

# AMERICAN MUSEUM NOVITATES

Number 825

Published by  
THE AMERICAN MUSEUM OF NATURAL HISTORY  
New York City

March 14, 1936

56.9, 1 M:14.31.4

## A SPECIMEN OF THE UPPER CRETACEOUS MULTITUBERCULATE *MENISCOËSSUS*

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Numerous isolated mammalian teeth have been discovered in the American Upper Cretaceous, but associated teeth or jaws are extremely rare. A hitherto undescribed specimen, Amer. Mus. No. 22708, includes  $P_4$ ,  $M_1$ ,  $M_2$ , the root of  $P_3$ , and much of the bone of the left lower jaw of the multituberculate *Meniscoëssus*. It is far the best multituberculate specimen yet to be discovered in the American Cretaceous and is of great interest on that account and as providing conclusive evidence of the generic association of isolated teeth hitherto collocated on more theoretical grounds.

The specimen was found by Miss Idella Kennedy thirty-five miles southwest of Ekalaka, Montana, Sec. 9, T. 1S., R. 55E., in Hell Creek beds at a horizon designated as about 400 feet below Fort Union lignite beds. It was presented to the Museum by the Carter County Geological Society, through Mr. W. H. Peck of that Society.

The accompanying drawings are by Mrs. Mildred Clemans.

In 1889 Marsh named, described, and figured several multituberculates from the Lance ("Laramie"), among them *Dipriodon robustus* (genotype), based on a tooth identified as the last left upper molar (now known to be right  $M_2$ ), *Dipriodon lunatus*, based on a tooth identified as left  $M^1$  or  $M^2$  (now known to be right  $M_1$ ), and *Halodon sculptus* (genotype), based on a tooth correctly identified as a last lower premolar. In 1893 Osborn recognized these genera, and three others based on lower incisors and upper teeth, as synonymous with each other and with *Meniscoëssus* Cope and although he still had only isolated teeth he made a hypothetical composition of the dentition.

Osborn's study showed remarkable insight in interpreting such fragmentary materials, and one of the interesting features of the present specimen is that it absolutely proves, for the first time, associations of teeth deduced by Osborn forty-two years ago.

In my study of Lance mammals (Simpson 1929), I accepted Osborn's collocations, pointed out the impossibility of any specific revision on

the materials then known, and included all the Wyoming, Niobrara County, *Meniscoëssus* in one species, *M. robustus* (Marsh), as inseparable although not of proven specific synonymy.

The question of the synonymy of Marsh's various specific names for forms now referred to *Meniscoëssus*, nine in all, is not much advanced

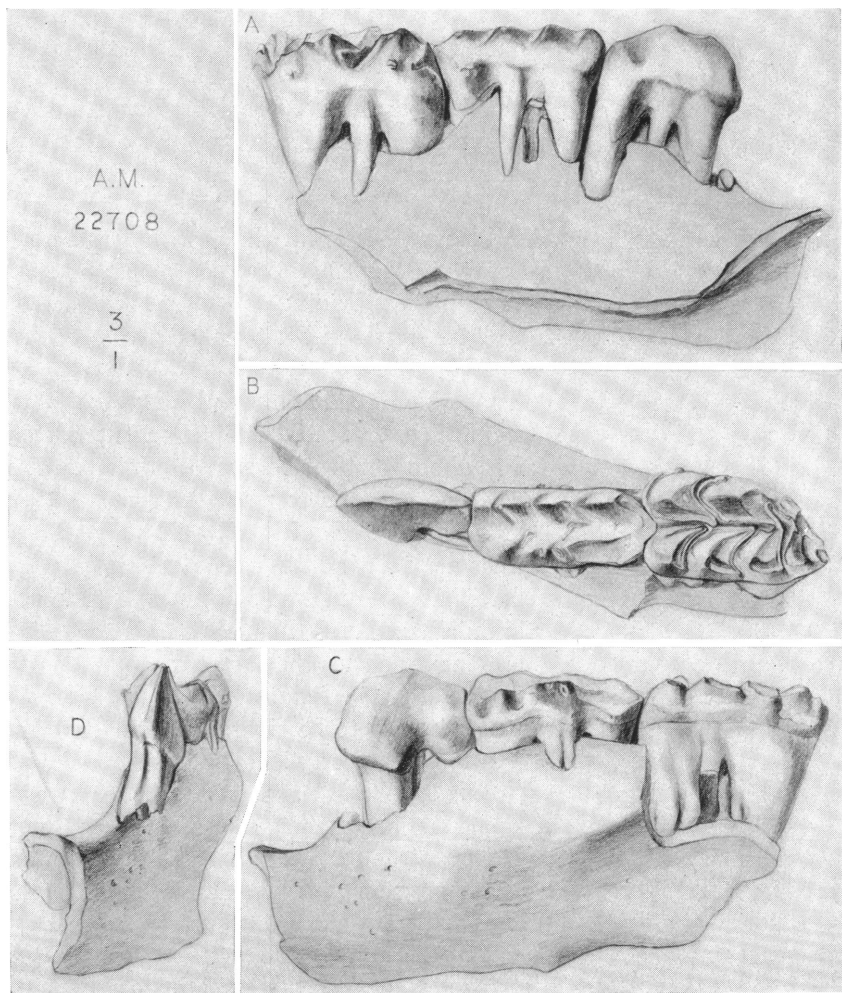


Fig. 1. *Meniscoëssus* sp. Amer. Mus. No. 22708, left lower jaw with  $P_4$ - $M_2$  and root of  $P_3$ . A, internal view. B, crown view. C, external view. D, anterior view. All three times natural size.

by this specimen, and indeed it is doubtful whether these species can ever be properly revised on a positive and direct basis. This specimen is directly comparable only with the types of the three species mentioned above, *robustus*, *lunatus*, and *sculptus*. From the first named it differs in having  $M_2$  nearly as long but markedly narrower. It shows no certainly ascertained differences from the other two, but the preservation is not good enough to warrant the positive conclusion that these two names are synonymous and apply to a species distinct from *robustus* and including the new Montana specimen. In any event the three species are shown to be certainly congeneric and closely related.

The morphology of the separate teeth has already been described in some detail by Marsh, Osborn, and me, and the present specimen adds little of interest in this respect. It is, moreover, well worn, and the surfaces of  $P_4$  and  $M_1$  are corroded or abraded so that their superficial details are not reliable. One point of interest, long known to

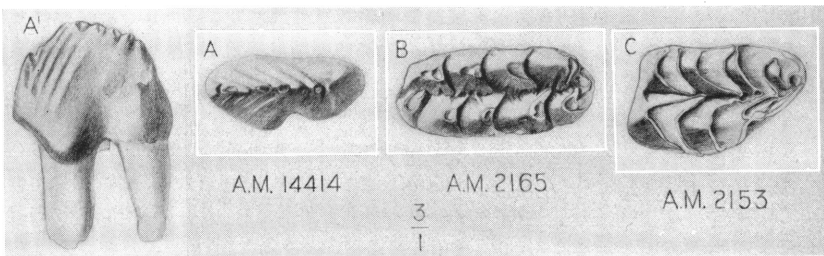


Fig. 2. *Meniscoëssus* sp. Isolated teeth from the Lance of Niobrara County, Wyoming, for comparison with the corroded, less well preserved, but associated teeth shown in Fig. 1. A, Amer. Mus. No. 14414, left  $P_4$ , crown view. A', same, external view. B, Amer. Mus. No. 2165, left  $M_1$ , crown view. C, Amer. Mus. No. 2153, right  $M_2$ , crown view. All three times natural size.

students of multituberculates but not very carefully described in publications is well shown in this specimen: the supernumerary roots of the cheek teeth. Each tooth (except the vestigial  $P_3$ ) is implanted by two stout roots, one anterior and one posterior, each extending the entire width of the base of the crown, but each tooth also has one or more much smaller, cylindrical roots. On  $P_4$  there is only one accessory root, in the middle of the internal side. On  $M_1$  there are two external and two internal accessory roots, and on  $M_2$  one internal and two external,

but one of the latter is imperfectly separated from the main anterior root.<sup>1</sup>

The proportions of  $P_4$ - $M_2$  have not previously been available for any one individual and are very typical in *Meniscoëssus*.  $P_4$  is shorter than either  $M_1$  or  $M_2$ ; in most ptilodontids it is considerably longer than either.  $M_1$  is very slightly longer than  $M_2$ ; in most ptilodontids it is relatively much longer, often twice as long as  $M_2$ .  $M_2$  is wider than  $M_1$ , which is true of most or all ptilodontids but often in less degree.

Osborn (1893) and Osborn and Earle (1895) suggested a close, possibly ancestral relationship between *Meniscoëssus* and the Puerco genus *Taeniolabis*. Granger and Simpson (1929) opposed this view, showing that *Meniscoëssus* is closer to the true ptilodontids and cannot be the ancestor of *Taeniolabis*. The present improved evidence strongly supports this view. *Meniscoëssus* is a ptilodontid with no definitely taeniolabidid characters. It is, however, an isolated genus among Ptilodontidae. Among other characters of *Meniscoëssus*, its relatively small  $P_4$  and relatively large  $M_2$ , the strongly selenodont molar cusps, and the laterally compressed, pointed, completely enameled incisor crown (assuming the collocation made by Osborn to be correct, not yet proven but highly probable) do not resemble any known Paleocene or Eocene genus and almost exclude the possibility of deriving any of the later forms from *Meniscoëssus*. It appears to be a specialized, aberrant Cretaceous ptilodontid. It is perhaps conceivable that a special relationship to some of the poorly known *Eucosmodon*-like forms does exist, but no positive evidence supports this and it is improbable.

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<sup>1</sup> Adherents of the moribund concrescence theory of molar evolution, and perhaps of some other theories, may be tempted to hail these multiple roots as significant support for their views. Without going into detail here, it may be noted that I have studied multituberculate (and other mammalian) roots with care, and that there is no doubt that the condition with just two roots on lower cheek teeth is primary, multiple roots secondary and specialized and that root number and arrangement do not reflect in any direct or simple way the number and arrangement of the cusps.