

AMERICAN MUSEUM NOVITATES

Number 376

Published by
THE AMERICAN MUSEUM OF NATURAL HISTORY
New York City

Oct. 7, 1929

56.9 (1181:51.7)

ADDITIONS TO THE FAUNA OF THE GASHATO FORMATION OF MONGOLIA¹

BY W. D. MATTHEW, WALTER GRANGER, and GEORGE GAYLORD SIMPSON

In 1923 a small collection of fossil mammals was made from the Gashato Formation, which unconformably overlies the Djadokhta Formation near Shabarahk Usu in the Gurbun Saikhan Basin, north of the eastern end of the Altai Mountains. This collection was described in 1925.² In that year a second, larger collection was made from these beds, including the remains of five new genera and six new species. The multituberculates have already been discussed,³ and preliminary descriptions of the remaining new forms are given in the present paper. A revised faunal list follows:

MULTITUBERCULATA

Tæniolabididæ

Prionessus lucifer Matthew and Granger, 1925

Sphenopsalis nobilis Matthew, Granger, and Simpson, 1928

?INSECTIVORA

?Leptictidæ

Praolestes nanus, new genus and species

Inc. sed.

Pseudictops lophiodon, new genus and species

?GLIRES

Eurymylidæ, new family

Eurymylus laticeps Matthew and Granger, 1925

CREODONTA

?Oxyclænidæ

Hyracolestes ermineus Matthew and Granger, 1925

?Hyænodontidæ

Opisthopsalis vetus, new genus and species

Inc. Sed.

Sarcodon pygmæus Matthew and Granger, 1925

?CONDYLARTHRA

Inc. sed.

Phenacolophus fallax Matthew and Granger, 1925

¹Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 93.

²Matthew, W. D., and Granger, W. Amer. Mus. Novitates, No. 189.

³Matthew, W. D., Granger, W., and Simpson, G. G. 1928, Amer. Mus. Novitates, No. 331.

AMBLIPODA

Uintatheriidae

Prodinoceras martyr, new genus and species

NOTOUNGULATA

Arctostylopidae

Palæostylops iturus Matthew and Granger, 1925

Palæostylops macrodon, new species

On the basis of the first collection, Matthew and Granger (1925, pp. 1-2) concluded that "the presence of a multituberculate suggests Paleocene or late Cretaceous age; the ancestral relationship of *Palæostylops* to the Wasatch genus *Arctostylops* is indicative of Paleocene, Torrejon or possibly older age. The remaining genera throw no light upon the correlation . . . but they are not incongruous with a Paleocene fauna, although not representing the ancestral relationship to the Eocene faunæ of Europe and America that had been anticipated."

Most of the mammals of the Gashato appear to represent phyla previously unknown. From the standpoint of European and American early Tertiary mammals they are aberrant, and, despite their early age and primitive stamp, they are for the most part too specialized and peculiar to cast much light either on phylogeny or on correlation.

Including multituberculates, creodonts, and ungulates of archaic character, the fauna is, however, definitely of Paleocene type. As previously noted, *Palæostylops* is clearly allied to the Wasatch *Arctostylops* and is slightly less advanced than the latter. To this is now added the still more definite evidence of *Prodinoceras*, which is closely related to an undescribed genus from the Clark Fork, uppermost Paleocene, of Wyoming. *Prodinoceras* may be a little more advanced than the Clark Fork genus, but this would not necessarily militate against their essential contemporaneity, especially if, as seems probable, Mongolia was closer than Wyoming to the center of origin of the uinatheres. Rodents do not occur in the American or European Paleocene, but *Eurymylus*, even if it prove to be a true rodent, is not nearly related to any other known genus and the earlier presence of the Order in Mongolia would not be anomalous.

More exact correlation of so peculiar an assemblage cannot now be definitively made, but the rather specialized nature of its members and the relationship of *Prodinoceras* to the Clark Fork genus suggest that it belongs in the later Paleocene.

The known Paleocene mammal horizons of the world may be tentatively correlated as follows:

	North America				Europe	Asia
Upper	Tiffany	Clark Fork	Fort Union	Paskapoo	Cernaysian	Gashato
Middle	Torrejón					
Lower	Puerco					

The drawings in this paper are by John Germann.

Praolestes nanus, new genus and species

TYPE.—Amer. Mus. No. 21718, part of left lower jaw with last premolar and first two molars.

CHARACTERS.—Last premolar moderately compressed, with sharp, recurved main cusp, distinct anterointernal accessory cusp, very inconspicuous cuspule on posterointernal slope of main cusp, and well developed but unbasined heel with a single cusp. M₁ with only one heel cusp and no true talonid basin; trigonid about as long as broad, with high protoconid, low paraconid, and intermediate metaconid. M₂ with anteroposteriorly compressed trigonid, metaconid relatively large, paraconid relatively smaller, basined talonid nearly as wide as trigonid, with small entoconid and strong, elevated hypoconid. Anteroexternal cingula on molars, nearly vertical on M₁, more sloping on M₂. Length P₄-M₂ about 4.5 mm.

This very diminutive jaw somewhat resembles that of *Hyracolestes ermineus* from the same formation. The latter, however, is about 45 per cent. larger, with P₄ higher and more slender and its heel and cuspules less developed, no cingula on M₁₋₂, M₂ with trigonid relatively longer, paraconid relatively higher, talonid more elongate and with larger, less internal entoconid, the hypoconid (broken) probably less dominant, the jaw relatively stouter.

Praolestes appears to be an insectivore and is possibly a leptictid, although its P₄ is less molariform than in the known leptictids with the exception of the quite different *Acmeodon*. M₁ is peculiar and more resembles P₄ of the Leptictidæ. This tooth of *Praolestes* must be a molar, however, as it does not belong to the deciduous dentition and is on a level with the fully molariform tooth which follows it, while that which precedes it is as yet only partially protruded.

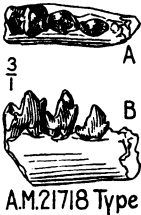


Fig. 1. *Praolestes nanus*, new genus and species. Part of left lower jaw with P₄ and M₁₋₂. Type. A, crown view. B, internal view. Three times natural size.

¹πρᾶος, meek.

***Pseudictops lophiodon*, new genus and species**

TYPE.—Amer. Mus. No. 21727, part of left lower jaw with P_3 – M_3 .

PARATYPE.—Amer. Mus. No. 21712, part of right upper jaw with two cheek teeth.

CHARACTERS.— P_3 with the protoconid and the somewhat lower metaconid forming a cross crest; paraconid small, anterior and slightly internal to the protoconid; small basined heel with raised posterior rim, obscurely cuspidate. P_4 larger; trigonid essentially a short, transverse crest; metaconid slightly higher than protoconid; paraconid vestigial, anteromedian, united to the protoconid by a small secondary

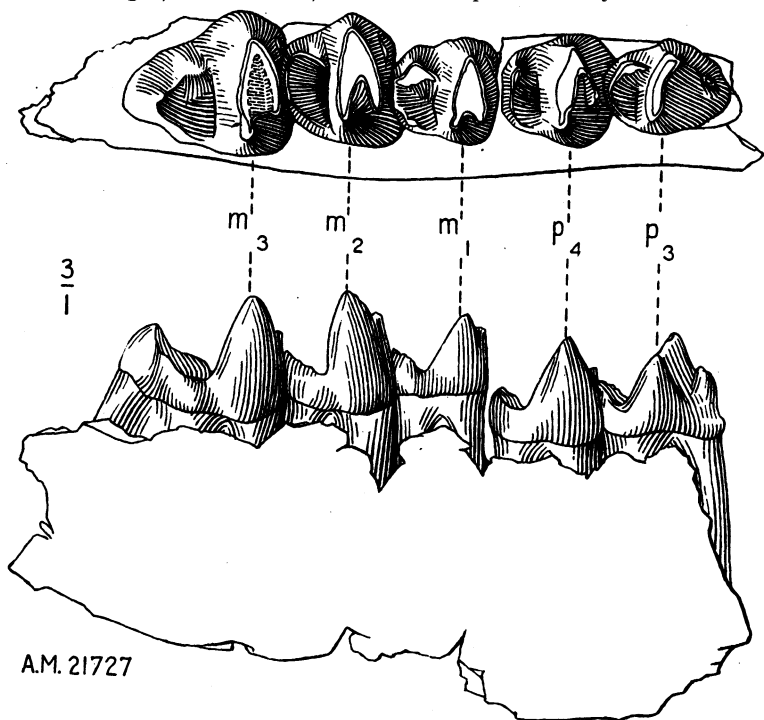


Fig. 2. *Pseudictops lophiodon*, new genus and species. Part of left lower jaw with P_{3-4} and M_{1-3} . Type. Crown and internal views. Three times natural size.

crest; heel low, short, transverse, posterior rim raised, with distinct hypoconid. M_1 smaller than P_4 , M_{1-3} progressively larger. Molar trigonids strongly compressed anteroposteriorly, progressively higher relative to talonids. Paraconids vestigial, united to protoconids by small secondary crests, internal on M_1 , progressively less so on M_{2-3} . Molar talonids basined, narrower than trigonids, short and small on M_{1-2} and with distinct hypoconids, more elongate on M_3 , with elevated hypoconulid, small but distinct hypoconid, and obscure entoconid. P_4 – M_3 with small anteroexternal cingula. Lower jaw of moderate depth, stout transversely.

Known upper cheek teeth (paratype), probably M^{1-2} , strongly transverse, with short, crescentic protocone; conical, high paracone and metacone, bases connate; distinct parastyle, smaller metastyle, narrow anterior cingulum; well marked, basined, non-cuspidate posterior cingulum rising to protocone. P^1 (part of alveolus) probably wider than M^1 . M^2 slightly larger and more transverse than M^1 . M^3 (alveoli) as large as M^2 or larger.

Despite its large size, this genus is suggestive of the Leptictidæ, although this resemblance is not sufficiently close necessarily to indicate true relationship. The molarization of the premolars has gone farther than in any leptictid, the bilophodont lower molars are not very closely paralleled in that group; the cheek teeth of the latter do not increase in size posteriorly as in *Pseudictops*, and their upper molars always have a hypocone which does not closely correspond to the posterior cingulum of *Pseudictops* in its relationship to the protocone.

The Cretaceous *Zalambdalestes* from an earlier formation near the same locality is leptictid in aspect and to that extent resembles *Pseudictops*, but there are no indications of special affinity.

The complication of the premolars, lophiodont lower molars, reduced paraconids, short heels on M_{1-2} , and retention of triangular upper molars recalls the Amblypoda, but the resemblance is even less close than to the Leptictidæ.

Eurymylidæ, new family

PROVISIONAL DEFINITION.—Cheek teeth P_2^2 M_3^3 . Lower incisor fully gliriform, extending far back beneath cheek teeth. Lower cheek series hypsodont, rooted, with elevated trigonids and low talonids, each wearing to a transverse enamel ring. Upper cheek teeth strongly transverse, tritubercular, with a tendency to form anterior and posterior molar cingula. Masseter origin confined to zygoma, insertion not extending forward of posterior end of M_3 . Infraorbital foramen small.

If other members of the family are found, it may well prove that not all of the above characters do apply to them, but there is no doubt that *Eurymylus* should be placed in a family distinct from any previously defined.

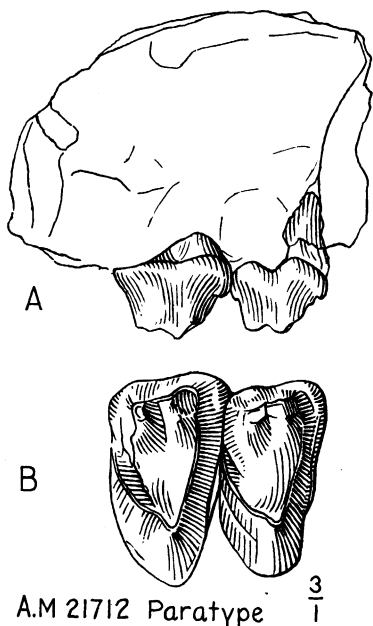


Fig. 3. *Pseudictops lophiodon*, new genus and species. Part of right upper jaw with two cheek teeth. Paratype. A, external view. B, crown view. Three times natural size.

***Eurymylus laticeps* Matthew and Granger, 1925**

SYNONYM.—*Baënomys ambiguus* Matthew and Granger, 1925.

Restudy with additional specimens indicates that *Baënomys ambiguus* and *Eurymylus laticeps* are respectively the lower and upper jaws of the same species. Published simultaneously, the latter name is selected as definitive, being based on a better type.

Two new lower jaws (Nos. 21735 and 21738) reveal the structure of P_{3-4} . P_3 is a plump tooth implanted by two roots, with an elevated anterior cusp, its apex somewhat transverse and higher externally, a minute cuspule on its anterior side, and a low broad heel which bears a transverse ridge. P_4 is nearly as large as the molars which follow it, and it has an elevated trigonid with two main, blunt, subconical cusps, the

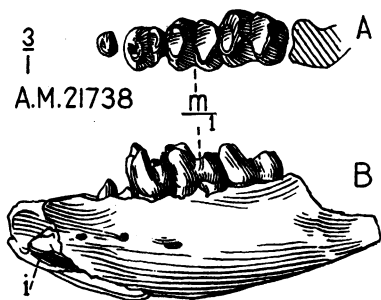


Fig. 4. *Eurymylus laticeps* Matthew and Granger. Left lower jaw with part of incisor, P_{3-4} , and M_{1-2} . Referred specimen. A, crown view. B, external view. Three times natural size.



Fig. 5. *Eurymylus laticeps* Matthew and Granger. Right P_{3-4} , crown view. Referred specimen. Three times natural size.

internal one somewhat the higher. Between these anteriorly is a small cuspule. The heel is low and when unworn has two small transverse ridges united externally. The molars are as described for the type of "*Baënomys ambiguus*," and in all cases are too worn to make out the original cusp structure. In No. 21738, P_4 is smaller than in No. 21735, and they may prove to represent distinct species.

Much of the intra-alveolar portion of the incisor is preserved in both of the new specimens and it is seen to be of persistent growth, extending back beneath the molars, slightly wider than deep, the enamel confined to the broad inferior, or anterior, face, which is flat and bounded by sharp angulations externally and internally.

No. 21737 is a left upper jaw with all the cheek teeth, but it adds little to what was known from the type of *Eurymylus laticeps*. On P_4 a distinct cingulum passes anterior to the paracone, and there is a slight shelf external to this cusp. On M^1 the same features are present, but less distinct, and on M^2 they are not observed. M^{1-2} and probably also P^4 have a definite posterior cingulum which ends in a small cusp posterior and slightly internal to the metacone. On M^3 this feature is still more strongly developed and forms a prominent part of the crown. The region between the protocone and the external cusps is worn in the known material.

The anterior root of the zygoma is above the three anterior cheek teeth. The infraorbital foramen is small and is slightly anterior to the roots of the first cheek tooth.

This genus is so isolated that its affinities remain in doubt. The isolated upper cheek teeth were referred tentatively to the Menotyphla (with *Plesiadapis* and its allies in mind). The lower jaw was referred to the Glires and here left *incertæ sedis*, although compared with the heteromyids on one hand and the lagomorphs on the other. The zygomatic arch is not like that of known rodents, but the evidence in hand does not more strongly favor any other allocation.

If *Eurymylus* is a rodent, it is the oldest known, primitive in many respects, but peculiarly and aberrantly specialized in others. In both upper and lower teeth there is a superficial resemblance to the lagomorphs, but in some characters it is more specialized than even the recent Lagomorpha, and these specializations are in a direction so unlike any known member of the group that it is probable that *Eurymylus* does not belong in the duplicitentate division of the Order. To the non-lagomorph characters of the lower jaw previously mentioned (Matthew and Granger, 1925, p. 6) may be added the fact that the incisor in *Eurymylus* extends far back beneath the cheek teeth. The upper teeth are indeed transverse, but otherwise they show little evidence of lagomorph specialization and, even aside from the absence of P², more definitely resemble the primitive simplicidentates.

The upper teeth do not strengthen the resemblance to the heteromyids. They might conceivably have given rise to those of some members of this family, but the gap is much too great to be filled by inference. There is a more definite resemblance to some of the earlier simplicidentates, such as *Paramys* and its allies, but the differences are striking, and the resemblance, if not wholly deceptive, may indicate only common derivation from the ultimate (Cretaceous) simplicidentate ancestry. The upper cheek tooth formula is the same, and the presence of two lower premolars, while striking, is primitive. Although different in proportions, the tritubercular upper molars with incipient anterior and posterior cingula are not very unlike those of some sciurormorphs, and M³, with its almost basin-like posterior expansion, is more definitely similar. The lower molars have very evident traces of a tuberculo-sectorial ancestry, and their transverse trigonids and sharp division between trigonids and talonids are approached by some sciurormorphs, but the detailed specialization is along unfamiliar lines.

***Opisthopsalis*¹ *vetus*, new genus and species**

TYPE.—Amer. Mus. No. 21701, very badly crushed skull and jaws.

CHARACTERS.—Dentition $\frac{?}{1}, \frac{1.74.8}{1.4.3}$. Canines moderately developed, laniary. P_4 elevated, carnassial, with distinct paraconid and metaconid and low, unbasined heel. M_1 relatively small, trigonid with subequal protoconid and metaconid and slightly smaller, internal paraconid; talonid slightly narrower than trigonid, basined, with three cusps, the hypoconulid somewhat the highest. M_3 large, with elevated, strongly carnassial trigonid, metaconid (broken in type) apparently present but smaller than paraconid; heel long and narrow, with three cusps, elevated hypoconulid. Jaw slender. P^2 with simple, high, slender crown. M^3 small, transverse, metacone reduced, strong parastylar spur. Length of skull about 60 mm. (much crushed). Brain case very long and narrow, with prominent sagittal and lambdoid crests.

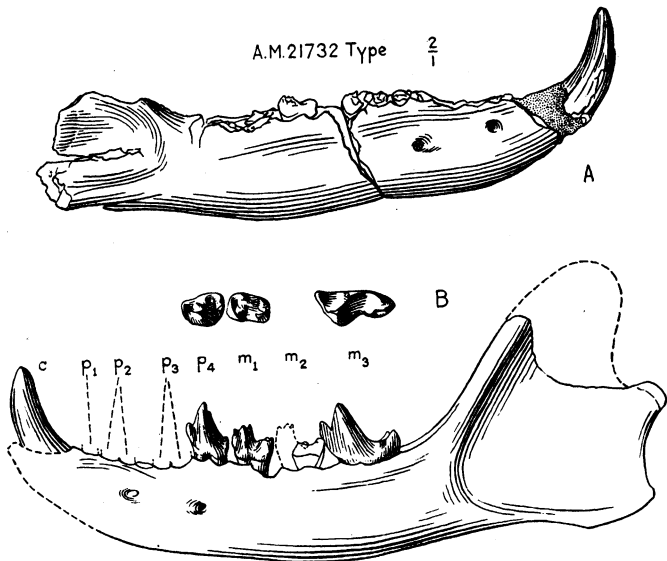


Fig. 6. *Opisthopsalis vetus*, new genus and species. A, right lower jaw with canine, external view. B, left lower jaw with canine, P_4 , M_1 , and M_3 , external view, and crown view of preserved cheek teeth. Distortion of left lower jaw corrected. Type. Twice natural size.

The type of this species is a skull, with articulated lower jaws, nearly complete, but so crushed and broken as to yield few definite characters. The right lower cheek teeth and most of those of the upper jaws were crushed out of place and reduced to minute, irretrievable fragments, but by painstaking separation of the jaws several teeth of the left lower series were exposed nearly in place.

¹δπισθεν, behind; ψαλις, scissors—in allusion to the carnassial posterior lower molar.

It is possible that this is the same genus as *Sarcodon*, based by Matthew and Granger on a first or second upper molar, but direct comparison is not possible, and the interest of the present specimen demands its separate diagnosis.

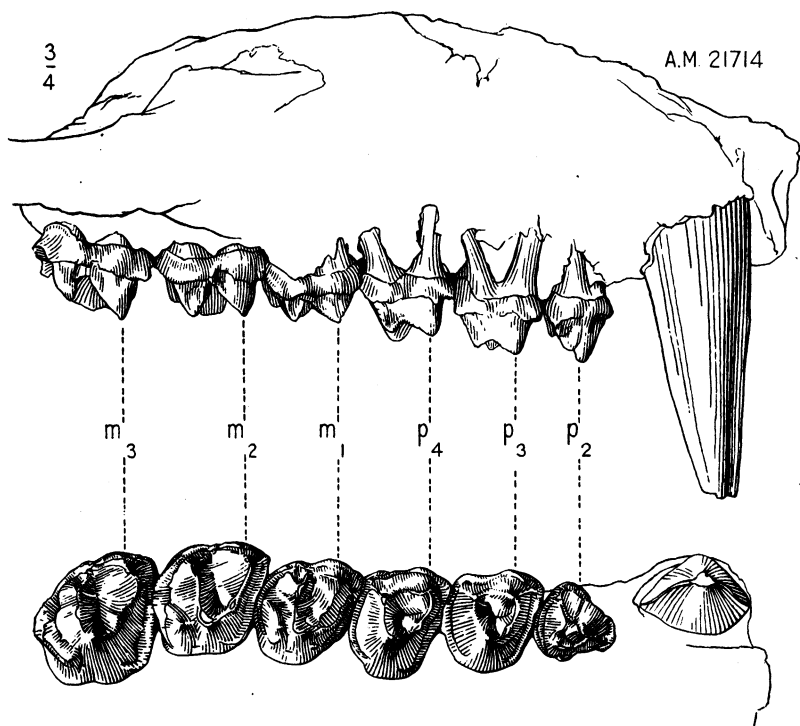


Fig. 7. *Prodinoceras martyr*. new genus and species. Right upper jaw with canine and all cheek teeth, external and crown views. Type. $\frac{3}{4}$ natural size.

There can be little doubt that this small animal is a creodont, but its affinities within this group are doubtful. The large carnassial M_3 suggests the more primitive members of the Hyænodontidæ, and *Opisthop-salis* may be provisionally placed in this family. Both M_3 and M_1 resemble those of *Sinopa* rather more than any other genus, but *Opisthop-salis* differs from any certain hyænodont in the complication of P_4 . This tooth is more nearly, although not exactly, paralleled in the Oxyclænidæ, but that family never shows the carnassial specialization of M_3 .

Prodinoceras martyr,¹ new genus and species²

TYPE.—Amer. Mus. No. 21714, crushed palate and lower jaws, with upper canines and cheek teeth and heels of M_3 , right and left, and of M_2 , right.

CHARACTERS.—Canine protruding about 45 mm. from alveolus, nearly straight, tapering evenly to apex, anterior and posterior edges sharp, compressed, external face more convex than internal. P^2 with ectoloph turned inward anteriorly at 45° to tooth row, metacone indicated but not rising free of ectoloph; protocone distinct, lower than metacone, united to paracone by a strong crest and to metacone by a weaker one, enclosing a small basin. P^3 and P^4 similar, the latter larger, distinct metacone and higher paracone, protocone equal to metacone and united to it by a strong, high crest, to paracone by a lower crest with a conule near the protocone, making the



Fig. 8

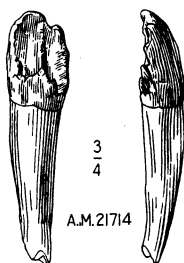


Fig. 9a



Fig. 9b

Fig. 8. *Prodinoceras martyr*, new genus and species. Posterior part of right M_3 , crown view. Type. $\frac{3}{4}$ natural size.

Fig. 9. *Prodinoceras martyr*, new genus and species. Isolated incisors associated with type. $\frac{3}{4}$ natural size.

crown subquadrate; continuous anterior, external, and posterior cingula, but not continuous across internal base of protocone. M_1 - M_2 differing from P^3 - P^4 chiefly in the lower crown, more separate paracone and metacone, and presence of a hypocone directly posterior to the protocone, above the posterior cingulum. M_3 larger, metacone relatively more internal and smaller, anterior and posterior cingula more developed, hypocone more internal, a small cusp posterointernal to it. Talonid of M_3 with high hypoconid, with crest running anterointernally, but heel posterior to this low, posteromedian cusp not elevated. Length P^2 - M_3 , 102 mm.

Prodinoceras is obviously a true uintathere of primitive type, and it is the first indication of this group (as distinct from the coryphodonts) outside of North America.³ It is very closely comparable with an undescribed genus from the Clark Fork Beds, upper Paleocene, of Wyoming, and like the latter it is an almost ideal ancestral type of uintathere so

¹Latin, *martyr*, Greek, *μαρτυρ*, testifier—i. e., to the age of the beds and to the presence of true uintatheres in Mongolia.

²*Prodinoceras* Matthew, Proc. Zool. Soc. London, 1927 [pub. 1928], pp. 956, 969-970, is the present genus plus that from the Clark Fork, but it was a *genus celebs*, and publication dates from the present paper.

³*Eudinoceras*, from the Irudin Manha, upper Eocene, of Mongolia, proves to be a coryphodont.

far as known. It differs, however, from the Clark Fork genus in details of P^2 , heel of M_3 , and other minor features, which might be interpreted as being very slightly more advanced in the present form and in any event remove it somewhat farther from the later North American genera. As might be expected, the ancestry of the latter is to be sought rather in the Clark Fork form than in that from the Gashato, and although the difference between the two Paleocene genera is slight, *Prodinoceras* appears to be commencing to diverge from the line followed by the American uinatheres.



A.M.21725 Type

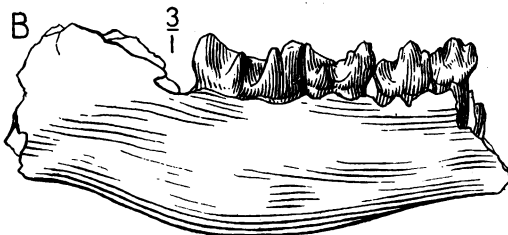


Fig. 10

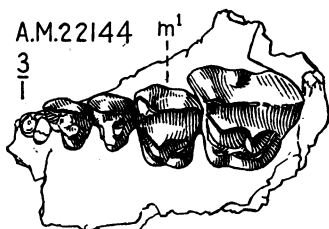


Fig. 11

Fig. 10. *Palæostylops macrodon*, new species. Left lower jaw with P_3 - M_2 . Type. A, crown view. B, internal view. Three times natural size.

Fig. 11. *Palæostylops macrodon*, new species. Left upper jaw with P^3 - M^2 , crown view. Paratype. Three times natural size.

***Palæostylops macrodon*, new species**

TYPE.—Amer. Mus. Nos. 21725, left lower jaw with P_3 - M_2 .

PARATYPES.—Amer. Mus. No. 20416, right lower jaw with I_3 - M_2 , somewhat broken. Amer. Mus. No. 22144, left upper jaw with P^3 - M^2 . Amer. Mus. No. 22142, right upper jaw with $M^{2,3}$ and part of M^1 .

DIAGNOSIS.—Cheek tooth series about 20 per cent. longer than in *P. iturus*, molars relatively narrower, M_2^2 larger relative to other teeth.

In the 1925 collection, *Palæostylops* is very abundant. At least fifty individuals are represented, and they are the most numerous members of the fauna as known. They indicate the presence of a somewhat larger species in addition to the genotype, closely related to the latter but easily distinguished and with intermediate forms absent in the available ma-

terial. The tooth figured by Matthew and Granger (1925, Fig. 4), as possibly indictating a larger species of *Palæostylops*, does not belong to *P. macrodon*, and its affinities are still uncertain. It does not belong in the upper jaw of this genus.

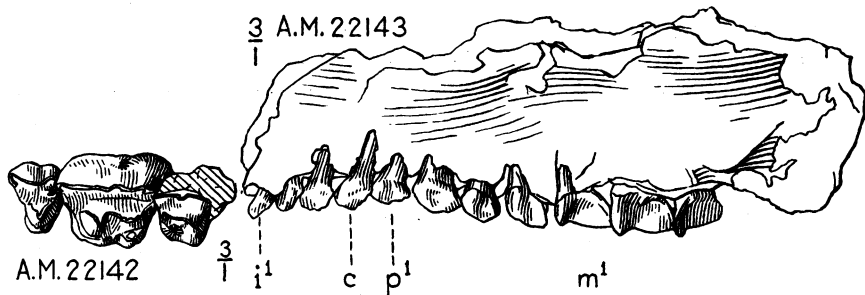


Fig. 12

Fig. 13

Fig. 12. *Palæostylops macrodon*, new species. Right upper jaw with M^{1-3} , somewhat broken, crown view. Paratype. Three times natural size.

Fig. 13. *Palæostylops iturus* Matthew and Granger. Left upper jaw with complete dentition, external view. Referred specimen. Three times natural size.

***Palæostylops iturus* Matthew and Granger, 1925**

The only important gap in previous knowledge of the dentition of this species was due to the absence of I^1 - C , but these teeth are now clearly displayed in Amer. Mus. No. 22143, a left upper jaw with the complete dentition. The dental formula is $\frac{3.1.4.3.}{3.1.4.3.}$. The upper incisors, canine, and premolars form an evenly graded series without any definite morphological breaks. Each of these teeth consists of a simple external wall and an internal heel, sloping and very inconspicuous on I^1 but progressively stronger until on the posterior premolars it forms a sharp internal cusp. Contrary to the inference from its incomplete alveolus, the canine is not larger than P^1 and it is hardly to be distinguished in form from this tooth or from I^3 .