

Article XIII. — NEW OLIGOCENE HORSES.

By HENRY FAIRFIELD OSBORN.

PLATES IV AND V, AND EIGHT TEXT FIGURES.

The explorations of the American Museum of Natural History under Messrs. Wortman, Matthew, and Gidley in the Oligocene have brought to light a large number of new species of horses which have been awaiting description for many years. It has become apparent that there were varied races of horses in the Oligocene, which gave rise to the great variety of horses which we have found in the Miocene.

It is hoped that the special explorations and researches on the evolution of the horse under the William C. Whitney Fund will enable us to connect these Oligocene and Miocene races in continuous series.

With the able coöperation of Mr. J. W. Gidley, who is in special charge of this branch of the work in the American Museum, the following revision is presented. The numbers refer to the chronological sequence of description of species of *Mesohippus*, *Miohippus*, and *Anchitherium*, including the John Day types.

The distinctive characters are either persistent or progressive, namely: (1) Increase in size; (2) development of pre-orbital fossæ in the skull; (3) persistent bunodont or separate character of conules and cones as contrasted with (4) progressive union of cones and conules into more or less continuous and sharply defined crests; (5) hypsodont elongation of the crown as contrasted with (6) persistent primitive brachyodont condition; (7) appearance and development of the hypostyle; (8) proportions of the crowns correlated with greater or less elongation of the face; (9) size and proportions of pm^2 and of m^3 .

SYSTEMATIC TABLE OF SPECIES FROM WHITE RIVER AND JOHN DAY BEDS.

PRESENT REFERENCE.	ORIGINAL NAME AND AUTHOR.	DATE AND PLACE OF PUBLICATION.	PUBLICATION OF FIGURE.	COLLECTION CLAIMING TYPE.
1. <i>Mesohippus bairdi</i> .	<i>Palaeotherium bairdi</i> Leidy.	1850, Proc. Acad. Nat. Sci. Phila., p. 122.	1854, Ancient Fauna of Neb., pl. x, figs. 14-21; pl. xii, 1873, Ext. Vert. Fauna of West. With first description, pl. xx, fig. 19.	National Museum, Washington.
2. <i>Miohippus condoni</i> .	<i>Anchitherium condoni</i> "	1870, Proc. Acad. Nat. Sci. Phila., Vol. XXI, p. 112.	1873, Ext. Vert. Fauna of West. With first description, pl. xx, fig. 19.	National Museum, Washington.
3. <i>Hypohippus australis</i> .	" <i>australe</i> "	1873, Ext. Vert. Fauna of W. Ter., pp. 250, 251.	1873, Ext. Vert. Fauna of W. Ter., pp. 251, 252.	National Museum, Washington.
4. (?) <i>Parahippus agrestis</i> .	" <i>agreste</i> "	1873, Ext. Vert. Fauna of W. Ter., pp. 251, 252.	1873, Paleont. Bull. No. 16, p. 7.	National Museum, Washington.
5. <i>Mesohippus</i> (?) <i>bairdi</i> (Milk dent.).	" <i>cuneatum</i> Cope.	1873, Paleont. Bull. No. 16, p. 7.	1873, Paleont. Bull. No. 16, p. 7.	National Museum, Washington.
6. <i>Miohippus amneciens</i> .	<i>Miohippus amneciens</i> Marsh.	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 249.	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 249.	Yale Museum.
7. (?) " <i>anceps</i> .	<i>Anchitherium anceps</i> "	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 250.	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 251.	" "
8. <i>Mesohippus celer</i> .	" <i>celer</i> "	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 251.	1874 (Mar.), Am. Journ. Sci. (3), Vol. VII, p. 251.	" "
9. <i>Mesohippus</i> sp.	" <i>exoletum</i> Cope.	1874 (Apr.), Am. Rep. U. S. Geol. Soc., p. 496.	1874 (Apr.), Am. Rep. U. S. Geol. Soc., p. 496.	(?) Am. Mus. Nat. Hist.
10. <i>Mesohippus equiceps</i> .	" <i>equiceps</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 73.	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 73.	" "
11. " <i>brachylophus</i> .	" <i>brachylophus</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 74.	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 75.	" "
12. <i>Mesohippus longicristis</i> .	" <i>longicristis</i> "	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 75.	1879 (1878), Proc. Am. Phil. Soc., Vol. XVIII, p. 75.	" "
13. <i>Anchitherium praestans</i> .	" <i>praestans</i> "	1879, Am. Nat., Vol. XIII, pp. 462, 463.	1879, Am. Nat., Vol. XIII, pp. 462, 463.	" "
14. (?)	" <i>ultimum</i> "	1886, Proc. Am. Phil. Soc., Vol. XXIII, p. 357.	1886, Proc. Am. Phil. Soc., Vol. XXIII, p. 357.	" "
15. (?) <i>Mesohippus westoni</i> .	" <i>westoni</i> "	1889, Am. Nat., Vol. XXIII, p. 153.	1889, Am. Nat., Vol. XXIII, p. 153.	Canada Geol. Surv.
16. <i>Colodon longipes</i> .	(?) <i>Mesohippus longipes</i> Osb. and Wort.	1894, Bull. Am. Mus. Nat. Hist., Vol. VI, p. 214.	1894, Bull. Am. Mus. Nat. Hist., Vol. VI, p. 214.	Am. Mus. Nat. Hist.
17. <i>Mesohippus intermedius</i> .	<i>Mesohippus intermedius</i> Osb. and Wort.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 354-356.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 354-356.	" "
18. (?) <i>Colodon copei</i> .	<i>Mesohippus copei</i> Osb. and Wort.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 356-358.	1895, Bull. Am. Mus. Nat. Hist., Vol. VII, pp. 356-358.	" "
19. <i>Mesohippus latidens</i> .	<i>Mesohippus latidens</i> Douglass.	1903, Annals Carn. Mus., Vol. II, pp. 161, 162.	1903, Annals Carn. Mus., Vol. II, pp. 161, 162.	Carnegie Museum.

Horses of Smaller Size from the Lower Oligocene or Titanotherium Beds.

With one exception, so far as known, the horses of this stage are small, not over eighteen inches at the withers. The hypostyle is wanting or rudimentary in the superior molars.

8. **Meshippus celer**
Marsh.

Amer. Journ. Sci. (3),
Vol. VII, 1874, p. 251.

Type: superior molars,
Yale Museum, p⁴-m⁸.
Measurements: m¹⁻⁸.027
(Marsh), .0295 (Gidley);
m¹ a. p. .010 by tr. .015;
m⁸ a. p. .0085 by tr. .012.
Locality: Miocene of
Nebraska (Marsh).

Molar series somewhat smaller than those of *M. bairdi*; protoloph and metaloph nearly of equal length; molar crowns short, brachyodont, but more elevated than in *M. westoni*, less elevated than in *M. latidens* or in *M. bairdi*. No hypostyle. M³ of very small size.

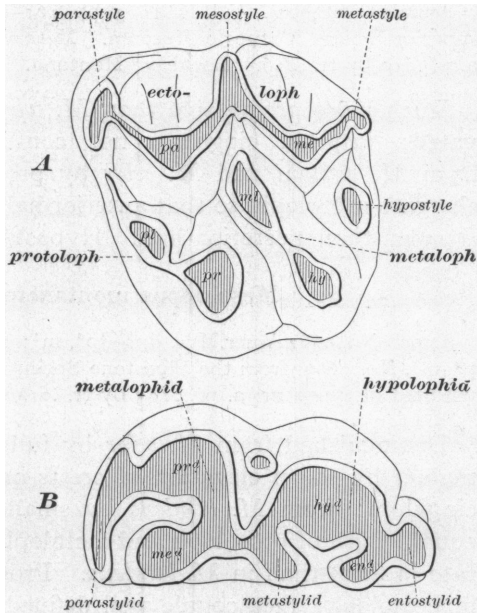


Fig. 1. Nomenclature of typical Equine molars.

15. **Meshippus westoni** Cope.

Amer. Nat., Vol. XXIII, 1889, p. 153.

Type: a fractured upper molar and two lower molars of doubtful association, Ottawa Museum. Measurements: Superior molar a. p. .0095, tr. .012+; height of hypocone .004-, of ectoloph .005+; lower molar a. p. .0095. Locality: Swift Current Creek, Assiniboia, Canada.

Superior molar extremely primitive and brachyodont; transverse diameter proportionately great; crests low and obtuse;

persistent, well defined internal cingulum; protoloph with defined protoconule; metaloph continuous, with metaconule not clearly defined. No hypostyle.

19. **Mesohippus latidens** Douglass.

Annals Carn. Mus., Vol. II, 1903, pp. 161-162, fig. 7, p. 161. Type: superior molars, Carnegie Museum. Measurements: m^1-m^8 .032; m^1 a. p. .010 by tr. .016. Locality: Montana.

Much more progressive than *M. westoni*; crests more elevated; internal cingulum not continuous. Distinguished from *M. westoni* and *M. celer* by prominent parastyle and elongate protoloph, so that anterior half of the crown is much broader than posterior half. Hypostyle wanting.

20. **Mesohippus montanensis**, sp. nov.

Type: No. 9662 Amer. Mus. dp^8-dp^4 , m^1 ; cotypes, dp^8-m^4 , No. 9661, p^8-m^1 , No. 9663, from the Pipestone Springs Beds, Montana. Measurement of type: m^1 a. p. .0105 by tr. .014.

Distinguished from *M. celer* by full size of m^3 ; from *M. westoni* by sharp elevation of crests and absence of internal cingulum; from *M. latidens* by smaller parastyle and subequal length of protoloph and metaloph. Molars more quadrate in form than in *M. latidens*. Protoconule quite distinct in protoloph; metaconule well defined on base of metaloph. Hypostyle absent or extremely rudimentary.

A forefoot associated with a single m^3 of the same species exhibits a large splint of mtc. v.

Upper Titanotherium Beds.

21. **Mesohippus hypostylus**, sp. nov.

PLATE V, A.

Type: No. 1180 Amer. Mus., palate with complete series of teeth on both sides, p^1-m^8 . From Cheyenne River, S. Dakota. Measurements: p^1-m^8 .075; m^1-m^8 .032; m^1 a. p. .010 by tr. .0135; vertical hypocone .006, ectoloph .0075.

Distinguished from the preceding species by (1) a clearly

defined but rudimentary hypostyle just budding off from the posterior cingulum, (2) by protoloph tending to unite with paracone; from *M. bairdi* by more rudimentary hypostyle and less elevated crests. Metaloph sharp; metaconule

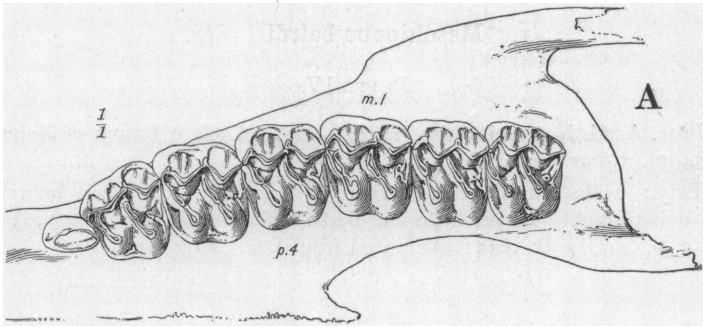


Fig. 2. *Meshippus hypostylus*, sp. nov. Type. No. 1180 Am. Mus.

not defined at base. Pm^1 small. Skull with preorbital fossa apparently deeper than in *M. bairdi*.

22. *Meshippus proteulophus*, sp. nov.

Type: upper teeth, p^4-m^2 , No. 514_a Amer. Mus., Cotype lower jaw, No. 8 Amer. Mus. From the upper Titanotherium Beds, Cheyenne River, South Dakota.

This is a relatively large animal for the Titanotherium Beds, and is the oldest horse known with perfect crests on the molar teeth — hence the name *proteulophus*. The superior molars are readily distinguished by: (1) their large size; p^3-m^2 measure .037 mm. as compared with .0335 for the same teeth in *M. bairdi*; (2) by the primitive absence of a distinct hypostyle; (3) especially by the very advanced or progressive condition of the proto- and metalophs which are continued to the ectoloph, and are very little divided, thus resembling those of *M. eulophus*; (4) the external cingulum sweeps upward across the parastyle instead of rising with it.

The cotype lower teeth p_2 to m_3 measure 79 mm., indicating an animal of large size.

Horses of Intermediate Size, Middle Oligocene, Oreodon Beds.

All the known species of horses of this and overlying beds exhibit a hypostyle on the molars. The horses are between 18 and 20 inches at the withers.

1. **Meshippus bairdi** Leidy.

PLATE IV.

Proc. Acad. Nat. Sci. Phila., 1850, p. 122. Ancient Fauna of Nebr., 1854, pl. x, figs. 14-21, pl. xi.

Type: a skull and teeth, misplaced at present. Horizon not recorded, probably Lower Oreodon Beds. Measurements: m^{1-3} .032; M^1 a. p. .011 by tr. .014; estimated from Leidy's figures.

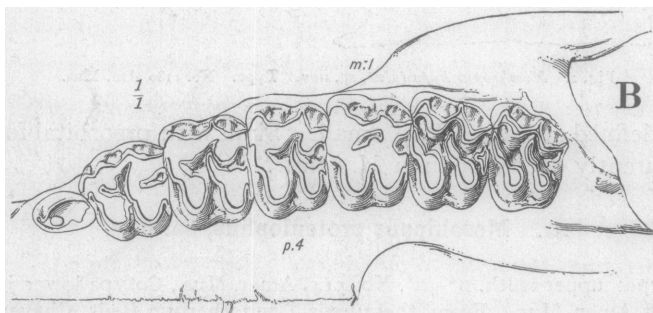
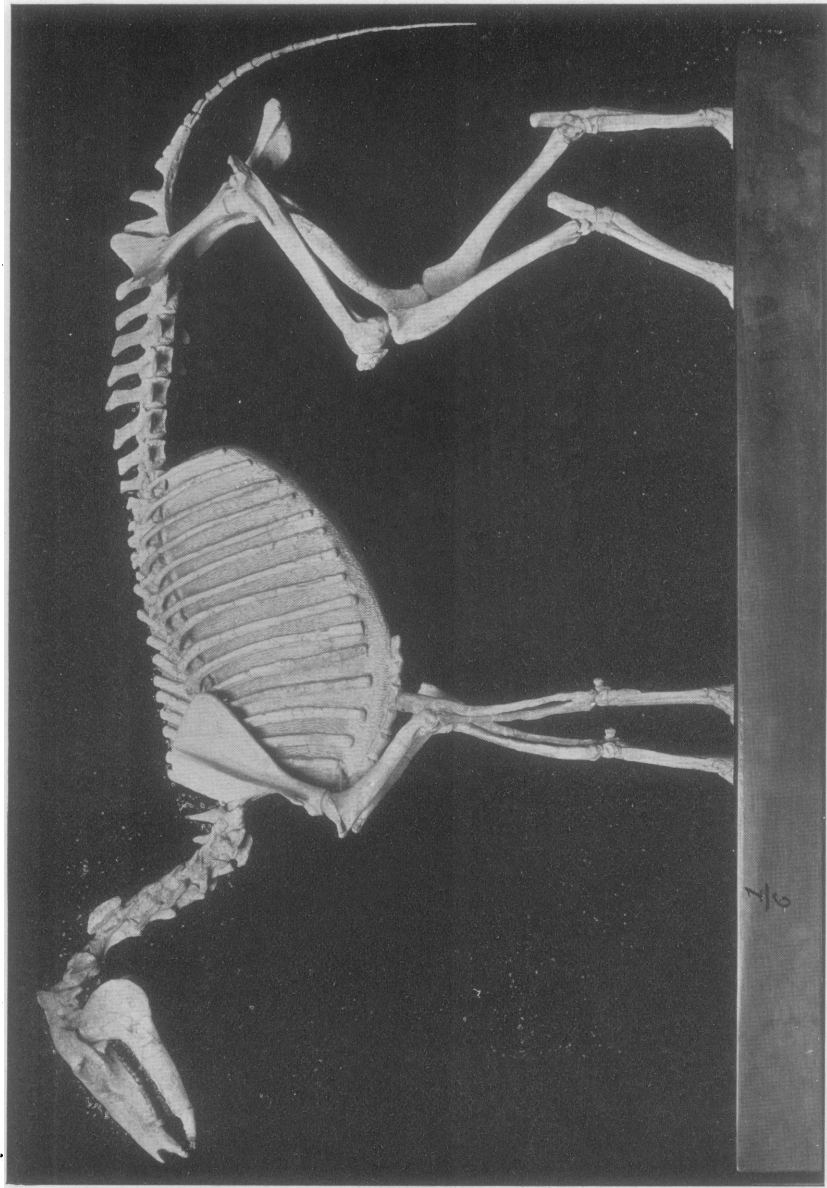


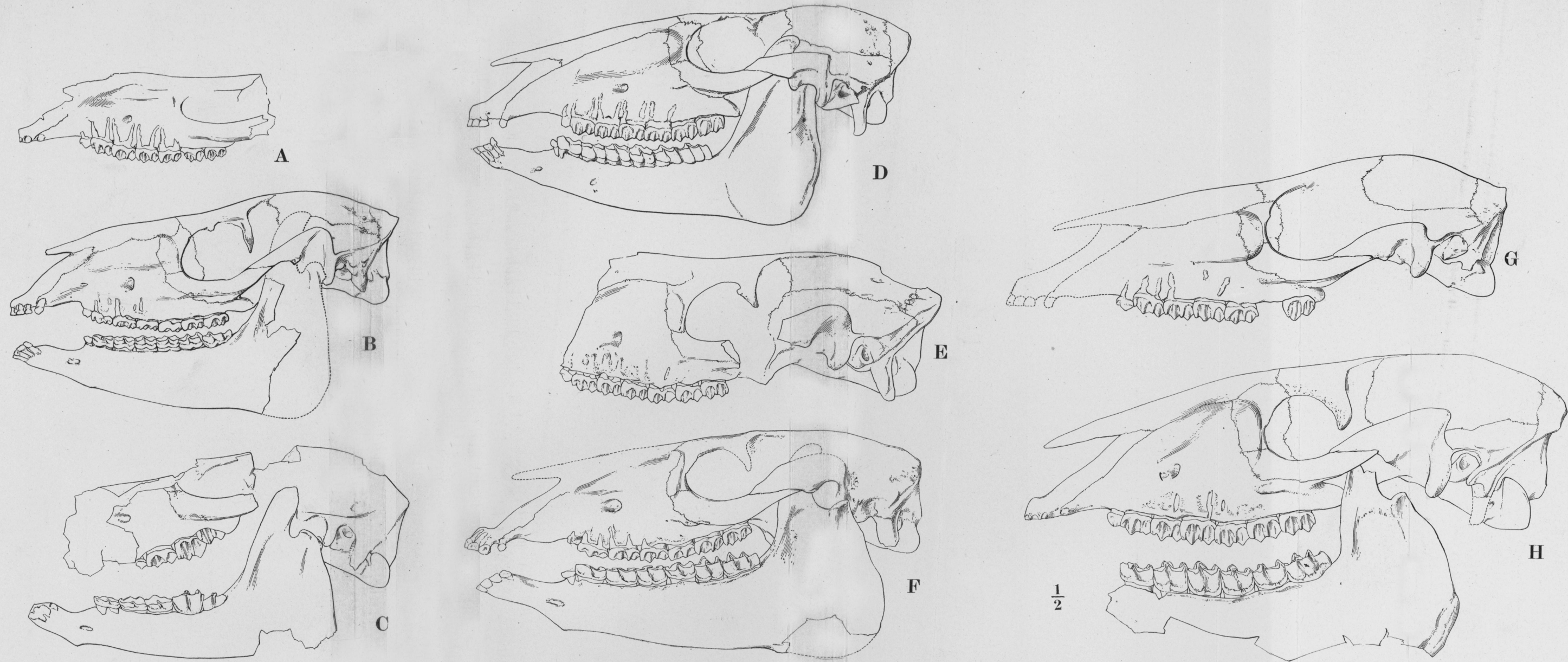
Fig. 3. *Meshippus bairdi*. No. 1477 Amer. Mus.

Skull with a shallow preorbital fossa. Molars with more elevated crests than in species described above, excepting *M. montanensis* and *M. proteulophus*. Hypostyle present and well developed, but still connected with posterior cingulum. Protoloph interrupted by protoconule, tending to unite with parastyle. Metaloph more sharp and continuous. Parastyle broad.

A skull and skeleton, No. 1477 Amer. Mus., almost identical with Leidy's type, was found in the Lower Oreodon Beds of South Dakota; it is figured in Plate V, B. Another specimen in the Princeton Museum (No. 11367), found by J. W. Gidley, tends to confirm the Lower Oreodon level as that of *M. bairdi*.



MESOHIPPUS BAIRDI. No. 1492 AMER. MUS.



OLIGOCENE HORSES.

- A. *Meshippus hypostylus*. Type, No. 1180 Amer. Mus.
 B. " *bairdi*. No. 1477 Amer. Mus.
 C. " *obliquidens*. Type, No. 668 Amer. Mus.
 D. " *meulophus*. Type, No. 1210 Amer. Mus.

- E. *Meshippus brachystylus*. Type, No. 11860 Amer. Mus.
 F. " *intermedius*. Type, No. 1196 Amer. Mus.
 G. *Miohippus gidleyi*. Type, No. 1192 Amer. Mus.
 H. *Meshippus validus*. Type, No. 680 Amer. Mus.

9. **Meshippus exoletus** Cope.

Ann. Rept. U. S. Geol. Surv. Apr. 1874, p. 496.

Type: misplaced. Species at present indeterminate.

23. **Meshippus obliquidens**, sp. nov.

PLATE V, C.

Type: skull and jaws, No. 668 Amer. Mus.; young individual with milk teeth *in situ*. From the nodular layer in lower middle layer of the Oreodon Beds; specimen covered with ferruginous oxide. Measurements: lower jaw from condyle to symphysis .149; m^1 a. p. .013 by tr. .015.

This is the larger horse of the Oreodon Beds, with long-crowned teeth.

Distinguished from other species of the Oreodon Beds by (1) large size of skull and teeth as compared with *M. bairdi*, (2) pre-orbital fossa shallow or wanting, (3) but especially by the high crowns of upper and lower molars: ectoloph of m^1 measures .0105 vertical as compared with .008 in an unworn m^1 crown of *M. bairdi*, (4) metaloph elevated, metaconule not being clearly defined, (5) proto- and metalophs directed obliquely backward at a sharp angle with ectoloph, to which fact the name *M. obliquidens* refers.

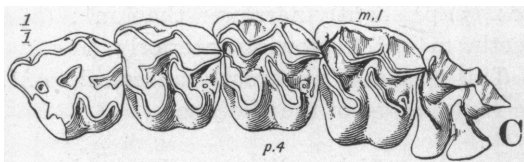


Fig. 4. *Meshippus obliquidens*. Type. No. 668, Amer. Mus.

of m^1 measures .0105 vertical as compared with .008 in an unworn m^1 crown of *M. bairdi*, (4) metaloph elevated, metaconule not being clearly defined, (5) proto- and metalophs directed obliquely backward at a sharp angle with ectoloph, to which fact the name *M. obliquidens* refers.

24. **Meshippus eulophus**, sp. nov.

Type: complete superior dental series and portion of cranium, No. 8791 Amer. Mus. Found by Dr. F. B. Loomis in the Upper Oreodon Beds (Horizon B) of Cedar Creek, Colorado. Measurements: p^1 - m^3 .076; m^1 - m^3 .036; m^1 a. p. .0115 by tr. .015; m^3 a. p. .0123 by tr. .015.

The name *eulophus* is assigned in reference to the perfect or continuous and uninterrupted condition of the transverse crests.

Distinguished from *M. bairdi* by (1) deep preorbital fossa, which is deeper also than in *M. hypostylus*; (2) large size

of m^3 ; (3) protoloph with very faint protoconule, and strongly connected with parastyle, constituting a nearly perfect anterior crest; metaloph also continuous; (4) as in *M. meteulophus* $m^1 - m^3$ exceed in linear measurement $p^2 -$

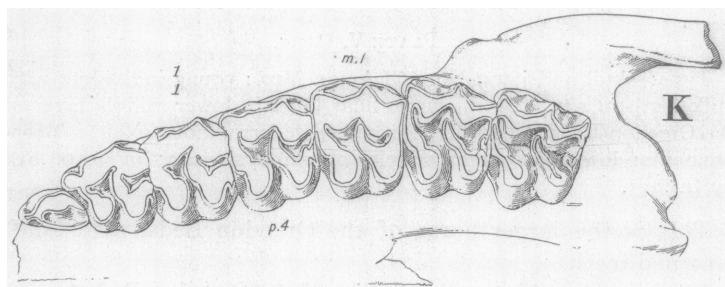


Fig. 5. *Mesohippus eulophus*. Type. No. 8791, Amer. Mus.

p^4 ; (5) p^4 slightly narrower than m^1 ; (6) series of grinding teeth, $m^2 - p^2$, narrowing anteriorly.

This species is apparently ancestral to *M. meteulophus* and to *Hypohippus* of the Miocene.

Upper Oligocene, Leptauchenia Beds.

25. ***Mesohippus meteulophus*, sp. nov.**

PLATE V, D.

Type: skull and jaws, Amer. Mus. No. 1210. Measurements: condyles to premaxillaries .215; $p^1 - m^3$.078; $m^1 - 3$.038; m^1 a.p. .013 by tr. .017.

This species is a successor of *M. eulophus*, from which it is distinguished (1) by its decidedly more elongate or hypsodont molar crowns, the crests being .002 higher; (2) by its larger size; (3) unlike *M. eulophus* p^4 is broader than m^1 , a progressive stage towards the equine condition; (4) it accents the *M. eulophus* character of the heavy but continuous meta- and protoloph which are not distinctly interrupted by conules. In the ectoloph the parastyle, mesostyle, and ribs are sharply defined but not prominent, in fact, the ectoloph is somewhat flattened. (5) Another feature is that the protoloph is more elongate

transversely than the metaloph, causing these crests to be somewhat asymmetrical as in *M. latidens*.

While more progressive than *M. intermedius* in these respects, this species is sharply distinguished by the fact (6) that the hypostyle rises directly on the posterior cingulum; it is not in the least separate. It differs from *M. gidleyi* in the conformation of the crests, the small size of pm^2 , and the large size of m^3 .

It resembles *Hypohippus* in: (7) external cingulum crosses base of parastyle, (8) crests are simple and continuous, (9) postfossette is fully formed in premolars, (10) preorbital fossa is simple, long, and deep, (11) flattened or angulate parastyle.

26. *Mesohippus brachystylus*, sp. nov.

PLATE V, E.

Type: skull, No. 11860 Amer. Mus. Collected by H. F. Wells in Leptauchenia Beds, Cheyenne River, South Dakota. Measurements: p^1-m^8 .082; m^1-m^8 .038; m^1 a. p. .0135, tr. .0175; m^8 tr. .0155.

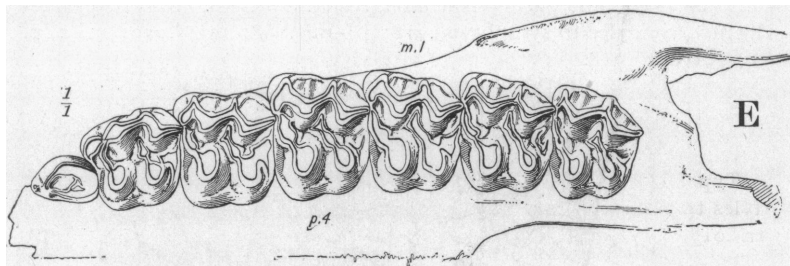


Fig. 6. *Mesohippus brachystylus*. Type. No. 11860, Amer. Mus.

The name refers (1) to the broad rounded parastyle, readily distinguishable from the flattened angulate parastyle of *M. eulophus*, *M. meteuulophus*, and *Hypohippus*.

This species is further distinguished by: (2) depressed proto- and metalophs, (3) protoloph interrupted, with large oval protocone and distinct protoconule, uniting externally with parastyle, as in *M. bairdi*, (4) ectoloph with broad prominent rounded parastyle and defined mesostyle, ribs defined, (5)

hypostyle connected with cingulum but giving off a strong outward spur, (6) a broad, shallow preorbital fossa.

This horse, which is larger than *M. bairdi*, appears to be one of its successors, although of larger size and in some respects ancestral to the type of *M. intermedius* of the Protoceras Beds through a simpler intermediate stage, Amer. Mus. No. 1218.

Horses of somewhat Larger Size, Upper Oligocene, Protoceras Beds.

16. "(?) **Mesohippus**" **longipes** Osborn and Wortman.

= *Colodon longipes*.

Bull. Am. Mus. Nat. Hist., Vol. VI, 1894, p. 214.

Type: the type of this species is a foot which has since been determined as belonging to the lophiodont species *Colodon longipes*.

17. **Mesohippus intermedius** Osborn and Wortman.

PLATE V, F.

Bull. Amer. Mus. Nat. Hist., Vol. VII, 1895, pp. 354-356. Fig. 4, p. 355.

Type: skull and parts of skeleton, Amer. Mus. No. 1196. Measurements: condyles to symphysis .218; p^1-m^8 .088; m^1-8 .040; m^1 a. p. .0135 by tr. .018.

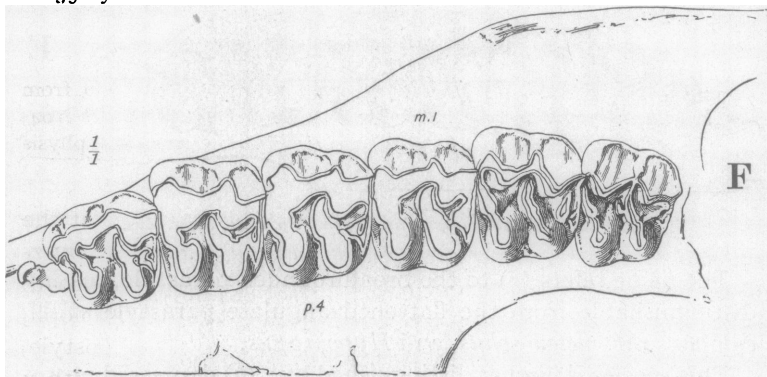


Fig. 7. *Mesohippus intermedius*. Type. No. 1196, Amer. Mus.

(1) Skull with large and apparently undivided preorbital fossa. (2) Hypostyle separated and distinct or only slightly connected with posterior cingulum; in some specimens, e. g.

Amer. Mus., No. 1043, it is still partly connected. Despite the foregoing progressive characters, (3) the protoloph is decidedly interrupted by the protoconule, (4) the molars are more brachyodont than in *M. meteulophus*. (5) The parastyle is broad and rounded when worn, as in *M. brachystylus* and *M. bairdi*.

This species is also represented in the Amer. Mus., by skull No. 1218 and palate No. 1043 which exhibit the same characters.

18. **Meshippus copei** Osborn and Wortman.

= (?) *Colodon copei*.

Bull. Am. Mus. Nat. Hist., Vol. VII, 1895, pp. 356-358.

Type: pelvis, femur, tibia, and part of hind foot, Amer. Mus. No. 1197, from Protoceras Beds.

The pelvis, the part first mentioned, belongs to some species of rhinoceros or lophiodont, and is certainly not that of a horse.

The association of the other parts proves to have been erroneous. The femur does not belong to the pelvis. The identification of the tibia and astragalus has not been made; both bones are, however, equine and may be provisionally referred to *Miohippus crassicuspis*.

27. **Meshippus validus**, sp. nov.

Type: skull, jaws, and portions of limbs, Amer. Mus. No. 680, from the Protoceras Beds of South Dakota. Measurements: p^1-m^8 .104; m^1-m^8 .047; m^1 a. p. .0165, tr. .021. Condyle to pmx. symphysis .250 + .

This is a large horse standing not less than 28 inches at the withers. The species is readily distinguished from *M. intermedius* as follows: (1) elevated ectoloph, .013, parastyle broad, ribs marked, (2) metaloph short, well separated from ectoloph, (3) protoloph interrupted, protocone indented, (4) hypostyle, < shaped or triangular, connected with cingulum and with a strong outward spur, (5) preorbital fossa subdivided by a low median ridge into anterior and posterior depressions.

This species is admirably represented by skull No. 680, Amer. Mus., also by skull No. 10733, Princeton Museum.

[May, 1904.]

28. *Miohippus gidleyi*, sp. nov.

PLATE V, G.

Type: a skull, No. 1192 Amer. Mus. Measurements: p^1-m^8 .0975; m^1-m^8 .042; m^1 a. p. .0145 by tr. .019.

This species is readily distinguished by the moderately elongate crown, the interrupted transverse crests (proto- and metalophs) of the premolar teeth, the nearly or quite continuous internal cingulum on the grinders. Its affinities are with the genus *Miohippus* Marsh.

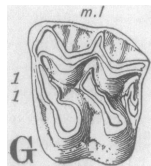


Fig. 8. *Miohippus gidleyi*. Type. No. 1192, Amer. Mus.

This animal is also somewhat larger than *M. intermedius*, which however it resembles: (1) in the presence of preorbital fossa, (2) the sharpness of the metaloph of the molars. It is more primitive than *M. intermedius* in (3) the somewhat larger size of pm^1 , (4) hypostyle large but still connected with posterior cingulum, (5) internal cingulum persisting, quite strong especially on the premolars, (6) ectoloph more elevated than the protoloph or metaloph.

Special characters which may prove to be distinctive are (7) the crenulation of the enamel surface of the premolars especially, (8) rudimentary spur or crochet from metaloph, (9) external cingulum tends to cross base of parastyle, (10) protoloph longer than metaloph in premolars.

Its characters are confirmed by a specimen (No. 10501) in the Princeton Museum, which is slightly more progressive.

This species is named in honor of Mr. J. W. Gidley who has devoted himself with such great success to the explorations for fossil horses under the Whitney Fund.

29. *Miohippus crassiscuspis*, sp. nov.

Type: 2nd and 3rd right upper premolars, Amer. Mus. No. 683. Measurements: p^2-s measure together .035. In *M. intermedius* the same teeth measure .031.

These teeth, which were mistakenly associated with the pelvis of *Colodon* (*Mesohippus*) *copei*, are now found to closely resemble those of *M. annectens* Marsh from the John Day Beds.

The distinctive characters of the type are (1) the highly interrupted transverse crests of the premolars, the cones and conules being quite distinct and separate, (2) internal cingulum strong but not continuous, (3) in the median valley are low, transverse ridges, which rise into cuspules in the related species *M. annectens*, (4) sides of the inner crests crenulate, as in *M. gidleyi*, (5) unlike *M. gidleyi*, hypostyle strong and nearly separated from posterior cingulum.

