one of the *Felidae* are also ad-

The animals inhabiting this western tract of country during Oligocene times are seen to have belonged to a variety of groups. That the number of individuals in some of the groups was large is evident from the abundance of the fossil remains of some forms. Some of the groups have since become extinct, others have undergone great changes and are difficultly recognized in their descendants of the present day; whilst a few are represented by existing species that show but slight differences in form and structure.

Twenty-five vertebrate species in all, have, hitherto, constituted the Oligocene fauna of the Cypress hills: this number is now raised to over fifty. The following is the fauna as known to date :—

Class **PISCES.**

Order **ACTINOPTERYGII.**

Suborder **PROTOSPONDYLI.**

Family *Amiida.*

- \* *Amia whiteavesiana*, Cope.
- \* *Amia macrospondyla*, Cope.
- + *Amia exilis*, sp. nov.

**AETHEOSPONDYLI.**

*Lepidosteida.*

- + *Lepidosteus longus*, sp. nov.

**NEMATOGNATHI.**

*Silurida.*

- \* + *Rhineastes rhoas*, Cope.
- \* + *Amiurus cancellatus*, Cope.
- \* + *Amiurus macconnelli*, Cope.

**REPTILIA.**

**CHELONIA.**

**CRYPTODIRA.**

*Chelydridæ.*

- + *Anosteira ornata*? Leidy.

*Testudinidæ.*

- \* + *Styemys nebrascensis*, Leidy.
- + *Testudo exornata*, Lambe.

**TRIONYCHIA.**

*Trionychidæ.*

- \* + *Trionyx leucopotamicus*, Cope.

+ **SQUAMATA.**

**LACERTILIA.**

*Anguidæ.*

- + *Peltosaurus granulatus*, Cope.

**OPHIDIA.**

*Palaophidæ.*

- + *Ogmophis compactus*, sp. nov.

+ **CROCODILIA.**

**EUSUCHIA.**

*Crocodylidæ.*

- + *Crocodylus prenasalis*? Loomis.

The signs before the names of species or groups signify as follows:—

\* Represented in one or more of the collections made previous to 1904; but not in that of 1904.

+ Represented in collection of 1904; but not in previous ones.

\* + Represented in the 1904 as well as in one or more of the previous collections.