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MAMMALIAN FAUNA OF THE HELL CREEK FORMATION OF MONTANA

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In 1907, Barnum Brown¹ announced the discovery, in the Hell Creek beds of Montana, of a small number of mammalian teeth. He then listed only *Ptilodus* sp., *Meniscoëssus conquistus* Cope and *Meniscoëssus* sp., without description. In connection with recent work on the mammals of the Paskapoo formation of Alberta, this collection was referred to the writer for further study through the kindness of Mr. Brown and of Dr. W. D. Matthew, and a brief consideration of it is here presented.

The material now available consists of two lots, one collected in 1906 by Brown and Kaisen, the other part of the Cameron Collection. The latter has no definite data as to locality save "the vicinity of Forsyth, Montana, and Snow Creek," and is thus from a region intermediate between the locality of the other Hell Creek specimens and that of the Niobrara County, Wyoming, Lance, but much nearer the former. Brown's collection is from near the head of Crooked Creek, in Dawson County, about eleven miles south of the Missouri River, Crooked Creek joining the latter about four miles northeast of the mouth of Hell Creek, along which are the type exposures of the formation.

The mammals agree with the other palæontological data in being of Lance age, although slightly different in detail from the Wyoming Lance fauna. The only localities now known for mammals of Lance age are the present ones, the classical Niobrara County Lance outcrops whence came all of Marsh's specimens, and an unknown point or points in South Dakota where Wortman found the types of *Meniscoëssus conquistus* Cope and *Thlæodon padanicus* Cope.

So far as now identified the Hell Creek mammals are as follows:

MULTITUBERCULATA

Ptilodontidæ

Essonodon browni, new genus and species

Meniscoëssus borealis, new species

?*Meniscoëssus* sp.

Cimolodon sp.

¹1907, Bull. Amer. Mus. Nat. Hist., XXIII, p. 842.

MARSUPIALIA

Didelphiidæ

Didelphodontinæ

Ectoconodon montanensis, new species

"Stagodon" spp.

?Thlæodon sp.

Pediomyinæ

Pediomys sp.

INSECTIVORA

Leptictidæ

Gypsonictops hypoconus, new genus and species

MULTITUBERCULATA

Ptilodontidæ

Essonodon browni, new genus and species

TYPE.—Amer. Mus. No. 14410, an isolated second lower molar from Crooked Creek, Montana.

CHARACTERS.—This little tooth measures 2.4 mm. in length by 3.6 mm. in breadth, being thus just one and one-half times as broad as long. The outer contour is somewhat irregularly quadrate, although the inner side is shorter than the outer one and the posterior and internal borders form a single markedly convex curve. As in all multituberculate lower molars, there are two cusp rows, with three cusps in the outer and two in the inner row. The three external cusps are small, transversely elongated, and subselenodont, the wings of the crescents pointing posteriorly. Each sends a ridge, curving a little posteriorly, down into the central groove, and the last cusp also sends a somewhat less marked ridge curving backward and inward around the posterior end of the tooth. The bases of these cusps are united externally, and the second and third are united on this side almost to their tips, so that they are not very distinct in external view, although perfectly separate as seen in crown view. The internal cusps are considerably larger, the anterointernal one being, as is usually the case in this family, the largest of the tooth. It, too, is somewhat crescentic backward, but this general effect is obscured by the three ridges which it sends toward the midgroove in the rather complex fashion seen in the figure. This cusp is well separated from the others in all aspects. The posterointernal cusp is shorter and smaller than the preceding one, but larger than any external cusp. It sends two slightly diverging crests down into the midgroove, so that it is narrowly crescentic in that direction. The longitudinal groove, as in ptilodontids generally, is marked by a complicated pattern of branching and anastomosing, sharp, small ridges, connecting with those which run into it from the cusps. The crown was supported by two external roots and one internal one.



AM.14410

Fig. 1. *Essonodon browni*.
Type, A. M. No. 14410.

Crown view of m₂.
×3.

RELATIONSHIPS.—Although founded on a single tooth, this genus is highly distinctive. The ratio of length to width is less than in any other

known multituberculate, and the cusp number is also lower. The usual number is six in M_2 , and while more than this may occur, fewer have not hitherto been observed save in worn teeth where two have been secondarily united by wear. In the Jurassic, the formula, so far as surely known, is 3.3, while in the Cretaceous and Paleocene the basic and usual formula is 4.2, but there is a tendency to add cusps posteriorly, giving as high as 7.2 in some small Lance ptilodontids, and, according to Osborn, 4.4 or 5.4 in some of the Paleocene polymastodontids. *Essonodon* is unworn and has but 3.2. The general aspect, cusp shape and arrangement, and ridge pattern, however, are those of a small ptilodontid. Apparently it is highly specialized for this group, but judgment on this point is reserved until more of the animal is known. The root arrangement is also unique and is correlated with the extreme shortness of the tooth.

***Meniscoëssus borealis*, new species**

TYPE.—Amer. Mus. No. 14411, an isolated second left upper molar from Crooked Creek.

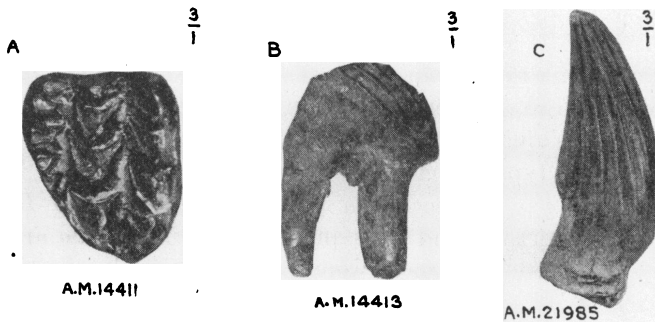


Fig. 2. *Meniscoëssus borealis*.

A, type, A. M. No. 14411. M_2^1 .
 B, A. M. No. 14413. P_4 .
 C, A. M. No. 21985. $I_2 r$. All $\times 3$.

CHARACTERS.—This well-preserved but somewhat worn tooth has a cusp formula of 4.4.5 and measures 8.3 mm. in length by 7.0 mm. in width. The four subequal outer cusps are rounded externally, but each sends a sharp ridge curving inward and forward from its apex. In the anterior one this ridge bifurcates, and this cusp has also another distinct ridge which connects it with the anterior median cusp along the anterior border of the tooth. The larger middle cusps are strongly crescentic forward, save the first one, which is smaller, less crescentic and more or less contained within the limbs of the following crescent. The inner cusps are all smaller and are less equal in size among themselves, the second and third from the front being the largest and the others smaller in progression. Each is rounded internally and sends a ridge

externally into the groove between this row and the median one, this ridge bifurcating in the second and third cusps. The first cusp is closely appressed to, but distinct from, the second. The inner row is shorter than the others, the inner and posterior borders of the crown forming a single convex curve, while the outer and anterior borders are more nearly straight and at right angles to each other.

DISCUSSION.—This tooth differs from *Dipriodon* of the Niobrara County Lance in being a little longer relatively and in having a larger number of cusps in the middle and inner rows. These are just the features in which *Meniscoëssus*, from an uncertain horizon, quite surely Lance, in South Dakota, also differs from *Dipriodon*, and the present species is therefore referred to the former genus. Direct comparison with the type of *M. conquistus* (Amer. Mus. No. 3011) shows that M^2 of *M. borealis* is about twenty per cent. larger and has the first cusp of the inner row more separated from the following one. In addition to the type, the collection includes several other specimens probably referable to this genus and perhaps species. No. 14407 is a badly broken right first upper molar of a large and strongly selenodont type. No. 14408 appears to a left upper incisor of the same or a related form; it has a long root, short crown, the apex now worn and broken, but with a small posteroexternal accessory cusp. No. 21985 is a right lower incisor of the large, pointed, grooved type so familiar in the Wyoming fauna, while No. 14413 is a fairly well-preserved fourth lower premolar, about 6.8 mm. in length and having eight projections along its cutting edge. Like the other teeth and fragments, save the type, it has close counterparts among the Wyoming specimens tentatively referred to *Dipriodon*, and it is probable that *Dipriodon* and *Meniscoëssus* were essentially similar in these relatively uncharacteristic parts.¹

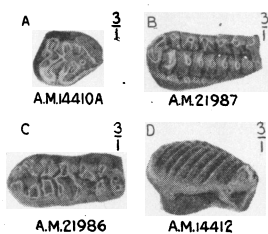


Fig. 3. *Cimolodon* spp.

- A, A. M. No. 14410A. M^2 .
 B, A. M. No. 21987. M^1 .
 C, A. M. No. 21986. M^1 .
 D, A. M. No. 14412. P_4 . All $\times 3$.

Cimolodon spp.

Amer. Mus. No. 14410A is a badly worn and slightly broken second lower molar of a small ptilodontid. It measures 2.7 mm. in length by 2.2 mm. in width and has a cusp formula of 4.2. It agrees in all essentials with certain teeth from Niobrara County which are tentatively referred to *Cimolodon*. No. 14412 is a small fourth lower premolar with thirteen projections along

the edge and a like number of external and internal oblique ridges, measuring 4.5 mm. in length. It too has its Wyoming counterpart among specimens referred to *Cimo-*

¹They may, it is freely admitted, be synonymous, as has been supposed, but until they are better known it seems wiser to retain them as separate genera in view of the definite differences in M^2 . In any event, the present specimen would be referred to *Meniscoëssus*.

lodon. No. 21987 is a first upper molar with a cusp formula of 7.9.7, the inner row incomplete anteriorly, as in most ptilodontids, and No. 21986 is a first lower molar of comparable size and character, again both referable to *Cimolodon* in the present state of our knowledge. Specific, and even generic, identification of these rather central, small ptilodontids is not yet possible, and the term *Cimolodon* as used by the present writer may include more than one genus, and certainly includes several species which cannot be defined adequately until associated material has been found. While awaiting fortunate future discoveries, it is conceived to be a sounder scientific procedure to use a name in a broad sense to include a number of closely related forms which may eventually prove to be distinct than to attempt a fine taxonomic discrimination on grounds which time must inevitably show to be in part erroneous.

MARSUPIALIA

Didelphiidæ

Didelphodontinæ

Ectoconodon montanensis, new species

TYPE.—Amer. Mus. No. 14406, an isolated left upper molar from Crooked Creek.

CHARACTERS AND COMPARISONS.—This molar is of the broad, rather blunt-cusped, crushing didelphodontine type. It is a small tritubercular tooth with a wide external shelf, notched in the middle, and bearing a large stylar cusp external to the paracone and a smaller but still distinct and sharp one external to the metacone. There is also a still smaller cusp between and slightly external to the pa and me. From *Didelphodon* it differs in the presence of the last-mentioned cusp and in the greater development of the style external to the metacone. From the larger of the two specimens figured by Osborn as types of *Ectoconodon petersoni*, it differs in being smaller, of different proportions, and (by comparison of the originals) in the greater development of the style external to the metacone. From the smaller it differs in proportions, being shorter and more slender, more like the type of *Didelphodon*, and in having the parastylar and metastylar lobes more separate and projecting, and the small cusp between pa and me more central. It is, however, congeneric with them with as much certainty as can be derived from the comparison of isolated teeth.

“*Stagodon*” spp.

There are a number of teeth in the collection, as Nos. 14400, 14402, 14403, and 14404, which correspond to those commonly referred to *Stagodon* Marsh, a genus comprising heavy premolars, upper and lower, pertaining to opossums of the *Didelphodon-Thlæodon* group.

?*Thlæodon* sp.

Amer. Mus. No. 21988 is a broken left lower jaw without teeth but with alveoli for the last premolar and all four molars. The jaw, as far as preserved, has the form and character of the type of *Thlæodon padanicus* Cope, but is a little more elongate. The depth of the horizontal ramus is the same, but the four molars occupy about one-fourth more linear space. The last three were subequal, the first smaller and with

reduced anterior root. It is closely crowded up against the posterior root of the last premolar, which was very large. The posterior mental foramen is beneath the posterior root of M_1 and anterior root of M_2 .

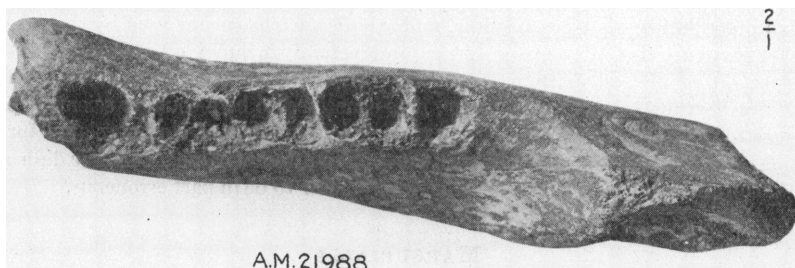


Fig. 4. ?*Thlæodon* sp. A. M. No. 21988.

Top view of left mandibular ramus. $\times 2$.

Number 21989 is a still more fragmentary right ramus with alveolus for M_4 . It is identical in character with the foregoing and may even have pertained to the same individual, although its color is not the same, perhaps due to weathering.

PEDIOMYINÆ

Pediomys sp.

Amer. Mus. No. 14401 is a rather worn, typical (2d or 3d) right upper molar of a *Pediomys* of moderate size. *Pediomys* is a genus which, as used by the writer, is certainly too inclusive, but it forms a very convenient receptacle for upper molars of a more *Didelphis*-like type as opposed to the more *Didelphodon*-like ones, and its separation into several natural genera can be safely accomplished only when associated material is more plentiful.



Fig. 5. *Pediomys* sp. A. M. No. 14401.

Crown view of M_2 or M_3 . $\times 3$.

The pediomyine Lance didelphids are, perhaps, also represented by a fragment of a right lower jaw with alveoli for the last two molars and enough of the jaw back of this to show that it is of marsupial nature. In size and character it corresponds quite closely with *Eodelphis* of the Belly River, a genus which has at least one very close relative (perhaps a direct descendant) in the Wyoming Lance.

INSECTIVORA

Leptictidæ

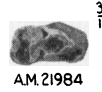
Gypsonictops hypoconus, new genus and species

TYPE.—Peabody Museum, Yale University, No. 13662, an upper molar from Niobrara County, Wyoming.

REFERRED SPECIMEN.—Amer. Mus. No. 21984, Hell Creek formation, Montana (Cameron Collection).

CHARACTERS.—Typical upper molars of leptictid type, short, with crescentic pr, transversely compressed pa and me, the former slightly larger, small pl and ml, narrow but sharp external cingulum, low and cingulum-like but distinct directly posterior to the pr, and a feeble anterior cingulum on the pr.

DISCUSSION.—This genus is known from a number of teeth from the Wyoming Lance, including examples of P⁴ and of all the molars, and a detailed description of it has been prepared and will appear elsewhere. In the meantime it has seemed advisable to record it here in order that the Hell Creek lists may be as complete as the material in hand permits. The significance of the genus lies in the fact that its very probable leptictid affinities afford the first strong indication of the presence of placentals in the Lance, by far the greater number of the trituberculates present being certainly marsupials. It is the writer's belief that *Batodon* and *Telacodon*, and perhaps some other even more doubtful forms, are also placentals, but this is very uncertain, while *Gypsonictops* is so like the other leptictids in all details of upper cheek-tooth structure and so unlike any known marsupial that its placental affinities can hardly be denied.



AM.21984

Fig. 6. *Gypsonictops hypoconus*. A. M. No. 21984.

Crown view of m¹.
×3.

