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A NEW MAMMALIAN FAUNA FROM THE FORT UNION OF SOUTHERN MONTANA

BY GEORGE GAYLORD SIMPSON

The discovery of a new mammalian fauna in the Paleocene is of considerable interest and importance. Previous knowledge of the mammals of the Fort Union Formation has rested almost altogether on collections made at a single locality in Sweetgrass County, Montana.[1] Although equivalent to the Torrejon of New Mexico in age, the Sweetgrass fauna is of quite distinct facies and is rich in forms not known from the Torrejon. Similarly, the present fauna is probably of nearly or quite the same age as that from Sweetgrass County but is of quite different facies, as confirmed by Dr. Gidley who kindly compared it with the rich and largely undescribed collection in his care.

The discovery of this fauna and its prompt announcement are due to Dr. J. C. F. Siegfriedt of Bear Creek, Montana. The first mammal tooth found, said to be a molar of *Tetraclaenodon*, was found by Dr. Siegfriedt Nov. 5, 1927, and received some attention in the press as it was at first believed to be a primate. On May 10, 1927, Dr. Siegfriedt wrote to Professor Henry Fairfield Osborn regarding his discovery and he later sent his own collection, much enlarged since the first discovery, to this museum where it was cleaned from the stubborn matrix, cast, and photographed. From September 10th to 16th, 1927, Barnum Brown visited this locality and with Dr. Siegfriedt's coöperation examined the occurrence and made a characteristic collection of mammal jaws and teeth. He also shipped to New York a quantity of matrix from which an even larger number of specimens has since been recovered. It is hoped to continue work in this field on a more intensive scale during 1928.

The fossils come from the "bone" layer, so called because of its argillaceous nature and not because it is literally bone-bearing, in the roof of the Eagle Mine, about one mile south of Bear Creek in the Red Lodge Coal Field, Carbon County, in southern Montana. The deposit is just

[1] See especially:
Douglass, E. 1908. Vertebrate Fossils from the Fort Union Beds. An. Carnegie Mus., V, 11–26.
Gidley, J. W. 1909. Notes on the Fossil Mammalian Genus *Ptilodus*, etc. Proc. U. S. Nat. Mus. XXVI, 611–26.
. . . 1915. An Extinct Marsupial from the Fort Union, etc. Ib., XLVIII, 395–402.
. . . 1923. Paleocene Primates of the Fort Union, etc., Ib., LXIII, 1–38.

above coal vein No. 3 of the local field.[1] Mr. Brown states that this coal vein is about 1500 feet above the base of the Fort Union as determined lithologically according to the accepted boundary.

The fauna represented by the American Museum specimens is as follows:

INSECTIVORA
- Nyctitheriidæ, new family.
  - *Protentomodon ursirivalis*, new genus and species.
- Pantolestidæ
  - *?Pentacodon* cf. *inversus* Cope.
- Adapisoricidæ
  - *Leipsanolestes siegfriedti*, new genus and species.

PRIMATES
- Plesiadapidæ
  - *?Plesiadapis* sp.
- Tarsiidæ
  - *Carpolestes nigridens*, new genus and species.

CREODONTA
- Oxyclænidæ
  - *Thryptacodon pseudarctos*, new species.

PLACENTALIA INCERTÆ SEDIS
- *Planetetherium mirabile*, new genus and species.

There are also a number of unidentified isolated teeth, especially incisors, and fragmentary jaws. In the same layer occur many remains of freshwater molluscs, fishes, turtles, champsosaurs, and crocodiles.

In age the fauna is clearly Paleocene and post-Puerco. There is some suggestion that it is later than the Sweetgrass County mammalian fauna from the same formation. *Plesiadapis* and *Thryptacodon* have not hitherto been recorded earlier than the Tiffany—Clark Fork, but neither reference is sufficiently certain to be impelling. *Protentomodon*, *Leipsanolestes*, and *Carpolestes* also find their closest allies in definitely post-Torrejon faunas, but their apparent absence in the Torrejon and Sweetgrass County Fort Union may well be due to lack of discovery only, as all are minute. *Pentacodon* is a Torrejon genus, but the reference is not certain and members of the same family with very similar molars also occur in the lower and middle Eocene.

Large animals and especially ungulates are so far noticeable by their almost total absence. The fauna is that of a heavily forested and swampy region.

[1] See Woodruff, E. G. 1909. The Red Lodge Coal Field, Montana. U. S. Geol. Surv., Bul. 341, p. 92–107.

The drawings in this paper are by John German.

Nyctitheriidae, new family

PROVISIONAL DIAGNOSIS.—Antemolar teeth relatively little specialized. Symphysis long and slender, not fused. P_4 not molariform. Lower molars tuberculosectorial, Trigonid notably higher than talonid, with slender, sharp, angulate cusps. Paraconid present, but smaller than other trigonid cusps. Talonid low, basined, with strong entoconid and hypoconid but hypoconulid sometimes small or absent. Heel of M_3 little if any longer than that of preceding molars. Upper molars basically tritubercular, but with hypocone. Paracone and metacone not definitely lambdoid.

TYPE.—*Nyctitherium* Marsh, Wasatch and Bridger.

REFERRED GENERA.—*Entomacodon*, Wasatch and Bridger; *Centetodon* and *Myolestes*, Bridger; *Protentomodon*, Fort Union; and possibly some other Eocene and perhaps Oligocene genera.

Various genera of this group have been referred to the Talpidæ, Chiroptera, Zalambdodonta, Leptictidæ, and Soricidæ. So far as known, however, all show definite differences from any of these groups. It seems probable that most or all of them are soricomorphs. Matthew in 1909 referred them to the Talpidæ, although questioning the correctness of this reference. Later he abandoned this view and referred *Nyctitherium* to the "?Soricoidea or Chiroptera." In either case they represent a new family, the structure of the antemolar teeth excluding them from the Soricidæ, the molars, especially the uppers, from either Talpidæ or Soricidæ, and the character of the anterior part of the mandible from any family of chiropterans.

It is not certain that all the poorly known genera provisionally referred to this family are really very close relatives of *Nyctitherium*, but the structure of the lower molars is so similar that such a convenient arrangement has much to commend it. It seems possible in the absence of really adequate evidence that the nyctitheriids have much the same relationship to the soricomorphs as that of the leptictids to the erinaceomorphs.

Protentomodon ursirivalis,[1] new genus and species

(Figure 1)

TYPE.—A. M. No. 22164, left ramus with M_{2-3}.

TOPOTYPE.—A. M. No. 22173.

CHARACTERS.—On M_{2-3} the trigonid is lofty, elevated well above the heel, its cusps acute and angulate. The metaconid is anterointernal to the protoconid and is large, although on M_3 and probably also M_2 it was apparently not quite as high as the protoconid (it is broken or worn off in the type but another specimen, probably refer-

[1] πρῶτον, first; ἔντομον, insect; ὀδούς, tooth—i.e. an ancient insectivore. *Ursus*, bear; *rivalis*, creek—from the locality.

able to this genus, shows it clearly). Although distinct and pointed, the paraconid is low and is median on the tooth, united by a sharp ridge to the protoconid. The heel of M_2 is short, low, about as wide as the trigonid. It has a basin surrounded by a sharp raised rim which is continuous and bears the entoconid, hypoconulid, and hypo-

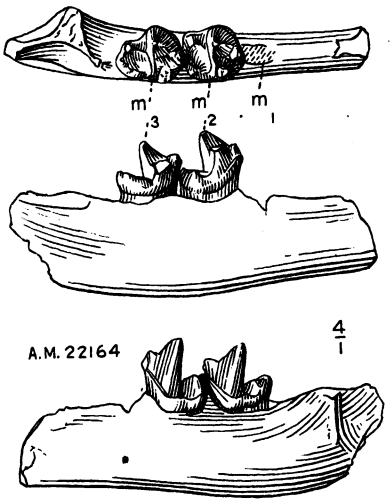

Fig. 1. *Protentomodon ursirivalis*, new genus and species. Crown, inner, and outer views of type. Four times natural size.

conid as elevations of about equal prominence. The hypoconulid is somewhat closer to the hypoconid. The heel of M_3 is narrower and longer and its hypoconulid is truly median and is elevated above the other cusps, which are indistinct. On both posterior molars a cingulum runs sharply downward and externally from near the paraconid and then around the external base of the protoconid. The jaw is very slender and elongate, with the posterior mental foramen beneath M_1.

Fig. 2. *?Pentacodon* cf. *inversus* Cope. Crown view of M^1 right. Four times natural size.

Pantolestidæ

?Pentacodon cf. inversus Cope

(Figure 2)

A. M. No. 22175, a right upper first molar, is tentatively referred to the Torrejon genus *Pentacodon*. It is a transversely elongate tritubercular tooth with sharp angulate cusps. Paracone and metacone are subequal and slightly connate at the base. There is a sharp external cingulum, somewhat expanded opposite the metacone, but without a definite metastyle or mesostyle. The parastyle is very small and almost directly anterior to the paracone. There are distinct, equal conules. The protocone is large, equal to the external cusps in height, and crescentic. Its apex points slightly forward and it has a long internal slope. There is a small anterior cingulum not forming a definite protostyle

("ectocone" of Teilhard). The posterior cingulum is wide, basined, and projects well inward. The highest point of its rim corresponds to the hypocone although it is not definitely free and cusp-like. It is low on the crown.

This tooth is referred to the Pantolestidæ chiefly on the basis of its fairly close resemblance to *Palaeosinopa* of the Wasatch. It is referred to *Pentacodon* because this is the only genus of similar age so far known in this family and because M_1 agrees as far as can be determined from the imperfect material. There are two species of *Pentacodon* in the Torrejon, *P. inversus* and a second, undescribed, more robust species. The upper teeth of *P. inversus* are unknown, but there is a specimen of the other species which appears to show its upper dentition, although in a poor state of preservation. There is an admixture of several genera, but the upper jaw fragment probably is naturally associated with the lower jaw of *Pentacodon* sp. ined. for it is of appropriate size, could not belong with the other genera present, has the same peculiarly enlarged P^4, and is closely similar to *Palaeosinopa* which was already believed on other grounds to be an ally of *Pentacodon*. The Fort Union tooth is smaller than the corresponding one of this specimen in the same ratio as the lower teeth of *Pentacodon inversus* are smaller than those of *P.* sp. ined. The Fort Union specimen therefore cannot be proven to be distinct from *P. inversus*, although directly comparable material will probably show that it is different specifically.

The resemblance of this tooth to the Oxyclænidæ on the one hand and to the Leptictidæ on the other and the absence of good figures of pantolestid upper molars in the literature may lead to this reference's being questioned. There are excellent examples of the pantolestid upper dentition in our collection, however, and direct comparison shows that the Fort Union tooth differs as much from oxyclænids and leptictids as do the other pantolestids and in just the same way.

Adapisoricidæ

Two groups of Paleocene and Eocene mammals have been referred to the Menotyphla. One of these, the Plesiadapidæ, has little actual resemblance to recent menotyphlans but has molars of tarsioid type accompanied by greatly enlarged median teeth and reduction of the other ante-molar teeth. The morphological grounds for referring this family to the Menotyphla seem very equivocal, and I am inclined to agree with Stehlin, Gidley, and others in considering them as true primitive primates. There are a few minute forms, however, especially *Adapisorex* of the Thanetian (upper Paleocene), *Entomolestes* of the

Wasatch and Bridger (lower and middle Eocene), and *Leipsanolestes*, new genus, of the Bear Creek Fort Union (middle or upper Paleocene), which show a positive morphological resemblance to the Tupaiidæ and no differences which separate them markedly from this recent family. In view of the somewhat inadequate nature of the material, these genera are here retained in the family Adapisoricidæ, but further discovery may well show that this family is not distinct from the Tupaiidæ.[1] The hope of throwing further light on the early history of this very important group is one of the greatest incentives for further collecting at the Bear Creek locality.

Leipsanolestes siegfriedti,[2] new genus and species

(Figure 3 and 3A)

TYPE.—Amer. Mus. No. 22157, part of right ramus with M_{2-3}.

TOPOTYPES.—Amer. Mus. Nos. 22158, 22177, 22178, 22174, 22179.

CHARACTERS.—Lower molars with trigonid little elevated above talonid. Paraconid small, internal, not elevated but forming the end of an anterior ridge from the protoconid. Protoconid and metaconid acute, opposite, subequal or metaconid

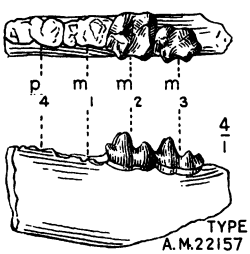

Fig. 3. *Leipsanolestes siegfriedti*, new genus and species. Crown and inner views of type. Four times natural size.

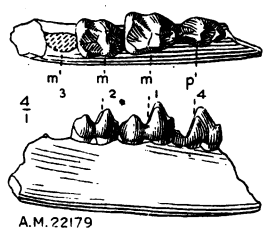

Fig. 3A. *Leipsanolestes siegfriedti*, new genus and species. Crown and inner views of A. M. No. 22179. Four times natural size.

slightly larger on M_{2-3}. M_{1-2} without definite hypoconulid but with strong hypoconid and entoconid, the latter much larger but not as high as the metaconid. M_3 with distinct median hypoconulid, posterior to hypoconid and entoconid, nearer the former in height, the entoconid being higher, as in other molars. P_4 submolariform, but compressed, with small metaconid and rudimentary paraconid. Internal part of heel of P_4 very narrow, with shallow basin, rising to a single posterior point. External part of heel a long, steep slope outward. Size of species minute, $M_{2-3}=3.1$ mm. in type.

[1] *Adapisoriculus* of the Thanetian has nothing to do with this group, being a didelphid as suggested by Teilhard and confirmed by a study of the known material through the kindness of Professors Boule and Depéret.

[2] λείψανον, remnant; λῃστής, robber—in allusion to the fragmentary nature of the material. The species is dedicated to Dr. J. C. F. Siegfriedt, discoverer of the fauna.

Plesiadapidæ

?Plesiadapis species undetermined

(Figure 4)

This genus is apparently represented by a third lower left molar. This tooth agrees very closely with *Plesiadapis gidleyi*[1] save in being a little larger. It differs from *Pronothodectes matthewi* Gidley of the Sweetgrass County Fort Union in being nearly twice as large and more complex than M_3 of this species, although the difference in complexity may be due in part to wear in Dr. Gidley's material. In size it agrees most closely with the very badly preserved plesiadapid M_3 from the Paskapoo.[2] The presence of this tooth is one of the facts which suggest but do not prove that the Bear Creek fauna is later in age than that from Sweetgrass County.

Fig. 4. *?Plesiadapis* sp. indet. Crown view of M_3 left. Four times natural size.

Tarsiidæ

Carpolestes nigridens,[3] new genus and species

(Figure 5)

TYPE.—Amer. Mus. No. 22159, right ramus with P_4, M_{1-2}.

CHARACTERS.—P_4 is high, laterally compressed, trenchant. Along the ascending anterior edge there are five projections below each of which there is a short vertical ridge on both lateral faces. The apex is broken in the type, but was apparently formed by a sixth, more prominent cusp. Back of this was another accessory cusp in the same longitudinal series and at the posterior end is another cusp, apparently the eighth, on about the same level as the paraconid of M_1. The base of the tooth extends far down, especially externally. There is a discontinuous cingulum internally, rising to a median point.

The trigonid of M_1 is much modified and continues the shearing edge of P_4. The paraconid is directly anterior to the protoconid and nearly as high, and both are median on the tooth. The metaconid is small and is on the posterointernal slope of the protoconid. There is a small basined heel, the inner rim lower than the outer, the fairly prominent hypoconid connected by an oblique crest with the metaconid. M_2 has an unusually small basined trigonid, considerably narrower and shorter than the talonid. Paraconid and metaconid are internal, with connate bases, the paraconid somewhat the smaller. The protoconid is lower than the internal cusps. The heel is large and well basined, with distinct, subequal hypoconid and entoconid, but apparently no hypoconulid. M_3 is absent, but its alveoli show it to have been a small tooth with an elongate heel.

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[1] *Nothodectes gidleyi* Matthew. The recent work of Father Teilhard de Chardin seems to leave no grounds for generic separation of *Nothodectes* and *Plesiadapis*.

[2] Amer. Mus. Novitates No. 268, p. 4. I was in Europe when the figures were prepared for this paper and they were accidentally mislabeled. In Fig. 4, C is M_3 right, broken posteriorly, and E is M_1 left.

[3] Καρπός, fruit; λῃστής, robber—in allusion to probable habits and in symphony with *Carpodaptes*, a close relative. *Niger:* black; *dens*, tooth—literally true of all these coal fossils.

The coronoid arises outside the posterior end of M_3. The horizontal ramus is rather deep and short, with the posterior mental foramen between P_3 and P_4. The angle is largely preserved and is not inflected, but projects downward and backward.

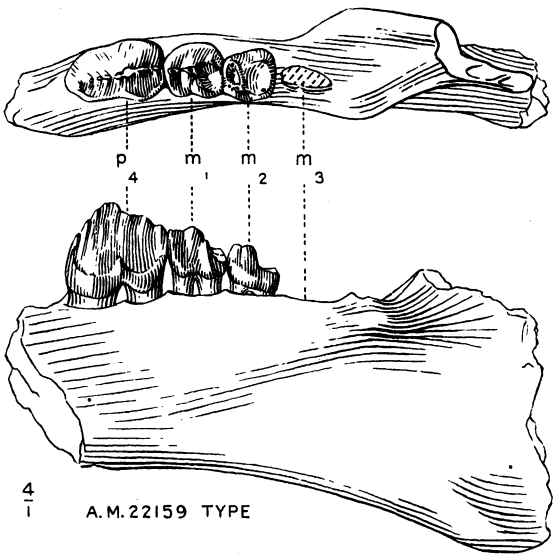

Fig. 5. *Carpolestes nigridens*, new genus and species. Crown and inner views of type. Four times natural size.

There is only one other known genus which is readily comparable with this odd animal: *Carpodaptes* of the upper Paleocene (Tiffany = Thanetian) of southwestern Colorado.[1] The resemblance between the two is so striking that they must be closely related. Besides its greater size, *Carpolestes* differs from *Carpodaptes* chiefly in the more specialized P_4, with a greater number of cuspules, the last one less distinct, less definitely heel-like, higher on the crown. M_{1-2} are almost identical in structure. In *Carpodaptes* M_3 is known and it has an elongate bilobed heel of typical tarsioid type. Despite their clear affinity with each other, *Carpolestes* and *Carpodaptes* are very peculiar and their relationships with other established genera are not obvious.

At first sight they offer a striking resemblance to certain fossil South American Cænolestoid marsupials, but a study of the molar and other characters shows that this is entirely superficial. Trenchant grooved teeth of this general type have been evolved quite independently at least

[1]Matthew, W. D. & Granger, W. 1921. New Genera of Paleocene Mammals. Amer. Mus. Novitates, No. 13, p. 6.

four times: In the multituberculates (P_{2-4} in Plagiaulacidæ, P_4 in Ptilodontidæ), in the Cænolestoids (Abderitinæ and Polydolopidæ, M_1), in the Macropodidæ (Several genera, P_3), and in *Carpolestes* and *Carpodaptes* (P_4). In the first three cases this character has often been seized on as indicative of special affinity, although the shearing teeth are not homologous and the resemblance not very close. In the present case we can fortunately avoid such an error from the beginning. This striking exemplification of convergent evolution of a single character must be due to community of food habits, probably to a diet of roots, grasses, seeds, small nuts, and fruits.

In describing *Carpodaptes*, Matthew and Granger said, "Molars fundamentally of tarsioid type, but considerably specialized in various respects," and as an added remark, "This form cannot be definitely assigned to any family or order; it may be a primate or a menotyphlan insectivore, or neither."

Aside from the modification for shear, which affects only the trigonid of M_1, the molars are of a definite, ordinally specialized type which among all mammals, living or extinct, occurs only in primates or in certain forms sometimes referred to the Menotyphla but more like the Eocene primates and in any event essentially forming a broad unit with the latter. If this were a less exact sort of resemblance or a type of structure occurring in two or more unrelated groups, it could not be considered as special evidence of affinities, but since the contrary is true it can hardly be otherwise considered. Specifically the resemblance is with the Plesiadapidæ and the Tarsiidæ (Anaptomorphidæ) of the Paleocene of North America and Europe.

Carpolestes may possibly have a gliriform lower incisor, like some plesiadapids, although this is uncertain. *Carpodaptes* had three small, one rooted, button-like premolars in front of the enlarged shearing tooth. The anterior one was crowded externally by the large canine, and there was no truly gliriform incisor, none with the root extending back beneath the premolars. The presence of the canine, reduction of premolars in size but not in numbers, and absence of a very long-rooted incisor clearly excludes this genus from the Plesiadapidæ, and *Carpolestes* is certainly closely allied, whether it had a gliriform tooth or not. Enlarged incisors do occur among tarsiids, although not characteristic of the family.

As further evidence of the tarsiid nature of *Carpolestes* and of its entire distinction from the convergent cænolestoids are to be cited the short jaw with robust symphysis, the tarsioid and *non-inflected* angle (almost completely preserved in the type), and the fact that the stages of

transition from a normal P_4 to this highly specialized one are clearly shown in known Paleocene and Eocene tarsiid genera. In several Eocene forms P_4 is much enlarged and shearing, although not much compressed or grooved, e.g., in *Tetonius*, *Absarokius*, *Uintanius*. In the Sweetgrass Fort Union *Elphidotarsius*, which in the known parts furnishes a good morphological ancestry for *Carpodaptes* and *Carpolestes*, P_4 is more compressed and has four apical cusps nearly in an anteroposterior series and a low heel with one cusp, while the trigonid of M_1 is also markedly compressed. In *Carpodaptes* P_4 is larger, slightly more compressed, the four apical cusps are in a more nearly linear series, and the heel is higher and narrower. In *Carpolestes* P_4 is still larger, the number of cusps is greater, and heel is even narrower and higher than in *Carpodaptes*. In all the molar structure is almost identical, save that in the most strongly trenchant types the paraconid of M_1 becomes more directly anterior to the protoconid.

Perhaps the greatest peculiarity of *Carpodaptes*, in view of its manifest relationship to the tarsiidæ, is the character of the small button-like P_{1-3} which is also convergent towards the cænolestoids. But these premolars are often reduced in size in the Tarsiidæ and the character is certainly not of family value.

With due reservation for the possible influence of future discoveries, the evidence in hand seems fully to warrant the positive conclusion that *Carpolestes* and *Carpodaptes* represent an aberrant early stirps of the Paleocene and Eocene group commonly referred to the Tarsiidæ.

Oxyclænidæ

Thryptacodon pseudarctos[1], new species

(Figure 6)

TYPE.—A. M. No. 22176, isolated M^2 right.

CHARACTERS.—M^2 is subquadrate, consisting of a trigon of low, blunt cusps, surrounded by a strong, continuous but irregular cingulum which rises to form a large hypocone posterior and somewhat internal to the protocone. The cusps of the trigon are united by ridges and enclose a triangular basin. The ridge between paracone and metacone is low and sharp, but the union of protocone with the external cusps is chiefly by the conules, which are small but distinct. The transverse space occupied by the metaconule is somewhat greater than that of the paraconule, but the former is no higher. In our specimen it is distinctly double. It does not project posteriorly and is far from the edge of the tooth. The hypocone is as high as the trigon cusps. The enamel of the crown is coarsely rugose.

[1] ψευδής, false; ἄρκτος, bear—in allusion to the somewhat bear-like molars. On *Thryptacodon* see Matthew, 1915, Bul. Amer. Mus. Nat. Hist., XXXIV, p. 7-13.

This tooth differs from the homologous ones in the two Wasatch species in many details. Most marked is the fact that in the latter the metaconule is single and enlarged, breaking the symmetry of the trigon. The trigon cusps are also more separate and the ledge around them narrower, but the resemblance to *T. pseudarctos* is certainly close and there is insufficient evidence in this one tooth for generic separation. *Thryptacodon* also occurs in the Tiffany, upper Paleocene, but the Tiffany form is equally distinct from the present one.

Fig. 6. *Thryptacodon pseudarctos*, new species. Crown view of type, M^2 right. Twice natural size.

Arctocyonides Lemoine from the Thanetian of Cernay-les-Reims is very closely allied to *Thryptacodon* Matthew, and the differences may not be of more than specific value. In some respects the Fort Union tooth is closer to the M^2 of *Arctocyonides* figured by Teilhard (Ann. de Paleont., XI, Pl. 1, fig. 23) than to any species certainly referred to *Thryptacodon*, but until better material is available it seems best to place it in the American genus.

Placentalia Incertæ Sedis

Planetetherium mirabile,[1] new genus and species

(Figures 7–9)

TYPE.—Amer. Mus. No. 22162, left ramus with P_{3-4} and M_1.

PARATYPE.—Amer. Mus. No. 22161, left ramus with P_4 and M_{1-3}.

TOPOTYPES.—Amer. Mus. Nos. 22151, 22165, 22170.

CHARACTERS.—P_3 is submolariform, with the trigonid sharply compressed laterally trenchant, about the same height as the molar trigonids. The paraconid is small and anterointernal to the protoconid. The metaconid is represented only by an almost imperceptible rudiment, posterointernal to the protoconid and lower on the crown than the paraconid. The heel is shorter and narrower than in the more fully molariform teeth and is basined.

The trigonid of P_4 is but little elevated above the talonid and has three distinct cusps. The protoconid and metaconid are nearly equal and opposite. The paraconid is slightly smaller and is a little external relative to the metaconid, but not median on the tooth. The heel is slightly broader than the trigonid, nearly as long, and is deeply basined. The entoconid is distinctly higher than the hypoconid and has a minute accessory cusp, or incipient duplication, immediately anterior to it. A small median hypoconulid is present. The enamel of P_4 and of the true molars is crenulated, especially in the talonid basins, the degree of crenulation varying somewhat in different individuals.

M_{1-2} are subequal. The trigonids are formed by the opposite and nearly equal protoconid and metaconid, the paraconid being represented only by a minute median

[1] *πλανήτης*, wanderer; *θηρίον*, beast. *Mirabilis*, strange.

cusp on the anterior border of the tooth between the protoconid and metaconid. On M_1 of the paratype even this vestige can hardly be distinguished, possibly because of wear. The heels are like that of P_4 but somewhat larger.

M_3 is slightly smaller than the preceding tooth but its trigonid has the same structure. The heel has the entoconid and hypoconid united by a low ridge and the entoconid slightly the larger, as in the preceding teeth, but the heel is elongated, with the hypoconulid extending far back of the talonid basin as a spur.

As shown by alveoli in the type, P_{1-2} were present and P_2, at least, was about as long as P_3. None of the incisor roots extends back beneath the premolars and there is no diprotodont or rodent-like specialization.

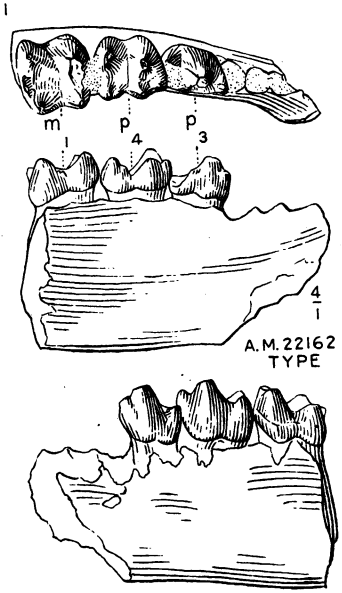

Fig. 7. *Planetetherium mirabile*, new genus and species. Crown, inner, and outer views of type. Four times natural size.

Two upper teeth, P^4 (Amer. Mus. No. 22168) and probably M^2 (Amer. Mus. No. 22160) are referred to this genus. The bases for this reference of isolated teeth are agreement in size, correct occlusional possibilities, similar crenulation of the enamel and the more general facts that *Planetetherium* is the most abundant genus in the collection and that no other known from lower jaws could include these upper teeth. The association is not proven, but it is highly probable.

P^4 has paracone and metacone separate, equal, but with connate bases. Parastyle and metastyle are small but distinct and do not project externally. There is no external cingulum. The protocone is lower than the external cusps and projects anterointernally. It is united to the paracone only by a low ridge and there are no conules. The apex of the protocone is inclined forward. M^2 has similar equal, subconical paracone and metacone and a lower, blunt protocone inclined anteriorly.

The conules are distinct and tend to form ridges uniting the protocone to the external cusps. There is a strong metastyle posteroexternal to the metacone and from it a sharp nodulated cingulum extends around the external and anterior sides of the tooth, forming a small parastyle immediately anterior to the paracone. There is also a narrow posterior cingulum, not extending onto the base of the protocone.

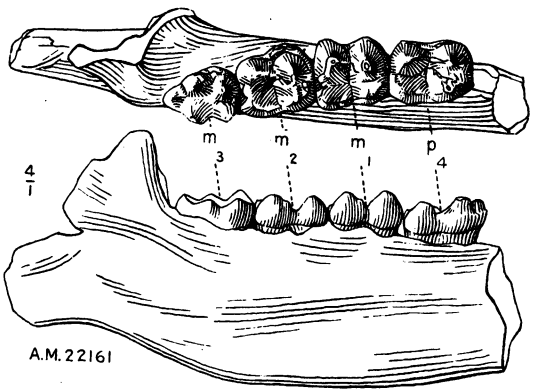

Fig. 8. *Planetetherium mirabile*, new genus and species. Crown and inner views of paratype. Four times natural size.

Planetetherium is the most abundant element in the Bear Creek fauna so far as may be judged by the present collection. Its relationships are obscure and I do not know any genus with which detailed comparison is possible. At first sight the presence of four molariform teeth might suggest the Marsupialia, but this is readily shown to be an erroneous impression. In the type, P_4 is slightly less worn than P_3 and belongs to the same series in regard to degree of protrusion. In the paratype P_4 is slightly less worn than M_1 and is at a definitely lower level, not belonging to the molar series in regard to protrusion. These facts, confirmed by all of our material, seem to prove beyond reasonable doubt that this tooth was erupted after M_1, that it belongs to the premolar series, and that it cannot be either the first true molar or the last deciduous premolar—and hence that the animal cannot be a marsupial. P_4 is not fully molariform and in molarization as well as in indications of relative time of eruption it agrees very closely with many placentals in which the posterior premolars are becoming molariform. There is no more reason for referring *Planetetherium* to the marsupialia on this ground alone than for similarly treating *Tetraclænodon*, for instance.

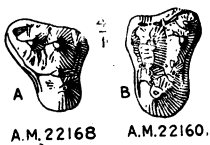

Fig. 9. *Planetetherium mirabile*, new genus and species. A, P^4 right. B, M^2 left. Four times natural size.

The molar structure is equally placental. No molars at all close to these morphologically are known in any group of marsupials. Among placentals similar upper and lower molars occur in Paleocene or Eocene forms belonging to at least four orders: Primates, Insectivora, Creodonta, Condylarthra. This widespread occurrence of the same general molar structure combined with the many peculiarities of *Planetetherium* in detailed generic character make it impossible to assign it definitely to any order or family at present and it must be left as a placental of uncertain affinities until more evidence is forthcoming.

Incisors

(Figures 10–14)

In the same bed as the teeth and jaws described above there occur many isolated incisors. These cannot be definitely classified or correlated with cheek teeth as yet, but they are of some importance morphologically and seem to warrant brief descriptions and figures.

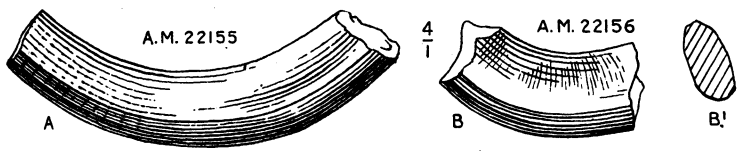

Fig. 10. Incisors. A, More slender, less strongly curved gliriform type. B, Stouter, more strongly curved gliriform type. B', Same as B, end view. Four times natural size.

A number of these are truly gliriform, arcuate, rootless or nearly so, with limited enamel band. Although rodent-like, they probably did not belong to rodents, as these did not arrive in America until the beginning

Fig. 11. Incisor. Four times natural size. Natural facet of wear preserved, to right in figure. Four times natural size.

of the true Eocene (Wasatch) so far as known. Furthermore they are not closely similar to Eocene rodent incisors in detail but resemble the incisors of *Eucosmodon*, a multituberculate, more nearly. They probably belong to multituberculates, although not to any otherwise known species of *Eucosmodon*. Cheek teeth of multituberculates are quite lacking in

the collections so far, and it is possible that these incisors, or some of them, belong rather to forms similar to the plesiadapids or tarsiids. The slightly larger, more arcuate incisors (Fig. 10B) are very like some of the "chryomyoid" incisors from the European Eocene figured by Stehlin.

The next three incisors figured belong to insectivores or primates. One, resembling a plesiadapid lateral upper incisor, has a hook-like main cusp with a posterior basal cuspule and a suggestion of an antero-internal basal cusp (Fig. 12A). Another, (Fig. 12B) probably a median

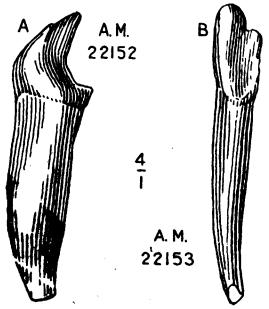

Fig 12.

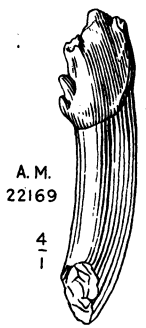

Fig. 13

Fig. 14

Fig. 12. Incisors. Four times natural size.
Fig. 13. Incisor. Four times natural size.
Fig. 14. Incisor cf. *Labidolemur*. Twice natural size.

incisor, is less recurved, without a basal cusp, but with a strong external accessory cusp. The third (Fig. 13) has an excavated posterior surface, without a basal cusp, with one accessory cusp and a suggestion of a second below the main apex on the median side and three distinct cuspules or decreasing size down the lateral side.

A last type of incisor (Fig. 14) has a long, closed, enamel-free root and a completely enameled, pointed, upward curved crown with a flat inner surface, convex outer surface, and concave upper working face. This closely resembles the lower incisor of *Labidolemur soricoides* from the Tiffany and is probably related if not actually representative of the same genus. No cheek teeth resembling those of *Labidolemur* are as yet present in our collection.