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## NEW MAMMALS FROM THE IRDIN MANHA EOCENE OF MONGOLIA<sup>1</sup>

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The following descriptions are based upon collections secured by the Third Asiatic Expedition during 1923. The stratigraphy of the Irdin Manha formation has been briefly described and notices of some of the fossil mammals secured in 1922 and 1923 have been published in preceding articles in *Novitates*.<sup>2</sup> The most important finds of the expedition in this formation, skulls of a series of titanotheriids, and skeleton, skulls, etc., of a large amynodont rhinoceros, are described by Professor Osborn in articles now in press or forthcoming. The smaller perissodactyls are described by us in a following number of *Novitates*.

### **CARNIVORA** (Creodonta)

#### **Mesonychidæ**

In addition to the giant *Andrewsarchus*<sup>3</sup> skull, this family is represented by scattered teeth and jaw fragments of at least four smaller animals.

Mesonychid, gen. indet.

One species, No. 20132, is of about the size of *Harpagolestes uintensis* of the Uinta, but we are unable to determine the molar formula, and it cannot be even provisionally assigned to any genus.

Mesonychid, gen. indet.

A second, smaller species, about the size of *Synoplotherium lanius*, is likewise represented by isolated teeth, No. 20133, and cannot be placed in any one of the mesonychid genera.

#### **Hapalodectes serus**, new species

TYPE.—No. 20172. Lower tooth, molar or posterior premolar.

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<sup>1</sup>Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 60.

<sup>2</sup>Amer. Mus. Novitates, Nos. 42, 77, 91, 104, 145, 146.

<sup>3</sup>Osborn, Henry Fairfield, 1924, Amer. Mus. Novitates, No. 146, November 11.

AM.20172 Type



Fig. 1

Fig. 1. *Hapalodectes serus*. Lower molar, type specimen, No. 20172, twice natural size, crown and side views.

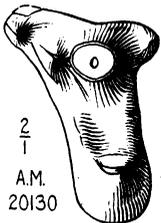
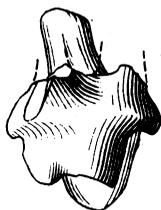


Fig. 2

Fig. 2. ?*Hapalodectes auctus*. Upper molar, type specimen, No. 20130, twice natural size, crown and side views.

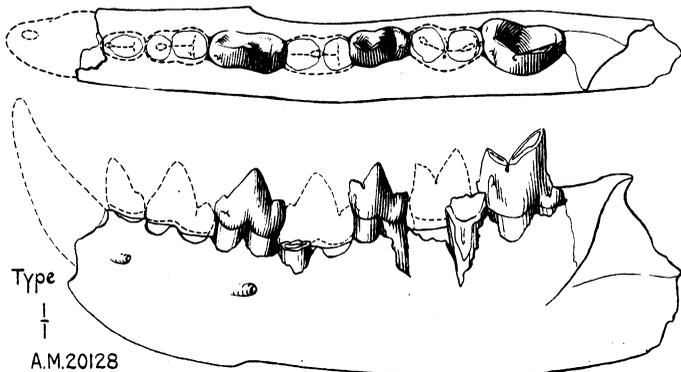


Fig. 3. *Propterodon irdinensis*. Lower jaw, type specimen, No. 20128, natural size, external and crown views.

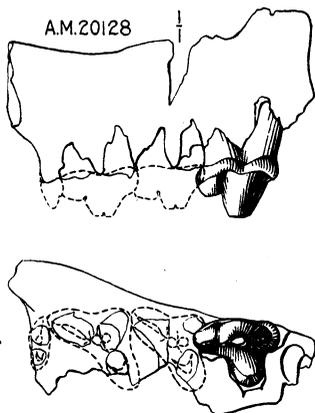


Fig. 4

Fig. 4. *Propterodon irdinensis*. Upper jaw with p<sup>4</sup> and roots of molars, somewhat doubtfully associated with the type lower jaw. Natural size, crown view.

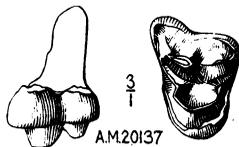


Fig. 5. *Miacis invictus*. Upper molar, type specimen, No. 20137, three times natural size, external and crown views.

CHARACTERS.—Cusps high and sharply compressed, the principal cusp (protoconid) showing no trace of metaconid; the heel large, sharply crested in the characteristic mesonychid style, a minute anterior basal cusp (paraconid). Length of tooth 5.6 millimetres, smaller than either of the described American species. Much smaller than ?*H. auctus*.

**?*Hapalodectes auctus*, new species**

TYPE.—No. 20130. An upper molar (possibly a premolar).

CHARACTERS.—Tooth much wider than long, protocone high, round, metacone and paracone moderately connate into a high, rounded cusp, with basal heels representing parastyle and metastyle. Valley between inner and outer portions of tooth deep and wide, this portion of the tooth rather strongly constricted. No crests from protocone. Size of the smaller *Dissacus* species, but very different in proportions of the tooth.

In its general character this peculiar tooth somewhat suggests the Leptictidæ. It is unlike any known mesonychid upper molars, and it may not in fact belong to the Mesonychidæ. The upper teeth of *Hapalodectes* (Wasatch and Wind River) are not known, but they should be much of this type, and the peculiar roundness of the cusps and the absence of connecting crests are suggestive of mesonychid and not leptictid relationships. The tooth, therefore, is referred provisionally to *Hapalodectes*.

**Hyænodontidæ**

This family is represented in the Irдин Manha fauna by a lower jaw described in 1923 as *Paracynohyænodon morrissi*, and by a number of jaw fragments of a species referable to *Propterodon*.

**Propterodon** Martin, 1906

GENOTYPE.—A lower jaw from the Egerkingen beds, probably identical with *Hyænodon schlosseri* Rutimeyer.

Martin bases this genus<sup>1</sup> upon a lower jaw, figured by Rutimeyer<sup>2</sup> under the name of *Pterodon*, but not given any specific name. On a later page of the same memoir (*op. cit.*, p. 461), Martin discusses two lower molars which Rutimeyer figured (*op. cit.*, figs. 13, 14) and described as *Hyænodon schlosseri*. Rutimeyer regarded these teeth as  $m_2$ ; Martin identifies them as  $m_3$  and observes that they must represent a genus distinct from *Hyænodon* and retaining the third upper molar; but he does not say whether he refers them to *Propterodon* or make any comparison

<sup>1</sup>Martin, Rudolf, 1906, Revision der obereocänen und unteroligocänen Creodonten Europas. Rev. Suisse de Zool., XIV, p. 454.

<sup>2</sup>Rutimeyer, Ludwig, 1891, Eocäne Säugethierwelt von Egerkingen. Abh. schw. pal. Ges., p. 99, Pl. VII, fig. 15.

with  $m_3$  of the genotype jaw. So far as one can judge from Rutimeyer's figures, they might well belong to the same species, and we have provisionally so referred them.

Depéret<sup>1</sup> questions Martin's identification of the type teeth of *H. schlosseri* as  $m_3$ , but without considering the evidence afforded by the lower jaw above mentioned, or the peculiar proportions of the teeth, which are not like the  $m_2$  of *Hyænodon*.

The above record is cited to show the status of *Propterodon* in nomenclature of the hyænodonts. It does not affect the validity of the genus or the reference to it of the species here described.

#### **Propterodon irdinensis, new species**

TYPE.—No. 20128, a number of jaw fragments, probably in part associated (field No. 156), from the Irdin Manha Eocene of Mongolia.

CHARACTERS.— $M_3$  with minute talonid, no metaconid, protoconid broad, with flat posterior face (in place of the narrowed ridge of *Hyænodon*);  $m_1$  with rather large, high-crested heel nearly as broad as the body of the tooth, a minute metaconid, paraconid considerably smaller and lower than metaconid. Four rather large, close-set premolars, not pitched backward,  $p_3$  lacking anterobasal cusp,  $p_1$  one-rooted, crowded. Three upper molars, the third about as in *Pterodon*, transverse, two-rooted, crown unknown. First and second with well-separated antero-internal roots, crowns unknown.  $P^4$  lacks antero-external cusp, the inner root is well developed, antero-internal in position (not median as in *Hyænodon* and *Pterodon*), and carries a shelf and cingulum but no distinct cusp. Principal cusp and postero-external cusp much as in *Hyænodon crucians*. In size the species about equals *Hyænodon mustelinus*.

The heel of  $m_3$  is decidedly more reduced than in *Pterodon*, but in other particulars the teeth are more like the primitive hyænodonts *Sinopa*, *Tritemnodon* and *Cynohyænodon*, especially the constitution of  $p_3$ ,  $p^4$  and  $m_1$ , and the genus—or at least this species—might be regarded as a connecting link and structurally ancestral to *Hyænodon*.

Whether its stratigraphic position would admit of this is another question. *Hyænodon* proper makes its first appearance in Europe in the lower Ludian<sup>2</sup> (Euzet-les-Bains), in America in the Chadron, *Titanotherium* beds, commonly regarded as Sannoisian. The Irdin Manha is correlated with the lower Uinta of America, but its European equivalent is by no means certain; it may be Ludian, but is possibly older. There is little or nothing on which to base a direct comparison.

<sup>1</sup>Depéret, Charles, 1917, Mammifères fossiles d'Euzet-les-Bains, Ann. Univ. Lyon, N. S., fasc. 40, p. 187.

<sup>2</sup>"*Hyænodon*" *nouleti*, Bartonian of Castrais, is excluded as generically indeterminate; "*H.*" *schlosseri*, Lutetian of Egerkingen, as probably not *Hyænodon* (vide supra).

### Miacidæ

#### *Miacis invictus*, new species

TYPE.—No. 20137. An isolated upper molar, m<sup>1</sup>.

CHARACTERS.—Size nearly as in *M. medius* of the Washakie, but construction of molar more as in *M. parvivorus* of the Bridger. Anteroposterior width considerably greater than in m<sup>1</sup> of *Procynodictis vulpiceps*. Paracone larger than metacone, protocone with both wings complete, conules distinct, parastyle well developed as a simple crest, no meta- or mesostyle, a moderately broad shelf external to the paracone and metacone. Cingulum encircling outer half of tooth, joining conules at its inner ends, a separate basal cingulum encircling inner half of tooth broadened into a "bourrelet" at the postero-internal part of the protocone.

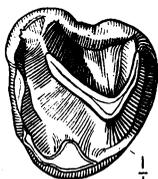
The reference of a single tooth is necessarily doubtful, but this specimen agrees very closely with the genotype of *Miacis*, *M. parvivorus*. It is readily distinguished from *Cynodictis* and other genera by the inequality of para- and metacone, from *Procynodictis* by the less compressed proportions of the tooth, from *Viverravus* and *Uintacyon* by the equal development of the wings of the protocone. The proportions of the tooth indicate that it belongs in the typical section of the genus, represented in the Uinta by *Miacis* ("*Mimocyon*") *longipes* Peterson, rather than to the subgenera *Lycarion*, *Harpalodon* and *Prodaphænus*, in which the tubercular dentition is relatively reduced. A species of *Miacis* (*M. exilis* Filhol) is recorded from the Phosphorites, but it is much smaller than this one; *Viverravus angustidens* is distinguishable by absence of metaconule and of "bourrelet" on m<sup>1</sup>.

### AMBLYPODA

#### *Eudinoceras mongoliense* Osborn

This genus was based upon two upper premolars identified by Osborn as p<sup>3</sup> or p<sup>4</sup>. A third isolated upper premolar, No. 20134, is probably p<sup>2</sup> of the same genus. It is considerably smaller and less expanded transversely, the outer crescent is not so deeply inflected, the inner cusp more rudimentary (?vestigial), and a strong encircling cingulum expanded into a considerable shelf on the antero-internal face.

Osborn regards these teeth as representing a higher stage of specialization than "*Dinoceras*," and specifies that he applies the prefix "eu" in this sense [i.e. = meta]. It might equally well be regarded as more primitive, the small internal cusp being intermediate between the uintatheres, in which it is absent, and *Coryphodon* and *Pantolambda*, in which it is well developed. The new tooth is suggestively like the *Bathyopsis* premolars, although the type teeth are very unlike p<sup>4</sup> of that genus.



AM.20134

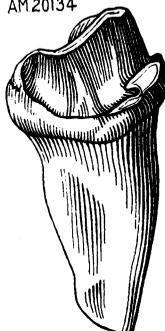


Fig. 6. *Eudinoceras*. Upper premolar, No. 20134, natural size, external and crown views.

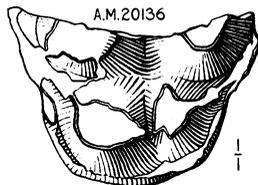


Fig. 7. *Achænodont*. Supposed upper milk molar, No. 20136, natural size, crown view.

## ARTIODACTYLA

### *Achænodontidæ*

No. 20136, an incomplete upper tooth, is doubtfully identified as  $dp^4$  of an achænodont. It is too incomplete for positive reference. The outer border of the tooth is missing, but it appears to have been of rounded subtrigonal outline with two major outer cusps (paracone, metacone) rounded and well separated, a smaller internal cusp (protocone) and a much smaller postero-internal cusp (hypocone) which stands a little apart but not far from intermediate between protocone and metacone.

The tooth has some resemblance to  $dp^4$  of the entelodonts, differing in absence of the conules, which are well developed in the deciduous as also in the permanent molars of entelodonts. In the achænodonts they are absent in the permanent molars;  $dp^4$  is not known, but presumably would conform to the permanent molar construction. The Mesonychidæ have a similarly simple construction of the molars, but lack the hypocone;  $dp^4$  appears to be unknown in Mesonychidæ but presumably would also conform to the permanent molar pattern and lack a hypocone.

The above reasons warrant a provisional reference of No. 20136 to the Achænodontidæ. We agree with Peterson that this group is not ancestral to the entelodonts, and probably only distantly related.<sup>1</sup>

<sup>1</sup>This view was indicated by Matthew in 1899, *Achænodon* and *Protelotherium* being referred to a separate family from *Entelodon*.

The relationship to *Helohyus* may be much closer, and, if brought into the same family, the name *Helohyidae* Marsh, 1877, would have precedence.

### **Helohyidae**

#### **GOBIOHYUS, new genus**

TYPE.—*Gobiohyus orientalis* infra.

DIAGNOSIS.—Teeth bunodont, low-crowned, upper molars five-cusped, without hypocone or mesostyle, with small parastyles and encircling cingula. Third and fourth upper premolars trigonal, with deutocone and inner root, large on  $p^4$ , rather small on  $p^3$ ;  $p^2$  simple-crowned, compressed, two-rooted. Lower molars with very small internal paraconids, minute hypoconulids on  $m_{1-2}$  and large conical third lobe on  $m_3$ .  $P_4$  with distinct deutoconid. Anterior premolars spaced,  $p_1$  one-rooted,  $c_1$  large, procumbent, incisors small.

A few specimens in the Irdin Manha collection represent a bunodont artiodactyl resembling the Bridger genus *Helohyus*, but distinguished by the double cusp of  $p_4$  (upper premolars unknown in *Helohyus*). It is well distinguished from any of the genera of the European Eocene, nor do any of the known bunodont artiodactyls of the Uinta approach it closely. The absence of hypocone distinguishes the new genus from *Dichobunidae* and *Entelodontidae*, the proportions of teeth and jaw, size of third lobe of  $m_3$ , etc., from *Cebochaerus* and *Chaeromorus*, and from the earlier genera of *Suidae* and *Tagassuidae*. The conical cusps and lack of external styler cusps on the upper molars sufficiently distinguish it from the *Anthracotheriidae*, to which, however, it may be rather nearly related. From *Chaeropotamus* it is distinguished by absence of either mesostyle or central cuspule on the upper molars, simple third lobe of  $m_3$  and other details that suggest the closer affinity of the Parisian genus to the pigs.

*Chaeropotamus* and *Cebochaerus* are generally regarded as primitive suillines, and grouped by Depéret under the family *Hyotheriidae*. On the other hand, Schlosser makes *Chaeropotamus* the starting-point of the *Anthracotheriidae*. Whether *Hyotherium*, which is much more clearly of *Suidae* affinities, should be included in a separate Eocene family may be open to question; in any event the family name *Chaeropotamidae* Owen, 1840, long antedates *Hyotheriidae* Cope, 1888.<sup>1</sup> This family might be regarded as the common ancestral stock of suillines and anthracotheres, and it may well prove that *Helohyus* and its allies, separated as a distinct family by Marsh in 1877, united with the *Dichobunidae* in Sinclair's revision, are in reality a more primitive group of the same stock, and

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<sup>1</sup>*Hyotheriinae*, Amer. Nat., XXII, p. 1087. *Hyotherida* Hæckel, 1895.

should be referred to Chœropotamidæ.<sup>1</sup> The American genera are very imperfectly known at present, and no distinctively suilline or anthracothere characters appear in the parts described, so that it seems better to retain the family for the present, pending determination of its real affinities. Near relationship between *Gobiohyus* and *Helohyus* is indicated by the close resemblance throughout of the molars and premolars, apart from the more progressive character of the latter (indicated in  $p_4$ , inferred in upper premolars), a difference to be expected in an Upper Eocene genus compared with its Middle Eocene relatives. It should also be observed that Stehlin's interpretation of the anterior teeth in *Chœropotamus* would exclude it from any typical position in the common ancestral stock of Suidæ and Anthracotheriidæ. The Helohyidæ may likewise prove to belong rather with the dichobunids than with the chœropotamids, in spite of the absence of hypocone.

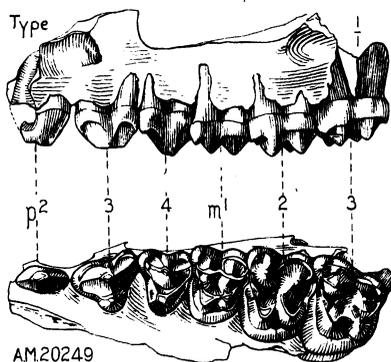


Fig. 8

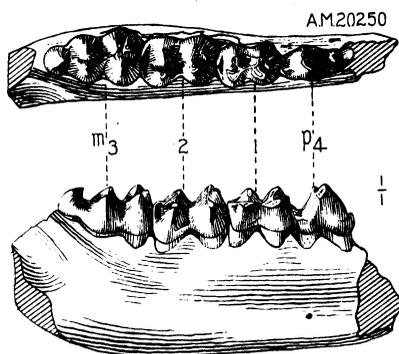


Fig. 9

Fig. 8. *Gobiohyus orientalis*. Upper jaw, type specimen, No. 20249, natural size, external and crown views.

Fig. 9. *Gobiohyus orientalis*. Lower jaw, No. 20250, natural size, crown and external views.

#### *Gobiohyus orientalis*, new species

TYPE.—No. 20249, upper jaw with  $p^2$ - $m^3$ . Paratypes: No. 20248, lower jaw,  $m_{1-3}$ , and two upper molars probably accidentally associated; No. 20250, lower jaw,  $p_4$ - $m_3$ . All from Irdin Manha formation.

SPECIES CHARACTERS.— $P^2$ - $m^3$  = 50;  $m^{1-3}$  = 26.5;  $m_{1-3}$  = 30;  $m_{2-3}$  = 22. Lower molar teeth more robust, trigonid of  $m_3$  wider and heel smaller;  $m_3$  length  $\frac{12.8}{8.2} = 1.56$  width

<sup>1</sup>Stehlin, H.-G., 1906, however, regards *Helohyus* as more probably of dichobunid affinities. See his discussion in *Säugethiere des schweizerischen Eocäns*, part iv, 1906, p. 672.

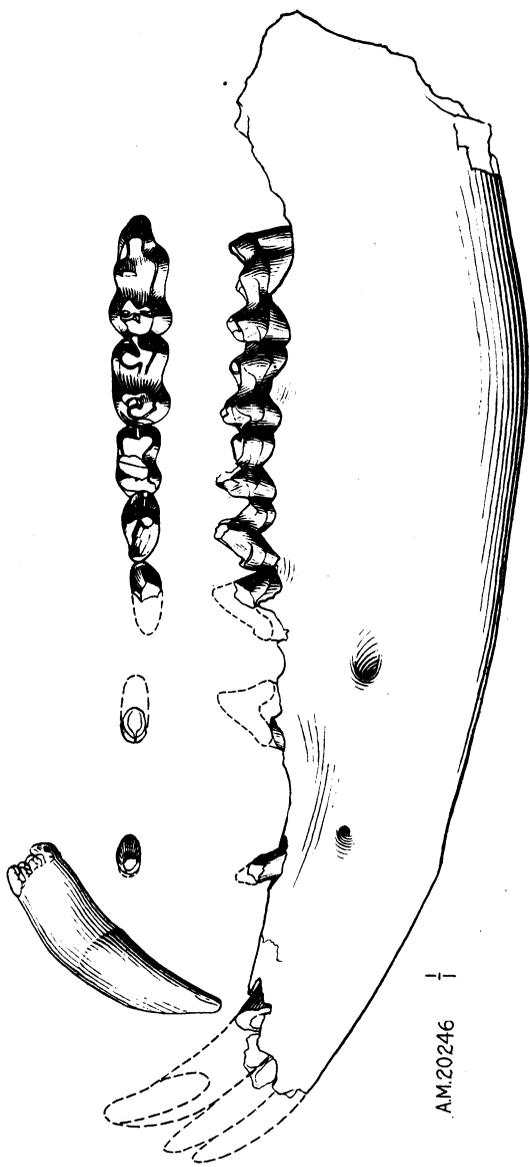


Fig. 10. *Gobiichthys robustus*. Lower jaw, external and crown views, with external view of upper canine. Type specimen, No. 20246. Natural size.

**Gobiohyus pressidens**, new species

TYPE.—No. 20247, lower jaw fragment with  $m_{2-3}$ . Irдин Manha formation.

SPECIES CHARACTERS.—Size smaller than *G. orientalis*, teeth narrower,  $m_3$  with narrower trigonid and larger heel.  $M_{2-3} = 18.5$ ;  $m_3$  length =  $\frac{11}{\text{width } 5.2} = 2.11$ .

**Gobiohyus robustus**, new species

TYPE.—No. 20246, lower jaw,  $p_4$ - $m_3$ , broken canine and premolars, and alveoli of incisor teeth.

CHARACTERS.—Teeth eighteen per cent. larger than in *G. orientalis*, relatively more robust, the trigonids of lower molars equaling talonids in breadth, whereas in *G. orientalis* they are narrower.

The relations of the anterior lower teeth as shown in the type specimen are presumably typical of the Helohyidae. The canine is enlarged, procumbent, the incisors small, three in number, as indicated by their alveoli. The first premolar is rather small, one-rooted, with rather long diastemata before and behind it. There was apparently a considerable diastema behind the two-rooted, compressed second premolar. The third premolar was compressed, apparently simple, as long as  $p_4$  or slightly longer.  $P_4$  has the same construction as in the genotype, but is more robust, as are also the three molars.

This construction of the anterior teeth suggests the primitive Anthracotheriidae<sup>1</sup> and Suidæ—not *Chæropotamus* if Stehlin's interpretation of the front teeth in that genus be correct.

**TRAGULINA**

cf. **Archæomeryx**, gen. indet.

No. 20173. A fragment of lower jaw, with  $p_{3-4}$  badly damaged, belongs to the ruminant group, but can hardly be definitely placed or compared. It is about the size of *Archæomeryx*, and the construction of the premolars, so far as preserved, appears to be similar.

The principal interest of this specimen is that it shows the presence of pro-Pecora in the Irдин Manha fauna as well as in the Shara Murun.

<sup>1</sup>The arrangement of the lower premolars is exactly as in the type of *Lophiohyus* Sinclair of the Bridger Eocene; a complete skull and jaws of a small anthracothere from the Eocene of Burma (shortly to be described by Barnum Brown) also agrees in the relations of the anterior teeth.