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AMERICAN EOCENE DIDELPHIDS

BY GEORGE GAYLORD SIMPSON

In 1884, Cope¹ described a didelphid from the Wasatch of the Big Horn Basin, Wyoming, under the name *Peratherium comstocki* (*P. comstockianum* in legend to plate). This long remained the only record of didelphids in the American Eocene. In 1909, however, Matthew² figured two specimens from the Bridger, Middle Eocene, which he considered as marsupial and probably *Peratherium* but did not name. Still more recently Troxell³ has described a Bridger specimen in the Yale Collection, under the name *Herpetotherium marsupium*. He considered this specimen as probably marsupial and suggested that one of Matthew's unnamed specimens (*loc. cit.*, Pl. XLIX, Fig. 4, Amer. Mus. No. 13046) was probably specifically identical. It is the purpose of this paper to correlate these three observations—Cope, Matthew, Troxell; to apply a name to the second specimen of Matthew, and to give some brief remarks on the evolution of the Didelphiidæ in North America.

Didelphids are abundant, indeed predominant, in our known Cretaceous mammalian faunas. In the Paleocene of this country they were supposed to be absent, but the recent work of Matthew and Granger⁴ has shown that they are present in the Puerco (*Thylacodon pusillus*) and in the Tiffany (*Peradectes elegans*). They are rare in the Eocene, about six specimens being recorded from Wasatch and Bridger, but are fairly common in the White River Oligocene. One species is also known in the John Day (*Peratherium merriami*)⁵ but no North American Miocene or Pliocene didelphids have been recorded. It has been customary to draw inferences from this negative evidence and to suppose our didelphids to have a great expansion in the Cretaceous, to be nearly or quite absent in the Paleocene and Eocene, to have another expansion in the Oligocene, and then to die out entirely and to be reintroduced from South America

¹Cope, E. D. 1884. Vertebrata of the Tertiary Formations of the West. Rept. U. S. Geol. Surv. Ter. (Hayden). P. 269, Pl. xxva, Fig. 15.

²Matthew, W. D. 1909. The Carnivora and Insectivora of the Bridger Basin, Middle Eocene. Memoirs Amer. Mus. Nat. Hist., IX. Pp. 339, 540; Pl. XLIX, Fig. 4; Pl. L, Fig. 9.

³Troxell, E. L. 1923. A new marsupial. American Journ. Sci., V, pp. 507-510.

⁴Matthew, W. D., and Granger, W. 1921. New Genera of Paleocene Mammals. Amer. Mus. Novitates, No. 13, p. 2.

⁵Stock, C., and Furlong, E. L. 1922. A Marsupial from the John Day Oligocene, etc. Univ. Calif. Pub. Geol., XIII, pp. 311-317.

in late Pliocene or Pleistocene times. The fact that opossums are small and are largely arboreal should warn one that such conclusions are entirely unwarranted, at least as regards the number of individuals present at a given time. Thus, marsupials were supposed to be absent in the Paleocene, but in the Mason Pocket of the Tiffany beds one of the two most abundant genera is a marsupial. This happened to be a deposit of facies suitable for didelphid preservation. Most of our Tertiary deposits are not so favorable in facies, even supposing the microfauna to be adequately known, which is rarely true.

From the evidence in hand, it is clear that didelphids were present in North America from at least Belly River time until the end of the Oligocene, and that they were abundant in environmental facies suitable for them. They may then have disappeared, but their mere absence in the collections means nothing, and it is much more probable, *a priori*, that they remained in North America continuously to the present time, although unquestionably with fluctuations of northern limit as the climate varied. In the Oligocene, probably the warmest of the Tertiary epochs, they ranged well into Canada, as they had in the warm Belly River. During the glacial episodes they no doubt were forced southward with other animals not strongly resistant to cold.

In the Cretaceous the didelphids were more varied than they have ever been since. Along with some forms of more generalized type, there occurred a great variety of others with numerous differences in the development of individual cusps and clear indications of wide differences of habit. Beginning with the Eocene, however, they become almost stereotyped. After the Cretaceous, the premolars are always of simple, primitive, trenchant type; the lower molars have but one pattern, with the protoconid higher than the metaconid and the latter higher than the paraconid; the upper molars always have the normal *Didelphis*-like contour and have reduced paracones and large metacones. Despite the presence of numerous species, especially in the American and European Oligocene, the fundamental tooth-pattern is monotonously unvaried, and the only observed differences are in size and proportions. Even in the Eocene the only fairly constant known difference between the various species collectively assigned to *Peratherium* and the recent *Didelphis* lies in the proportions of the premolars, P_3 being equal to or larger than P_2 .

The known material illustrates in a rather clear way the evolution of the recent type of didelphid dentition from the more generalized of the various types seen in the Cretaceous, especially those referred to *Pedionomys* in a broad sense. In the lower molars there is little change, save that

only one of the various Cretaceous types of construction survives. The upper molars are more interesting (Fig. 1). In the Cretaceous the paracone and metacone are nearly or quite equal. In the Paleocene *Peradectes* both are well developed, but the paracone is smaller. In the species referred to *Peratherium*, the paracone varies somewhat but is always much reduced and may be quite as small, especially in the later species, as in any recent didelphid. The conules are well and equally developed in the Cretaceous, but are represented at most by vestiges in the later species of *Peratherium* and in the recent didelphids. Although always rather variable and difficult to study because of their rapid modification or effacement by wear, the styler cusps also undergo definite changes. In *Pedionomys* there are five styler cusps, of which the second (external to the paracone) is the least developed and most inconstant. As the paracone is reduced this style becomes increasingly important until in *Peratherium* and in recent didelphids it is the most constant and usually the largest. The first (most anterior) styler cusp, large and independent in the Cretaceous, becomes a mere accessory cuspule on the second. The fourth is generally reduced—it lies along the outer edge of the metastylar spur and nearly opposite the metacone, which is not reduced. This style may be lost altogether, although it is often removed by wear so that loss in some cases is apparent only. The median (third) style, almost always lower than the fourth in the Cretaceous, is retained and may become the largest of all (Fig. 1G).

In passing, it is important to note that the condition with three styler cusps, the middle one largest, which Winge and those who might be called Neo-Wingians consider as extremely primitive, is very clearly a specialized and considerably modified condition in the didelphids, a group on which they place much emphasis.

The three known Eocene species are here placed in the genus *Peratherium*, a genus ranging from upper Eocene to upper Miocene in Europe. A range for a single genus almost through the Eocene, Oligocene, and Miocene seems, at first sight, excessive, but the genus belongs to the most conservative known line of mammals. The only American Eocene species in which upper molars are known, *P. marsupium*, is clearly more advanced than the late Paleocene *Peradectes*, and it is in a *Peratherium* stage of development. None of our Eocene forms shows any definite superspecific distinction from typical *Peratherium*, although more complete material might conceivably show some such difference.

Brief specific revisions follow.

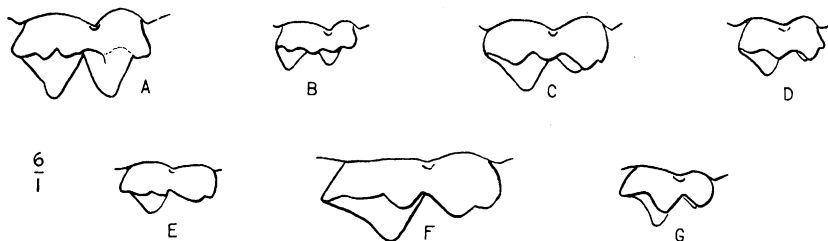


Fig. 1. External views of M^2 right, in various primitive polyprotodonts. A, *Pedimys* sp., Cretaceous. B, *Peradectes elegans*, Paleocene. C, *Peratherium marsupium*, Eocene. D, *Peratherium fugax*, Oligocene. E, *Marmosa chapmani*, Recent. F, *Didelphis* sp., Recent. G, *Phascogale macdonnelensis*, Recent. All $\times 7.5$.

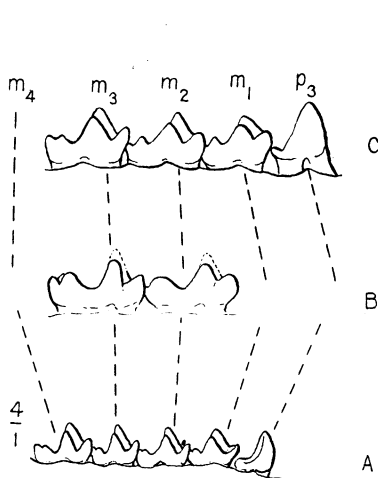


Fig. 2

Fig. 2. Internal views of left lower cheek-teeth of early didelphids. A, *Peradectes elegans*. B, *Peratherium comstocki*. C, *Peratherium marsupium*. All $\times 4$.

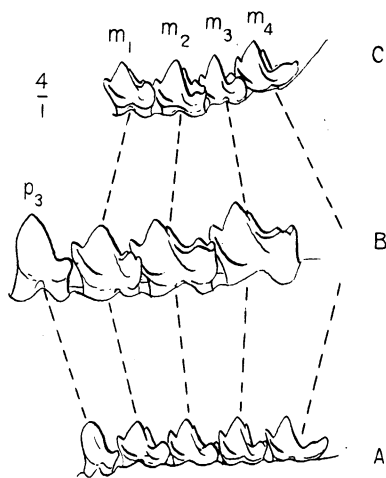


Fig. 3

Fig. 3. External views of left lower cheek-teeth of early didelphids. A, *Peradectes elegans*. B, *Peratherium marsupium*. C, *Peratherium innominatum*. All $\times 4$.

***Peratherium comstocki* Cope, 1884**

TYPE.—Amer. Mus. No. 4252. Part of left lower jaw with broken M_{2-3} . Collected by J. L. Wortman, 1881.

HORIZON AND LOCALITY.—Wasatch, Big Horn Basin, Wyoming.

DIAGNOSIS.—Trigonids low. Cusps blunt. Talonids relatively long. Length M_{2-3} , 6.3 mm.

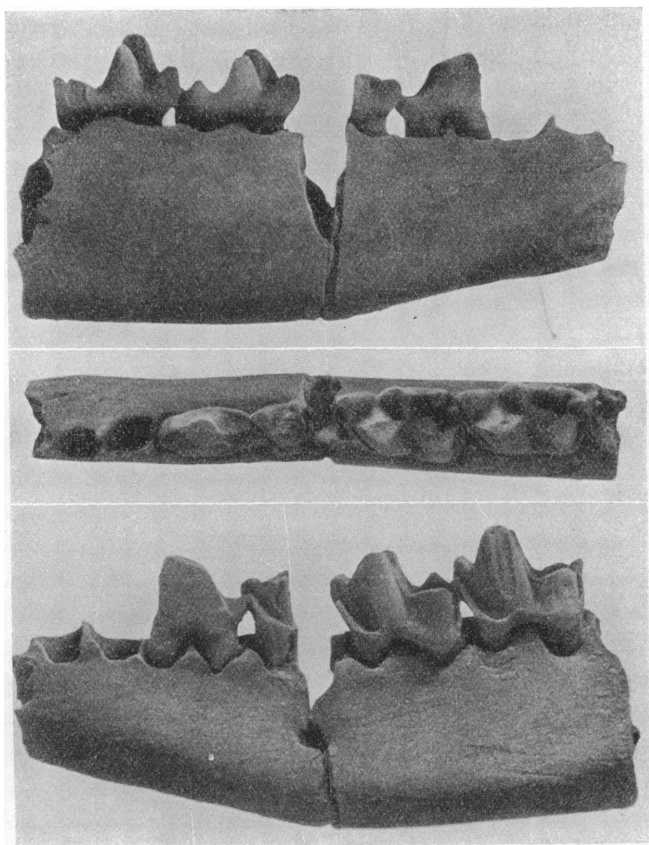
***Peratherium marsupium* (Troxell, 1923)**

Fig. 4. *Peratherium marsupium*. Amer. Mus. No. 13046. Inner, crown, and outer views of left lower jaw with P_3 , M_{1-3} . After Matthew. $\times 6$.

TYPE.—Yale Peabody Museum Cat. No. 13518. Part of right lower jaw with P_3 , M_{1-3} . Collected by J. W. Chew, 1874.

HORIZON AND LOCALITY.—Bridger, Bridger Basin, Wyoming.

DIAGNOSIS.—Low trigonids. Molars close to those of *P. comstocki*, but a little smaller, talonid relatively shorter and entoconid not so stout. Length M_{2-3} , 5.5 mm.

Amer. Mus. No. 13046 (Matthew, 1909, *loc. cit.*, Pl. XLIX, Fig. 4) belongs to this species, as Troxell considered probable. Both Matthew and Troxell considered this form as didelphid, although both with some reserve. No doubt need longer be entertained. The whole molar construction is clearly didelphid (note especially character and position of hypoconulid), and there is no question as to the presence of four molars and three premolars. The upper molars (Fig. 1C) are also obviously didelphid and agree closely with *Peratherium*, less closely with other didelphid genera. The species was referred by Troxell to *Herpetotherium* Cope, but Cope himself came to recognize that there is no valid distinction between this genus and *Peratherium*.

***Peratherium innominatum*, new species**

TYPE.—Amer. Mus. No. 11493, left lower jaw nearly complete, with M_{1-4} . Collected by A. Thomson, 1903.

HORIZON AND LOCALITY.—Lower Bridger, Millersville, Bridger Basin, Wyoming.

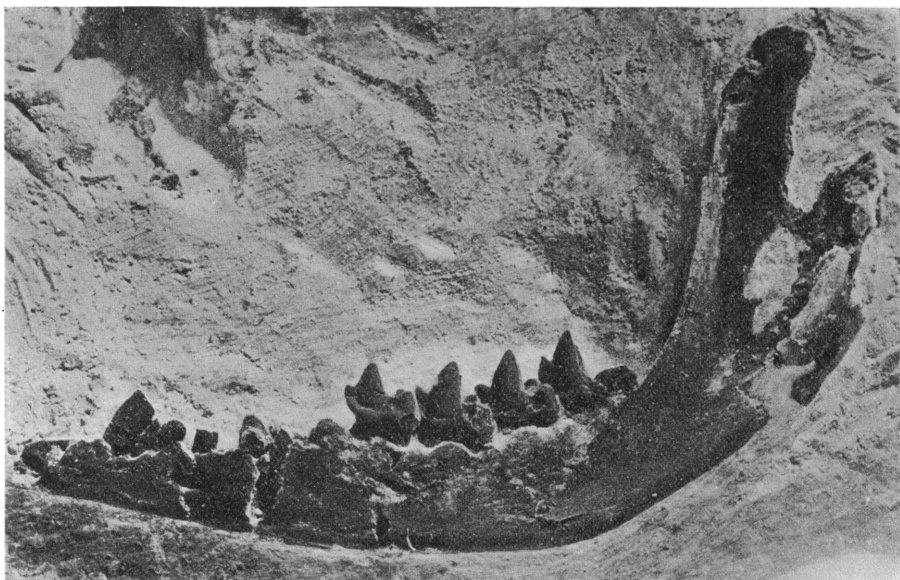


Fig. 5. *Peratherium innominatum*. Type. External view of left lower jaw with M_{1-4} . After Matthew. $\times 6$.

DIAGNOSIS.— $P_3 = P_2$. No diastemata. Molar trigonids high. Talonids, save that of M_3 , short. M_3 longer than preceding teeth and with elongate heel. Coronoid high and slender. Markedly smaller than other Eocene species. Length M_{2-3} about 3.0 mm.

The posterior part of the jaw is crushed, making the coronoid and articular process appear higher than they originally were and crowding the molars somewhat. As noted by Matthew, the jaw is typically didelphid, with strongly inflected angle. There is a mental foramen beneath M_1 and another between P_1 and P_2 .

