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## NEW MAMMALS FROM THE SHARA MURUN EOCENE OF MONGOLIA<sup>1</sup>

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The Shara Murun formation is typically exposed about 100 miles south of the Irdin Manha Eocene and carries a fauna of corresponding type, including the very characteristic titanotheres which enabled the expedition to refer it in the field to the end of the Eocene. It was at first regarded as a probable equivalent of the Irdin Manha, but, as first observed by Professor Osborn in his studies upon the titanotheriids of the two faunas, and fully confirmed by the present review of the smaller mammals, it is quite distinct and represents a later phase of the Upper Eocene.

### CARNIVORA (Creodonta)

#### Hyænodontidæ

##### *Pterodon hyænoides*, new species

TYPE.—No. 20307, complete skull from Shara Murun formation at Ula Usu, Mongolia. Third Asiatic Expedition, 1923.

CHARACTERS.—Dentition 2.1.4.3. Premolars enlarged and robust as in *Hyænodon*. Last molar transverse, as in *P. dasyuroides*, but smaller and more vestigial in cusp construction. Protocones of molars 1-2 probably present, but less prominent than in *P. dasyuroides*, and worn off in the type and only known specimen. P<sup>1</sup> one-rooted as in *Pterodon* and the Eocene hyænodons. Molar series extended on maxillary portion of zygomatic arch behind the back of the palate, but not so much so as in *Hyænodon*. Skull broad and robust, comparable in proportions with *Pterodon*; basicranial construction as in *Hyænodon* except for greater width, this portion of the *Pterodon* skull being undescribed so far as we can find.

This species is in all observed particulars an intermediate between *Pterodon* and *Hyænodon*. It is very well distinguished from the European species of either genus; its precise relations to the several more or less intermediate species from the Fayûm 'fluviomarine' fauna are not certain. These species as distinguished by Osborn<sup>2</sup> are based upon the lower jaws. Schlosser<sup>3</sup> comments upon their intermediate position

<sup>1</sup>Publications of the Asiatic Expeditions of the American Museum of Natural History. Contribution No. 59.

<sup>2</sup>Osborn, H. F., 1909. Bull. Amer. Mus. Nat. Hist., XXVI, pp. 415-424.

<sup>3</sup>Schlosser, M., 1911. Beitr. z. Pal. u. Geol. Österreich-Ungarns u. d. Orients., XXIV, pp. 87-88.

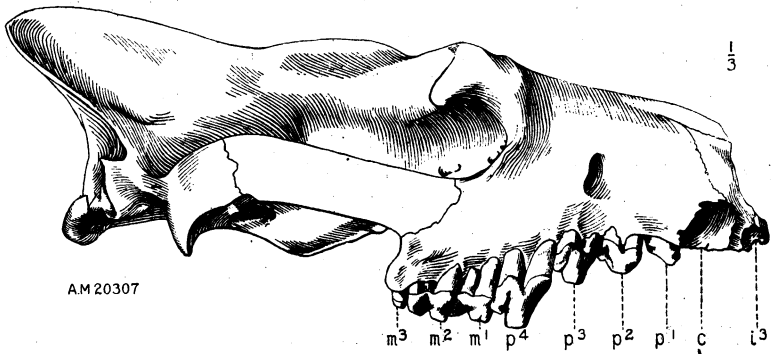


Fig. 1. *Pterodon hyænoides*. Skull, side view, one-third natural size. Type specimen No. 20307.

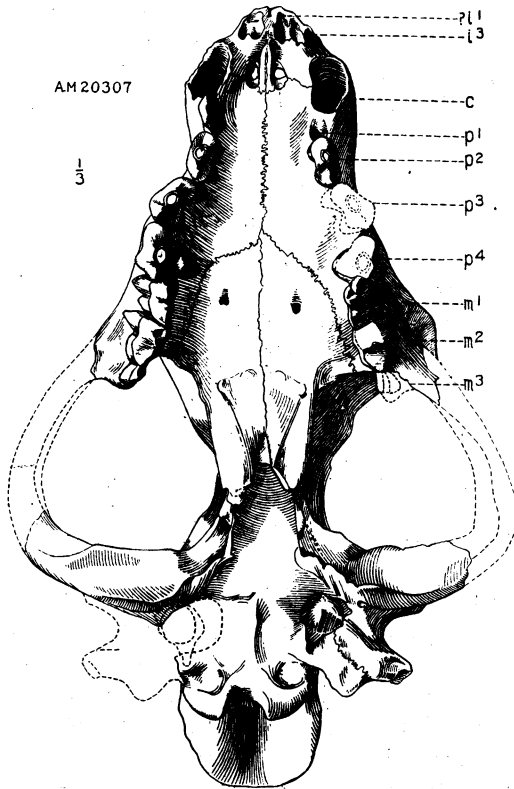


Fig. 2. *Pterodon hyænoides*. Type skull, palatal view, one-third natural size.

between the two genera. None of the species, however, appears to be very near to *P. hyænooides*.

? **Mesonychidæ**

***Olsenia mira*, new genus and species**

TYPE.—No. 20303, left astragalus.

CHARACTERS.—Size comparable to the tapir. Trochlea broad and rather shallow, both keels prominent, a prominent external flange on outer face of outer keel. Neck short, distinct, head about as deep as wide, intermediate in type between perissodactyls and mesonychid creodonts, with a considerable cuboid facet, separated by a marked keel from the narrow but deep navicular facet, the keel running parallel with the facet for distal end of calcaneum. Astragalo-calcaneal facet long, narrow, deeply concave, with parallel margins, sustentacular facet set far back on the body of the astragalus, so that its posterior border is strongly rolled down under the back of the

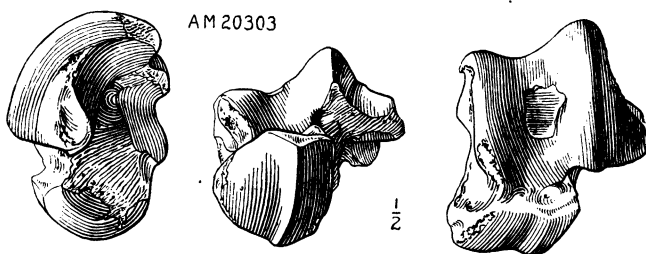


Fig. 3. *Olsenia mira*. Astragalus, internal, distal and dorsal views, one-half natural size. Type specimen, No. 20303.

trochlea. The body of the astragalus is singularly shallow on its external side, the space between trochlear and astragalo-calcaneal facets very small; on the inner side the depth of the body is more nearly normal.

We are unable to refer this astragalus to any known genus, and are uncertain as to its family relationships. It is not a perissodactyl or artiodactyl, although it has some points of resemblance to both orders. It is unlike any normal creodont or carnivore, but it conforms to the constructive features of Mesonychidæ in most respects. It is distinguished from most mammals by the peculiar type of cuboid facet, which is characteristic of Mesonychidæ and of Artiodactyla. The distal ginglymus of artiodactyls is lacking, and the bone is in other ways much nearer the mesonychid type, although the astragalar foramen is absent and various other differences appear. The proportions are not unlike those of the Ursidæ, but the bear astragalus never shows the sharply keeled separation between navicular and cuboid facets.

To this genus is possibly referable No. 20319, an upper premolar of mesonychid type, recalling in its size and proportions the fourth premolar

of *Dissacus* or of *Pachyæna*. It appears small in proportion to the astragalus; it may, however, be a milk tooth. These two specimens sufficiently indicate the survival of aberrant Mesonychidæ in the Shara Murun.

#### GLIRES (Rodentia)

The only rodent specimens in the collection are a jaw fragment with one molar, and two isolated incisors.

#### Lagomorph, indet.

A fragment of lower jaw with one molar, No. 20326, from the Shara Murun beds, is comparable with *Desmatolagus*, but is too incomplete for definite identification. It differs from that genus in a much less hypsodont crown and more divergent roots, and probably represents a primitive undescribed genus of Lagomorpha.

#### PERISSODACTYLA

#### Helaletidæ (Colodontidæ)

#### *Deperetella*, new genus

We name this genus in honor of Professor Charles Depéret, whose discoveries and researches have added so greatly to our knowledge and understanding of the Tertiary faunas of Europe.

TYPE.—*D. cristata* infra.

CHARACTERS.—Molar pattern related to that of *Desmatotherium* and *Colodon* but more specialized in the direction of sharp transverse crests; the premolars more molariform. Limbs and feet long and slender, manus and pes tridactyl. The upper molars have high, sharply compressed, nearly transverse crests curving around to join externally. Parastyle and free portion of ectoloph much reduced, joined by a continuous basal cingulum which passes around the anterior, inner and posterior margins of the tooth. Upper premolars with sharp, well separated, transverse crests, external crest higher, somewhat convex externally, distinct parastyle and encircling basal cingulum. P<sup>1</sup> small, ? one-rooted. Lower molars with wide, sharp transverse crests, no connecting ridge, a low, transverse, crested cingulum behind the posterior crests of all three, but no heel on m<sub>3</sub>. External and anterior basal cingula, inner cingulum imperfect to absent. Fourth lower premolar fully molariform, third partly so, with strong connecting crest between the transverse crests and well-developed paraconid. First and second premolars compressed, two-rooted, the second submolariform and longer than the posterior premolars. Diastema short, canine of moderate size, incisors smaller.

Humerus of moderate proportions, radius much elongate, one-third longer than humerus, manus tridactyl, the fifth digit reduced to a small, short, strongly divergent, vestigial nodule. Pes long and slender, all the tarsals relatively long as well as the metatarsals. Lateral digits reduced much as in *Colodon*. Phalanges short.

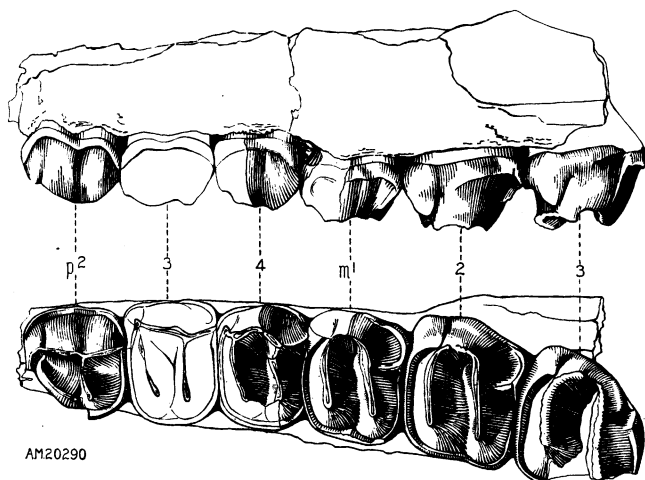


Fig. 4. *Deperetella cristata*. Upper jaw, external and crown views, two-thirds natural size. Type specimen, No. 20290.

The outlined portions of teeth restored from No. 20293.

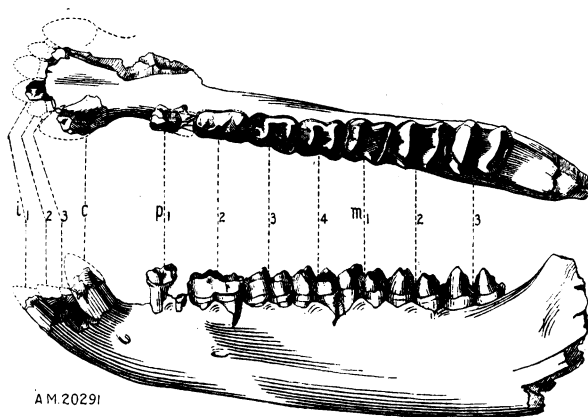


Fig. 5. *Deperetella cristata*. Lower jaw, external and crown views, one-third natural size. No. 20291.

This remarkable genus is clearly related to *Colodon*, with which it agrees in teeth and feet more nearly than with any other described perisodactyl. It is, however, very well distinguished by the sharply crested, peculiar pattern of the molars, entire absence of heel on  $m_3$ , etc. It is the largest and most specialized of the colodont group. The character of the entocuneiform is tapiroid and not rhinocerotoid or equid; it

would probably be more nearly approached by *Colodon* if the bone were known in that genus.

***Deperetella cristata*, new species**

TYPE.—No. 20290, parts of upper jaws and fragments of skull, young individual, with unworn molars and premolars.

PARATYPES.—Nos. 20291, lower jaw; 20292, lower jaws; 20295 and 20305, hind feet; 20294, humerus, radius, part of forefoot.

HORIZON AND LOCALITY.—Ula Usu beds of the Shara Murun formation.

Size comparable to modern Brazilian tapir, but limbs much longer. Length of  $p_1$ - $m_3$  = 141 mm.

**Hyracodontidæ**

***Cænolophus*, new genus**

Upper teeth rhinocerotoid in structure. Upper molars with very oblique protoloph and metaloph, the metaloph relatively reduced. Posterior flange of ectoloph of  $m^3$  reduced to varying degree.  $P^4$  with two strongly oblique transverse crests, the protoloph higher and directed toward the parastyle, the metaloph directed toward the paracone or anterior external rib; no distinct postero-external rib.  $P^3$  with the transverse crests united internally to protocone but similar relations external.

Lower molars with crests somewhat more oblique than in *Prothyracodon*, no heel on  $m_3$ .

This genus appears to be rather nearly related to *Prothyracodon* of the Uinta, but the construction of the premolars does not agree entirely with that shown in Osborn's figures ("*Triplopus*"), and the proportions of  $m^3$  are considerably different. The lower teeth are characteristically like those figured by Osborn. Skull and feet are unknown, but if, as seems probable, they are like those figured by Peterson as *Prothyracodon obliquidens*, the nares are not extended backward and the manus is tridactyl.

***Cænolophus promissus*, new species**

TYPE.—No. 20297, left upper jaw with  $p^3$ - $m^3$  moderately worn.

HORIZON AND LOCALITY.—Shara Murun formation, Ula Usu, Expedition 1923.

SPECIES CHARACTERS.—Size medium,  $p^3$ - $m^3$  = 61,  $m^1$ - $m^3$  = 43 mm.  $M^3$  trapezoidal, with moderate posterior flange or ectoloph. Metaloph of  $p^4$  shorter, metaloph of  $p^3$  imperfectly separated. No. 20304,  $m_{1-2}$  in a fragment of jaw from the Shara Murun beds, is probably of this species. There is no trace of paraconid cusp on the lower molars, the anterior crest sweeping down uniformly to the base of the tooth at the antero-internal angle.

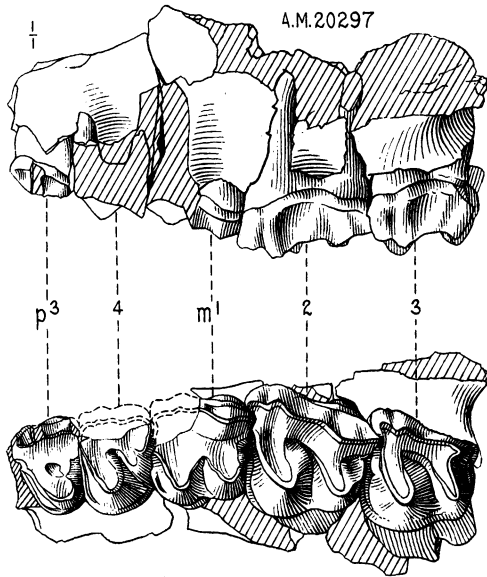


Fig. 6. *Cænolophus promissus*. Upper jaw, external and crown views, natural size. Type specimen, No. 20297.

#### ***Cænolophus obliquus*, new species**

TYPE.—No. 20296, upper jaw with  $dp^3$ - $m^1$ , part of  $m^2$ ,  $p^3$ - $4$  preformed and chamber of  $m^3$ . Shara Murun formation, Ula Usu, Mongolia.

CHARACTERS.—Larger than the two preceding species;  $p^3$ - $4$  with strongly oblique transverse crests united at protocone on  $p^3$ .  $P^3$ - $m^2$  approximately 66 mm.; estimated length of  $p^3$ - $m^3$  = 83 mm.

#### ***Cænolophus progressus*, new species**

TYPE.—No. 20298, left upper jaw with  $m^1$ - $3$  moderately worn. Same horizon and locality as *C. promissus*.

SPECIES CHARACTERS.—Size smaller,  $m^1$ - $3$  = 35 mm.  $M^3$  subtrigonal, the posterior flange of ectoloph vestigial.

No. 20309, lower jaw fragment with  $m_{1-2}$  (possibly  $dp_4$ - $m_1$ ), may belong to this species, although smaller than the type if the teeth are both permanent molars. It has the same characters as the jaw fragment referred to *C. promissus*.

#### ***Cænolophus ? minimus*, new species**

No. 20310, a jaw fragment with  $m_{1-2}$ , represents a species provisionally referable to this genus, but decidedly smaller than any of the preceding. The molars have the same characters as those referred to the preceding species, but the length of  $m_{1-2}$  is 15.5 mm., of  $m_{1-3}$ , estimated at 24 mm.

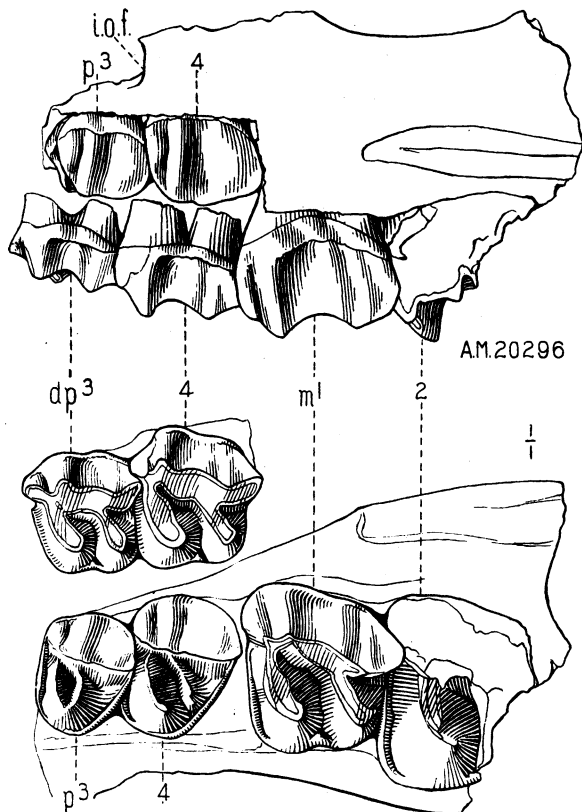


Fig. 7. *Cænolophus obliquus*. Upper jaw, external and crown views. Natural size. Type specimen, No. 20296.

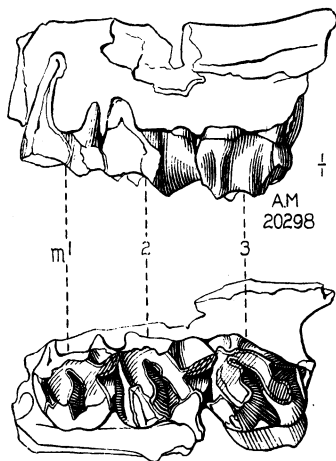


Fig. 8. *Cænolophus progressus*. Upper molars, external and crown views, natural size. Type specimen, No. 20298.

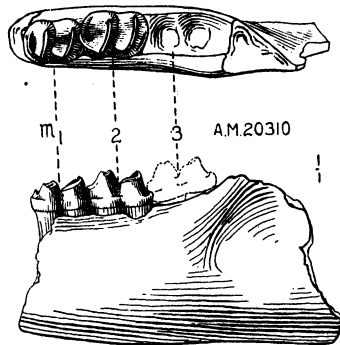


Fig. 9. *Cænolophus minimus*. Lower jaw fragment,  $m_1-3$ , crown and external views, natural size. Type specimen, No. 20310.



**ARTIODACTYLA**

**Hypertragulidæ**

**Archæomeryx optatus**, new genus and species

TYPE—No. 20311, skull and jaws; paratypes, Nos. 20320-20322, articulated skeleton, skulls and jaws, all found associated in one pocket in the Ula Usu locality, Shara Murun formation, later Eocene.

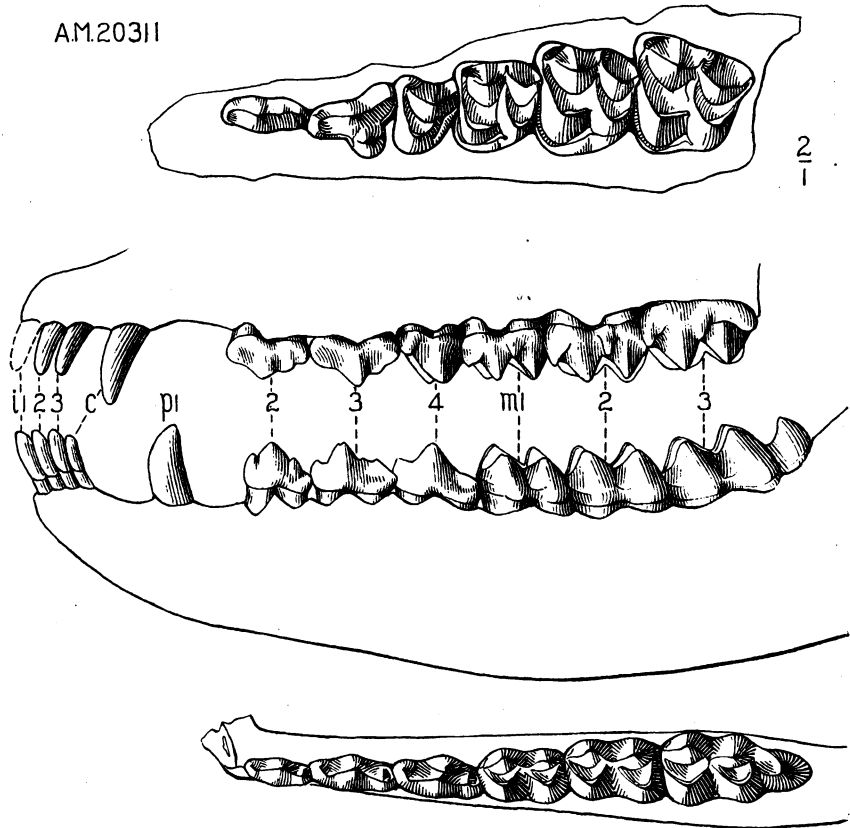


Fig. 10. *Archæomeryx optatus*. Upper and lower dentition, external and crown views, twice natural size. Type specimen, No. 20311.

Front teeth supplied from No. 20322.

CHARACTERS.—Dentition  $\frac{3 \cdot 1 \cdot 3 \cdot 3}{3 \cdot 1 \cdot 4 \cdot 3}$ . Upper molars tetracuspid, brachyselenodont, the pairs of cusps somewhat obliquely set, the posterior wings of the inner crescents low and incomplete. Parastyles prominent, continuous with anterior wing of antero-internal crescent; mesostyles well developed; metastyles very weak or absent on

$m^1-2$ , moderately developed on  $m^3$ . Anterior external rib prominent, posterior rib absent. Postero-internal crescent of molars smaller than antero-internal; inner cingula well developed; molars increasing somewhat in size from first to third.

Upper premolars three,  $p^4$  with complete inner and outer crescent,  $p^3$  with inner cusp and three-cusped outer crest,  $p^2$  with outer crest imperfectly three-cusped, no inner cusp. Postcanine diastema rather short, canine small, pointed, recurved, one-rooted, three very small, pointed, simple incisors in front of it, a little spaced, but no considerable diastemata.

Lower incisors three, very small and like the upper incisors; lower canine close behind them and but little larger.  $P_1$  with short diastemata before and in some individuals slightly spaced behind, small, simple caniniform, but with more flattened crown.  $P_2$  two-rooted, with three strongly compressed cusps in line, the central one highest.  $P_3$  similar, but with anterior crested cusp inturned to a transverse ridge, and a suggestion of posterior transverse ridge behind the posterior cusp.  $P_4$  with anterior crest partly inflected, a distinct cusp internal to the central and the transverse crest at posterior border further developed and sweeping around to become connected with the median inner cusp; a small oblique crest also extending posterointernad from the posterior of the three original cusps.

Lower molars tetracuspid, brachyselenodont, with the pairs of cusps set somewhat obliquely, third lobe of last molar looped, no internal cusp. The crests of the loop correspond to the wings of the external crescents of the molars, the posterior wing sweeping around to an internal basal crescent.

Skull about as large as that of *Tragulus javanicus*, but much more primitive and generalized. The braincase is much smaller and the orbits are smaller; the orbits appear to be enclosed behind; from the postorbital process the postorbital crests run obliquely inward and backward to meet at the anterior ends of the parietals and form a low continuous sagittal crest. The occipital crest appears also to be prominent, as usually in Eocene mammals. The skulls are so crushed and incomplete that little more has been determined from them than the above. The lower jaws are rather heavier than in *Tragulus* and shorter anteriorly, the muzzle in front of  $p_2$  being little more than half as long.

Skeleton somewhat larger than that of *Tragulus*, the femur an eighth longer and heavier in the shaft, the tibia of the same length but considerably heavier shaft. Radius and ulna separate, the ulnar shaft with less breadth but greater thickness in its distal portion than *Tragulus* or *Hyæmoschus*, the shaft of the radius more slender than in *Tragulus* but the proximal and distal ends about the same size. Fibula reduced to proximal and distal vestigia, the latter with long, slender splint, but shaft apparently not complete. Navicular and cuboid coössified, carpals all separate. Metacarpals and metatarsals separate, the lateral digits complete and moderately reduced, less relatively than in *Hyæmoschus*, much less than, in *Tragulus*. Distal keels of metapodials not extended over dorsal face. Phalanges proportioned much as in *Tragulus*, but both fore and hind feet are of considerably larger size.

Ischia constructed as in *Hyæmoschus* and the pecora, in contradistinction to *Tragulus*. Tail long (cf. anoplotheres).

This genus is of exceptional interest, as it appears to be an approximate ancestral type for the pecora. It has assumed the characteristic pecoran-traguline character of the united naviculo-cuboid, but it still

retains the separate median pair and complete lateral pair of digits, the ulnar and fibular shafts are more primitive than in any pecora, the upper incisors are still retained, the premolars are of primitive pattern, the molars brachyselenodont. It lacks any of the various aberrant specializations which exclude all of the Eocene genera hitherto described from direct ancestry to the pecora and, as fortunately the principal osteological and dental characters are determinable from the exceptionally complete material, the affinities of the genus can be very satisfactorily appraised. So far as the higher ruminants are concerned, it affords tangible and very convincing proof of the theory of an Asiatic dispersal center.

