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CONTRIBUTIONS

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CANADIAN PALÆONTOLOGY

VOLUME III (Quarto).

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

> BY LAWRENCE M. LAMBE, F.G.S., F.R.S.C. Vertebrate Palaontologist.



OTTAWA GOVERNMENT PRINTING BUREAU 1908

No. 1020.

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CANADA DEPARTMENT OF MINES GEOLOGICAL BURVEY BRANCH Hon. W. Templeman, Minister ; A. P. Low, Deputy Minister ; R. W. Brock, Acting Director.

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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 Paheontology. Part I by Professor Edward D. Cope, on "The species from the Oligocene or Lower Milcene 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 photogravure plates.

P. W. BROCK, Acting Director,

DEPARTMENT OF MINES, GEOLOGICAL SURVEY BRANCH, OTTAWA, JANUARY 5, 1908.



GEOLOGICAL SURVEY OF CANADA

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

BY LAWRENCE M. LAMME.

INTRODUCTION

The discovery in 1883 by Mr. R. G. McConnell of this Survey, of Tertinry 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 20 cent 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 Cretaceons, Tertiary, and Quaternary periods. In the Cypress hills and vicinity the rocks seen were reformed to the Miocene, Laramie and Fox-hill-Pierre formations, of which the last three are comable, but the first lies unconformably on the Laramie, in places overlapping it and resurg on the Fox-hill. The Miocene beds " cap all the more elevated parts of the runge of uplands extending in a direction a little north of cast, from the west end of the Cypress hills to the cust end of Swift-current Creek platean; 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, which they are the at thickness of fully 500 feet, and consist of conglomerate, usually formed of quart publies, commuted together by earbounte of lime, associated with beds of randstone, ands, clays, and muths. West of the "Gap" the formation is represented only by a shear of hard conglomerate, about 50 feet thick.

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

Robert ATV CANADA

^{*} Geol. and Nat. Hist. Survey of Canada, Report of Progress, 1882 83-84; Summary Report of the operations of the geological corps to 41st Dec. 1883 (published in Jan., 1881), p. 4. ** Geol. and Nat. Hist. Survey of Canada, Annual Report (new series), vol. 1, 1885, (1886), port 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 breceia, are occasionally found."

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

The above deposits are best seen in Bone coulée which runs almost due north and south abont nine miles west of the castern 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 coulde 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 n collection; but unfortunately all the specimens then obtained were lost by the sinking in Lake Superior of the steamer *Glenfinlus* on which the collection had been shipped for the cast from Port Arthur. During the summer of 1884 Mr. Weston revisited the enstern 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 coulde. In 1904 the writer spent some weeks in the castern 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. X1X, 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 palacontologist, followed in 1889, after Mr. Weston's collection of 1888 had also been placed in his hunds 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 bods of Swift-current river, North West Territory.

rta. Ada.

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

 *** 1889. American Naturalist, vol. XX111, p. 151, The Vertebrata of the Swift-current river, H ; and p. 628, Vertebrata of the Swift-current river, H1.

**** The speciestrum the Oligovene or Lower–Miocene beds of the Cypress hills ; Geol, Survey of Canada, Contr. to Can. Palacont., vol. III (quarto), pt. I.

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2 D. Cope. 28, Verte-

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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 Titano-therinam 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 hier material were deposited at a higher level, and probably on extensive areas of overllow.

Regarding the Cypress hills as an onthier of the Wood Monntain area, Mr. McCounell has pointed out that, the part of the country "now covered by the Cypresshills 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 demudation over its surface by the hard conglomerate beds which cover it, whilst the surrounding country, destitute of such protection, has been gradnally lowered; and so affords an index of the amount of material removed from the neighbouring plains 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 npper 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 demutation 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 coulde, 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 tributnry coulées, and in its southern extension for a few miles along Fairwell creek. Here the grasseovered 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, 1993.

The most prolific beds are composed of a fine conglomerate that, on disintegration, h freed the enclosed fossils. Associated bels of coarse sand, of a rich brown colour, also yield 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 localid detracts much from their value as definite horizon markers. Many of the specimens clean show that they had been broken and often worn prior to being deposited in the beds who they were found. Some excellently preserved jaws with continuous series of teeth we 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 gene sense, to the horizon of the Titanotherium beds of Montana, some of their upper memb may be synchronous with the Oreodon beds. Whether the time equivalent of the upperm division of the Oligocene (Protoceras beds) is present at all is problematical. The fossile the finer conglomeritie beds show in some cases evidence of having been transported from distance, and on this account it is possible that a certain admixture of remains from sligh different horizons has taken place.

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

The species described as new, with those not recorded, hitherto, from this locality, belto the three classes of fishes, reptiles, and mammals. New species of fishes of the fam Amiidæ and Lepidosteidæ are described. Among the reptiles are two chelonians, ot w one species is new; also lizards, snakes, and erocodiles representing the orders Squamata Crocodilia, both of which are additional to the fama. The mammals preponderate in num and variety and include a marsupial, ungulates, rodents, and carnivores. The artioda genera Ancodus, Anthracotherium ?, Agriocherus, and Merycoidodon are now recorded f the Cypress hills, as well as new species of horses, hyracodonts, rhinoceroses, and titanoth A new species of Leptomeryx is described. Further evidence of the presence of Chalicother an ancylopod, is given. The rodents include four families of which three, the Ischyromy Castoridæ, and ? Sciuridæ, are new to the list. Two known species of the creck earnivores, three already described species of the Canidæ, and one of the Felidæ are also ad

The animals inhabiting this western tract of country during Oligoeene times are seen to have belouged to a variety of groups. That the number of individuals in some of groups was large is evident from the abundance of the fossil remains of some forms. If of the groups have since become extinet, others have undergone great changes and are difficulty recognized in their descendants of the present day; whilst a few are represent existing species that show but slight differences in form and structure. gration, has also yielded ates, and, as

this locality mens clearly beds where f teeth were were in all

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beality, belong f the families ians, ot which Squamata and the in numbers The artiodactyl recorded from d titanotheres. thalicotherium, Ischyronyide, the ereodont are also added.

times are thus in some of the forms. Some s and are with represented by 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.

AETHEOSPONDYLL.

Lepidosteida.

+ Lepidosteus longus, sp. nov.

NEMATOGNATHI.

Silurida.

- * + Rhineastes rhaas, Cope.
- * + Amiurus cancellatus, Cope.
- * + Amiurus maconnelli, Cope.

REPTILIA. CHELONIA. CRYPTODIRA.

Chelydridæ.

+ Anosteira ornata ? Leidy.

Testudinida.

+ Stylemys nebrascensis, Leidy. + Testudo exornata, Lambe.

TRIONYCHIA.

Trionychida.

* + Trionyx leucopotamicus, Cope.

+

+ SQUAMATA.

LACERTILIA.

Anguidar.

Peltosaurus granulosus, Cope.

OPHIDIA.

Pala ophida.

+ Ogmophis compactus, sp. nov.

+ CROCODILIA.

EUSUCHIA.

Crocodilidar.

+ Crocodilus prenasulis? 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 1901.

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, 12529 = 2

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MAMMALIA.

+ MARSUPIALIA

POLYPROTODONTIA. Didelphyida.

+ Didelphys valens, sp. nov.

UNGULATA.

ARTIODACTVLA.

Anthracotheriala.

- + Ancodus (Hyopotamus) bruchyrhynchus, Osboru and Wortman.
- + Anthracotherium ? pygmæum, sp. nov.
- Elotherida. + Elotherium coarctatum, Cope. *

Agriocharida.

- + Agri charus antiquus, Leidy.
- + Merychoidodon culbertsoni, Leidy.
- Camelida. + Poëbrotherium wilsoni, Leidy.
 - Tragulidar.
- + Leptomeryx esulcatus, Cope. + Leptomeryx mammifer, Cope.
- + Leptomery. speciosus, sp. nov.

Position uncertain.

- + Leptomerys semicinctus, Cope.
- Hypertragulus transversus, Cope.

PERISSODACTYLA.

Equidar.

- + Mesohippus vestoni (Cope).
- + Mesohippus prococidens, Lambe.
- + Mesohippus propinguus, Lambe.
- + Mesohippus brachystylus, Osborn.
- + Mesohippus stenolophus, Lambe.
- + Mesohippus plunidens, I ambe.
- + Meschippus assiniboiensis. Lambe.

Hyracodontida.

- + Hyracodon nebrascensis, Leidy.
- + Hyracodon priseidens, Lambe.

Rhinocerotidar.

+ Aceratherium mite, Cope. *

*

*

- + Aceratherium occidentale (Leidy).
- + Accratherium exiguum, sp. nov.
- + Leptaceratherium trigonodon, Osb. and Wort.

Tetano'heriidar.

- Megaccrops angustigenis (Cope).
- Megacerops selwynianus (Cope).

* Megacerops syceras (Cope).

+ Magacerops primitivus, sp. nov.

+ Mugacerops assinibuiensis, nom. prov.

ANCYLOPODA. Charlicotheriidar.

+ Chalicotherium bilobatum, Cope.

RODENTIA.

SIMPLICIDENTATA.

? Sciurida.

+ Sciurus ? suskatchewensis, sp. nov.

Ischyromyida.

+ Ischryromys typus, Leidy. ? Castorida.

+ Cylindrodon fontis, Douglass.

+ Eutypomys pareus, sp. nov.

DUPLICIDENTATA.

Leporido.

Palaolagus turgidus, Cope.
+ Palaolagus haydeni, Leidy.

CARNIVORA.

CREODONTA.

Hyarnodontida.

* + Hyanodon cruentus, Leidy.

+ Hymuodon cruciuns, Leidy.

* + Hemipsalodon grandis, Cope.

FISSIPEDIA (CARNIVORA VERA).

Canida.

Felidar.

+ Cynodictis lippinrottianus (Cope).

+ Dapha nus felinus, Scott.

+ Protemnocyon hartshornianus (Cope).

+ Dinictis felina, Leidy.

PISCES.

ACTINOPTERYGII.

AMIA WHITEAVESIANA, Cope.

Amia whiteavesiana, Cope, 1891. The species from the Oligocene or Lower Miocene boot the Cypress hills. Geol. Survey of Canada, Contr. to Can. Palaeont., vol. III (quart pt. I, p. 2, plate I., figs. 1, 1a and 1b.

No remains of this species were obtained by the writer in his expedition of 1904 to a Cypress hills. The type of this species, as well as those of all of the species referred to described in the following pages, are in the Museum of the Geological Survey at Ottawa.

AMIA MACROSPONDYLA, Cope.

A cia macrespondyla, Cope, 1891. The species from the Oligocene or Lower Miocene be of the Cypress hills. Geol. Survey of Canada, Contr. to Can. Palwont., vol. III (quart pt. I, p. 2, plate I, figs. 2, 2a and 2b.

Cope established this species on a single vertebra from the Cypress hills. No addicion material is included in the collection of 1904, to throw further light on the structure this fish.

AMIA EXILIS. Sp. nov.

Plate I, figs. 1-6.

A number of centra, found separately, represent an apparently undescribed speciof *Amia*, of small size as compared with *A. whitewesiana*, Cope, and *A. macrospondyla*, Cop both of which species are from the Oligocene of the Cypress hills.

All the fossil remains of North American species of Amia so far described are of Eccen age, with the exception of the two Oligocene species above mentioned.

Amia exilis was about the size of Amia elegans, Leidy, from the Bridger Eocene of Wyoming; but had vertebral centra of quite a different shape.

The centra on which Amin critis is founded are mostly from the dorsal region, and var somewhat in size, being probably from a number of individuals. The one represented of plate 1, figures 1, 2, and 3, from the middle dorsal series, is one of the hurgest of the specimens, and is about the best preserved (type). Its articular faces are oval in ontline with the major axis horizon'.d, the height being but slightly over two-thirds of the breadth. Its thickness (length), is equal to about half the maximum height and there is a perceptible flattening of the upper surface. The concave articular surfaces exhibit a few concentric lines, but have the general appearance of being rather smooth. A small notochorda foramen, preserved in all the specimens, pierces the centrum at about mid-height. Above is the median line of the upper surface, the floor of the neural canal appears as a narrow, oblong, transversely concave depression, with a shallowly excavated area, square in ontline on each side of it, marking the position of the base of the neurapophysis. The parapophyses are placed slightly below the middle of the sides; they are circular in section and were apparently very short. On the lower surface, one on each side of the median line and almost touching, are two poorly defined very shallow oblong depressions—(well defined and comparatively deep in one of the small centra). The sides of the centrum are slightly depressed between the raised margins of the articular faces; here the surface when preserved is seen to be marked by short inosculating ridges directed antero-posteriorly. The structure of the articular faces is dense; that of the remainder, which forms the greater part of the centrum, is finely cancellons.

Measurements.	M.M.
Type specimen, Plate I, figures 1, 2 and 3 : -	
Height of contrum	12.0
Breadth	16 8
Length	5.8
Smaller specimen:	
Height of centrum	9×0
Breadth	11.0
Length	$3 \cdot 8$

A basi-occipital bone that apparently belongs to this species is shown on plate I, figures 4, 5 and 6. Its posterior termination has the form of a vertebral centrum having a concave surface for articulation with the first vertebra. The bone narrows slightly forward; anteriorly it is incomplete, but apparently only a small portion is missing. Seen from above, (fig. 4), there is a deep excavation in the median line at some distance in advance of the posterior end, representing the hinder hasal part of the brain cavity. Above, posteriorly, is seen the floor of the *foramen magnum*, extending backward from the brain cavity as a narrow smooth surface, on each side of which is an area indicating the probable position of occipital arches such as are found in the living Amia calva, Linu. Laterally, and directed upward and ontward, occur concave facets for the articulation of the exoccipitals. Inferiorly, (fig. 5), the bone is flatly convex transversely, with a broad median longitudinal groove that does not extend backward to the border of the articulating eup. On each side of the basal surface is preserved the facet for the parasphenoid which evidently in this fossil form terminated posteriorly in two branches as in the living species. A canad enters the basi-occipital at the side (c, fig. 4) and

Is an exit from the lower surface beside a similar opening of the corresponding canal of the opposite side of the bone : this pair of foramina have their position in the median line of the bone between the hinder ends of the parasphenoid. The posterior articulating enp, fig. 6, corresponds in general size and contour with $t^* \circ type$ centrum of A mia exilis, its breadth being considerably greater than the height. Slightly above mid-height in the cup is a minute notochordal foramen. As seen from behind, the outline of the cup is rather flat in the centre below, and laterally subangular. The limits of the vertebra forming the posterior end of the basi-occipital, being the third of the three vertebrae that are thought to enter into the composition of this bone, are faintly indicated in the specimen.

LEPIDOSTEUS LONGUS, Sp. nov.

Plate I, figs. 7, 8 and 9.

A species of *Lepidosteus* is represented by an opishocolous vertebra. A few thick, smoothly enamelled, rhomboid scales, included in the collection, probably belong to the same species as the vertebra.

Miocene heds III (quarto),

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a, and vary resented on est of the l in outline dls of the there is a hibit a few otochordal . Ahove, a narrow, n outline, apophyses and were The vertebral centrum is from about the middle of the dorsal series, and is long in proportion to its breadth and height. In end view the unicentar surfaces are six-added, the anterior surface is slightly convex : the posterior one as slightly concave. The parapophyses are given off at the mid-height of the centrum a little in advance of the mid-length, p, fig. 9. Beneath each parapophysis is a deep fossa, long in an antero-posterior direction, occupying the lateral inferior face of the centrum and separated from its fellow by the narrow, flat inferior surface which is broadest at either end, where it is also most deeply impressed by a longitudinal median groove. The surface between the parapophyses and the neurapophyses, n, fig. 7, is deeply exeavated. The floor of the neural capal channels the upper surface of the centrum, the depression being greatest at mid-length. There is also a small fossa above, a little behind the parapophyses. The surface of the centrum throughout is quite smooth.

A conspicuous character of the above centrum is its length as compared with its height and breadth; length of centrum, along median line, inferiorly, 10 mm.; height of posterior articular face, 6.8 mm.; breadth of same, 8.8 mm.

The name longue is here made use of for the fossil gar represented by the Cypress Hills specimen.

RUINBASTES RILEAS.

Plate I, figs. 10-16.

Rhineastes rhaus, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills. Geol. Survey of Canada, Contr. to Can. Paleont., vol. III (quarto), pt. I, p. 3, pl. I, figs. 3, 3a and 3b.

A few broken vertebre are apparently referable to this species. In comparison with the type material, the internal structure of the centrum in the present perimens is seen to be the same, viz., close set vertical lamina parallel to the articular surfaces.

The vertebrae mentioned in the original description of the species consist of a median abdominal vertebra (the type spec.men), and a second centrum that is referred by Cope to this species not without some doubt. There is with this material a third vertebra, not mentioned by Professor Cope, and possibly not seen by him, which is slightly larger, and more perfect than the type. This specimen, with little doubt, belongs to this species, but calls for remark in that it is definitely flattened below, and is without a fossa beneath the base of the diapophysis. In the type the inferior surface is broken away.

In the 1904 collection are a number of bases of pectoral spines, serrated on both the anterior and posterior borders, probably referable to *Rhineastes rhouss*. In the genus Amiurus, to which the other Siluroid remains in the collection belong, the pectoral spine is serrated on the posterior border only, whilst in *Rhineastes* this spine may be serrated on one or both borders.

All the pectoral spines are imperfect distally, and show a considerable range in size. One of the most perfect is small, but gives the details of ornamentation well. The sides are covered with low narrow longitudinal ridges which often inosculate. There is no sign of tuberculation here; such as is found in conjunction with longitudinal ridges on the spines of *Arius ejertoni* of the middle Eccene of England, and Belginm. On the anterior border there is a median serrated ridge bounded on either side by a well-marked narrow groove. g in proided, the pophyses p, fig. 9. ccupying row, flat sed by a sophyses, mrface of sa above, soth.

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a median be to this entioned feet than k in that popbysis.

both the Amiurus, rrated on or both

in size. sides are sign of ne spines r border groove. There are nine outwardly directed serrations in a space of 3 mm. A similar ridge likewise occurs on the posterior border with slightly larger serrations, about six of the latter occurring in a space of 3 mm. These posterior serrations show a tendency to point backward, and they are not continued so far toward the base of the spine as are those of the anterior border. The measurements of this specimen are as follows :-length (distul half missing) 13 mm., greatest height at proximal end 6 mm., antero-posterior diameter at broken distal end about 2.8 mm., with a vertical diameter distally of about 1.6 mm. The pectoral spines in the collection are of various sizes, from 4 up to 16 mm., as measured in a vertical direction across the base, with the more auterior part in proportion.

The servations in the majority of the specimens have been worndown, and in some cases almost entirely removed, although indications of them can still be seen. In the hirgest specimen (16 mm. neross the base) the number of servations in a space of 3 mm, is about six on both borders. In all, the ornumentation of the sides is the same.

A few dorsal fin spines, with sculpture similar to that of the pectoral spines, are, probably, also referable to this species. They are broken neross at some distance from the base, and the distal end lost. One, of small size and somewhat worn, is sermited on both borders. In a second, a large spine, figs, 14, 15 and 16, the anterior border is rugose, and no satisfactory evidence of serrations can be made out; posteriorly its surface is deeply grooved proximally as in the smaller spine, and the specimen is broken off behind where the serrations would probably begin. The measurements of this large spine are—length of specimen 30 mm., breadth across proximal end 18 mm., antero-posterior diameter at fractured distal end 8 mm. transverse diameter distally 6.5 mm.

A number of fragments from the distal end of spines are, probably, also referable here They are longitudinally strinted, and three are serviced on both borders. Another is servated at least on the posterior border; whilst one bears on its posterior border comparatively long backwardly enryed barb-like denticles (figure 13).

These spines appear to approach closely, in detail of ornamentation and shape, to those of R, arcuatus, described by Cope from the Bridger Eocene of Wyoming. In the Oligocene specimens the sermitions of the borders, and the ornamentation generally, are on a smaller scale.

AMIURUS CANCELLATUS, Cope.

Amiarus cancellatas, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills. Geol. Survey of Canada, Contr. to Can. Pulscont., vol. 111 (quarto), pt. 1, p. 3, pl. 1, figs. 4, 4a-b, 5, 5a-b.

This species, founded on two vertebral centra from the Cypress hills, is one of two species of the genus described from this region.

In the 1904 collection are a few centra, with parts of others, that, judging from their form and structure in comparison with the type specimens, are apparently refeable to Cope's species.

In the type specimens the dense tissue of the articular surfaces is succeeded within by vertical lamina forming two thin layers which are connected by tissue, disposed for the most part longitudinally, in which are many openings of variable size having their longer axes in an antero-posterior direction. This open structure occupies the greater part of the thickness of the centrum.

The 1904 specimens have this general structure, with a considerable variance as to the number, size, and disposition of the openings in the inner tissue. Superiorly there is a centra excavation or fossa, with one more or less developed on either side of the centre. Laterally a fossa is present beneath the base of the diapophyses, and on the lower surface there is a median, single, or double fossa.

AMIURI'S MACONNELLI, Cope.

Aminras maconnelli, Cope, 1891. The species from the Oligocene or Lower Miocene bed of the Cypress hills. Geol. Survey of Canada, Contr. to Can. Pakeont. vol. 111 (quarto) pt. 1, p. 4, pl. I, figs. 6, 6a-b, 7a-b.

The vertebue of this species differ from those of the preceding principally in having the inner longitudinally disposed tissue more compact. This tissue, in which there is a conspicuous absence of large openings, is made up of slender longitudinal strands with secondary connect ing ones at right angles to the former, having small interspaces. As in *A. cancellatus*, there are vertical hamine beneath the dense articular surface layer of tissue, but they occupy a greater thickness and consequently restrict the innermost cancellous tissue to a narrower area.

Cope, in describing the two centra on which this species is based, states that they are without a fossa on the inferior face. This is no doubt an error of observation, as in the large of the two type specimens there is a single deep fossa below, and in the smaller centrum there is also a single median inferior fossa.

A few imperfect centra and large vertebral fragments belonging to the collection of 1904 are probably referable to this species.

The lower or proximal ends of a few dorsal fin spines, differing from those that have been provisionally assigned to *Rhineastes rhaas*, are in the collection of 1904.

These spines may have belonged to one of the two species of Amiurus here referred to or possibly both species may be represented. They differ considerably in size, and were apparently without tubercles, or longitudinal sculpture ridges on their sides. From the specimens it is impossible to state whether serrations were present along the anterior, and posterior edges, or not. The sides of the spines were apparently smooth, but the specimens are either slightly worn or weathered so that, any delicate markings, if they were present, have been obliterated. The largest specimen, figures 14, 15 and 16, has a maximum transverse diameter at the base of 13 mm., the smallest does not exceed 4.5 mm., measured similarly.

The largest spine is one that hus been broken off farthest from the proximal end It is subtriangular in section above the base, and is excavated longitudinally behind by a deep groove. Above, the ridge bounding the posterior groove on one side persists, on the other side it disappears, so that the spine is not bilaterally symmetrical. The lateral surface of the spine, on the side on which the posterior ridge continues, is convex, the opposite side is slightly concave. In the centre of the angular anterior surface is a longitudinal, shallow, but well defined, marrow groove. The basal perforation is about 3 mm, wide. Seen sideways the unterior surface curves backward, the posterior outline is almost straight. Measured from back to front, near the distal end of the specimen, the diameter is 12 mm., the transverse measurement at the same height from the base is about 7 mm. thickness.

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Compared with a dorsal spine* of Arius egertoni, var. belgieus, Leriche, from the Eocene of Beigium, the Cypress Hills spine is much more - shust above, although the proximal end and the basal perforation are of about the same size in each.

REPTILIA.

CHELONIA.

ANOSTEIRA ORNATA? Leidy.

Plate I, figs. 17, 18 and 19.

.tnosteira ornata, Leldy, 1871. Proc. Acad. Nat. Sei. Phila., p. 102.

A marginal plate of a tartle from the eastern escarpment of the Cypress hills (collection of 1904) bears so striking a resemblance in general form and ornamentation to those of Leidy's species from the Bridger Eocene of Wyoming, that it is, for the present, referred to that species.

The plate is triangular in section, the free edge being sharp and smooth, the inner surface excavated (figure 19). It is apparently the eleventh plate from the right side of the shell. The sculpture beneath, fig. 18, consists of distinct, discontinuous, radiating ridges of varying length with a few tubercles at the centre. The upper surface, fig. 17, is somewhat similarly, but more ragosely ornamented, the tubercles here predominuting ; ulthough toward the margins of the plate they tend to coalesce into short divergent ridges. A furrow across the middle of the npper surface marks where contiguous epidermal shields met. This groove is continued, though very faintly, on the under surface of the plate. Leidy was doubtful as to the presence of shields in this species. In his description** he mentions that the shell "appears to be devoid of the usual outlines more or less strongly expressed, of the investing scutes."

A second marginal plate from the same locality bears a slightly different sculpture. The upper surface is granulose throughout, without the formation of definite ridges, although the tubereles frequently coalesce. The lower surface would be quite smooth but for an indistinct granulation near the free border. The plate is wedge shaped, shallowly concave above, but convex beneath, and grooved on the inner border. A sulcus also in this plate denetes the presence of epidermal shields. The anterior marginals in the type are stated to be smooth beneath, and it is probable that this plate belongs to that part of the shell anterior to the axillary noteh.

In Bone coulse, Cypress hills, was found another specimen probably belonging to the species represented by the eastern escarpment marginals. It is a lateral marginal, probably the fifth of the right side, and is definitely sculptured in agreement with the type of A. ornato. This specimen also bears scute impressions.

More material is needed to more definitely determine the Cypress Hills species, which, from the evidence now available, and so far as a comparison can be made, apparently very closely resembles the Eccene species described by Leidy. Additional specimens, however, will probably prove the Cypress Hills species to be distinct from A. ornata, bringing to light a form representative of the Oligocene deposits.

^{*} Memoires du Musée Royal d'Histoire Naturelle de Belgique, t. 111. Les Poissons rocènes de la Belgique, par Maurice Leriehe, 1905, p. 143, pl. 1X, figs. 4 and 5.

^{** (673,} Contr. to the Extinct Vertebrate Fauna of the Western Territories. Report U. S. Geol. Survey Terrs., vol. 1, p. 175, pt. XVI, figs. 1 6, 12529-3

STYLEMVE NEBUASCENSIS, Loidy.

This species has aircady been recorded by Cope, (this volume, pt. I, p. 5) from the l waters of Swift-enrrent creek in Bone conlée (collection of 1884), who considered that ce tragments from this locality were not distinguishable from Leidy's species from the Olige of South Dakota and Colorado. The 1904 collection includes parts of the shell of a tor which is also, apparently, referable to the same species.

TESTUPO EXORNATA, Lambe.

Plate I, figs 20, 21 and 22.

"estudo exornato, Lambe, 1906. Ottawa Naturalist, vol. X1X, p. 187, pl. 3, figs. 1, 2 and

Among the chelonian remains of the Cypress Itilis Oligocene collection of 1904 are of a number of costal plates that were described in 1903, as appertaining to a new spot *Testudo*, under the above name.

The specimens were found separately, but were considered to belong, evhlently, to the species. The three figured are the proximal end of the left first costal, the distal half o left fifth costal, and the proximal end of the left sixth costal.

All the specimens show decided groove markings. The distal end of the fifth c plate 'figure 20, the type of the species), is particularly narrow and thick, but its outline cates that the bone when entire had a considerable breadth proximally. Its upper su presents a number of parallel shallow furrows in the direction of the length of the carait is thickened along its posterior articular border where it joined the similarly thick anterior border of the sixth costal, thus forming a stout ridge for the reception of the increbuttress.

The specimen shown in figure 21, is apparently the proximal end of the left sixth of plate. This costal when complete was evidently much broader toward its outer end. I sulci on the upper surface mark the position of the fourth vertebral, also the third, and for costal shields. Distinct grooves also cross this plate from side to side near its inner end, we the sutural surfaces for articulation with the sixth and seventh neural plan are preserved.

The third specimen, figure 22, is the inner end of the left first costal. On its surface concentric grooves indicating an epidermal shichl pattern such as is found in some of modern species of the genus.

These specimens show that the costal plates were alternately narrow rud broad dist and broad and narrow proximally : a common character of species of *Testudo*.

Measurements,

	748 148 1
1st Costal plate. Plate I, figure 22:	
Maximum thickness at centre of proximal end,	7
Thickness of specimen at anterior suture	5
" " posterior "	4
5th Costal plate. Type. Plate t, figure 20 :	
Thickness at proximal end of specimen	5
" near distal end at anterior suture	5
" distally near posterior suture	8
6th Costal plate. Plate I, figure 21 :	
Thickness at proximal end	8

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the fifth costal ts outline Indiupper surface f the carapace, arly thickened of the invarial

eft sixth costal er end. Deep ird, and fourth ner end, where re preserved.

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broad distally,

19

This species is peculiar on account of the extreme narrowness and thickness of the 5.h costal plate. The surface of the carapace hore a distinct pattern of grooves which were, anterioriy at least, arranged constructing within the boundaries of the epidermal shields.

TRIONYX LEUCOPOTANICUS, Cope.

This species was described by Cope in 1891*. The material on which it is based consists of part of a costal hone from Bone coulde, Cypress hills, (Mr. T. C. Weston's collection of 1×84) and some well preserved fragments from the White buttes, Dakota.

In the collection of 1904 from Bone coulée are a number of fragments of shell, principally broken costals, that are evidently referable to this species.

Other fragments may be assignable to T. punctiger, Cope, from the Oligocene (White River) of South Dukota, but the material is too poor to admit of a satisfactory determination.

BQUAMATA.

PELTOSAUNUS GRANULOSUS, Cope.

Plate 1, figs. 23, 24 and 25.

Peltosaurus granulosus, Cope, 1878. Paleontological Bulletin, No. 15, p. 5.

" Cope, 1874. Annual Report U. S. Geol. and Geog. Survey Terrs. for 1873, p. 513.

Peltosaurus granalosus, Cope, 1884. The Vertebrata of the Tertlary Formations of the West, F.S. Geol. Survey Terrs., vol. 111, p. 773, pl. LX, figs. 3-11.

Peltosaurus granulosus, Lambe, 1905. Geol. Survey of Canada, Summary Report for 1904. p. 366.

With this species are identified part of a left dentury (fig. 23) and the posterior half of a right maxilla (fig. 24), in both of which specimens a number of the trath are preserved. A worn portion of a second dentary from which the teeth have been abraded, probably, also belongs to this species.

The type specimens described by Cope are from the Miocene of north-eastern Colorado; the Canadian specimens were obtained by the writer from the Oligocene beds of Bone coulde, Cypress hills, in 1904.

In the dentary shown in figure 23, the teeth are pleurodont, of fair size, chisel-shaped, and apparently in all particulars agreeing with those of the type specimens. There are four of the largest teeth in a space of about 5 mm. The mandibular groove, second the inferior surface of the specimen, is of large size, and the dentary canal is well shown, piercing the bone midway between the surface of attachment of the teeth and the exterior surface of the specimen in which occur a few small foramina.

In the maxilla there are eight teeth preserved, diminishing in size toward the back. Exteriorly the bone enryes slightly outward behind, and above posteriorly is seen the surface for the articulation of the jugal. The teeth correspond in size with those of the dentary.

The Cypress Hills specimens are smaller than the corresponding bones on which the species is based, but there is no evidence to indicate that they belong to a different species.

* The species from the Objecche of Lower Moscherbedcol, the Cypress hills. Geol. Survey of Canada. Contr. to Can. Pal sont., vol. 119, (quarto, pt. 1, p. 5, pl. 1, figs. 8 and 9. A dermal seute, fig. 25, from Bone coulde, possibly referable to this species, may be tioned here. It is quadrangular in shape, flat, longer than broad, and broadest behind, straight sides, and a convexly curved, sharp-edged posterior margin. It attains a maxithickness of 0.5 mm in front and thins gradually to the rear. No overlapping surface seen. Above it is finely tuberculated, the turbercles being distinct from each other, and set, about three in a space of 1 mm. A well defined median ridge is developed in direction of its length. This scute differs from those of this species described by Cope, in it is keeled, and the granulation, apparently, more distinct.

OGMOPHIS COMPACTUS, Sp. nov.

Plate I, figs. 26-30.

Ophidian vertebra, Lambe, 1905. Geol. Survey of Canada, Summary Report for 1904, p. Four dorsal vertebray apparently helonging to the same species were found separate They are all of different sizes, and, probably, are from different individuals. The maxi breadth is across the zygapophyses, which are broadly expanded laterally; it appar exceeds the maximum height (unobtainable on account of the abrasion of the neural spin all the specimens) and greatly exceeds the length measured so as to include the pre postzygapophyses. A marked character is the shortness of the centrum. The cup is w than high with a well defined sharp rim, and is directed very slightly downward. The b as slightly inclined upward. The zygosphene is broader than the neural canal is wide, and a plane upper surface, and a straight sharp front margin that slightly overhangs the u rim of the eup. The neural spine starts as an angular ridge hehind the upper surface of zygosphene. The neural canal is subtriangular in cross section, the angles being rou with the apical one the most obtuse; its sides are slightly incurved. A low rounded a occupies the centre of the floor of the canal longitudinally, corresponding in shape with hypapophysial keel of the lower surface of the centrum. An angular interzygapoph ridge is feebly developed, the surfaces above and below the ridge being shallowly cone The front margin of the neural arch between the postzygapophyses is, in outline as seen above, deeply emarginate, restricting the space available for the base of the neural spine. facettes of the zygapophyses and of the zygosphene and zygantrum are inclined at a slight a to each other, those of the zygapophyses being the less removed from the horizontal. Thee tuherele is not prominent; its articular face in all the specimens is a little worn, hut sufficie well preserved to show that it is single. Its face is higher than broad, and is directed oblig outward and downward from beneath the prezygapophysis at a level corresponding with

of the cup. In the largest vertebra (No. 3) the articular face is seen to he convex above slightly concave below posteriorly. A rounded ridge is developed near the base of tubercle, and passes backward almost to the side of the ball at its mid-height. This rileaves a longitudinal depression on either side of the hypapophysial ridge which passes f the ball to the cup, and is well rounded and distinct but not prominent. There are slivariations in the above vertebrae but their general proportions are similar. The verte figured on plate I is No. 2 of the table of measurements given below.

Measurements in M.M.

No. 1	Length of centrum, 4+3	Breadth of ant. 9+5	vertebra. Josti	Height of vertebra ant. post.
No. 2 No. 3	5.0		7:75	6.0
No. 4	4 · 3	11:0	6.00	6+75 6+4

s, may be menst behind, with ins a maximum ng surfaces are other, and close veloped in the by Cope, in that This species is distinct from O. angulatus described by Cope* from the White River (Oligocene) beds of north-eastern Colorado. The vertebrae of Cope's species approach more closely in general form those of the Cypress Hills species than do those of other described species of the genus. O. arcnarum, Douglass,** from the Flint Creek beds (Miocene) of Montana, differs in important particulars.

CROCODILIA.

Chocepilus PRENASALIS? Loomis.

Crocodilus prenasalis, Loomis, 1904. Two new river reptiles from the Titanothere beds; Amer. Jour. Sei., vol. XVIII, p. 427, figs. 1-9.

Few croceodilian remains were found in the Oligocene deposits of the Cypress hills in 1904, and none had been secured previous to that date. The writer obtained in 1904 the fellowing specimens:—two vertebral centra, two keeled scutes, a fragment of a pitted bone from the head and a tooth. These specimens were found separately, but probably belong to the same species.

The vertebre are from the dorsal region. They are concave in front, and prominently convex behind, and in each case the base only of the neural arch remains. One specimen is nucle smaller than the other, and, probably, belonged to a young individual, as the suture between the neural arch and the centrum is strongly marked. The dermal scutes have numerous deep, rounded pits in the upper surface, are prominently keeled longitudinally, and their margins bear no evidence of having been in contact with other scutes. The under surface is even and that. The tooth is elongate conical and curved slightly inward, and backward; its surface is quite smooth. The inner face is defined in front, and behind, by a well developed ridge that extends from near the base to the apex. The base of the tooth is deeply excavated.

Measurements.	
Large vertebra :	MM
Maximum length at mid height of centrum	35
Height of anterior articular face	20 0
Maximum breadth of same	22
Height of posterior articular face	18 :
Maximum breadth of same	17.8
Length of floor of neural equal	28
Length of inferior surface	22 .
Small vertebra : -	
Maximum length at mid height of centrum	25
Height of anterior articular face	15
Maximum breadth of same	15
Height of posterior articular face	13
Maximum breadth of same	15
Length of floor of neural canal	18
Length of inferior surface	15.

Report U. S. Gool. Survey Terrs., vol. III, Termary Vertebrata, book 1, 1881, p. 783.

** Annals of the Carnegie Museum, 1903, vol. 11, Att. N. p. 171.

r 1904, p. 366. and separately. The maximum it apparently neural spine in e the pre- and e eup is wider d. The ball is wide, and has ngs the upper surface of the being rounded rounded ridge shape with the zygapophysial owly concave, e as seen from al spine. The a slight angle al. The costal out sufficiently eted obliquely ling with that ex above and e base of the . This ridge h passes from ere are slight The vertebra

of vertebra. post. S+0 6+0

6.1

Lar	ger dermal scute :	
	Length	0
	Breadth	1
	Maximum height or thickness	7.5
	Average diameter of pits	3
Too	th :	.,
	Length	7.5
	Antero-posterior diameter at base.	0.0

The above erocodilian remains are referred provisionally to the species lately desc by Dr. F. B. Loomis, from the Titanothere beds of South Dakota. The larger vertebra the Cypress hills agrees well in size, and general proportions with the South Dakota of centrum (p. 428, fig. 3, of Dr. Loomis's paper), whilst the larger dermal sente of resembles the Dakota plates in the disposition and size of the surface pits

MAMMALIA.

MARSUPIALIA.

DIDELPHYS VALENS, SP. nov.

Plate VIII, figs. 1-7.

An upper right molar from Bone eoulée, Cypress hills, is provisionally referred to genus. The tooth in erown view, is triangular in outline, has three prominent V-sh eusps, and a strong external style-bearing eingulum. Of the three cusps, the int one (protocone) occupies the apex of the triangle, the other two (paracone metacone) form an antero-posterior pair somewhat removed from the external fac the tooth by the strong development of the cingulum. The three primary cusps compressed antero posteriorly, the protocone to a less extent than the other two; all their external slopes well excavated. The protocone is the stoutest, and is of about the height as the paracone, which is the smallest : the metacone is conspicuously higher than others. At the base of the posterior spur of the protocone, is a decided though small fo eusp that may represent the hypocone. Three principal stylar cusps occur in the eingn Of these, the most prominent occuries a position only slightly posterior to the mid-ler of the eingulum : it is compressed transversely, and has a vertical external face with a se what rounded internal slope; its height is nearly equal to that of the paracone. Of the c two stylar cusps one is at either end of the cingulum, the anterior one being the larger of two. The demarcation between the anterior style and the large one posterior to it is decided, and is accentuated by a furrow in the vertical external face of the cingulum. the anterior slope of the central stylar cusp are two inconspicuous secondary styles. cingulum is continued round the anterior base of the paracone as a narrow shelf. The er is borne on three short roots.

This tooth, plate VIII, figures 1-4, probably the second or third upper molar, is consi ably larger than (slightly more than one-third as large again as) the corresponding mo of *Didelphys* (*Perotherium*) fugar, which exceeds in size the other species of the ge described by Cope from the Oligocene of Colorado. For the species represented by Cypress Hills tooth the name ralens is proposed. Collection of 1904.

		20
•		14
•		7.5
•		3

Le Tra Le Ma

٠	•		17.5
	•	•	$9 \cdot 2$

ately described r vertebra from Dakota dorsal scute closely

eferred to this nent V-shaped , the internal paracone and ternal face of ary cusps are two; all have bout the same gher than the h small fourth the eingulum. ie mid-length with a some-Of the other e larger of the or to it is very ngulum. On styles. The The crown

r, is consider. onding molars of the genus sented by the

100	

Measurements of type specimen.	MM.
ngth of external face of crown	$2 \cdot 25$
ansverse diameter	2.50
ngth of interno-posterior faco	3 30
ximum height of crown (height of metacone)	1.30

The presence of an incipient hypocone is a decidedly progressive character, and one that has been considered by Bensley* in the Australian genus Perameles as an indication of a change from an "insectivorous to an omnivorous condition." The hypocone appears not to be present in the molars of Didelphys, and suggests that the Cypress Hills tooth may represem a distinct genus. Under the eircumstances, however, with so little evidence to go on, a provisional reference to the above, mainly Oligocene genus is at present adhered to.

Another small tooth, plate VIII, figures 5-7, from the same locality us the above, deserves attention. It possibly represents an undescribed genus of marsupial of the polyprotodont section, but the one small tooth found is quite insufficient for any definite determination. The crown is triangular in cross section, and consists of a high, apieal, principal cusp, subpyramidal in shape, with two less elevated, conical, subequal cusps occupying the base of the triangle. The tooth has one root which would suggest an anterior premolar, but the crown is molariform, and presumably a posterior molar is represented. Regarding the tooth as a lower molar, the principal apical cr. p is the protoconid, the smaller pair being the metaconid and paraconid occupying internal posterior and anterior positions respectively. A cingulum is continuous round the base of the crown except internally. Anteriorly, and externally, the cingulum is feeble, but posteriorly it becomes accentuated, and ends abruptly beneath the posterior slope of the metaconid in a minute tubercle. On the internal face of the crown a vertical furrow occurs between the bases of the two smaller cusps.

Measuremints.	MM.
Jaximum antem-posterior diameter of crown	1.20
" transverse diameter of crown	. 1.50
leight of external cusp (protoconid).	. 1.80
" internal cusps (metaconid and paraconid)	0.85

The second lower molar of Notoryctes typhlops*, Stirling, has a cusp arrangement very similar to that of the Cypress Hills tooth, suggesting that the dentition of this living Australian marsupial may be primitive in some of its characters rather than specialized. In the Cypress Hills tooth, however, the talonid is only indicated by a minute tubercle, or enlargement of the cingulum at the base of the metaconid, proportionately much smaller than the definite subsidiary ensp of Notoryetes.

It is possible that this tooth, and the upper molar above described, both of the collection of 1904, may belong to the same animal.

* On the Evolution of the Australian Marsupialia ; with remarks on the relationships of the marsupials in general, by B. Arthur Bensley, Ph. D., University of Toronto ; Trans. Linneau Society, vol. 1N, part 3, 1963.

* This tooth is described and figured by Dr. Bensley in his memoir of 1903, p. 119, pl. 6, figs. 47 a. b.

MM.

UNGULATA

ANCODUS (HYOPOTAMUS) MEACHYRHYNCHUS, Osborn and Wortman.

Plate II, figs. 1-9.

Hyopotamus brachyrhynchus, Osborn and Wortman, 1894. Fossil Mammals of the Miocene White River beds. Collection of 1892; Bulletin Amer. Mus. Nat. His vi, article vii, p. 220, fig. 68.

This genus was not known from Canada prior to the publication of the writer's list or remains from the Cypress hills in the Summary Report of the Geological Survey f year 1904. Unfortunately, separate teeth are the only evidence that we as yet have existence of this artiodaetyl in this country during Oligocene times.

A well preserved right upper third molar, fig. 1, belonging to this genus, is include the collection of 1904, and is thought to be referable to *A. brachyrhynchus*, Osborn and man, from the Protoeeras beds of South Dakota. In this species there is a greater de ment of the eingnlum in the upper premolars and molars than in *A. americanus*, Leidy, a slightly lower horizon. The eingnlum in the Cypress Hills molar is conspicuous, and i respect as well as in its general proportions this tooth agrees better with the corresponone of *brachyrhynchus* than with that of *americanus*. In the Cypress Hills tooth the messis prominent in the ectoloph, and apparently more protrudent than in *brachyrhynchus* protoconule is well defined and throughout the cingulum is molerately developed.

Measurements.	11.11
Antero posterior diameter	31.31
Anterior transverse diameter	29
Posterior transverse diameter	31.
Height of paracone	26
Height of protocone	13.4
get of protocolo content and a second s	12.4

Within a very short distance of the above tooth, and at the same level, were found other teeth that appear to belong to this genus, and are probably refeable to this spe-These teeth are determined as follows :--- a left lower first incisor, a right lower third incia right lower canine, and an upper left third premolur, all figured in plate II. The premfig. 2, is slightly smaller than the same tooth in *brachyrhynchus*, but is otherwise very simparticularly as regards the shelf-like, interno-posterior expansion of the eingulum, we greatly increases the breadth of the tooth behind. As seen from below, fig. 3, the ouof the tooth is triangular, with the inner posterior angle obtusely rounded. The eingulur continuous throughout, and is conspicuously prominent internally.

The lower eanine agrees in shape with the corresponding tooth of the Hyopotamus is the Lower Miocene of Ronzon, near Puy-en-Velay (Haute Loire), France, as figured Kowalevsky in the Philosophical Transactions of the Royal Society of London, 1873, 163, pl. XXXIX, figs. 3, 3¹. Its crown, viewed from the side, is nearly triangular, sha pointed above (unworn), with its height slightly in excess of the basal breadth. Its ante and posterior slopes are sharp-edged, the former curving inward below. The exterior face, fig. 5, is convex, somewhat flattened behind. Internally, fig. 4, it is excavated, wi median vertical rib breaking the general concavity. n.

ls of the Lower Nut. Hist., vol.

ter's list of fossil Survey for the yet have of the

s, is included in born and Wortgreater developus, Leidy, from ons, and in this corresponding h the mesostyle yrhynchus; the oped.

M.M. 29 31+5 26 13+5 12+5

vere found four o this species. r third incisor, The premolar, e very similar, gulum, which 3, the outline ie eingulum is

potamus from as figured by on, 1873, vol. gular, sharply Its anterior e exterior surwated, with a 25

Of the incisor teeth, the supposed lower third, figs. 6 and 7, is very similar in shape to the canine, but is smaller, less pointed above (worn), and the breadth of the crown below is greater than the height. The crown is set obliquely to the root. The left lower incisor, figs. 8 and 9, probably the first, is considerably worn above where the greatest breadth occurs. Its enting edge forms an almost straight line across, and the later margins slope gently inward to the root, without the abrupt basal constriction observed in the third incisor. Internally the crown is concave, with a median longitudinal rib.

ANTHRACOTHERIUM? PYGMLEUM, Sp. nov.

Plate V1, fig. 6.

A right upper molar of very small size indicates an artiodaetyl with deutal characters suggestive of an Anthracothere. As the tooth is imperfect, lacking some of the parts most essential for its exact determination, a description of it is given, in the hope that at some future date, better material may be forthcoming. For the present it is referred to *Anthracotherium*, but it is probable that an undescribed genus is represented. For the species the name pygmetum is proposed.

In crown view the outline of the tooth is quadrangular, with the antero-posterior diameter internally greater than the anterior transverse diameter, so that the tooth is longer than broad. In Anthracotherium and Ancodus these proportions are reversed. The margin of the tooth is perfect anteriorly and internally, but externally and posteriorly it is damaged. The specimen lacks the mesostyle and the posterior slopes of the metacone and hypocone. The four main ensps are crescent shaped and there is a distinct but small protoconule.

A deep transverse valley separates the unterior from the posterior cusps, a comparatively shallow longitudinal valley occurs between the ; otocone and the paracone, but a corresponding valley does not exist between the hypocone and metheone. The protocone is larger and more elevated than the hypocone, but both are prominent with steep inner slopes. A broad, median rib occupies the outer, otherwise slightly concave slope of the former. The paraeone is low (in the specimen much worn), but the metacone rises nearly to the height of the hypocone, whose outer slope is short, and descends but little to meet it. The outer slope of the paracone (judging from the small portion of it preserved) resembled that of the protocone. The anterior spur of the protocone reaches to the protoconule, which is close to a welldefined anterior cingulum. The posterior spur of the protocone is long, crosses the median transverse valley, and rises on the anterior slope of the hypocone nearly to the apex of the metacone. The basal cingulum occurs on the anterior face of the crown, and in the inner end The auterior spur of the hypocone connects with the posterior spur of the transverse valley of the protocone almost at the apex of the metacone. The specimen shows the junction of the anterior spur of the metacone with the posterior one of the paracone, but the mesostyle is missing. The parastyle is very feebly developed.

The approximation of the posterior cusps in this tooth is a character probably sufficient to distinguish the species generically from any of the known genera of *Anthracotheriida*. The selenodout form of the main cusps, and the presence of a protoconule, makes it most probable that this species is properly assignable to the *Anthracotheriida*. The tooth pattern indicates a closer relationship to *Anthracotherium* than to *Ancodus*.

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Measurements of type specimen.

Internal antero-posterior diameter	 	9 00
Anterior transverse diameter		8.00
Height of protocome	 	1.70
neight of hypocone	 	3+80

Locality :- Bone coulée, Cypress hills. Collection of 1904.

ELOTHERIUM COARCTATUM, Cope.

Plate II, figs. 10-15, and plate 111, ligs. 1-6.

This species, based on the greater part of a left mandibular ramus discovered by Mr. ' Weston in the Cypress Hills deposits during the summer of 1888, was first described by fessor Cope in the American Naturalist, vol. XXIII, p. 628, July 1889, in his third ar on the "Vertebrata of the Swift-current river." Cope's fuller description, with illustration of the type specimen, appeared in 1891 in part I of this volume.

The original description of 1889 is worded as follows:—" Elotherium coarectatum, nov.—Represented by a left mandibular ramus with condyle, which supports all of the n teeth. The species differs from the *E. mortonii*, with which it agrees nearly in size, in ha all the premolars in a series uninterrupted by diastemata, except a very short one bety pm. iii and iv.* The second premolar is the most elevated, and the third and fourth abruptly smaller. The fourth has one compressed grooved root. The molars are peculia having the two anterior cusps elevated above the three posterior ones, as in Miochenus The posterior, or fifth tubercle, is well developed, especially on the m. iii."

"Length from condyle to edge of canine alveolus, 295 num.; do. to last molar, 125; of true molar series, 67; do. of m.i, 22; width of do., 13; elevation of pm. ii, 21; lengt base of erown do., 28; depth of ramus at m.i, 55."

An upper molar, obtained by Mr. Weston at the Cypress Hills locality in 1884, assigned to *Elotherium mortoni*, Leidy, by Cope in his earlier references** to the Su collections, was, in 1891, referred to *E. coarctatum* in his final description of the species.

This upper tooth, plate II, fig. 10, is regarded as m¹ from the right side. It has low tubereles arranged in two rows transversely, of which the inner posterior tube (hypocone) is apparently not separate from the cingulum. The two onter tubereles (parad and metacone) are well developed, the paracone being the larger of the two. Both the in tubercles in this specimen are injured, but the protocone has been apparently of fair size. protoconule and metaconule are well marked but do not attain the height of the outer co The cingulum is conspicuous on the anterior and posterior faces of the crown. The tooth three roots.

Another right upper molar, fig. 11, belonging to the writer's collection of 1904, is refe to this species. It is the posterior tooth of the series and is of about the same size as first upper right molar just mentioned. It resembles the last upper molar of E, mortoni

* The usual premolar enumeration from front to back is here reversed.

** American Naturalist, 1885, vol. XIX. The White River beds of Swift current river, North West Territory, 1 (Entribution morton), Leidy); and Gool, and Nat. Hist. Survey of Canada, 1885, vol. I, new series, appendix I, p. (Ebtilterium morton), Leidy).

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waretatum, sp. ll of the molar size, in having t one between nd fourth are are peculiar in Miochenus sp.

olar, 125; do. 21; length of

in 1884, and to the Sarvey c species.

e. It has six erior tubercle eles (paracone Both the inner air size. The c outer cones. The tooth has

04, is referred ne size as the E. mortoni, as

Territory, p. 163 ppendix 1, p. 81 C

described by Leidy in 1853 in "The Ancient Fauna of Nebraska," plate VIII, fig. 1, but the six tubercles are more distinctly marked in the Cypress Ilills tooth. The cingulum is continued round the entire crown, except for a short distance at the base of the inner slope of the protocone; it forms a broad shelf anteriorly, and is prominent posteriorly. Seen from above the crown in outline is unequally four-sided; it is transversely much narrower behind than in front. It is low with six conspicuous tubercles, of which the outer and inner anterior ones (paracone and protocone), are about equal in size and larger than the others. Of the three tubereles forming the transverse posterior row, the inner one (hypocone) is connected with the cingulum.

Two fragments of the lower jaw of this species were also obtained in 1904. These are a part of the left ramus with molars i, ii, und iii, and a small portion of the right half of the jaw holding the first molar. The teeth agree in all particulars with the corresponding ones of the type specime ...

Two teeth, the upper third and fourth premolars of the right side, collected in 1904, are, on account of their large size, referred to E. coarctatum with some hesitation. They were found together, and probably belonged to the same individual. If they properly belong to this species, and they are apparently not referable to any other described species from the Oligoeene, they will indicate that in E. coaretatum the upper third and fourth premolars are considerably stouter in every way than the corresponding teeth of the lower jaw. Of these specimens, the third premolar, figs 12 and 13, is a simple robust cone, elongated anteroposteriorly, and supported on two roots, of which the hinder one is the thicker but shorter of the two. A cingulum passes round the base posteriorly and is present, but feebly developed, anteriorly. The enamel is roughened by short vermicular markings, which, toward the base, above the cingulum, pass into conspicuous wrinkles. The crown shows signs of wear toward the inner side behind and along the front slope. The fourth premolar, figs. 14 and 15, is a very strong, three-rooted tooth, with a transverse diameter greater than its maximum anteroposterior diameter. The crown consists of an outer conical cusp with a smaller, less elevated one on the inner side. A strong cingnlum is present except at the centre of the base of the external slope. This tooth is also considerably worn on the front and back slopes of the crown, more particularly on the former. Except where worn the surface above the eingnlum presents the same style of surface marking observed in the third premolar.

Measurements.

MM. Upper right m. iii, plate 11, fig. 11 :--Antero posterior " Upper right m. i, plate 11, fig. 10 :---Antero posterior Upper right iv, plate II, figs. 14 and 15 :-Transverse diameter of crown, at base..... 29 Height of crown, external..... 23 Upper right pm. iii, plate II, figs. 12 and 13 :---Transverse diameter of crown at base, maximum 18 Antero posterior 3 6 6 32-5

The reader is referred to part I of this volume for Professor Cope's description of the type of this species.

Five separate teeth from Bone coulée may be mentioned here as apparently belonging to *Elotherium*. They resemble incisors in form, and may represent more than one species, as four of them are nearly of a size, whilst one is much smaller. Two of the larger specimens are shown in plate 111, figures 1, 2, 3 and 4; the small one is shown in figures 5 and 6 of the same plate.

In his memoir on the Cypress Hills fauna Professor Cope alludes to the fewness of the remains of *Oreodonitda* in the collection studied by him. The only specimen mentioned by him is a left lower first premolar which was not assigned to any genus.

In 1904 a few additional separate teeth were obtained by the writer; these are noticed

as under.

AORIOCHERUS ANTIQUUS, Leidy.

Plate II, figs. 16 and 17.

Three imperfect posterior upper molars, one from the left side and two from the right, represent one or more species of Agriocharus. Comparing these teeth with the posterior molars of Agriocharus antiquus, Leidy, from the Oligoeene of South Dakota, as described and figured in the "Aneient Fauna of Nebraska" (Smith. Contr. to Knowledge, 1854, vol. vi) p. 24, pl. 1. the same general form of low cusps, pertaining to this genus, and distinguishing it from Oreadon, is observed. Of these molars, one is of about the size of the corresponding tooth of Leidy's figured types, the other two are slightly larger.

One of the above specimens (an upper right third molar, imperfect internally) may with little doubt be referred to A. antiquus; its dimensions slightly exceed those given by Leidy for this species. In this specimen the form of the external median buttress (mesosty!e), seen also in a molar to be mentioned presently, is low and flattened from without, quite unlike the high antero-posteriorly compressed mesostyle of Oreodon. In the other posterior right molar the agreement in form with the teeth figured by Leidy is close, so far as ean be judged; the ectoloph is missing and a full comparison is not possible. Its breadth is about the same, and the shape of the inner cusps is similar. This tooth is also referred to A. antiquus. The third specimen (plate II, fig. 16), the left posterior molar, has a greater proportionate as well as actual transverse diameter, and may represent a species distinct from A. antiques.

Besides the three above mentioned specimens, there is in the collection of 1904 another left upper posterior molar (plate II, fig. 17). The low rounded form of the mesostyle is here well shown. The tooth exceeds in size the corresponding one of A. antiquus, and the proportions of the cusps are somewhat dissimilar; the flatness of the outer slope of the metacone (postero-exterior cusp) is particularly noticeable. In the absence of better material this tooth is provisionally referred to A. antiquus.

MERYCOIDODON CULNERTSONI, Leidy.

Plate II, figs. 18-26.

A second genus of Agriochoridæ (Oreodontidæ) is represented by separate teeth from the Cypress hills, included in the collections of 1884, 1889 and 1904. They are referred to Merycoidodon culbertsoni, Leldy, of the Oligocene of South Dakota, and consist of the following specimens :- The left lower caniniform premolar, mentioned by Cope in part 1 of this volume, but not assigned by him to any species (Weston, 1884), a left upper canine (Lambe, 1904) and a right lower second molar (Lambe, 1904).

The premolar, plate II, figs 18 and 19, agrees closely in size and form with the corresponding tooth of the female skull of M. culbertsoni, described and figured by Leidy in "The Ancient Fauna of Nebraska." This premolar shows signs of wear, in front on the outer side, and behind on the Inner side, where it closed against the upper canine and the upper first premolar.

Measurements of lower first premovar.	M.M.
Exterior height of crown (worn)	13
Antero-posterior diameter of crown at base	13
ransverse diameter of crown at base	4.0

The left upper canine, figs. 20-23, is long, curved, and subtriangular in transverse section throughout its length. The posterior surface, fig. 21, is flatlened, and the exterior and interior surfaces are nearly flat, the former being slightly more convex than the latter, fig. 20, in which a low, longitudinal median ridge is developed in the fang above the crown. In the exterior surface a shallow groove is noticed in a corresponding position. The forward angulation is evenly rounded. The crown of the tooth is worn flat posteriorly, where it came in contact with the lower first premolar, and its side angles are sharp. The immediate extremity of the crown is broken off but it seems to have been bluntly pointed. The enamel of the erown extended upward from the point, about 20 mm., measured along the forward angulation. The antero-posterior diameter of the tooth throughout its entire length exceeds the breadth of the posterior flattened surface (max. transverse diameter), otherwise the resemblance of the Cypress Hills tooth to that of M. culbertsoni is strong. In describing the upper canine of this species, Leidy, in his above mentioned memoir (p. 42), states that the posterior side "is a little larger than the other sides," that is the transverse diameter exceeded the antero-posterior diameter.

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Measurements of upper canine.	MM.
Total length of specimen along anterior curve	. 58
Max, transverse diameter at base of crown	. 9
Antero-posterior diameter at base of crown	. 10.5
Antero-posterior diameter near upper end of fang	12
Trausverse diameter """"""	. 10

The remaining tooth, referred to M. culbertsoni, is a lower right second molar, figs. 24, 25 and 26. Comparing the specimen with Leidy's figure of the corresponding tooth (op. eit. pl. III, fig. 4) no difference is noticed, except that the Cypress Hills molar is a little the larger of the two.

POEBROTHBRIUM WILSONI, Leidy.

Plate VIII, f.gs. 8 and 9.

This species, made known by Leidy in 1847 (Pr. e. Acad. Nat. Sci. Phila., vol. HI, p. 322), from the greater part of a skull from the Oligocene (White River) of Nebraska, is represented in the 1904 collection from the Cypress Hills beds by two separate lower last temporary molars, one of which remains in a portion of the jaw. These teeth are composed of three double lobes decreasing in size to the tront. The jaw fragment in which the molar is preserved, has a depth agreeing with that of the lower jaw of the type skull, fully described and figured by Dr. Leidy in 1854* in his classic "Ancient Fanna of Nebraska" (Smith. Contr. to Knowledge, vol. VI). In advance of the molar in this specimen are the alveoli for the tooth next in front.

Measurements.

MM.

lower right last tempora	ry mont	12
Antero-posterior dia	meter	7
Posterior transverse	4 ⁶	4
Anterior "		
Lower left last temporary	y molar in jaw fragment : (Plate VIII, figs. 8 and 9.)	10
Antero-posterior dia	meter	6
	14 Contraction of the second s	1
Posterior transverse		
Posterior transverse Amerior "	44	1

LEPTEMERYX ESPLEATUS, Cope.

No teeth from Bone coulée belonging to the 1904 collection can with certainty be referred to this species, which is based on a worn upper, right molar of which the posterior half of the ectoloph is broken away. In size the type of *L. esulcatus* is between one-third and one-fourth smaller than the molars of *L. ecansi*, Leidy. The lower teeth figured by Matthew in his paper on the fauna of the Titanotherium beds, 1903, p. 223, fig. 15, and referred provisionally to *L. esulcatus*, belong evidently to a species considerably larger than the one represented by the type of *L. esulcatus*.

LEPTOMERYN MAMMIFER, Cope.

? Leptomeryz mammifer, Cope, 1885. The White River beds of Swift-current river, North-West Territory, American Nuturalist, vol. XIX, p. 163; name only.

Leptomeryz mammifer, Cope, 1885. Geol. and Nat. Hist., Survey of Canada, vol. I, new series, part C, appendix I, p. 84.

Leptomeryx mammifer, Cope, 1889. The Vertebrata of the Swift-current river, II, American Naturalist, vol. XXIII. p. 154.

Leptomerys mammifer, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills: Geol. Survey of Canada, Contr. to Can. Paleont., vol. 111, (quarto), pt. I, p. 22, pl. XIV, figs. 6, 6a, 7, 7a.

Leptomerys mammifer, Matthew, 1899. A provisional elassification of the Fresh-water Tertiary of the west, Bulletin Amer. Mus. Nut. Hist., vol. XII, article III, p. 61.

* For this species see also, 1869. The Extinct Mammalian Fauna of Dakota and Nibraska ; Jour. Acad. Nat. Sci. Phila., second series, vol. V11, p. 141, pl. X111.

Leptomerys mammifer, Mutthew, 1902. The skull of Hyphodus, the smallest of the Arthodaetyla, with a revision of the Hypertragulide., Bulletin Amer. Mus. Nat. Hist., vol. XVI, article XXIII, p. 313.

Leptomerys mammifer, Matthew, 1903. The fanna of the Titanotherium beds at Pipestone Springs, Montana, Bulletin Amer. Mus. Nat. Hist., vol. XIN, article VI, p. 224, figs. 16 and 17.

Leptomerys mammifer was founded on lower molars, from Bone coulée, hy Cope, who, at a later date, arbitrarily associated with them upper molars from the same locality. The best preserved of these latter, the one figured in 1891, may be regarded as the cotype of the species. There are in the collection of 1904 separate upper molars that agree closely in size and form with the cotype, and are, therefore, regarded as helonging to this species. An upper fourth premolar, obtained in 1904, is also thought to be referable to L. mammifer.

It has been pointed out by Matthew (1902) that one of the characters of *L. mammifer* relied on by Cope us a distinguishing one, viz., the presence in the lower posterior molar of u "peculiur column intercalited between the heel and the posterior internal column," is in reality the small antero-internal cusp of the heel found in other species of the genus.

No lower molars are recognized in the collection of 1904 as belonging to L. mammifer.

LEPTOMERYX SPECIOSUS, sp. nov.

Plate VIII, figs. 10-15.

A species of Leptomeryx is represented by a large number of separate teeth, of which the upper molars are much larger than the type of L esulcatus, Cope, considerably larger than those of L. eransi, but not reaching the size of those of L. mammifer. This species is apparently distinct from any of these three species.

In the upper molars the proportionate development of the mesostyle, the anterior (parastyle), and posterior (metastyle) styles, and the ribs of the external face are much the same as in L, cransi. The styles are quite different from the gibbous styles of L, mammifer, as seen in the cotype of that species.

In the upper molurs a moderately strong eingulum is generally present for a short distance at the base of the anterior slope of the protocone, and, in a number of specimens there is a slight indication, as well, of a eingulum on the posterior slope of the hypocone. In two fourth premolurs a eingulum is present for a short distance on both sides (anterior and posterior) of the inner crescent. In a majority of the upper molars a median internal cusp is present, smaller than that of the molars of *L. evansi*.

The lower molars referred to this species, relying on their size principally for their asso cintion here, agree in size and general shape with the mandibular teeth referred provisionally to *L. esulcatus* by Matthew in 1903, (op. cit, p. 222, fig. 15). The Cypress Hills lower molars have a slight anterior and posterior cingulum in the majority of cases, and there is also in most of the specimens a small median external cusp having about the same degree of development as the median internal cusp of the upper molars. No mention is made by Matthew of a cingulum, nor of a median internal cusp in the Pipestone Springs lower molars, which, however, in other respects, and as regards exact size, agree with the Cypress Hills specimens.

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Mexantrements.	MM.
Upper molar, plate V111, figs. 10, 11. Type :	
Maximum transverse diameter.	10.30
" antero posterior diameter	7.80
Lower molar, plate V111, figs, 12, 13 :	
Maximum transverse dinneter	2.30
Antero-posterior diameter	8.00
Posterior lower molar, plate V111, figs. 14, 15.	10.20
Antero posterior diameter	10.00
Upper mular of L. enulection (type) :-	
Maximum tennavores diameter	6 00
Anterogamterior diameter, approx	6.+
Upper molar of L. mammifer (rotype) :	
Mantenum transporter diameter	11.50
* antersposterior diameter	9.50
Lower posterior undar of L. manuaiter (type specimen) :	
	A . A

Antero-posterior diameter, approx The name species as is proposed for this apparently undescribed species of Leptomeryx. Locality :- Hone coulée, Cypress hills, collection of 1904.

LEPTOMERYX SEMICINCTUS, Cope.

Leptomeryz semicinctus, Cope, 1889. The Vertebrata of the Swift-current river, 11, American Naturalist, vol. XXIII, p. 154

Leptomeryz semicinctu., Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Paleont., vol. 111 (quarto), pt. I, p. 23, pl. XIV, figs. 8, 8a.

Leptomeryx semicinctus, Matthew, 1902. The skull of Hypisodus, the smallest of the Artiodactyla, with a revision of the Hypertragulidae, Bulletin Amer. Mus. Nat. Hist., vol. XVI, article XXIII, p. 314.

This species was founded by Cope on two upper molars, and part of a third, crom the Cypress hills. Additional upper molars were obtained in 1904, by the writer, in Bone coulée. This species is for the present referred to Leptomeryr; without the full dentition its generic affinities cannot be satisfactorily determined.

HYPERTRACULUS TRANSVERSUS, Cope.

Hypertragulus transversus, Cope, 1889. The Vertebrata of the Swift-current river, 11, American Naturalist, vol. XXIII, p. 154.

Hypertragulus transversus, Cope, 1891. The species from the Oligoeene or Lower Mioeene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Palcont., vol. III (quarto), pt. I, p. 22, pl. XIV, figs. 4, 4a.

Hypertragulus transversus, Matthew, 1902. The skull of Hypisodus, the smallest of the Artiodaetyla, with a revision of the Hypertragulidae, Bulletin Amer. Mus. Nat. Hist., vol. XVI, article XXIII, p. 816.

No teeth in the 1904 collection are recognized as belonging to this species. Matthew (1902) is of the opinion that the two worn upper molars from llone coulde, described by Cope, under the above name, are probably not referable to the genus Hypertragulue.

MESOHIPPUS WESTONI, (Cope.)

Plate III, figs. 10, 11, 12 and 13.

Anchitherium, sp. indet., Cope, 1885. The White River beds of Swift-current river, North West Territory ; American Naturalist, vol. XIN, p. 168.

- Anchitherium westonii, Cope, 1889. The Vertebrata of the Swlft-current river, II; idem, vol. XXIII, p. 153
- Anchitherium westonii, Cope, 1891. The species from the Oligocene or Lower Mlocene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Paleout., vol 111 (quarto), pt. I, p. 20, pl. XIV, figs. 1, 2 and 2a.
- Meschippus westoni, Osborn, 1904. New Oligocene horses; Builetin Amer. Mus. Nat. Hist., vol. XX, p. 169.
- Mesohippus westoni, Lambe, 1905. On the tooth-structure of Mesohippus westoni (Cope); American (icologist, vol. XXXV, p. 243, pl. XIV.
- Mesonippus westoni, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills, Assiniboia; Trans. Royal Soc. of Canada, second series, vol. XI, section IV, p. 44, pl. II, figs. 1, 10, 10, and 10.

The type material of this species, from Bone coulée, Cypress hills, consisting of a right upper molar, and two right lower molars in place in a fragment of the mandible, is in the Museum of the Geological Survey at Ottawa.

A right upper molar belonging to the collection of 1904, has been referred by the writer to this species. The upper molar described by Cope is imperfect, the outer slope of the cetoloph is missing and the auterior part of the tooth, including the protoloph, is much damaged.

The erown of the molar obtained in the summer of 1904 is practically perfect and had been subjected to little use during the life of the animal; it is most probably the second molar and is shown in figures 10-13 of plate III. This tooth is brachyodont, with well developed low cross crests (protoloph and metaloph). The crown, seen from be'ow, is suboblong in outline, transversely broader in front than behind and relatively narrow in an antero-posterior direction. The outer border (ectoloph) rises higher than the cross crests. The latter are unequal in length, the protoloph being longer and hetter developed than the metaloph. The intermediate cusps (protoconule and metaconule) are both well defined, although the protoconule is larger than the metaconule, and more distinctly separated from the protocone than is the metaconule from the hypocone. The protocone is slightly larger at its base than the hypocone, but both have about the same height. There is no hypostyle. The parastyle is large, and adds considerably to the crown's anterior transverse diameter. The mesostyle and metastyle are distinct, and the ribs distinguishable, the anterior ribs being the better defined of the two. The cingulum is well developed and passes from the metastyle entirely round the inner side of the crown to the parastyle without interruption, except for a short distance on the front inner slope of the protocone; it connects in front 12529 - 5

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with the parastyle, with which the outer end of the protoloph shows a marked tendency to unite. Outwardly the cingulum rises on to the parastyle, but does not cross it.

M. westoni, judging of its deutal characters principally from the molar obtained in 1904, approaches closely to M. lutidens,* Douglass, in tooth-structure, but its molars are distinguished principally by the presence of an internal cingulum, by the less pronounced parastyle, and a proportionately greater autero-posterior diameter, with the protoloph more nearly equal in length to the metaloph, as well as by other characters. M. celer, ** Marsh, and M. montanensis, *** Osborn, are two other nearly related, but apparently distinct species, from the Lower Oligocene. The presence of the highly developed internal cingulum is one of the most interesting characters in the dentition of M. westoni. This character, together with the absence of a hypostyle, points to this species being probably the most primitive of the known horses of Oligocene age.

A lower second premolar and a lower molar, are included in the collection of 1904. Figures of the two lower molars obtained by Mr. Weston are given in Cope's memoir of 1891.

	Measurements in min. of injer molar of .M. <i>irestoni</i> obtained in 1994.	of type molar of <i>M</i> , restonias given by Osborn.	of M ¹ (type) of <i>M. montanen-</i> sis as given by Osborn.
Transverse diameter	13.0	12 +	14-0
Antero-posterior diameter	10.2	9.5	
Height of protocone	4.5		10.5
Height of hypocone	4.5	4	
Height of ectoloph	$6 \cdot 2$	5 +	

Mr. Gidley has expressed the opinion that, the tooth collected in 1904, approaches more closely to M. montanensis than to M. westoni, and would be inclined to refer it to the former species with some degree of doubt. In comparing it with M. montanensis he has noted the somewhat less elevated inner cones and the presence of an internal cingulum, regarded by him as differences of perhaps not more than varietal value, which may be explained by calling the tooth a premolar instead of a molar.

Judging from the characters of the teeth and their size, it is evident that the two species M. westoni and M montanensis approach each other closely. The type of M. westoni is not as accurately figured in the original description) as is desirable, and the as well preserved absence of the ectotoph and the anterior margin, including the front slope of the protoloph, precludes the taking of exact measurements. That the tooth of 1904 (figures 10-13) comes from the same locality as the type of M. westoni, and that it has a particularly well defined inte. aal cingulum, are facts worthy of every consideration in determining its specific affinity.

MESOHIPPUS PR.ECOCIDENS, Lambe.

Plate III, fig. 14.

Mesohippus precocidens, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills, Assiniboia; Trans. Royal Soc. of Canada, second series, vol. XI, section IV, p. 46, pl. II, fig. 2.

* 1903. New Vertebrates from the Montana territory by Earl Douglass : Annals of the Carnegie Museum, vol. 11, p. 161, ¹136, 7.
 ¹1874. American Journal of Science, vol. V14, p. 251,
 ¹1864. Op. cit.

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The left upper molar, on which this species is founded, lacks the ectoloph and the posterior border with the hinder slope of the hypocone, but is otherwise well preserved.

This tooth is about the size, or possibly smaller than M. westoni, but is more progressive in every way. There is an entire absence of an internal cingulum, the cross crests are better developed, and relatively higher, with steeper ellipses. The protoconule is relatively larger, and the metaconule, although defined, scarcely breaks the continuity of the metaloph, which unites in a decided manner with the ectoloph. The protoconule is distinctly defined in the protoloph, and connects closely with the forward where of the protocone. The hypocone has about the same height as the protocone. The astronor cingulum is strong. Mr. Gidley has informed the writer that he "would expect to see the hypochyle well developed, were that portion of the tooth present."

MESOHIPPUS PROPINQUUS, Lambe.

Plate III, figs. 15 and 16.

Mesohippus propinguus, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills, Assiniboia; Trans. Royal Soc. of Canada, second series, vol. XI, section IV, p. 47, pl. II, figs. 3 and 4.

> 2nd right upper premolar, worn (figure 16). 2nd left upper molar, unworn, (figure 15). Type. 2nd right upper molar, unworn.

The above teeth have been regarded by the author as characterizing a species of *Mesohippus* distinct from *M. bairdi*, Leidy, although closely allied to it and most resembling it.

They are of nearly the same size as those of *M. bairdi*, if anything slightly larger, and on the whole more primitive. Their general proportions are somewhat different. *Measurements in mm.*

p² a.p.....13 by tr.....18.5.
m² left a.p.....12 by tr......15.5, height of protocone.....5.
height of protocone.....5.7, height of ectoloph....8.
m² right. a.p....12.2 by tr....15.

In the unworn tooth, tigure 15, (left upper m^2), the ectoloph is well devated above the cross crests, in which the protocone and hypocone are conspicuously higher than the conules. The hypocone exceeds the protocone in height. The protoconule is well defined and distinctly breaks the continuity of the protoloph. The metaloph is fairly continuous and shows a disposition to unite with the ectoloph, which, however, it does not reach. The hypostyle is connected at its inner end with the posterior cingulum and outwardly abuts against the ectoloph; it is of fair size. In the ectoloph the mesostyle is conspicuous, the parastyle is flattened and connects with the protoloph, and the ribs are faintly shown. There is no trace of an internal cingulum.

Mr. Gidley has drawn the writer's attention to the interesting fact that the protocone in these teeth "is peculiar in having the slope of its anterior face about equal to that of its posterior face, while in M. bairdi, and all the middle and upper Oligocene horses, the anterior face of the protocone is always much more abrupt than the posterior one."

Left upper molar (imperfect). Type.

A right upper molar, presnmably the third, arbitrarily associated with the foregoing, is considerably larger than the corresponding tooth of M. buirdi. A flatness of the ectoloph is principally noticeable, as well as the smallness of the hypocone, otherwise its characters are very similar to those of the left upper second molar already mentioned.

MESOHIPPUS BRACHYSTYLUS, Osborn.

Plate III, fig. 17.

Mesohippus brachystylus, Osborn, 1904. New Oligocone horses; Bulletin Amer. Mus. Nat. Hist., vol. XX, p. 175, fig. 6.

Mesohippus brachystylus, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills, Assiniboia; Trans. Royal S. of Canada, second series, vol. XI, section IV, p. 48, pl. II, fig. 5.

4th left upper premolar, worn.

Measurement in mm.

p⁴ a. p.....12.5.

A fourth left upper premolar is referable to this species. The internal eingulum is slightly more accentuated than in the corresponding tooth of the type, but the general proportions and the size seem to bo the same. In the Cypress Hills specimen the greater part of the eetoloph is unfortunately missing, but enough remains of its anterior end to show that the parastyle was rounded and of a relatively large size. There are certain slight differences of detail to be noticed but nothing apparently of importance.

The type of M. brachystylus is from the Upper Oligocene, Leptauchenia beds of the Cheyenne river, South Dakota, U.S.A.

MESOHIPPUS STENOLOPHUS, Lambe.

Plate III, figs. 18, 19 and 20.

Meschippus stenolophus, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills, Assiniboia ; Trans. Royal Soc. of Canada, second series, vol. XI, section IV, p. 48, pl. II, figs. 6, 6a and 6b.

1st left upper molar, unworn. 3rd right upper molar, unworn. (figures 18, 19 and 20). Type.

Measurements in mm.

 m^1 a. p.....14.

 $m^3 a. p. \dots 12.5 by tr.\dots 15.$

This species of Meschippus is larger than M. brachystylus, but resembles it in some particulars of its dentition. The differences are: (1) The greater relative size of m3, with a more pronounced obliquity of the cross crests in these teeth, (2) the greater length of the metaloph, which in m³ is connected with the ectoloph, and (3) the intimate connexion of the hypostyle with both the posterior eingulum and the metastyle. The resemblances are (1) somewhat similar general proportions, with about the same degree of development of the protoconule and a like suppression of the metaconule, (2) the parastyle and internal eingulum similarly developed.

A special character of M. stenolophus, seen in m³, is the obliquo crossing of the parastyle by the external eiugulum, which rises rapidly from without and appears very distinct on the g, is h is are

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upper anterior surface of the style (figures 19 and 20). The cross crests are narrow in proportion to their height, a feature suggested in the same that has been given to the species.

MESOHIPPUS PLANIDENS, Lambe.

Plate III, fig. 21.

Mesohippus planidens, Lambe, 1905. Fossil horses of the Oligocene of the Cypress hills,
 Assiniboia; Trans. Royal Soc. of Canada, second series, vol. X1, section IV, p. 49, pl. II, tig. 7.

1st and 2nd left upper molars, worn. Type.

Mensurements in mm.

 $m^1 m^2 \dots 31$

m¹ a. p......15 by tr......178

These teeth indicate a species of about the size of M. intermedius, Osborn, from the Upper Oligoceuc, Protoceras beds of Sonth Dakota, but smaller than M. validus, Osborn, from the same horizon and state. They differ from those of M. intermedius in the greater obliquity of the protoloph and metaloph, in which respect they resemble those of M. obliquidens, Osborn. The teeth are brachyodont, and are devoid of an internal cingulum. Externally, the betoloph is noticeably flat, with only a slight development of the parastyle and mesostyle, the ribs are absent or but feebly indicated, and the metastyle is particularly inconspicuous. The bypostyle is of fair size, curved and attached at either end to the posterior cingulum. The cross crests are oblique to the ectoloph, well elevated, and moderately continuous, the metaloph more so than the protoloph. The protoconule slightly interrupts the protoloph, and unites with the parastyle. The metaconule scarcely breaks the continuity of the metaloph, which is sharply separated from the ectoloph and develops a rudimentary crochet. The protocone and hypoeone are not so clevated as the ectoloph.

The specific name has reference to the flattened condition of the ectoloph.

MESOHIPPUS ASSINIBOIENSIS, Lambe.

P! IT, figs. 22, 23 and 24.

Mesohippus assiniboiensis, Lambe, J Assiniboia; Trans. Royal Soc. II, figs. 8, 8a and 8b. da, second series, vol. XI, section IV, p. 50, pl.

2nd right upper premolar, unworn. Type.

Measurements in mm.

p[?] a p.18[·]5 by tr.....17, height of tritocone....10[·]5. height of tetartocone....8.

This species is larger than *M. intermedius*, Osborn and Wortman, and apparently than *M. validus*, Osborn, from the Leptanchenia beds of S. Dakota. It resembles *M. brachystylus*, Osborn, from the Leptanchenia beds of S. Dakota, in the great development of the parastyle, which is, however, more distinctly set ated in the Cypress Hills species.

In the above tooth (p²) the anter-posterior diameter is greatly increased by the separation and large size of the parastyle. The cross crests are short, steep-sided and set almost at right angles to the ectoloph. The two i er cusps (deuterocone and tetartocone) are strongly and about equally developed. The protoconule* (anterior intermediate eusp) is very nuch smaller than the metaconule (posterior intermediate eusp), and passes posterior to, and beyond the inner end of, an inwardly directed spur from the protocone (antero-external eusp of the premolar, adopting Seott's nomenelature). The eetoloph has a distinct mesostyle, a broadly rounded and well detached parastyle, and strong ribs, of which the anterior one is particularly rotund. The hypostyle tends to separate from the posterior eingulum, to which it remains connected by a stout bar. The eingulum is robust, high and sharp edged behind, low and forming a narrow shelf abutting against the base of the parastyle in front, and is entirely absent within. The external eusps (protocone and tritocone) rise considerably higher than the internal ones (deuterocone and tetartocone).

This species, known only from the second premolar, in which the size of the parastyle would be expected to be accentuated, appears to approach most nearly in tooth development to the nucle smaller *M. brachystylus*. It exceeds *M. intermedius* and ? *M. validus* in size, but apparently, more closely resembles the latter. It is distinguished from the last two species by (1) the greater development of the protocone and deuterocone in this species, (2) the slight development of the protoconule, (8) the more complete separation of the parastyle, and (4) the intermediate height of the ectoloph.

The foregoing species of *Mesohippus* are related to, or resemble, previously described species of the genus from Moutana and Dakota as follows :--

M. westoni, (Cope.)	More primitive than <i>M. latidens</i> , Douglass, and <i>J. montanensis</i> , Osborn, from the Lower Oligocene, Titanotherium beds.
M. præcocidens, Lambe.	Nearly related to and more advanced than <i>M. westoni</i> (and ? <i>M. montanensis</i> of the Titanotherium beds).
M. propinquus, Lambe.	Nearly related to and more primitive than M. bairdi, Leidy, of the Middle Oligoeene, Oreodon beds.
M. brachystylus, Osborn.	The type of the species is from the Upper Oligoeene, Lep- tauchenia beds.
M. stenolophus, Lambe.	Approaches closely M. brachystylus of the Leptauchenia beds.
M. planidens, Lambe.	Approaches in size <i>M. intermedius</i> , Osborn and Wortman, from the Upper Oligoeene, Protoceras beds.
M. assiniboiensis, Lambe.	Some resemblance to, but larger than <i>M. validus</i> , Osborn, of the Protoceras beds.

It would seem probable then, that the species from the Cypress hills, in their relative degrees of progressiveness, are to be assigned to the horizons of the Oligoeeue in the following order :--

M. westoni, M. præcocidens	Lower Oligocene, Titanotherium beds.
M. brachystylus M. stenotophus	Upper Oligoeene, Leptauchenia beds.
.M. planidens M. assiniboiensis	Upper Oligoeene, Protoceras beds.

* (t has been pointed out by Scott (The Evolution of the Premolar Teetb in the Mammals, Proc. Acad. Nat. Sci. Philadel, vol. NLIV, 1892) that the anterior and posterior intermediate countes of the p. emolar tooth are not homologous with the proto and metacombes of the molar although they correspond in position.

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HYRACODON NEBRASCENSIS, Leidy.

Aceratherium pumilum, Cope, in part, 1885. The White River beds of Sw current river, North West Territory; American Naturalist, vol. XIX, p. 163, name only.

Accratherium pumilum, Cope, 1885. Geol. and Nat. Hist. Survey of Canada, vol. I, new series, part C, appendix I, p. 83, specimen II; and 1891, this volume, part 1, p. 19, specimen II, pl. IV, fig. 4.

Hyracodon nebrascense, Osborn, 1898. The Extinct Rhinoceroses. Memoirs Amer. Mus. Nat. Hist, vol. I, pt. III, p. 138, fig. 28.

The principal specimen from the Cypress hills, representing this species, is the port on of mandible, holding teeth, described by Cope under the name *Canopus pumilus*, (specimen 2). This specimen, as pointed out by Osborn in 1898, is part of the right ramus of a young individual of *H. nebrascense*. A tooth, belonging to the collection 1904, is referred to this species; it is from the right side of the lower jaw, and is apparently a deciduous third pre-molar.

HYRACODON PRISCIDENS, Lanibe.

Plate IV, figs. 1, 2, 3 and 4.

Hyracodon sp., Lambe, 1905. Geol. Survey of Canada, Summary Report for 1904, p. 368.

Hyracodon priscidens, Lambe, 1905. A new species of Hyracodon (II. priscidens) from the Oligoeene of the Cypress hills, Assiniboia; Trans. Royal Soc. of Canada, second series, section IV, vol. XI, p. 37, pl. I, figs. 1, 1a.

Another species of Hyracodon is represented, in the collection of 1904 from the Oligocene deposits at Bone coulée, Cypress hills, by an upper jaw with teeth, giving the complete premolar-molar series. Three teeth are missing, viz., the fourth premolar from the left side, and the second and third premolars from the right. As the form of the tooth in each case is seen in the corresponding one of the opposite side, the details of structure of all the cheek teeth are presented. The ectoloph of the right third premolar remains. The teeth are in an excellent state of preservation and, as they are only slightly worn, evidently belonged to a young animal. The last molar on either side has not protruded from the jaw to its fullest extent. Both jugals are preserved, and, on the right side, part of the squamosal also.

The specimen to which the following remarks apply consists for the most part of the two maxillary bones holding teeth. These bones are imperfect in their lateral upward extension. The right maxilla is broken off slightly in advance of the first premolar, but, on the left side, the full extent of the diastema, separating the first premolar from the canine, is preserved. The lower margin of the orbital opening on either side is intact.

This specimen (type) indicates an animal of about the size of Hyracodon nebrascensis, Leidy, from the Oligoeene of Nehraska, South Dakota and Colorado, from which, however, judging from its tooth structure, it differed specifically. The species has been described under the above name.

Hyracodon priscidens, as compared with H. nebrascensis, exhibits the following charac teristics:—(1) The teeth are shorter or more brachyodont, (2) in the premolars the protoloph is continued in a curve round the inner end of the metaloph, the tetartocone being confluent with the deuterocone and arising from the protoloph, (3) in the last molar, m^3 , the ectoloph

is relatively much shorter, with a concomitant greater development of the metaloph, (4) the exterior eingulum is developed only on the posterior half of the base of the ectoloph in the seven teeth, and the internal cingulum is absent in p^1 , (5) the parastyle in the premolars in only slightly developed, (6) the skull is apparently flatter and relatively more elongate, the lower margin of the orbit heing less distant from the alveolar horder, and the jugal less curved upward in the posterior halt of its length, (7) the diastema in advance of p^1 is proportion ately longer and its margin is not so arched.

For this species of Hyracodon the name priscidens has been proposed, indicative of the less advanced stage of its dentition as compared with H. nebrascensis. In the form of its premolars it is decidedly primitive, and implies a position in a direct line of descent from Hyrachyus. A progressive character is seen in the squareness of the premolars which in Hyrachyus are triangular; also in these teeth the metaloph is much advanced in compariso with the Eocene genus.

In *H. priscidens*, as in the type species, m^2 is much the largest tooth, and m^1 is large than p^4 . The molars occupy about the same space antero-posteriorly as the premolars.

In the premolars there is a progression toward the molar pattern, but the advance has heen slow. The anterior premolars are more progressive than the posterior ones in some respects. This is shown in the tendence to the separation of the tetartocone from the deutercone seen in passing from p^{\dagger} forward. In p^{\dagger} the tetartocone and the deuterocone are verclosely united, hut in p^{2} , although still connected to the protoloph, the tetartocone has move farther toward the posterior horder of the crown, lengthening the anterior loph, and als effecting a junction with the metaloph.

In p⁴ the cross lophs are unequal in length, the protoloph, in which the tetartocone very intimately united with the deuterocone, not passing heyond a point in line with the inner end of the metaloph, which is short and curves slightly backward. In p³ the protolog is increased in length hy the shifting hack ward of the tetastocone, with a tendency to separa from the deuterocone. The two lophs remain distinct, the anterior one passing slight beyond the inner end of the metaloph, which in this tooth is developed to about the sar extent as that of p⁴, with a like backward obliquity. In p² the protoloph is still furth increased in length, and curves round the inner margin of the crown considerably past t metaloph toward the posterior border of the tooth. The metaloph curves slightly forward and unites with the protoloph at a point some distance in advance of the latter's poster termination. The increased length of the protoloph is due to the further recession of t tetartocone from the deuterocone, "Ithough the union of the two remains complete. In the protoloph is separate from the metaloph, a narrow but distinct sinus dividing them, a the tetartocone arises from the metaloph which in its inner half presents a concave surface forward. A variation is noticed in the right first premolar of the Cypress Hills specimen. this tooth the sinus, seen in the left first premolar, in advance of the metaloph, does not occ in which case the tetartocone would still he said to arise from the protoloph which, ec mencing at the ectoloph, hehind the parastyle, forms a high continuous wall curving rou the inner horder of the tooth for some distance past its union with the metaloph, giving the protoloph a length proportionately still greater than the corresponding loph of p^2 . left first premolar, above described, resembles the corresponding tooth of II. nebrascensis figured hy Leidy in plate XIV, figure 5, accompanying his description of the type species "The Ancient Fauna of Nehraska," 1852, (Smithsonian Contributions to Knowledge).

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artocone is ne with the e protoloph to separate ng slightly ut the same still further bly past the tly forward r's posterior ssion of the lete. In p¹ g them, and cave surface pecimen. In es not occur, which, comrving round h, giving to of p². The brascensis as pe species in ledge). The other preunolars in this figure denote a stage of evolution much in advance of the corresponding teeth of *H. priscidens*.

In the premolars of *II. priscidens* the deuterocone arises from the protoloph, as in p^3 and p^1 of *Hyrachyus agrarius*, Leidy, of the Bridger Eocene of Wyoming and Utah; also, in the second, third and fourth premolars, the general outline of the tooth is quadrangular instead of triangular as in *Hyrachyus*. The transverse diameter of p^1 is relatively greater than that of either p^3 or p^2 . The second, third and fourth premolars are provided with a well defined eingulum that is continuous round the entire base of the erown, except at the base of the tritocone; at the base of the parastyle the eingulum is feebly shown, with increasing faintness in passing from p^1 to p^2 . In the first premolar the exterior cingulum is developed only in the posterior half of the ectoloph, the posterior cingulum is strong, the anterior cingulum extends but a short distance from the parastyle, and there is no internal cingulum.

In the molars the cross lophs are nearly equal in length, the protoloph being slightly the longer, the hypocone is strongly developed and of the size of the protocone, from which it is separated by a deep anterior valley (medisinus). A crista, strongest in m^1 , is developed from the ectoloph, and an antecrochet, of fair size in m^1 , smaller in m^2 and incipient in m^3 , is given off from the protoloph. In p^1 , in addition to a small crista, and an indication of an antecrochet in the form of a decided tubercle, there is a delicate crochet* which is of interest as a decidedly progressive character. In the molors there is no internal cingulum, hut posteriorly, anteriorly, and externally the cingulum is as in the premolars, except that externally it is scarcely more than suggested at the base of the parastyle. As already mentioned, the ectoloph in m^3 is short as compared with that of m^2 and m^1 , principally on account of the reduction in size of the metacone, which does not extend, as in the other molars, tar posterior to its junction with the metaloph, but is curtailed at this point, in consequence of which there is only a slight indication of the formation of a posterior valley (postsinus) that in *II. nebrascensis* has reached a more advanced stage.

The order of premolar transformation in H. priscidens is apparently an exception to the usual metamorphosis of the Hyraeodont premolars, which, as stated by Osborn in his memoir on "The Extinct Rhinoceroses" 1898, p. 90, is presented in three successive stages of evolution toward the molar pattern in the second, third and tourth premolars, the last premolar (p^4) being the most advanced.

In *H. priscidens* the fourth premolar is the least advanced, as regards the relation of the lophs to each other, although in other respects, viz., in the presence of secondary crest folds ("crista," "anteerochet" and "crochet"), a decided advance has been made, and it may be considered in this regard as more progressive than p^1 , p^2 and p^3 .

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^{*} Professor H. F. Osborn in his memoir on "The Extinct Rhinoceroses" (Memoirs of the Amer. Mus. of Nat. Hist., vol. 1, part 114, p. 89, 1898), has mentioned that the "crochet" is "peculiar to the true Rhinoceros molars" and is "only feebly developed, if at all, in the Amynodonts and Hyracodonts,"

Measurements.

	H. priscule as.	H. planiceps"	M. netreserensis
	MM.	MM.	MM.
Upper molar series, length	62	103	70
Upper premolar series, length	62		
M1 width, (tr.)	23.2	85 .	26
M ² "	24.5	36	28
Ma "	24	87	26
M ¹ length (a p.)	22		
M ² "	23	35	27
M ^a "	19.5	40	
P ¹ width (tr)	13.2		
P2 4	20		
P.1 "	21.7		
124	23		
P: length (a.p.)	12.8		
P2 "	16		
P ³ "	16.8		
P4 "	17.3		

The anterior end of the mandible of a Hyracodon, obtained in 1904 from the Bone Coulée beds, is of special interest; it is provisionally assigned to this species.

The specimen (plate IV, figures 3 and 4) consists of nearly half the left ramus with that part of the right ramus anterior to the second premolar. Premolars 2, 3 and 4 are preserved, as well as the roots of the canines, and of the three pairs of incisors. The alveolus of the second premolar is partly seen on the right side.

A striking feature is the long diastema, between the canine and the second premolar, nearly equal to that of Hyrachyus (H. agrarius) in proportionate as well as actual length, and about twice as long as that of Hyracodon nebrascensis, Leidy. A basal eingulum is continuous round the entire crown of the premolars, except for a short distance internally, in the second and fourth teeth, posterior to their mid-length.

Mrasarements. M	М.
Length of premolar series	1
Premolar 2:	
Antero-posterior diameter	3
Transverse diameter	0
Premolar 3:	
Antero posterior diameter	5
Transverse diameter	2
Premolar 4:	
Antero posterior diameter 1	$6 \cdot 5$
Transverse diameter,	3.2
Depth of ramus in front of premolar 3	28.5
Maximum thickness of ramus beneath same tooth	15
Length of diastema behind canine.	26
Breadth of mandities at mid length of diastema	21
Length of symphysis	52
Thickness of mandible dear posterior end of symphysis	14

** The measurements of the test \mathcal{A} H, phonorps and H, nobroscowis are taken from the "Preliminary account of the Fossil Mammals from the White River is mation, contained in the Museum of Comparative Zoology" by W. B., Scott and Henry F. Osborn, 1887, p. 174, Bull. Mus. Comp. Zeed., Harvard College.

ACERATHERIUM MITE, Cope.

Plate IV, fig. 5.

Accorditorium mite, Cope, 1874. Annual Report U. S. Geol. and Geog. Survey Terrs. for 1873, p. 493.

Accratherium mile, Cope, 1885. The White River beds of Swift-current river, North West Territory, American Naturalist, vol. XIX, p. 163.

Aceratherium mite, Cope, 1885. Geol. and Nat. Hist. Survey of Canada, vol. I, new series, part C, appendix I, p. 83.

Canopus mitis, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress h.'ls, Geol. Survey of Canada, Contr. to Can. Palwont, vol. III (quarto), pt. I, p. 19, pl. IV, fig. 2.

Canopus pumilus, Cope, in part, 1891. Idem, p. 19, specimen No. 1, pl. IV, figs. 8, 3a.

Accratherium mite, Osborn, 1898. The Extinct Rhinoceroses, Memoirs Amer. Mus. Nat. Hist., vol. I, pt. 11I, p. 136.

In his 1891 report Cope assigned certain remains of Aceratheres from the Cypress hills to this species. They consist of parts of two left mandibular rami, and are referred to as specimens Nos. 1 and 2. The first specimen is a section of a left ramus holding the roots of the last two molars, and extending back beneath the base of the eoronoid; the fragment is 87 mm. long. The second is part of the anterior half of another left ramus, with premolars 8 and 4 preserved, the roots of premolar 2, and the inner end of the alveolus of a procumbent canine. A figure was given (pl. IV, fig. 2, pt. I of this volume) of this second specimen viewed from above.

A symphysis of a mandible, also from the Cypress hills, described and figured by Cope in 1891, under the name *Canopus pumilus*, in the same publication as the above, is regarded by Osborn (op. cit. 1898) as properly referable to A. mite. The second of the two specimens on which C pumilus was founded (pt. I, this volume, pl. IV, fig. 4) has been shown by Professor Osborn (op. eit. 1898) to be part of the lower jaw of *Hyracodon nebruscensis*.

In the type ramus from Colorado, described by Cope in 1874, the space occupied by the first three lower premolars (2, 3 and 4) is 80 mm. as given in the original description. A similar measurement, taken from the "type lower jaw" (and therefore presumably from the same specimen), is stated by Osborn (op. cit. p. 139) to be 55 mm. In specimen 2 from the Cypress hills (A. mite) the three premolars together measure in length 58 mm, and in the symphysial specimen (C. pumilus) a like measurement gives 43 mm. In one only of the three Cypress Hills specimens referred to A. mite, are premolar crowns preserved, and in the type ramus the erowns of the three premolars are imperfect.

A very perfect lower jaw from the Protoceras beds of South Dakota is referred doubtfully by Osborn (op. cit. p. 139) to this species. The premolar series in this last specimen occupies a space of 47 mm.

An upper left third molar tooth, obtained by T. C. Weston at the Cypress Hills locality in 1884, is probably referable 'o this species. Its dimensions are :---antero-posterior diameter, 25 mm., transverse diameter 28 mm.

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A much larger tooth, plate 1V, fig. 6, an upper right posterior molar of the 1904 collection, compares favourably in size and general proportions with the third molar of Leptacera therium trigonodon, Osb. and Wort. Its diameters measure, antero-posterior, 31 mm., transverse 37 mm.

ACERATHERIUM OCCIDENTALE (Leidy).

Plate IV, fig. 7.

Rhinoceros occidentalis, Leidy, 1851. Proc. Acad. Nat. Sci. Philn., vol. V. p. 276.

This species is recorded by Cope (this volume, pt. I) from the Oligoeene of the Cypress hills. A number of lower jaw tragments, belonging both to the collection of 1904 and to the earlier collections, apparently represent species distinct from A. mite and A, occidentale, but they are too imperfect for determination.

An inferior left posterior molar (collection of 1904) evidently belongs to this species. In it the basal clugulum is developed in front and behind but not on the exterior and interior surfaces. Diameters—antero-posterior 32 mm., transverse 21 mm.

ACERATHERIUM EXIGUUM, Sp. nov.

Plate V, figs. 8, 4 and 5.

A mandibular symphysis, collected by the writer in Bone coulde, Cypress hills, in 1904, has entirely different proportions to the symphysis (Canopus pamilus, Cope) from the same locality, already referred to A. mite. This specimen consists of almost exactly the same parts of the jaw preserved in the symphysis of C. pumilus, viz., the anterior end of the left ramus, and a short length of the right carcus united with it so as to show the extent and form of the symphysis. No crowns of tech, are preserved, but in the left ramus the roots of premolars 2 and 3 remain. The alveoli for the canine and for one incisor in each ramus are preserved, as well as the alveolus for premolar 2 in the right ramus, and the anterior half of the alveolus for premolar 3 in the left.

Comparing it with the symphysial specimen of *C. pumilus*, the following differences are apparent :—a narrower and longer symphysis, having increased depth behind; a more rapid despening of the ramus from in front backward, with a corresponding increase in transverse thickness; a greater space occupied by the first two premolars; and very much larger canines as indicated by their alveoli. The greater depth of the ramus beneath the first two premolars is very noticeable.

In this specimen, belonging to the 1904 collection, the diastema is of about the same length as that of C, pumilus. The alveoli for the canines are 8 mm. apart in front, and close together at a lower level are those for two incisors, one on each side of the median line. Premolar 2 was a tooth of fair size with two well separated roots.

A small species of Acerathere, slightly exceeding A. mite (pumilum) in size, is here represented, to which the name exignum is given. The jaw is more robust than in A. pumilum, its main characteristics being the contracted and lengthened symphysis and the enlarged canines. 904 collec-Leptacera-

e Cypress and to the entale, but

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s, in 1904, the same parts eft ramus, prm of the remolars 2 served, as e alveolus

rences are nore rapid transverse er canines premolars

the same and elose dian line.

e, is here pumilum, enlarged

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Meanwrments.

Aceratherium exiguum compared with A. mile (pumilum).

	A. exignum.	A. mile.
Longth of sum had some	M.M.	MM.
ixagin or symphysis, approx	58	40
Depth in front	18	18
Depth behind		10
Distance sourt of premulars 0	- 20	21
Management of premining 2	. 27	32
space occupied by premolars 2 and 3	. 30	93
Antero-posterior diameter of premolar 2	10.5	0
Breadth of jaw transversely accuss alwayli for continue	4.3	10
Hoight of algorithm for many account of califies	. 42	33
strengthe of an reords for canine	. 12	7
Whith a a to to	. 16	10.5
Depth of rainus below posterior end of diastems	94	12.0
Depth 44 44 44 themeslan 2		02
heater he	. 16	39

MEGACEROPS ANGUSTIGENIS (Cope).

- Menodus angustigenis, Cope, 1885. Geol. and Nat. Hist. Survey of Canada, vol. I, new series, part C, appendix I, p. 81.
- Haplucodon angustigenis, Cope, 1889. The Vertebrata of the Swift-current river, II, American Naturalist, vol. XXIII, p. 153.
- Menodus angustigenis, Cope, 1891. The species from the Oligoeene or Lower Miocene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Palaont., vol. III, (quarto), pt. I, p. 13, pl. V, figs. 1 and 2, pl. VI, figs. 1, 2, 2a, pl. VII, figs. 1, 1a, 1b, pl. VIII, figs. 1, 2, 3 and figures of leg and foot boues.
- Titanotherium angustigenis, Osborn, 1896. The Cranial Evolution of Titanot'erium, Bulletin Amer. Mus. Nat. Hist., vol. VIII. p. 184.
- Megacerops angustigenis, Osborn, 1902. The Four Phyla of Oligocene Titanotheres, idem, vol. XVI, p. 99.

This species apparently approaches closest to *M. coloradensis*, Leidy, founded on coössified nasals with horns attached. In the Cypress Hills species the horns are much farther apart, with a flatter surface separating them. Also the nasals, besides being shorter, expand laterally in front instead of narrowing rapidly as in *M. coloradensis*.

Cope, in the American Naturalist, 1889, p. 153, made this species the type of Haplacodon, a generic term discarded by him in his later writings.

The species, of which the full description with figures is given in part I of this volume, is based on two maxillary bones from the same individual, a separate left ramus, and the symphysial part of another jaw. With these were associated, as probably belonging to the same species, an imperfect cranium, and certain separate leg and foot bones. One of the maxillary bones, the left ramus, and the nasal bones with horns and part of the frontal, were figured in plates V, VI, VII and VIII. In plate VI, figure I, a view from above was given of the coössified nasals shown in side and front view in plate VIII, and belonging to the cranium mentioned above. Through an error in the explanation of plate VI, these nasals (fig. 1) were ascribed to Menodus 7 americanus, Leidy, instead of to Menodus angustigenis. This error has been repeated in Professor H. F. Osborn's paper "The Cranial Evolution of Titanotherium," Bull. Amer. Mus. of Nat. Hist., 1836, foot note p. 175.



MEGACEROPS SELWYNIANUS Cope).

- Menodus selwynianus, Cope, 1889. Vertebrata of the Swift-current river, III, American Naturalist, vol. 111, p. 628.
- Menodus sclwynianus, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Palaont., vol. III (quarto), pt. I, p. 17, pl. V, figs. 3, 8a and 8b.
- Titanotherium selwynianus, Osborn, 1896. The Craniai Evolution of Titanotherium; Builetin Amer. Mus. Nat. Hist., vol. VIII, p. 193.
- Megacerops ? selwynianus, Osborn, 1902. The Four Phyla of Oligocene Titanotheres, idem, vol. XVI, p. 99.

The coossified nassi bones of one individual constitute the type of this species. They are long and narrow, abruptly rounded in front and bent downward at the sides. The lower surface is deeply excavated in a longitudinal direction. Frofessor Cope's full description, with figures, will be found in part I of this volume.





Coossified nasals of Megacerops seleginianus, fig. 7 viewed from above, fig. 8 from the left side. One-fourth the natural size.

from the left after Leidy).

MEGACEBOPS SYCERAS (Cope).

Menodus syceras, Cope, 1889. American Naturalist, vol. XXIII, p. 628.

" Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Pakeont., vol. III, (quarto), pt. I, p. 18, pl. VII, fig. 2, pl. VIII, figs. 4 and 5.

Titanotherium syceras, Osborn, 1296. The Cranial Evolution of Titanotherium; Bulletin Amer. Mus. Nat. Hist., vol. VIII, p. 193.

The type material of this species consists of the coossified nasal bones of three individuals, with a right horn, preserved in one of the specimens. Cope's description, with figures, appeared in part I of this volume

A separate left horn collected by T. C. Weston in 1884, closely resembles in shape the right horn with attached nasals, and is assigned to this species. The transverse subangulation of the surface between the horns, and the basal flattening of the horn on its antero-exterior surface, are well marked.







Nasals and horns of Megacerops success, fig. 9 viewed from above, fig. 10 from the front, fig. 11 from the right side. One-fourth the natural size; figs. 10 and 11, after Cope.

MEGACEROPS PRIMITIVUS, Sp. nov.

Plate VI, figs. 4 and 5.

In 1904 the writer was fortunate in securing, from the Oligocene deposits of the Cypress hills, a mandible of a Titanothere that is of considerable interest. It is the most perfect lower jaw obtained so far from this locality, and is the type of the above named species.

The specimen consists of both halves of the jaw. The left ramus is perfect, with the full number of teeth preserved; the right ramus lacks the fourth premolar, and the molars, with that part of the alveolar border that held these teeth.

The mandible is of fair size, and belonged to an adult individual. It presents the following dental formula: I_{s} , C_{i} , P_{4} , M_{4} . There is a diastema behind the canine, a character which, taken in conjunction with the presence of three incisors and four premolars, is indicative of a somewhat primitive species. The chief characters displayed are : incisors, in three pairs, with a space between the inner pair; canines, of small diameter, apparently short; a diastema between the canine and the first premolar; first premolar, small; third premolar, becoming molariform, fourth premolar, molariform; symphysis, long; symphysial surface between canines, narrow; jaw contracted at the diastema; external cingula, moderately developed; internal cingula, wanting; mental foramen, beneath the second premolar; coronoid process, short.

Megacerops avus (Marsh), from the Oligocene of South Dakota, has three pairs of inferior incisors but only three premolars below on each side, and there is a short diastema behind the lower canine. Its dimensions are greater than those of *M. primitivus*. These two species are apparently the only ones of the Oligocene Titanotheres in which there are three pairs of incisors in the lower jaw.

In the Cypress Hills specimen the crowns of the incisors are of a depressed spherical shape, with a tendency to come to a rounded central point above. The second incisor is the largest, and the first is slightly smaller than the third, which is the most upright. The first is more procembent than the second. Between the inner pair is a very decided interval, leaving a space of 6.5 mm. between the crowns of the two teeth The crowns of the canines

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ulation xterior are broken off (that of the right tooth heing restored in fig. 5 of plate VI), and the right first premolar is lost from its alveolus.

Compared with Megacerops angustigenis (Cope), (this volume part I, p. 13, plate V, fig. 2 and plate VI, figs. 2, 2a, M. primitivus differs in the following respects — There are six incisors instead of four, and the hreadth of the jaw between the canines, which are of smaller diameter, is relatively greater; the diastema between the canine and the first premolar is twice as long; the symphysis is of greater length, reaching hack to a point almost in line with the posterior edge of the fourth premolar (in angustigenis in line with the anterior root of the corresponding tooth); the exterior cingula are much less developed; the coronoid process is shorter. In hoth species the premolars have reached about the same stage of development toward the molar pattern, and the molars have very much the same proportions. In angustigenis the internal cingula are partially developed. In primitivus the mandihle is shorter, proportionately deeper, and not so thick in the neighbourhood of the alveolar border posteriorly.

Keeping in mind the differences due to sex in Titanotheres generally, and the apparent variability, hoth specific and individual, of certain dental characters, such as the degree of development of the cingula, the presence or absence of the first premolar, the size of the canines, and the number of the incisors, *M. primitivus* is apparently a well marked species, characterized principally, so far as known at present, hy the hreadth of the mandible anteriorly (as compared with *M. augustigenis*), and the presence of the full number of teeth, with a comparatively long diastema behind the canines.

This species, for which the name primitivus is used, is regarded as representing a rather early stage in the development of the Titanotheres. The general character of the dentition suggests the appropriateness of referring the species to the genus Megacerops. That the species is already represented by cranial fragments from the Cypress hills, found separately, is quite possible, and further material will probably prove the identity of some of the species, from this locality, described under different names.

Measurements of mandible of M. primitivus.

Length of ramus
Depth of same at posterior end of fourth premolar
" " second molar
" " from tip of coronoid process to lower border
Maximum thickness of same beneath third molar
Length of symphysis
Distance apart of inside surface of base of canines*
Length of previolar series
" molar series
Diamater & antero-posterior
transverse
(antero-posterior
transverse
Disputer of third summer (antero-posterior
transverse
Diamatan of fourth ## manualan (antero-posterior
transverse

^{*} In the mandible of *M. angustigenis* (No. 11) figured by Cope, op. cit., this measurement is about 18 mm, and in the symphysis of the jaw (No. 1, also figured) a like measurement given, by the same authority, as 27 mm, should read 22 mm. ** First premoting in Cope's description of *M. angustigraus*.

Diameter of first molar	fantero-posterior	8 9
Diameter of second molar	f antero-posterior	8 3
Diameter of third molar	fantero-posterior	23

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MEGACEROPS ASSINIBOIENSIS. Nom. prov.

Plate V, fig. 6, and plate VI, fig. 3.

A robust, short, left mandibular ramus, helonging to the 1904 collection, indicates a species distinct from M. angustigenis and M. primitives. In this specimen the three molars and the fourth premolar are preserved, with the roots of the third premolar. The posterior end of the ramus is missing, as well as the anterior end in advance of the third premolar. A part of the right ramus next to the symphysis remains.

The jaw is much deeper, thicker and relatively shorter than in angustigenis and primitivus, and the teeth are much larger than in these species. It is narrow anteriorly, and the symphysis extends back to a point in line with the division between the fourth premolar and the first molar. The hone is massive and heavy throughout. The mental foramen is placed heueath the posterior root of the third premolar, farther back than in *M. primitivus*.

The eingula are very slightly developed. The external eingulum is present for a short distance only, on the anterior face of each of the four teeth, and in the third molar in advance of the heel. The only trace of an internal eingulum is to 'e seen in the third molar on the posterior slope of the heel.

The fourth premolar is fully molariform. The teeth are stout, and of about the size of the corresponding ones in M. marshi, Osborn, but the jaw is relatively shorter than in this species.

From the material available, the species, for which the provisional name *assiniboiensis* is proposed, cannot be definitely characterized.

Measurements of ramus. Type.

Thickness of ranus above low fortical thickness of symphys fortical thickness of symphys	third molar er border beneath posterior end of first molar is a little in advanco of its posterior termination is in line with front root of third premolar
pace occupied by fourth pre-	nolar and the molars
Diameter of fourth premolar	antero-posterior
Diameter of first molar) antero-posterior
Diameter of second molar	antero-posterior
Diameter of third molar	autero-posterior.
pace occupied by roots of thi	rd premolar (antero-posterior)
pace between fourth premo	lars (twice the distance of fourth premolar from uphysis)

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With the left ramms, above described, is arbitrarily associated, as prohably referable to the same species, the abbreviated coössified nasal bones figured in plate VI, fig. 8, (collection of 1904). The specimen includes the bases of the horns which are seen to have been placed far forward and some distance apart. The horns apparently pointed laterally ontward and upward, as in M. angustigenis and M. coloradensis, but were much farther forward than in either of these species. These nasals are entirely different from those of M. selwynianus, and M. syceras; they are short, thick, and hroadly obtuse in front where they are but slightly bent downward. The front and lateral margins are thick and rounded, and the former is deeply notched in the middle. The lower surface is, as a whole, shallowly concave, a low longitudinal median ridge marking the line of union of the two bornes. The concave surface between the horn bases is shallowly and evenly curved. The horns at the base appear to have been longitudinally oval in transverse section, but a definite statement in this regard cannot be made, as the horn bases are imperfect posteriorly. The specimen is, on the line of coössification of the two hones, 70 mm. back from the front margin, 44 mm. thick.

The shortness and general rohnstness of the nasals, with like characters noticeable in the proportions of the above ramus, makes it appear probable that these specimens represent a single species.





Counsilied nasals of Megacerops assiniboienzis, fig. 12 superior aspect, fig. 13 left lateral aspect. One-fourth the natural size,

The two species, angustigenis and syceras, have the general form of horn found in the type of the genus Megacerops, viz., *U. coloradensis*, Leidy. In the other three species from the Cypress hills the horns are not known. In four of the five species, however, the nasals are known and show a wide variation in shape, all differing from those of the type.

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	4 TGO (C 60.	LIUTHS,
M. selwynianus.	Long and narrow, ohtusely rounded in front, under surface deeply ex- cavated, lateral margins produced downward.	Unknown ; probahly short.
M. angustigenis.	Thick and rather long, expanded anteriorly, front margin very ob- tusely pointed, under surface moderately excavated.	Short, far apart, flattened at base on anterior outer sur- face, and cylindrical above, directed decidedly ontward
M. coloradensis.	Of moderate length, thin and bent downward anteriorly.	Of moderate length, cylindri- cal ahove, flattened on pos- terior outer surface at base, directed ohliquely outward and upward.
M. sycerss.	Rather short, evenly rounded in front, stout, shallowly excavated heneath.	Lengthening, elose together and upright, more rounded in section near hase than in <i>M. angustigenis.</i>
M. assiniboiensis.	Very short and thick, ending square- ly in front, under surface only slight- ly concave.	Placed very far forward and rather far apart; probably long.

A series seems to be represented here with schoynianus and assiniboiensis as extreme forms, and coloradensis occupying an intermediate position. Compared with the type species, schoynianus has long and narrow nasals, whilst those of assiniboiensis are broad and very short. In angustigenis the nasals are rather long and the horns short. In syceras the reverse is the case, the nasals are rather short and the horns are lengthened. Coloradensis has both nasals and horns of medium length. A lengthening of the horns appears to have accompanied a shortening of the nasals, and it is probable that schoynianus had short horns and assiniboiensis long ones Schoynianus, primitivus and assiniboiensis are, for the present, referred to the genus Megacerops.

A portion of a right maxilla, holding the second, third and fourth premolars, and a separate left horn, are mentioned hy Cope in the first part of this volume, under the name Menodus americanus (Leidy), dimensions and figures of the horn being given. Two separate horns, also belonging to the Cypress Hills collection of 1884, were referred by the same author in the same publication to Menodus proutii (O. N. and E.). These two species are not determinate, and the specimens referred by Cope to them do not present characters sufficient for their identification with described forms. The horns evidently represent two species distinct from Megacerops angustigenis and M. syceras. It is possible that, with the advent of new material, they may he found to he assignable to two of the other three species of Megacerops from the Cypress hills, viz., M. selwynianus, M. assiniboiensis and M. primitivas, of which the horns are not known.

CHALICOTHERIUM BILOBATUM, Cope.

Plate III, figs. 7, 8 and 9.

Chalicotherium bilobatum, Cope, 1889. The Vertebrata of the Swift-current river, II American naturalist, vol. XXIII, p. 151.

Chalicotherium bilobatum, Cope, 1891. The species from the Oligocene or Lower Miocene of the Cypress hills; Geol. Survey of Canada, Contr. to Can. Paleont., vol. III (quarto), pt. I, p. 8.

The type specimen of this species has been described and fighted by Cope in part I of this volume. It consists of the coordinate coordinate the posterior end of the symphysis, and displays the alveoli of the second, third and fourth premolars, and of the first molar, with part of that of the second molar. In advance of the second premolar are the remains of alveoli for the canine, and three incisors. The bone is here slightly abraded, the alveol appearing as distinct but shallow depressions. Of those for the incisors, the first or inner most is the largest and deepest, and the third is the least distinct. That for the canine in narrow transversely and twice as long as wide. A smooth surface to the bone passes out ward between the second premolar and the canine, representing a narrow diastema. It is probable that the canine and incisor teeth were not present in the adult apimal. There is no indication of a first premolar. The roots of the three premolars are partially preserved.

In his observations on the genns, following the specific description in the American Naturalist (p. 152), Professor Cope proposed the order Ancylopoda for the reception of the two genera *Chalicotherium* and *Ancylotherium*. These remarks, which do not appear in the Contributions to Canadian Paleontology, were as follows :--

"Although this is the first announcement of the discovery of the genus Chalicotherinm in America, it is not the first discovery. Professor Scott showed me a series of superior molars from the Loup Fork formation of Kansas, from the Agassiz Museum, which he identified as belonging to this genus. The present species is of larger size than the Kansas form, and is apparently equal to the *C. goldfussi* of the Upper Miocene of Europe. The occurrence of this form in the Lower Miocene (White River), as well as the Upper Miocene (Loup Fork), of this country, is a noteworthy fact, but is parallel to its history in Europe Described from the Upper Miocene by Kaup, it was afterwards found in the Middle Miocene (*C. grande*) by Lartet, and in the Upper Eocene (*C. modicum*) by Gaudry."

"The remarkable character of this genus, as discovered by Filhol, has been already mentioned in the Naturalist." It has little relation to the family of Perissodactyla, to which it has given the name, and which it so resembles in molar dentition. It must form a family by itself, and the genera with which it has been associated must form a family to which the name Lambdotheriidae may be applied. The anterior ungual phalanges of Chalicotherium are of prehensile character, and not ungulate, but rather unguiculate. The phalanges resemble those of the Edentata, but the carpus and tarsus are, according to Filhol, diplarthrous in structure, while the Edentata are taxeopodous. We have in the Chalicotheriidae the antithesis of the Condylarthra. While the latter is ungulate, with an unguiculate carpus and tarsus, the former is unguiculate, with an ungulate (diplarthrous) carpus and tarsus.

* "Osborn on Chalicotherium, 1888, p. 728"

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er Miocene , vol. III,

n part I of which the hysis, and nolar, with remains of the alveoli t or innere canine is passes outma. It is al. Therc preserved. American on of the appear in

cotberinm of sn perior which he he Kansas ope. The r Miocene n Europe. e Miocene

n already , to which a a family which the cotberium pbalanges ol, diplarotheriidae ate carpus ad tarsus. Thus the Chalicotheriidae must be referred to a distinct order of unguiculate Mammalia, which I propose to call the Ancylopoda, with the above definition. Two genera belong to the single family, the Chalicotheriidae, viz., Chalicotherinm Kaup, and Ancylotherinm Gaudry. In the former, the phalanges are distinct; in the latter, the first and second are consisted (Lydekker). Marsh has not yet shown how his genus Moropus differs from Ancylotherium. The species described by Marsh under this name are from the Loup Fork bed of Kansas."

A separate lower left premolar of a Chalicotheroid (collection of 1904) is probably referable to this species. The tooth (plate I1I, figs. 7, 8 and 9) is regarded as the third premolar, and has an antero-posterior diameter about equal to the space for the corresponding tooth, of which the roots are preserved, in the above (type) mandible. Professor W. B. Scott, of Princeton University, has kindly examined this specimen, and, although agreeing with the writer that it is the lower premolar of a Chalicotheroid, considers it unlikely "that the genus Chalicotherinm should be found in the Titanotherium beds, for that genus is typical of the Middle and Upper Miocene of Europe." IIe is of the opinion that "much more probably the species of Cope will prove to be referable to one of the genera of the French Oligocene, such as Schizotherium."

The Cypress Hills species needs to be studied from better material before its true generic affinity can be determined.

RODENTIA.

SCIURUS ? SASKATCHEWENSIS, Sp. nov.

Plate VIII, figs. 16, 17.

A species of rodent, most nearly allied apparently to *Sciurus*, is represented by a molar tooth. As enough characters are no supplied by the single tooth for the proper definition of the undescribed genus seemingly indicated, a provisional reference to *Sciurus* is made for the present. The species is described as new.

The tooth is apparently an upper left molar. The crown, which is borne on three roots, is subquadrangular in outline as seen from below, with the antero-posterior diameter slightly less than the transverse diameter. The maximum antero-posterior measurement (length) is near the outer side. Of the three roots, one is internal and is much the largest, the other two are external and subequal. The height of the enamelled surface of the crown is twice as great internally as externally.

The tooth is only slightly worn. The pattern consists of an external median enamel inflexion, extending inward nearly across the crown, and two fossettes, one anterior, the other posterior. The enamel inflexion has a depth greater than half the beight of the external face of the crown but the two fossettes are not so deep. Of these latter, the posterior one is the larger and is complete, the anterior one is closed outwardly but communicates inwardly with the median inflexion. A narrow marginal ridge is continuous round the crown except where it is interrupted by the external enamel inflexion. This ridge is most prominent internally, anteriorly and posteriorly it sinks to a lower level, rising again to enclose the fossettes externally. The inner face of the crown is not strongly tunid as in *Sciurus* typically, but approach the marginal ridge as a moderately convex slope, in contrast to the other faces, which contratoward the base. The anterior cross creat is formed of two distinct cusps, recalling the sr division of the creats described by Matthew in *Sciurus* (*Prosciurus*) vetustus^{*}. A minustyle occurs in the marginal ridge external to the posterior fossette, breaking the continuiof the ridge to a slight extent. No style is present at the outlet of the median enaninflexion.

From the above description it will be seen that the tooth pattern implies a near approa to *Sciurus*, but the radical differences apparent preclude its definite reference to that genu The comparative prominence of the marginal ridge in front and behind is probably a primiti character.

Measurements of crown of type specimen :- Antero-posterior, 2.30 mm., transver diameter, 2.70 mm.

· Locality :- Bone coniée, Cypress hills, Saskatchewan.

ISCHYBOMYS TYPUS, Leidy.

Plate VIII, fig. 18.

A slightly worn molar is referred to this species described, originally, in 1856, from t Oligocene of Nebraska. The Cypress Hills tooth is apparently a second lower molar from t right side, and was mentioned in the writer's preliminary list of species contained in the 19 collection (Summary Report for 1905) as probably referable to this species. Its tooth patte agrees fairly well with that of the corresponding tooth, figured by Leidy, in his "Extin Mammalian Fauna of Dakota and Nehraska," 1869, pl. XXVI. In size the Cypress Hi tooth is slightly smaller. The antero-posterior diameter of the crown measures 8 mm. and about equal to the transverse diameter.

Bone coulée, Cyprese hills. Collection of 1904.

CYLINDRODON FONTIS, Douglass.

Plate VIII, figs. 19, 20.

Cylindrodon fontis, Douglass, 1901. Fossil Mamualia of the White River beds of Montan Trans. Amer. Philos. Soc, vol. XX, p. 15, pl. IX, figs. 9, 9a.

Cylindrodon fontis, Matthew, 1903. The Fauna of the Titanotherium beds at Pipesto Springs, Montana; Bulletin Amer. Mus. Nat. Hist., vol. X1X, article VI, p. 212, fi 7 and 8 A, B, C, D.

Douglass established this genus and species on two parts of right mandibular rami, w well worn teeth, from the Pipestone beds (Oligocene), near Pipestone Springs, in south-west Montana. The variation of the tooth-pattern through wear has been worked out by Matth from a scries of lower jaws, and an upper jaw, from the same locality.

In the writer's provisional list of the fanna of the Oligocene beds of Cypress hills, represented by the collection of 1904, part of a left mandibular ramus was referred to a spec of *Steneofiber* distinct from *S. nebrascensis*, Leidy. This specimen is now seen to be prope referable to *Cylindrodon fontis*, Douglass.

^{*} The Fauna of the Titanotherium lads at Pipestone Springs, Montana, 1903.

approaches lich contract ling the snb-A minute continuity lian enamel

that genus.

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66, from the lar from the l in the 1904 ooth pattern nis "Extinct Cypress Hills 5 mm. and is

of Montana;

at Pipestone p. 212, figs.

onth-western by Matthew

to a species be properly The Cypress Hills fragment of lower jaw is from the middle of the left ramus, and holds one tooth, the first molar. Anterior to the tooth is part of the alveolus for the fourth premolar, and behind it the alveolus for the second molar, and the remains of that for the posterior or third molar. The tooth is only moderately worn, and has reached the stage of wear shown by Matthew in his figure 8 B. Of the three fossettes in the worn surface of the erown, the anterior one is closed internally, a slight inflexion of the enamel remains to the posterior one, but there is still a very decided inflexion to the median one. When further worn the posterior fossette becomes complete internally, and later the median one also. The crown of this molar measures, antero-posteriorly 2.25 mm., transversely 2.20 mm. The full depth of the ramus is not preserved, but enough of the bone remains to show that the jaw was deep.

Matthew places the species with some doubt in the Castoriday. It is interesting to find this small species included in the 1904 collection, thereby adding to the number of species common to the faunas of the Cypress Hills and Pipestone Springs O⁴igoccue beds.

Locality :- Bone coulée, Cypress hills, Province of Saskatchewan.

EUTYPOMYS PARVUS, Sp. nov.

Plate VI, figs. 1 and 2.

A single molar represents this species. In the Summary Report of the Geological Survey for the year 1904, the writer specially mentioned this tooth as being worthy of notice on account of the large number of isolated enamel loops or lakes present in the worn autace of the crown, and in a foot-note, added whilst the report was being printed, the opinion was expressed that it was probably referable to Matthew's then newly established genus *Eutypomys*.

The Cypress Hills tooth, thought to be the lower third molar of the left side of the jaw, closely resembles, in tooth pattern, the teeth of *E. thomsoni*, Matthew, the type species of the genus# from the Oligocene (Lower Oreodon beds of the White River formation, Cheyenne river) of South Dakota. It is considerably smaller than the lower teeth of the type, and indicates a proportionately smaller animal.

Seen from above the crown is subtriangular in outline, the transverse diameter in front being greater than behind; the antero-posterior diameter exceeds the maximum transverse diameter. A view of the worn surface of the erown is given in plate VI, figure 2, in which are shown the numerous isolated lakes characteristic of the genus. In all about twenty lakes are seen. The tooth is constricted behind its mid-length exteriorly, the crown being well rounded and tumid on each side of the constriction or valley, in which are three or four shallow infoldings of the enamel below the level of the worn surface. On the inside, at mid-length, the erown is slightly inflected above, but the decided constriction of the external surface is wanting. The tooth is two rooted, the anterior fang being much the stouter of the two. The anterior surface of the crown is flattened, and has the appearance of having been preceded by a tooth in front. Posteriorly, however, the surface is rounded, as if no tooth pressed against it from behind; these considerations, together with the somewhat triangular shape of the tooth, suggest its being the last of the series.

"Notice of two new genera of Mammals from the Oligocene of South Dakota; Bulletin Amer. Mus. Nat. Hist., vol. XX1, p.21. 12529-8

Measurements of type specimen.

MM

....

Fotal height of tooth posteriorly		28
Height of crown posteriory.	 	16
Antero-posterior diameter of crown		27
Anterior transverse diameter of crown	 	23
Posterior transverse diameter of crown		18

PAL-EOLAOUS TURGIDUS, Cope.

A left mandibular ramus from the Cypress hills was referred by Cope, hu 1891 (part I, this volume, p. 5, pl. XIV, figs. 9, 9a), to this species. The specimen lacks the upper part of the anterior lobe of P, and the upper end of the inclsor. The posterior molar is missing, but its approximate size is given by its alveolus. The other lower toeth are perfect.

Comparing the specimen with the raml of this species figured by Cope, In his "Tertiary Vertebrata," 1884, pl. LXV1I, it is seen that the space occupled by the molar-premolar series is slightly greater, but the depth of tho jaw is the same, as is also the size of the diastema behind the ineisor. The teeth appear to have the same relativo size to each other, and the internal enamel inflexion, apparently, has a like development. Matthew has placed this specimen, described by Cope In 1891, in his species *P. brachyodon* (op. cit., 1903, p. 217) which is of the size of *P. turgidus*, but differs from it, as the namo implies, by being more brachyodont. Other characters ascribed to *P. brachyodon* as distinguishing it from *P. turgidus* are — 1¹² smaller and more conical, m³ apparently larger, the internal enamel inflexion less persistent. In lower jaw P₃ shorter, more conical, and the Inflexion disappearing earlier than in *P. turgidus*. These distinguishing characters are not apparent, to the writer, in the Cypress Hills specimen, which is here left under Cope's name.

Measurements of Cypress Hills specimen

Molar-premolar series			 	 		•••		 								 18	•0
Third premolar :																	
Antero-posterior diameter									 				 			 - 3	+4
Transverse "					 					 			 			2	++
Height above alveolar rim								 	 							5	+
Posterior molar :																	
Antero-posterior diameter													 			 2	.8
Transverse "													 			2	
I ength of diastema behind inci	801	r			.,				 		 		 			11	· 2
Depth of ramus beneath P																 9	.8

PALEOLAGUS HAYDENI, Leidy.

Plate VIII, figs. 21-25.

Another species of *Palsolagus*, distinct from the preceding, is represented by teeth, from both jaws, included in the collection of 1904. These teeth agree in size with those of *P*. haydeni, the type species of the genus (Oligocene (White River) of Nebraska, South Dakota, &c.), established by Leidy in 1856; they are for the present referred to that species. On plate VIII, are figured three of these teeth, an upper premolar, an upper molar, and a lower molar, from which the following measurements are taken :--

Measurements,	
Upper left preniolar, / fourth premiolar (plate VIII, figs. 22 and 23) :	MI 31.
Antero-posterior diameter of grinding anrface	2.0
Transverse diameter of grinding surface	2.8
Upper right molar, i first molar (plate VIII, fig. 21) :	
Antero posterior diameter of grinding surface	2.0
Transverse diameter of grinding surface,	3.0
Lower right molar (plate VIII, figs. 24 and 25) :	
Antero posterior diameter of tooth above	$2 \cdot 3$
Transverse diamolog of anteriog tobe above	

39

It is likely that more than two species of *Palcolagus* are represented from the Cypress hills. Among the separate teeth, obtained in 1904, are a number of incisors of rodents, some of which are probably referable to *Palcolagus*.

CARNIVORA

HY.ENODON CRUENTUS, Leidy.

Plate VII, 1, 2 and 8.

Hyanodon cruentus, Leidy. 1853. Proc. Acad. Nut. Sci., Phila., vol. VI, p. 392.

" Leidy, 1869. The extinct mammalian fauna of Dakota and Nebraska; Jour. Acad. Nat. Sci. Phila., second series, vol. VII, pp. 47 and 369, pl. V, figs. 10, 11.

The auterior half of a left mandihular ramus is referred to this species, and represents the second member of the Hyunodontidue to be recorded from this locality, the first being *Hemipsalodon grandis* described by Cope.

This specimen shows the alveoli of the canine, of the four premolars, and of the first molar; the roots of these teeth, with the exception of those of the canine and first premolar, being preserved. The alveolus of the canine indicates that the tooth was of large size, directed well upward, and oval in transverse section, with its greatest diameter in an anteroposterior direction. The first premolar, as shown by its alveolus, was single rooted, and followed closely behind the canine. The roots of the first and second premolars passed downward obliquely backward, those of the third and fourth as obliquely lorward. The first molar was of small size, its antero-posterior diameter being about equal to that of the second premolar.

Although the crowns of the teeth are missing in the Cypress IIills specimen, it is apparently properly referable to *H. cruentus*, Leidy, from the Oligoeene of South Dakota and Colorado, judging from its size and general proportions, and the relative spaces occupied by the teeth, in comparison with the published figures of Leidy and Scott.

The anterior end of the specimen, inside the alveolus for the canine, is broken away, and no trace of the alveoli for the incisors is preserved. Following the plane of the symphysis forward, however, it is seen that there could have been little room for the incisors, which must have been crowded. At the symphysis a small piece of bone, belonging to the right ranus, remains attached to the specimen, and, along the line of junction, indicates a

(part I, per part missing,

Fertiary ar series iastema and the ed this p. 217) ing more *P. tur*inflexion g earlier c, in the

ch, from se of *P*. Dakota, es. On and a rather thorough consufication of the two rami. The hinder end of the symphysis is in line with the front root of the third premolar. Two mental foramina are present, the larger of the two beneath the anterior root of the third premolar, the other beneath a point slightly in advance of the second premolar.

Maranant

	and a recommendation of the second seco	
Frank A		MM.
Length of specimen.	*******	89
Length of previola		2.1
the second se	***************************************	19.9
	ist premolar.	4
	2nd a	11
Longth of al		11
wenden manage a bie ert	aru	13.5
	4th	1.05
	lat molas	2
A. A	The month	11
Anterro-posta et	f alveolus of canine	10
Transverse di tre and tran	11181PH. #	
Same Interes 1	aldare and the second	
ubice nerment who w. Fil	ne and ist premolar	3
44 · · · · · · · · · · · · · · · · · ·	nel ?uil urenuolae	9.5
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theben of the life of the life	opp of rand 1st moisr	34
Depth of rame a mid hap h	H H pre point	1.0
Thickness of r turns t must	a second s	
THE BEST THE PARTY AND THE PAR	ympnysis	16

Collector T. C. Westen - He. and - of Swift-current creek (Bone coulde), Cyprese hills, 1888.

A left lower tooth found repairst 'y in 1904, plate VII, fig. 3, has the proportions of the second premolar of $H_{2^{-}}$ nodon. The adveoli (containing roots) of the second premolar of the left ramus, mentioned above and referred to *H. cruentus*, indicate by their size that this separate tooth is probably referable to this species.

HY.ENODON CRUCIANS? Leidy.

Plate VII, ligs. 4, 5 and 6.

Hyanodon crucians, Leidy, 1853. Proc. Acad. Nat. Sci. Phila, vol. VI, p. 393.

A second species of *Hyanodon* is represented by a superior left fourth premolar (collection of 1904). The tooth is not quite as large as the corresponding premolar of *H. crucians*, as described and figured by Leidy in 1869 in "The Extinct Mammalian Faura of Dakota and Nebraska"*, but approaches closely to it in shape; it is referred to this species provisionally.

In the Cypress Hills tooth the protocone is large and compressed, the tritocone (posterior ensp) is small and slightly trenchant, the denterocone (interior cusp) is fairly developed on the inner side in line with the protocone. There is an inconspienons protostyle (anterior basal cusp, and exteriorly, at the mid-length of the erown, the basal cingulum is feely developed.

Measurements

lax.	height of cro	wn of	tooth		MM.
44	length "	4+	6.6	······································	10 10
66	breadth "	86	64	* * * * * * * * * * * * * * * * * * * *	7.8

The specimen represents a species of about the same size as H. crucians, Leidy, but possibly distinct.

* The extinct manunalian fauna of Dakota and Nebraska. Jour. Acad. Nat. Sci. Phila., second series, vol. V11, pp. 48 and 369, pl. 11.

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HEMIPSALODON GRANDIS, Cope.

Plate VII, figs. 7 and 8.

Hemipsalodon grandis, Cope, 1885. The White River beds of Swift-current river, North West Territory, American Naturalist, vol. NiN, p. 163; and Geol. and Nat. Hist. Survey of Canada, vol. I, new series, part C, 1885, appendix I, p. 80.

Hemipsalodon grandis, Cope, 1891. The species from the Oligocene or Lower Miocene beds of the Cypress fills; Geol. Survey of Canada, Contr. to Can. Palcout., vol. 111 (quarto), pt. I, p. 6, pl. II.

The material on which this genus and species were established consists of a right mandibular ramus, a complete and well preserved right femur, and a left femur, of slightly smaller size, from which the distal end is missing. Cope's full description, with figures, is given in part I of this volume.

Hemipsalodon is the representative, in North America, of the European Upper Eccene Pterodon. It differs from the latter in the form of the enlarged posterior iower true moiar.

Among the characters of *H. grandis*, which is the largest of all known creodonts, are to be noticed the great depth of the mandible, the length of the symphysis, and the immense size of the canine, which so erowds the incisors that the second of these teeth is behind the other two. The symphysis reaches back to a point nearly below the middle of the fourth premolar.

Through an error, in printing probably, the length of the premolar series is given, in the description on p. 6, of part I, of this volume, as 108 mm. This measurement should read 87 mm.

In the 1904 collection from the typical locality is a large canine tooth, plate VII, figs. 7 and 8, that apparently belongs to this species. Its dimensions, at the point of greatest thick. ness, agree with those of the canine in the type specimen. In this separate tooth the upper part of the crown is broken off, but the whole of the root is preserved, giving a length to the specimen of 111 mm, with an estimated total length 10 the tooth, when perfect, of about 129 mm.

CYNODICTIS LIPPINCOTTIANUS (Cope).

Plate VII, figs. 9-14.

There are in the collection of 1904 four teeth that apparently belong to 'i's species, of which Cope was uncertain as to whether it was distinct from, or only a large variety of C. gregarius (Cope), one of the commonest of the White River (Oligocene) carnivores described from Colorado, Nebraska and South Dakota.

The teeth from the Cypress hills were obtained separately, and agree in size most closely with those described by Cope under the name Galecypress lipp nootlianus (see Cope's Tertiary Vertebrata, vol. 11), book I, 1884, p. 919, pl. 1.XV11c [7] ey are, a left lower third premolar, a left lower fourth premolar, and a right lower thest updar of which the anterior cusp is missing. Another tooth, slightly damaged, from the left -ide, is apparently a lower fourth premolar.

DAPHENUS FELINUS, Scott.

Plate VII, figs. 15 and 16.

Daphanus felinus, Scott, 1898. Notes on the Canidæ of the White River Oligocene; Trans. Amer. Philos. Soc., vol. XIX, p. 361.

The hinder part of a right maxilla, in which is preserved the sectorial tooth, is referred to this species with a certain amount of douht. The specimen includes the alveoli of the third premolar and of the three molars.

In his "Oligocene Canidar," Hatcher* has made known the complete dentition of this species, from excellent material from the Oreodon heds of Bad Lands creek, Sioux county, Nehraska. In comparing the dentition of the Cypress IIills specimen, so far as its incompleteness will admit, with that of the species as set forth by Hatcher in his description and figures (plates XIV and XVI) it is seen that there is a fair agreement in the size of the sectorial (fourth premolar), and the space occupied hy the teeth from the third premolar to the second molar, both inclusive, is almost the same, giving about a corresponding size to the third premolar, and the first and second molar teeth. A difference is noted in the position of the alveolus of the third molar, which is placed farther outward in the Canadian specimen, being in line rather with the exterior borders of the first and second molars than with the inner margins of the same as shown hy Hatcher. The alveolus of the third molar is very close to the hinder border of the second molar, and indicates a greater crowding of these teeth, with a prohably smaller antero-posterior diameter to the second molar. There seems also to have been a greater hackward obliquity to the outer border of the second molar. In the sectorial tooth of the Cypress Hills specimen the antero-internal cusp (deuterocone) is longer and narrower, and is directed more forward, so as to form with the base of the external cone a decided fork, into which the posterior border of the third premolar fitted closely. The deuterocone has a slightly convex upper surface (within the cingulum), on which is developed a distinct longitudinal median ridge. The antero-external cone (protocone) and the posterior cone (tritocone) apparently agree well with the corresponding parts of the sectorial of the Nehraska skull. A basal cingulum is present; it is moderatcly developed internally, and includes the anterior horder of the deuterocone, but is rather weak externally.

Hatcher (op. cit., p. 67) has drawn attention to the difference in the position of the upper third molar relative to the two precding molars in the genera Amphicyon and Daphanus, His remarks appeared as follows: — "The chief generic distinctions between Daphonus, Leidy, and Amphicyon, Lartet, in so far as they are at present known, are to be found in the relative size of the premolars, structure of canines, and position of the superior third tubercular molar. The canines of Daphanus are without either anterior or posterior cutting edges, while these are present in Amphicyon. The premolars are reduced in size in Amphicyon, while those of Daphanus show little or no reduction. In Daphanus the superior third tubercular molar is pushed inward and aligned with the internal cones of the preceding molars, while in Amphicyon this tooth occupies a more external position."

In the Cypress Hills specimen (1) the canine is not preserved, so that a comparison cannot be made in this connexion, (2) the fourth premolar at least is not reduced in size (Daphanus) and (3) the third molar is in line with the external cones of the preceding molar (Amphicyon).

*Memoirs of the Carnegie Museum, Pittsburgh, vol. 1, No. 2, Sept., 1902.

From this it appears that the Canadian specimen combines characters that, according to llatcher, belong to both of the above genera.

The Cypress Hills specimen represents an animal of about the size of *D. felinus*, and it is provisionally referred to that species, although there is not an exact agreement in the form of the sectorial, and although a difference is noticed in the alignment of the molars. The incompleteness of the specimen precludes a satisfactory comparison.

Locality :-- eastern escarpment of the Cypress hills, nine miles due east of Bone coulée. Lawrence Lamhe, 1904.

PROTEMNOCYON HARTSHORNIANUS (Cope).

Plate VII, figs. 17, 18, 19 and 20.

A left upper fourth premolar (sectorial), belonging to the collection of 1904, is referred to this species. The tooth, from which the inner anterior cusp (deuterocone) has been hroken off, is well worn, and probably belonged to an old individual.

This species is known from rather meagre material from the Oligocene of Colorado and South Dakota. Cope has referred to his species *Amphicyon hartshornianus** certain fragments of jaws, holding teeth, that Leidy, in his memoir on "The Extinct Mammalian Fauna of Dakota and Nebraska," 1869, included in his description of *Amphicyon vetus* (p. 32, pl. I. figs. 8, 4 and 6). The superior sectorial, obtained in 1904 from the Cypress hills, agrees very closely in size and form (without considering the inner anterior cusp which is missing in our specimen) with the sectorial shown by Leidy in his figure 6.

A second upper sectorial, also from the left side, obtained from the Cypress Hills locality by Mr. T. C. Weston in 1884, may belong to this species. It is slightly smaller than the 1904 specimen but is otherwise very similar. The protocone is robust and has a broad anterior face; posteriorly it narrows to a sharp, steep edge directed obliquely inward. The tritocone is compressed laterally and forms a good cutting edge. The deuterocone is of fair size and is well detached from the base of the protocone. A distinct cingulum encircles the entire base of the crown. The posterior root is laterally compressed, its antero-posterior diameter proximally greatly exceeding the transverse one. The root supporting the deuterocone is likewise compressed, but to a less extent.

Measurements.

Sectorial of 1884; plate VII, figs. 18, 19 and 20 -	arm.
Length from posterior end to antero-external base of protocone	12.5
Breadth anteriorly at large of antero-internal base of protocone	13.0
Height of protocone including simeland	7.2
Sectorial of 1004 - master VIT d. 17	8.9
second of 1504; plate v 11, ng. 17 (s.	
External length	12.0
Breadth anteriorly	10:0
Breadth anteriorly at base of protocome	4 2
Height of protocone, including cingulum	8.2

* 1884. The Vertebrata of the Tertiary Formations of the West. Report U. S. Geol. Survey Terrs., vol. 111, p. 783.

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on cannot apha:nus) phicyon).

According to Hatcher, Daphænus hartshornianus is properly referable to his genus Pro temnocyon,* founded on excellent material from the Oligocene deposits of Hat Creek basin Sioux county, Nebraska.

DINICTIS FELINA, Leidy.

Plate VII, figs. 21, 22, 23 and 24.

Dinictis felina, Leidy, 1856. Proc. Acad. Nat. Sci. Phila., vol. VIII, p. 91.

" " Leidy, 1869. The extinct mammalian fauna of Dakota and Nebraska; Jour. Acad. Nat. Sci. Phila., vol. VII, pp. 64 and 868, pl. V, figs. 1-4.

A right lower first molar, belonging to the 1904 collection, is referred to this species. The three figures of it in plate VII will give a fair idea of its proportions. The two large cusps, the principal one and the smaller anterior one, together form an admirable cutting edge. The posterior cusp or heel is well developed, trenchant and larger than the heel of the corresponding tooth in *Hoplophoneus*. A small postero-internal cusp is present, high on the posterior border of the principal cusp. There is also a very small anterior basal cusp or tubercle. The tooth has not been subjected to much wear, and its cutting edges are, throughout, slightly denticulated.

Another tooth, fig 24, an upper canine, probably also belongs to this species. It curves slightly backward and ends below in a moderately sharp point. In transverse section above it is narrowly elliptical. The posterior border is denticulated and sharper than the anterior one on which no denticles are seen. The surface of the specimen is weathered. Length (imperfect above), 28.5 mm.; max. antero-posterior diameter, 14 mm.; max. transverse diameter, 8 mm.

* "ngocene Canidæ. Memoirs of the Carnegie Museum, vol. 1, 1902, p. 104.

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e species. two large le cutting le heel of high on asal cusp dges are,

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* In this and the following seven plates all the figures are of natural size unless otherwise stated.

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PLATE II.

PLATE II.

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Abbreviations for cusps, etc., as in plate III.

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PLATE II



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PLATE III.

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pa., paracone; me., metacone; pr., protocone; hy., hypocone; pl., protoconule; ml., metaconule; ps., parastyle; ms., mesostyle; mts., metastyle; d., deuterocone; te., tetartocone; tr., tritocone.

GEOLOGICAL SURVEY OF CANADA.

PLATE III



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PLATE IV.

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PLATE IV.

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 - pr., protocone ; d., deuterocone ; tr., tritocone ; le., tetartocone ; c., canine ; P₂, second premolar.

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PLATE IV

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PLATE V.

PLATE V.

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c., canine ; i., incisor ; P2, second premolar.

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PLATE VL



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pl., protoconule ; pr., protocone.

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 - c., canine; d., deuterocone; m., molar; p., premolar; pr., protocone; prs., protostyle; tr., tritocone.

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PLATE VIE



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PLATE VIII.

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PLATE VIII

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PLATE VIII

