

**Article XXXII.—NEW OR LITTLE KNOWN TITANOTHERES
FROM THE EOCENE AND OLIGOCENE.**

BY HENRY FAIRFIELD OSBORN.

INTRODUCTION.

In the preparation of the United States Geological Survey monograph 'The Titanotheres' the collections of Eocene and Oligocene materials in the larger museums of the country have been reviewed with care. Like the Oligocene titanotheres previously reviewed,¹ the Eocene titanotheres prove to be in a high degree polyphyletic. The remarkable collections made by the American Museum expeditions under Messrs. Wortman, Peterson, Matthew, and Granger, throw a flood of light on the phylogenetic and stratigraphic succession. The present bulletin, published with the approval of Director Smith of the U. S. Geological Survey, is a partial synopsis of the new systematic and phylogenetic results which will be set forth fully in the monograph. It has been prepared with the assistance of Mr. W. K. Gregory.

I. SPECIES FROM THE WIND RIVER FORMATION, LOWER EOCENE.

Lambdotherium popoagicum Cope.

Eotitanops borealis (Cope).

***Lambdotherium popoagicum* Cope.**

(Figs. 1, 2, 3.)

Doubts (Osborn) as to the reference of this animal to the titanotheres have been removed by the careful examination (Gregory) of all the materials known, which proves that it is a very slender-limbed and in certain respects

¹ The Four Phyla of Oligocene Titanotheres. Bull. Amer. Mus. Nat. Hist., Vol. XVI, Feb. 18, 1902, pp. 91-109.

aberrant rather than generalized form. It was adapted to the dry land conditions which prevailed (Loomis) in the region of the deposition of the Lower Wind River beds in northern Wyoming, which at the same time



Fig. 1. *Lambdotherium popoagicum* Cope. Upper cheek teeth; composition from different individuals, chiefly No. 4664 Amer. Mus. $\times \frac{1}{2}$.

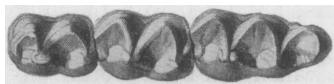


Fig. 2. *Lambdotherium popoagicum?* (type of *L. primævum* Loomis). Inferior true molars. No. 254 Amherst Museum. Courtesy of Prof. F. B. Loomis. $\times \frac{1}{2}$.

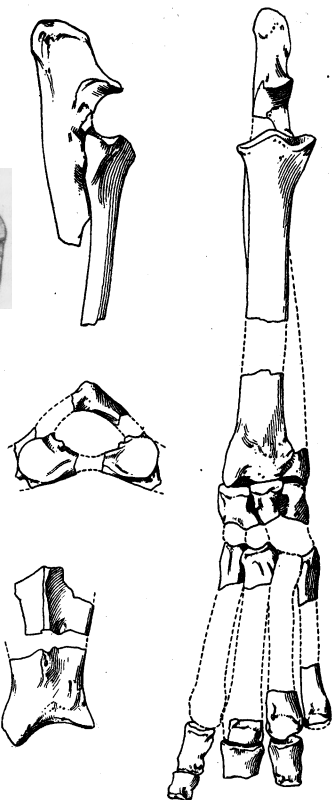


Fig. 3. *Lambdotherium popoagicum*. No. 4880 Amer. Mus. Left radius, ulna and manus, front view; right radius and ulna proximal portion, outer side view; atlas, back view; left scapula, distal portion, outer view. All $\times \frac{1}{2}$.

favorable other slender-limbed forms, such as *Eohippus* and *Heptodon*. The accompanying figures illustrate the principal characters of the feet and teeth.

Eotitanops Osborn.

Type reference.—Bull. Amer. Mus. Nat. Hist., Vol. XXIII, 1907, p. 242 (type species designated (*Palaeosyops borealis* Cope), genus not defined).

Type species.—*Palæosyops borealis* Cope (Fig. 4).

Generic characters.—From Wind River formation (? Lower). Superior molars subquadrate and rounded in form; conules reduced, sub-lophoid; m^1 – m^3 , 63 mm. (estimated). Inferior molars without metastylids. Hypoconulid of m_3 subconic. First inferior premolar present. Manus tetradactyl, functionally tridactyl with a tendency to mesaxonic structure.

The geological level of this animal is not as yet precisely determined, that is, whether it was contemporary with *Lambdotherium* in the Lower Wind River formation or a sequent form in the Upper Wind River. Cope placed it with the genus *Palæosyops* provisionally; it certainly does not belong to this short and broad-skulled phylum, but rather to one of the long-skulled phyla, possibly *Mesatirhinus*. In this uncertainty and in the presence of characters which distinguish it clearly from both *Lambdotherium* and *Mesatirhinus* it is well to assign this animal a new generic rank, under the name **Eotitanops**.



Fig. 4. *Eotitanops borealis* (Cope). Type. P^4 – m^3 right. No 4892 Amer. Mus. $\times \frac{1}{2}$.

It embraces the species *Eotitanops borealis* (Cope) and *E. brownianus* (Cope).

II. SPECIES FROM THE LOWER BRIDGER FORMATION, MIDDLE EOCENE.

Limnohyops priscus.

Limnohyops matthewi.

Limnohyops monoconus.

1. First broad-skulled group, LIMNOHYOPS Marsh and PALÆOSYOPS Leidy.

Members of these two phyla evolve contemporaneously and are especially characteristic of the Bridger. While very distinct in some characters they are so closely similar in others that in most previous descriptions they have been extensively confused.

***Limnohyops priscus* sp. nov.**

(Fig. 5).

Type locality.—Grizzly Buttes, Bridger Basin, Wyoming, level B2.

Type.—A crushed skull with excellent dentition, No. 11687, Amer. Mus. discovered by the American Museum expedition of 1903.

Specific Characters.—Level, Bridger B2; p^1 – m^3 148 (type) to 161 mm. Distinguished from the contemporary *Limnohyops levidens* Cope by its larger size and

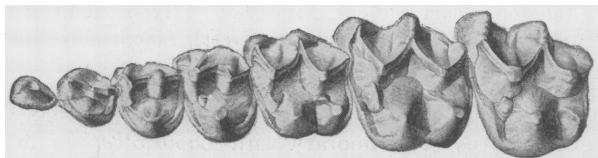


Fig. 5. *Limnohyops priscus*. Type. P^1 – m^3 left. No. 11687 Amer. Mus. $\times \frac{1}{2}$.

by the more progressive character of pm^2 – pm^3 . Second superior premolar obliquely elongate with a very rudimentary tritocane. Large hypocone on m^3 .

The name refers to the low geological level and primitive characters of this species.

***Limnohyops matthewi* spec. nov.**

(Fig. 6.)

Type locality.—Grizzly Buttes, Bridger Basin, level B2.

Type.—A skull, No. 11684 Amer. Mus., lacking the anterior portion and dentition. Discovered by the American Museum expedition of 1903.

Specific characters.—From level B2 Bridger formation. Intermediate in size between *L. levidens* and *L. monoconus*. M^3 of small size with large hypocone and

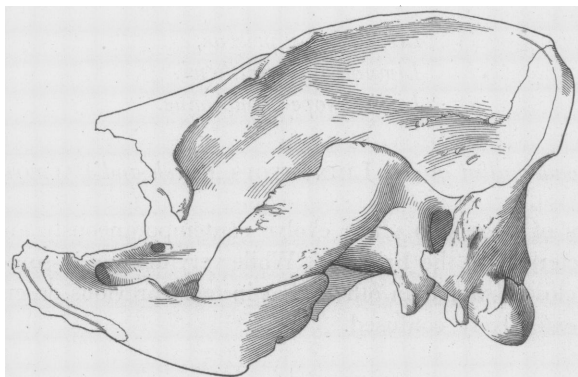


Fig. 6. *Limnohyops matthewi*. Type. No. 11684 Amer. Mus. $\times \frac{1}{2}$.

quadrate inner half. Occiput very high and narrow. Cranial portion of skull greatly abbreviated, bringing posttympanic and postglenoid processes into broad union. Temporal openings subcircular as defined by zygomatic arches.

The species is named in honor of Dr. W. D. Matthew of the American Museum staff.

***Limnohyops monoconus* spec. nov.**

(Fig. 7.)

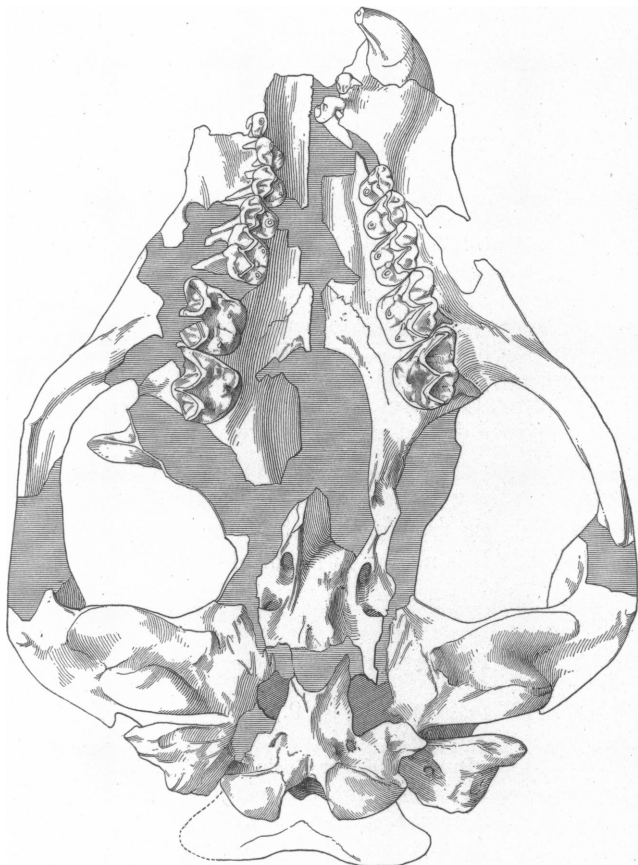
Type locality.—Grizzly Buttes, Bridger Basin, level B2.*Type.*—A crushed skull with dentition, No. 11679 Amer. Mus. Discovered by Mr. Quackenbush of the American Museum Expedition of 1903.*Specific characters.*—Recorded from level B2, Bridger. M^3 without hypocone, roundly triangular in form, with broadly extended ectoloph and parastyle. P^2-m^3 

Fig. 7. *Limnohyops monoconus*. Type. Crushed skull, inferior view. No. 11679 Amer. Mus. $\times \frac{1}{4}$.

150, p^1-m^3 163 mm. Condyle to incisive border 510. Occiput very high, cranium relatively elongated, with space (4 mm). between posttympanic and postglenoid processes. Temporal openings as defined by zygomatic arches elongate.

Named in reference to the presence of but a single cone on the inner side of the third superior molar, an exceptional condition in the genus *Limnomyops*.

III. SPECIES FROM THE UPPER BRIDGER AND LOWER WASHAKIE FORMATIONS, MIDDLE EOCENE.

Palæosyops leidy.

Mesatirhinus petersoni.

Palæosyops grangeri.

Manteoceras washakiensis.

Palæosyops copei.

1. *First broad-skulled group* (continued).

***Palæosyops leidy* spec. nov.**

(Fig. 8.)

Type locality.—Henry's Fork, Bridger Basin (Wyoming), levels C2–C4.

Type.—A well preserved skull No. 1544 Amer. Mus., associated with considerable portions of the skeleton. This specimen is now mounted in the American Museum, the missing parts having been supplied from other individuals. Discovered by the American Museum expedition of 1893 under Dr. J. L. Wortman.

Specific characters.—From Bridger levels C2–C4. Of larger size; total length of skull 415 mm.; p^2 – m^3 , 158; p_2 – m_3 , 168. Diastema behind canine. P^3 , p^4 superior with mesostyles. Barely defined swellings representing the rudiments of osseous frontonasal horns.

The species has long been confused with the *Palæosyops major* and *P. paludosus* of Leidy, the types of both of which are from the Lower Bridger, Cottonwood Creek. It is named in honor of Joseph Leidy, the discoverer of the family and of the genera *Palæosyops*, *Titanotherium* and *Megacerops*.

***Palæosyops grangeri* spec. nov.**

(Fig. 9.)

Type locality.—Twin Buttes, Bridger Basin, level C1.

Type.—A palate and grinding teeth with portions of the lower jaw and skull. Amer. Mus. No. 12189. (Amer. Mus. Exp. 1904.)

Specific characters.—From level C1 Bridger. Exceeding *P. robustus* in certain dental proportions, p^2 – m^3 , 165 mm. Fourth superior premolar enlarged (transv., 31). Molars with extremely prominent parastyles and oblique ectolophs.

This is named in honor of Mr. Walter Granger of the American Museum staff, whose explorations have transformed our knowledge of the Bridger animals.

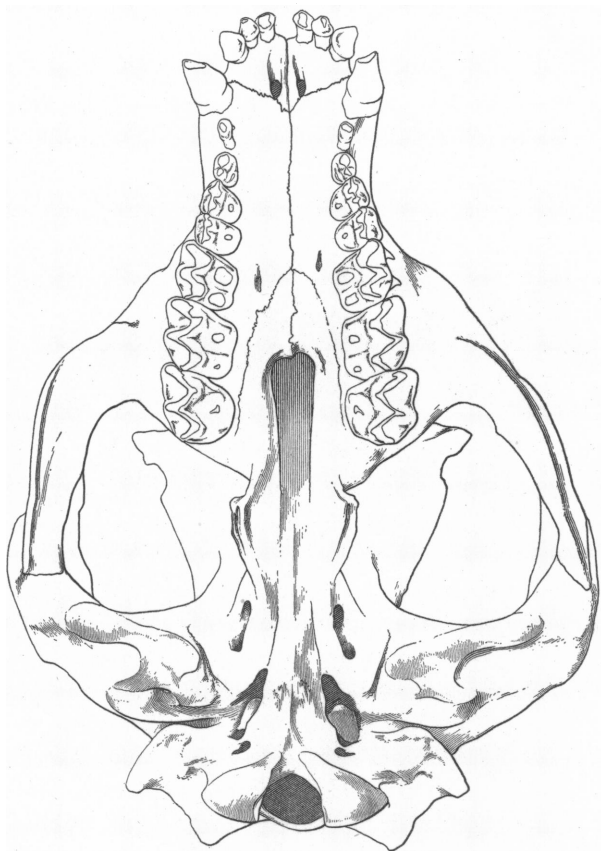


Fig. 8. *Palæosyops leidyi*. Type. Skull, inferior view. No. 1544 Amer. Mus. $\times \frac{1}{2}$.

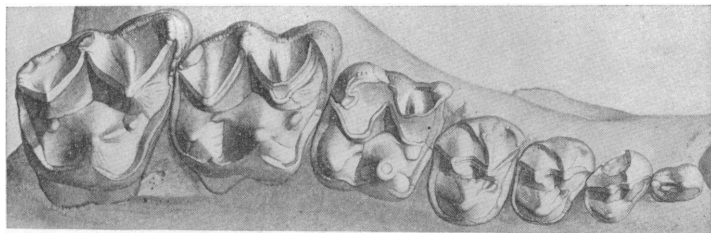
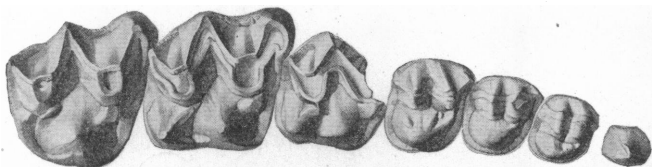


Fig. 9. *Palæosyops grangeri*. Type. Upper dentition, right side. No. 12189 Amer. Mus. $\times \frac{1}{2}$.

***Palæosyops copei* spec. nov.**

(Fig. 10.)

Type locality.— Lone Tree, Henry's Fork, Bridger Basin, level D3.*Type*.— A series of superior grinding teeth, No. 11708 Amer. Mus. (Expedition of 1903.)*Specific characters*.— From level D3 Bridger. Apparently the last of the *Palæosyops* phylum. Of more diminutive size (p^2 - m^3 , 153 mm.), but the mostFig. 10. *Palæosyops copei*. Type. $P1-m^3$, right. No. 11708 Amer. Mus. $\times \frac{1}{2}$.

progressive species of *Palæosyops* known in the evolution of its superior premolars and molars. Heavy cingula embracing the inner-sides of the crowns. A rudimentary tetartocone on p^2 .

Named in honor of the late Professor E. D. Cope, the describer of *Lambdotherium*, "*Palæosyops*" *borealis*, and other species of Eocene Titanotheres.

2. Second Broad-skulled Phylum, MANTEOCERAS.

There is little doubt that *Manteoceras* Hatcher¹ (of the Upper Bridger and Lower to Upper Washakie) represents the broad-skulled phase of that stock which gave rise to the long-skulled phyla *Mesatirhinus*, *Metarhinus*, and *Dolichorhinus*.

The type species of the genus is:

***Manteoceras manteoceras* (Osborn MS.) Hay.**

Type.— A skull lacking the dentition, No. 1569, Amer. Mus. from the Washakie Basin, Wyoming.

Paratype.— An incomplete skull, No. 1570 Amer. Mus., with dentition. In the original description by Osborn the type skulls were referred to "*Telmatotherium validens* Cope."

In Hay's catalogue² this species is entered as '*Manteoceras manteoceras* Osborn,' but under modern rules of nomenclature this name is technically

¹ Amer. Naturalist, Vol. XXIX, 1895, p. 1090.

² Bibliography and Catalogue of the Fossil Vertebrata of North America, 1902, p. 632.

attributable to Hay, since in his catalogue this manuscript name is printed together with the designation of the figure and description of the type specimens.¹

***Manteoceras washakiensis* spec. nov.**

(Fig. 11.)

Type locality.—Base of Haystack Mountain, Washakie Basin, Wyoming. Geological level, summit of the Lower Washakie (A).

Type.—A well preserved skull with dentition, No. 13165 Amer. Mus. Discovered by Mr. Paul Miller of the American Museum expedition of 1906.

Specific characters.—Distinguished from *M. manteoceras* of a somewhat lower geological level by its more progressive characters as follows: canines short, obtuse, recurved; internal lobes of pm^2 , pm^3 broadening, with shelf for development of deutocone; p^2 (ant. post. 19 mm., transv., 17) with marked external convexities and a reduced external cingulum; p^3 (ant. post. 19, transv. 25) exhibits the tetarto-

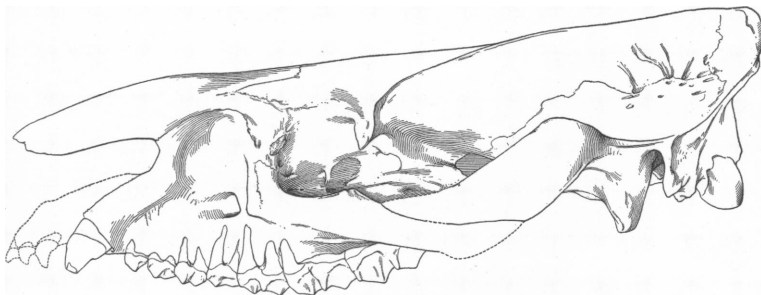


Fig. 11. *Manteoceras washakiensis*. Type. No. 13165 Amer. Mus. $\times \frac{1}{2}$.

cone fold somewhat more conspicuously than in the most progressive Bridger level D specimens. P^4 (ant. post. 24 by trans. 30) is progressive in transverse measurement and in the development of the tetartocone shelf. The molars are progressive in their large size (m^2 ant. post. 42, transv. 48), in the strong development of the internal cingulum, and in the elongate ectoloph.

The species is so named because it is a more recent phase, probably characteristic of the Washakie rather than of the Bridger.

¹ Osborn, Bull. Amer. Mus. Nat. Hist., Vol. VII, 1895, pp. 87–90, figs. 7, 8.

3. *The Narrow-skulled Phyla*, MESATIRHINUS, METARHINUS and DOLICHORHINUS.

Mesatirhinus gen. nov.

Type species.—*Palaeosyops megarhinus* Earle.¹

Generic characters.— Levels Bridger C and D, Washakie A, and base of Washakie B. Titanotheres of small size (skull length 354–425 mm.), typically mesaticephalic, persistent or progressing to dolichocephalic. The horns when present are incipient or rudimentary, chiefly borne on the nasals. An infraorbital shelf. Cranium with a sagittal crest. Molars with flattened outer cusps, reduced conules. Humerus relatively abbreviated, *i. e.*, with reference to *Palaeosyops*; carpus and tarsus narrow, astragalus with elongate neck, sustentacular distal and cuboidal facets continuous and forming a reversed L (J); metapodials slender.

Mesatirhinus petersoni spec. nov.

(Fig. 12.)

Type.— A skull with dentition, Amer. Mus. No. 12184, from Cat-tail Spring, Bridger Basin, level D 3. Discovered by Mr. Miller, Amer. Mus. Expedition of 1904.

Specific characters.— Levels: Bridger D (also C3) and Washakie A. Pm¹–m³, 156 mm.; m¹–m³, 90. Skull length, premaxillaries to condyles 412 (estimated); preorbital facial region more elongate (217). Other characters as in *Mesatirhinus megarhinus*, that is, broad occipital condyles, broad infraorbital shelf on malar, etc.

Comparison of this animal with the type of *M. megarhinus* can leave no doubt that we have to do here with a much more advanced stage of evolution. The skull is longer, the preorbital region especially. The grinding teeth occupy more space and there is an average

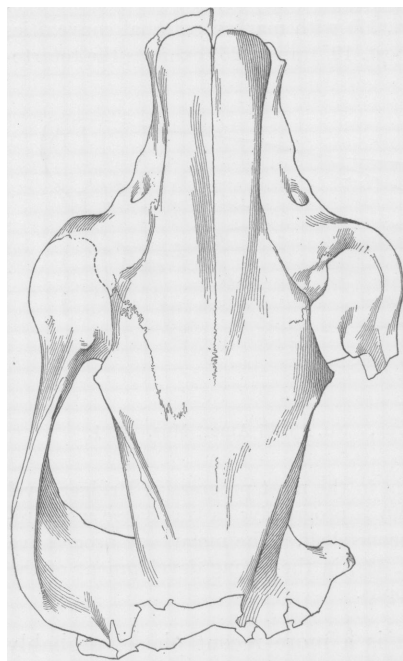


Fig. 12. *Mesatirhinus petersoni*. Type. Skull, top view. No. 12184 Amer. Mus. $\times 4$.

advance in all the rectigradations which proves that the differences in form and size are not merely due to fluctuations of size or differences of sex.

¹ Amer. Naturalist, Vol. XXV, Jan. 1891, pp. 45–47, 1 fig.

The species is named in honor of Mr. O. A. Peterson, now of the Carnegie Museum, whose titanotheres collections in the Uinta formation, greatly extended our knowledge.

IV. SPECIES CHIEFLY FROM THE UPPER WASHAKIE ("HORIZON B") AND LOWER UINTA ("HORIZONS A, B"), MIDDLE AND UPPER EOCENE.

Metarhinus earlei.

Dolichorhinus intermedius.

Metarhinus fluviatilis.

Dolichorhinus hyognathus ("cornutus").

3. *The Narrow-skulled Phyla* (continued).

***Metarhinus* Osborn gen. nov.**

Type species.—*Metarhinus fluviatilis* Osborn (*vide infra*).

Generic characters.—Levels Washakie B, Uinta A and B. Small titanotheres (skull length 355 to 440 mm.), persistently mesaticephalic. Narrow, abbreviated preorbital region, premaxillary symphysis greatly elongated and anterior narial openings deeply recessed in side view. Infraorbital shelf present, or wanting (*M. diploconus*); occipital condyles narrow. Grinding teeth subhypsodont; premolars progressive; hypoconulid of m_3 small, conic.

The name alludes to the somewhat later geological appearance of this genus as compared with *Mesatirhinus*.

This apparently represents a dwarfed and possibly fluviatile side phylum, leaving no descendants.

***Metarhinus fluviatilis* spec. nov.**

(Fig. 13.)

Type locality.—Uinta Basin, Utah, Level A.

Type.—A skull, No. 1500 Amer. Mus., discovered by the American Museum expedition of 1893 in the lower horizon (A) of the Uinta Basin.

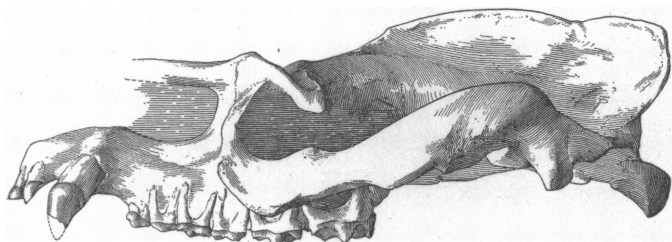


Fig. 13. *Metarhinus fluviatilis*. Type. No. 1500 Amer. Mus. $\times \frac{1}{2}$.

Specific characters.— Levels Uinta A and B. $Pm^1-m^3 = 144$ mm. A relatively short (355e), broad (200e) skull. Eye sockets small and very prominent. Pre-maxillary symphysis elongate, grinding teeth subhypsodont, m^3 with a cingulum-hypocone in the type.

The name is given in allusion to the possibly river-living or amphibious habits of the animal.

***Metarhinus earlei* spec. nov.**

(Fig. 14.)

Type locality.— North side of Haystack Mountain, Washakie Basin, Wyoming; level, Washakie B.

Type.— A skull (No. 13166, Amer. Mus., Expedition of 1906) lacking the nasals.

Specific characters. — Level Washakie B. $Pm^1-m^3 = 167$ mm. Skull proportions, length 380, breadth 230. Narrow occipital condyles. Extremely elongate premaxillary symphysis. A short sagittal crest. No hypocone on m^3 .

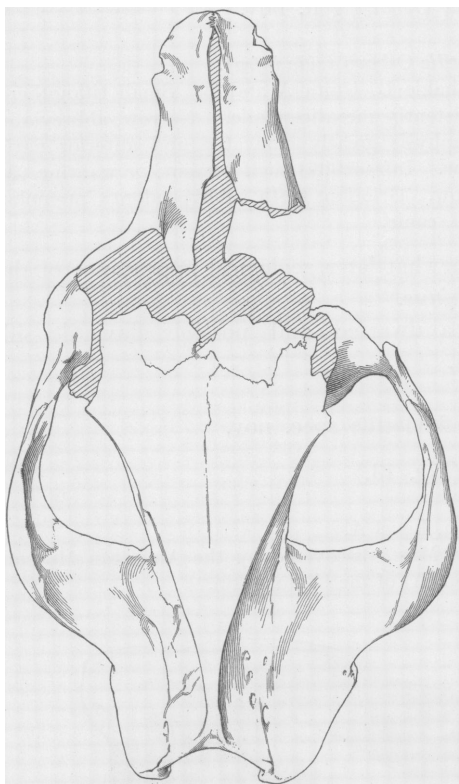


Fig. 14. *Metarhinus earlei*. Type. Skull, top view. No. 13166 Amer. Mus. $\times \frac{1}{4}$.

This animal is readily distinguished from *M. diploconus* by: (1) the infraorbital shelf of the malars; (2) the elongate premaxillary; (3) the absence of a double cone on m^3 . In many other respects it resembles *M. diploconus*, especially in its proportions. It is distinguished from *M. megarhinus* by: (1) the elongate premaxillary symphysis, correlated with the long narrow facial region; (2) the narrowness of its occipital condyles. It is distinguished from *M. fluviatilis*

by: (1) its greatly superior size and (2) the lesser prominence of the orbits.

The species is named in honor of Charles Earle, the first monographer of the genus *Palæosyops* and its allies.

***Dolichorhinus intermedius* spec. nov.**

(Fig. 15.)

Type locality.— Uinta Basin, northeastern Utah, level B. Age of Upper Washakie beds.

Type.— A skull with dentition, No. 1837 Amer. Mus., discovered by the American Museum expedition of 1894.

Specific characters.— Level Uinta B. Distinguished from *D. hyognathus* Scott

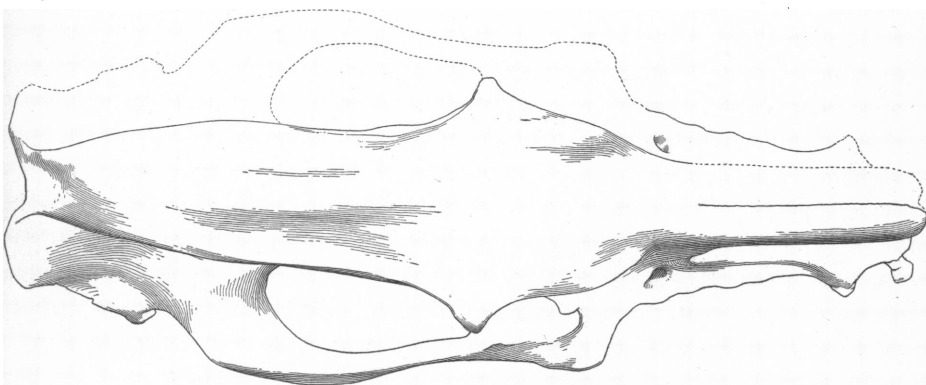


Fig. 15. *Dolichorhinus intermedius*. Type skull, top view, No. 1837 Amer. Mus. $\times \frac{1}{4}$.

and Osborn by (1) its inferior size ($pm^1-m^3 = 179$), $m^1-m^3 = 109$ mm.; (2) premaxillars less progressive, with subconic deuterococones; (3) all cingula less robust; (4) nasals more pointed and less expanded distally; (5) infraorbital shelf of malar relatively narrow.

The name '*intermedius*' is given because in some characters this species is intermediate between *Mesatirhinus petersoni* and *Dolichorhinus hyognathus*, although on the whole it is much more nearly allied to the latter.

***Dolichorhinus hyognathus* (Scott and Osborn).**

Syn. *Telmatotherium cornutum* Osborn.

(Fig. 16.)

It is unfortunate that the appropriate specific name *cornutus* (applied to a Uinta B type) must give way to the prior name *hyognathus* (applied to a Washakie B type) based upon a very large lower jaw found in the Washakie basin by the Princeton expedition of 1878. The American Museum expedition of 1906 proved that the deposits of the type localities (Middle Uinta

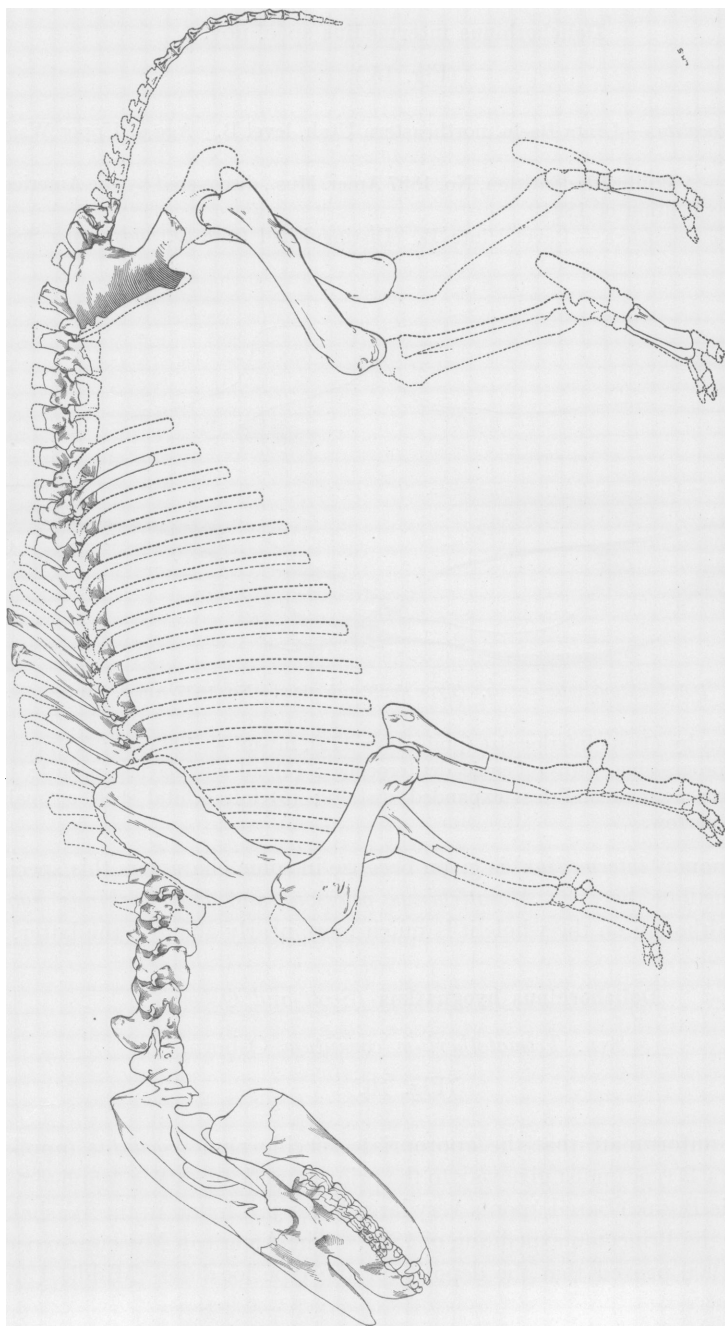


Fig. 16. *Dolichorhinus hypognathus*. Reconstruction of skeleton. Anterior half of skull, ramus of lower jaw, backbone, ilium, from No. 1843 Amer. Mus. (from Uinta B); parts in outline (except scapula) from No. 13184 (from Washakie B); remaining limb bones from various Uinta B. specimens; ribs hypothetical. $\times \frac{1}{12}$

and Upper Washakie) were formed contemporaneously and that both are sharply characterized by the presence of the long-skulled animal named *Dolichorhinus* by Hatcher. The accompanying reconstruction (Fig. 16) of this animal gives an idea of its peculiar proportions.

V. SPECIES FROM THE UPPER UINTA (HORIZON C), UPPER EOCENE.

Telmatherium ultimum.

Telmatherium (?) *altidens.*

Protitanotherium superbum.

***Telmatherium ultimum* spec. nov.**

(Fig. 17.)

The type of this genus is *Telmatherium validum* Marsh from the Upper Bridger. The phylum is an important and distinct one but its remains are scarce. It is really more nearly affiliated to the *Palæosyops-Limnohyops*

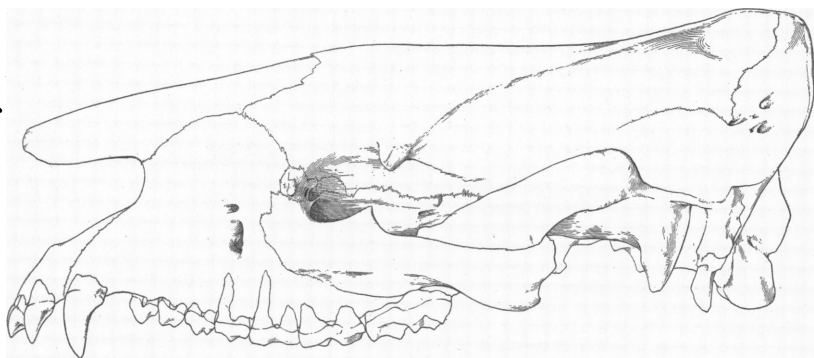


Fig. 17. *Telmatherium ultimum*. Type. No. 2060 Amer. Mus. The skull is somewhat deepened by pressure. $\times \frac{1}{2}$.

phylum and represents the long-skulled phase of the stock which gave rise to the above genera.

Nomenclature.—This species was mentioned by Matthew¹ as *Palæosyops ultimus* Osborn MS., but as no type was indicated or specific diagnosis given, the name remained a *nomen nudum* until now validated by the designation of a type.

¹ *Amer. Naturalist*, Vol. XXXI, 1897, pp. 57–58.

Type locality.— Uinta formation, northeastern Utah, Horizon C (lower levels).

Type.— A well preserved skull with dentition No. 2060 Amer. Mus., discovered by Mr. Peterson of the American Museum expedition of 1895.

Specific characters.—From lower portion of Uinta C. $P^1-m^3 = 226$. Lateral superior incisors greatly enlarged, caniniform. $Pm^2, ^3, ^4$ with internal subcrescentic deutercone ridges, with faint rudiments of tetartocones posteriorly. Ectolophs of premolars elevated and biconvex.

The specific name *Telmatherium ultimum* is given because this appears to be the last representative of the *Palæosyops-Limnohyops-Telmatherium* group.

***Telmatherium* (?) *altidens* spec. nov.**

(Fig. 18.)

Type locality.— Uinta Basin, northeastern Utah, horizon (level) C.

Type.— A lower jaw with dentition, No. 2025 Amer. Mus., discovered by the American Museum expedition of 1895.

Specific characters.— From Upper Uinta, level C. $Pm_1-m_3 = 330$ mm.; a wide diastema (70) behind the canines. Canines in male exceptionally elevated (76)

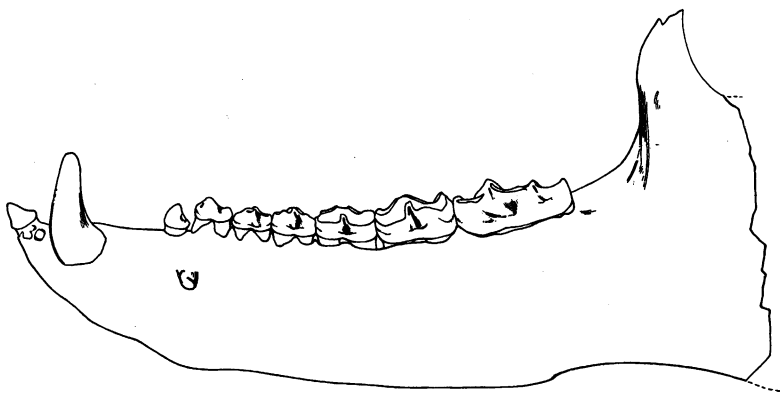


Fig. 18. *Telmatherium* (?) *altidens*. Type. Left ramus of lower jaw. No. 2025 Amer. Mus. $\times \frac{1}{4}$.

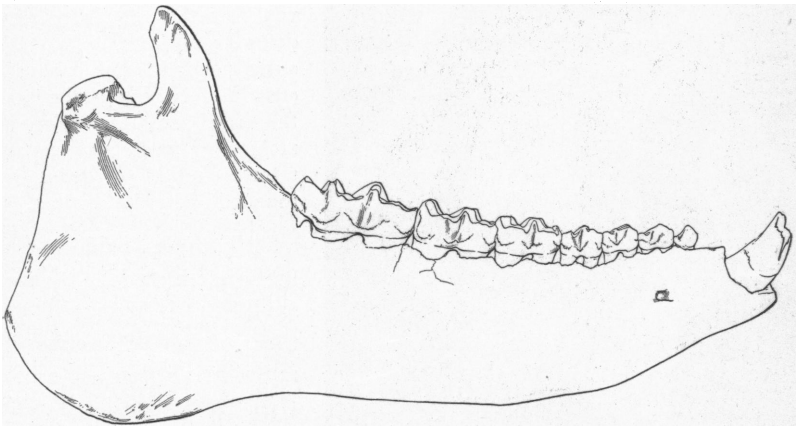
and pointed. P_1, p_2 laterally compressed, non-molariform; p_3, p_4 submolariform; dolichocephalic, anterior portion of face elongate.

Generic reference.— The generic reference to *Telmatherium* is provisional.

The specific name refers to the very high-crowned piercing canine.

Protitanotherium superbum spec. nov.

(Fig. 19.)

Type locality.— Uinta basin, northeastern Utah, "Horizon C."*Type.*— A well preserved lower jaw, No. 2501 Amer. Mus., discovered by the American Museum expedition of 1895.*Specific characters.*— From Upper Uinta, Horizon C, probably higher levels. $P_1-m_3 = 318$ mm. Canines in males very robust; p_1 double-fanged; post canineFig. 19. *Protitanotherium superbum*. Type. No. 2501 Amer. Mus. $\times \frac{1}{4}$.

diastema abbreviated; premolar series relatively abbreviated; p_2 with very large talonid and crescentic protoconid; p_3 , p_4 with talonid heavy and prominent, *i. e.*, submolariform, but no entoconid. M_3 with hypoconulid sharply constricted off at base.

The name is given in reference to the great size and presumed power of this Uinta Titanotheres which considerably exceeds that of the smaller Oligocene titanotheres.

VI. SPECIES FROM THE WHITE RIVER FORMATION, OLIGOCENE.

*Brontotherium hatcheri.**Symborodon copei.***Brontotherium hatcheri** spec. nov.

(Fig. 20.)

Type locality.— South Dakota. Level, Middle Titanotherium Beds, Lower Levels. J. B. Hatcher, collector.

Type.—A nearly complete skull No. 1216 (skull A) U. S. Nat. Mus., lacking the premaxillaries and anterior portion of the maxillaries.

Specific characters.— I_2^2 , p_4^4 . Nasals moderately long (97 mm.), thin at the edges. Horns 250+ mm. two-thirds the length of the *B. gigas* horns. Skull length (pmx-condyles) 710 est., width across zygomata 530 est. This species appears to represent an early phase of evolution of *B. gigas*. The horns are very round or convex in section, and have a well defined malar ridge on the lower outer portion. The connecting crest is relatively shallow, and the nasals are thin. The pre-molars are well advanced, the tetartocone of p^4 being well rounded and quite distinct.

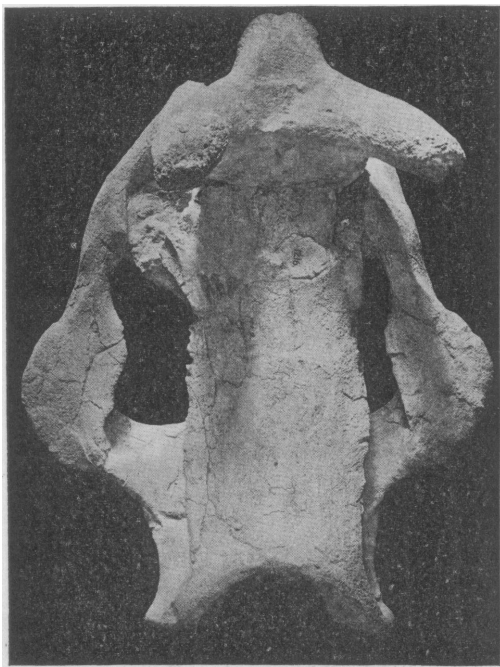


Fig. 20. *Brontotherium hatcheri*. Type. Superior view of skull. No. 1216 U. S. Nat. Mus. $\times \frac{1}{10}$.

Materials.—The referred material includes a second skull No. 4255 (skull Q) in the National Museum, the anterior portion of a skull (No. 1070) associated with a lower jaw, in the American Museum, and finally a very complete skull (No. P 5926) in the Field Museum.

The species is named in honor of the late J. B. Hatcher, who discovered many of Professor Marsh's titanotheres types, brought together the great collection of titanotheres in the National and Yale Museums, and placed the stratigraphic succession of the species upon a secure basis.

***Symborodon copei* spec. nov.**

(Fig. 21.)

Type locality.—South Dakota. Level probably Middle Titanotherium Beds. J. B. Hatcher, collector.

Type.—A complete skull No. 4711 (skull V) U. S. Nat. Mus., collected by J. B. Hatcher, 1888.

Specific and generic characters.—Incisors (type) persistent but greatly reduced; canines very small, reduced (28 mm.); premolars with cingula reduced or absent; tetartocones connected with deuterococones by a longitudinal ridge. *Skull:* nasals thin, short and broad in proportion, 80 mm. \times 125 mm.; horns, ♂, 300, no connecting crest, transverse oval near summit; buccal processes of zygomatica ♂ stout and convex; malar in front of buccal process very deep, beneath post-orbital process stout, convex; occipital pillars not greatly expanded at the summits.

Materials.— This species is known only from the type skull.¹

The skull differs from *Brontotherium gigas* especially in the position of the horns, which are placed very much farther back, immediately in front of and above the orbits, with buttresses extending backward at the base over the orbits. The horns thus obtained a good firm support posteriorly, a mechanical adaptation that compensates for the entire lack of a transverse connecting crest between the bases of the horns, this condition contrasting sharply with the deep connecting crest of *B. gigas*.

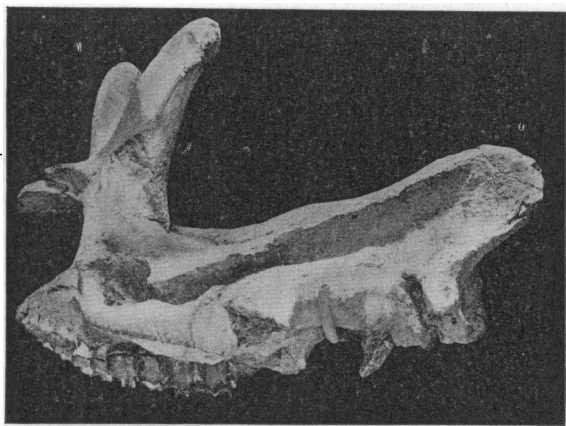


Fig. 21. *Symborodon copei*. Type. No. 4711 U. S. Nat. Mus. $\times 1\frac{1}{2}$.

¹ Figured in Osborn, 'The Four Phyla of Oligocene Titanotheres,' Bull. Amer. Mus. Nat. Hist., Vol. XVI, 1902, p. 104, fig. 8 (*Symborodon? montanus*).

