Article XXVII.—NEW MIOCENE RHINOCEROSES WITH REVISION OF KNOWN SPECIES.

RHINOCEROS CONTRIBUTIONS, No. 6.

By HENRY FAIRFIELD OSBORN.

The recent American Museum of Natural History expeditions under Dr. W. D. Matthew and Mr. J. W. Gidley have greatly extended our knowledge of Miocene stratigraphy, enabling us to distinguish Lower, Middle, and Upper horizons, with their characteristic faunæ, more or less clearly.

In 1898 a special expedition for rhinoceroses was conducted in the Republican River Valley of western Kansas, where Cope's principal Miocene types were obtained, in the hope of extending our knowledge especially of *Peraceras superciliosus* and *Aphelops malacorhinus*. This object was not attained. Our subsequent expeditions, however, to Colorado and Montana, chiefly under Dr. Matthew's direction, yielded specimens of the former species and of a number of new forms from the Middle and Upper Miocene. I am especially indebted to Dr. Matthew for several valuable observations on this collection.

My division of the rhinoceroses of Europe [1] and America

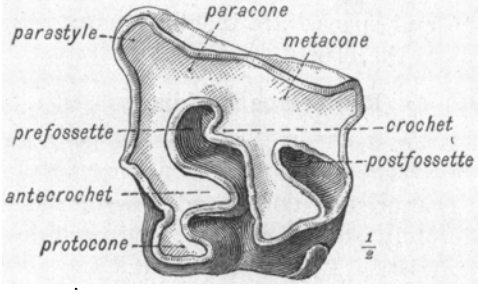

Fig. 1. Molar of *Teleoceras fossiger* with terminology.

into a number of contemporaneous and quite distinct phyletic series, characterized by profound differences in the proportions

[1] Osborn, H. F. Phylogeny of the Rhinoceroses of Europe. Bull. Amer. Mus. Nat. Hist., XIII, 1900, pp. 229-267.

of the skull and limbs and in the position and development of the horns, has rendered it altogether probable that we have much yet to learn regarding the polyphyletic relations of American Miocene rhinoceroses.

The object of the present paper is briefly to revise the species already described, in the chronological order of their original description, and to add a number of apparently new forms. The chief bases of specific and generic distinction have been already clearly stated in previous articles by the writer.

1. Systematic Revision of Species.

1. **Rhinoceros crassus** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1858, p. 28. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 228, pl. xxiii, figs. 4–9.

Type (Leidy): "Small fragments of two lower jaws, of young animals, a much worn upper incisor, a last upper molar, and an upper premolar apparently of the deciduous series." From the valley of the Niobrara River.

The third superior molar (*l. c.*, figs. 4–9, right side), distinguished by a feeble anticrochet and moderately developed crochet. The association of all these specimens, namely, the molar, an incisor (*l. c.*, fig. 6), a milk molar; (*l. c.*, fig. 5), is doubtful.

This type and species are indeterminate owing to the uncertainty as to the type.

2. **Rhinoceros meridianus** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1865, pp. 176, 177. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 229, pl. xxiii, fig. 10.

Type: a fractured first or second superior molar of the right side; moderately strong crochet, and well-developed anticrochet; no crista. Locality, "Texas."

This species is indeterminate.

3. **Rhinoceros hesperius** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1865, p. 177. Extinct Mammalian Fauna of Dakota and Nebr., 1869, p. 230, pl. xxiii, figs. 11, 12.

Type: right ramus of lower jaw from the supposed Miocene

of Calaveras County, California. The museum location of this type specimen has not been ascertained. The geological horizon is uncertain; it may be of Oligocene age.

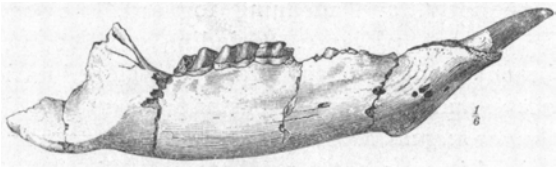

Fig. 2. Type of *Rhinoceros hesperius*. After Leidy. × ⅛.

4. **Rhinoceros matutinus** *Marsh.*

Proc. Acad. Nat. Sci. Phila., 1870, pp. 2, 3.

Type: a last lower molar (Yale Mus.); from the Miocene of Squankum, N. J. No figure or adequate description has been published.

This species is indeterminate at present.

5. **Aceratherium megalodum** *Cope.*

Palæont. Bull. No. 14, 1873, pp. 1, 2. Bull. U. S. Geol. Surv. of Terr., 1873, p. 520.

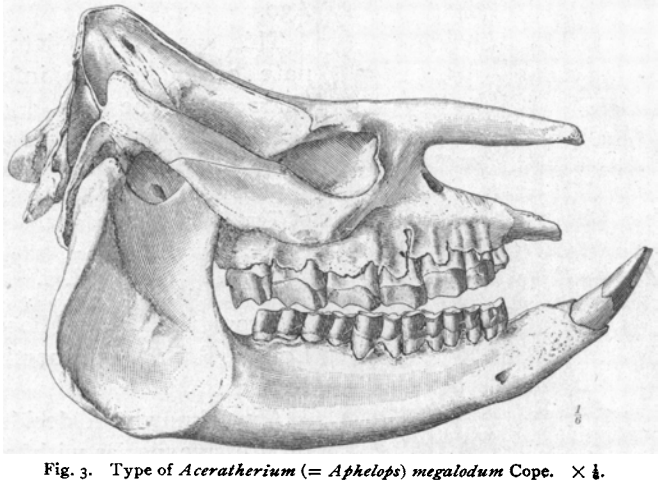

Fig. 3. Type of *Aceratherium* (= *Aphelops*) *megalodum* Cope. × ⅛.

Type: a complete skull and lower jaws, Middle Miocene, Pawnee Buttes, northeastern Colorado. Amer. Mus., Cope. Coll., No. 8292 (Fig. 3).

This male skull, which was subsequently made the type of the genus *Aphelops* by Cope, is mesaticephalic. Nasals smooth, flattened, and elongate. Occiput moderately high, narrow superiorly, and inclining forward. Lower canines large. P^1 present, $p\frac{3}{2}$ large. Grinding series comparatively simple, brachyodont, with moderately developed anticrochets and crochets, and well defined posterior fosettes.

= *Aphelops megalodus* Cope.

This animal is apparently a collateral or direct ancestor of *Peraceras superciliosus*, see p. 324.

6. **Aphelops jemezanus** *Cope.*

Proc. Acad. Nat. Sci. Phila., 1875, pp. 258–261. Palæont. Bull. No. 19, "June 28, 1875," p. 4. Wheeler's Survey, Palæontology, Part ii, 1877, p. 319, plates 73, 74.

Type: a lower jaw with m_{1-3} and back part complete. Coll. Nat. Mus. Locality near the town of Santa Clara on the west side of the Rio Grande, of Upper Miocene, Loup Fork Age.

This species is indeterminate owing to the inferior character of the type.

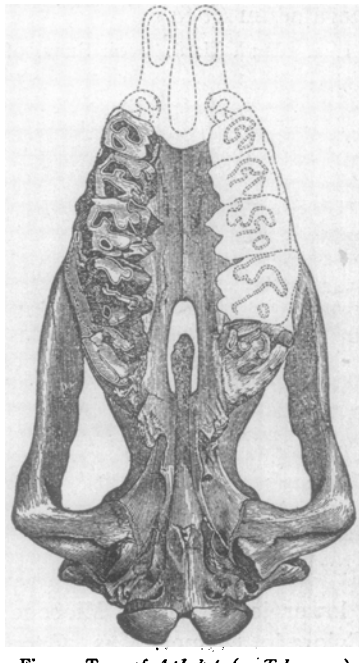

Fig. 4. Type of *Aphelops* (= *Teleoceras*) *fossiger* Cope. × ½. After Cope.

7. **Aphelops fossiger** *Cope.*

Bull. U. S. Geol. & Geogr. Surv. of Terr., 1878, IV, p. 382.

Type: skull, No. 8390, Amer. Mus., Cope Coll. (Fig. 4). from the Upper Miocene, Loup Fork, of northern Kansas.

A well known and decidedly progressive species, with broad occiput, laterally compressed nasals, and a terminal horn; hence made the type of the genus *Teleoceras* by Hatcher.

Large upper and lower cutting teeth; anterior premolars reduced, crowns of p^2, p^3 with crochet and anticrochet; molars enlarged, decidedly hypsodont, with strongly constricted protocone, strong anticrochet, and posterior fossette. Limbs extremely short.

= *Teleoceras fossiger.*

8. **Aphelops malacorhinus** *Cope.*

Amer. Nat., XII, p. 488.

Type: skull with crushed occiput, No. 8381, Amer. Mus., Cope Coll. (Fig. 5). Cotype: an elevated occiput (Amer. Mus., No. 8439) narrowing superiorly, not of certain association with this species, Fig. 20, from Sappa Creek, Decatur Co., Kansas. Smooth, abbreviated, and transversely flattened nasals.

$P\frac{1-4}{3}$; grinding teeth differing from those of *T. fossiger* in greater relative size of the premolar series, in somewhat shorter crowns of the true molars; protocone not constricted; small anticrochets. Very strong crochets present on premolars and molars, unlike *P. superciliosus.*

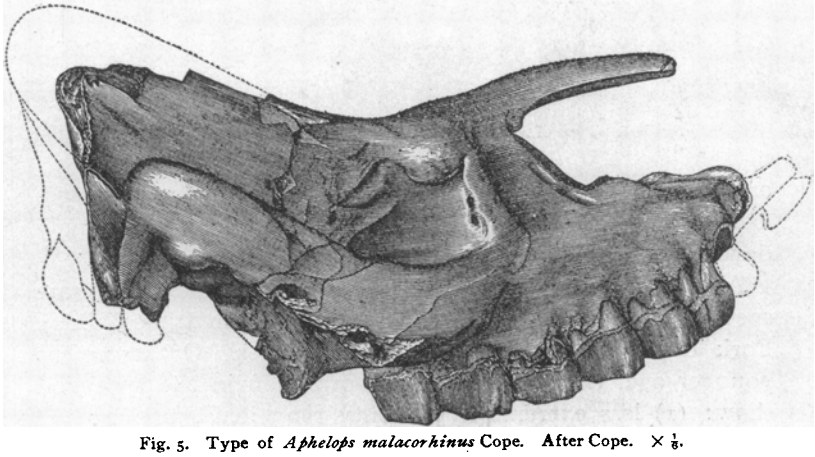

Fig. 5. Type of *Aphelops malacorhinus* Cope. After Cope. $\times \frac{1}{6}$.

This type shows affinities to *Aphelops megalodus* and *Peraceras superciliosus.* Professor Cope's association of very long limbs and foot bones with this species still awaits confirmation.

9. **Peraceras superciliosus** *Cope.*

Amer. Nat., XIV, 1880, p. 540.

Type: from the superior Miocene or Loup Fork of the Republican River valley, Nebraska, a cranium lacking extremities of the nasals; No. 8380, Amer. Mus., Cope Coll.

The skull (Fig. 6) exhibits the extreme of brachycephaly; occiput broad, low, and inclined forward; zygomata extremely widely arched, and skull foreshortened anteroposteriorly. Pattern of the grinding teeth comparatively simple; no

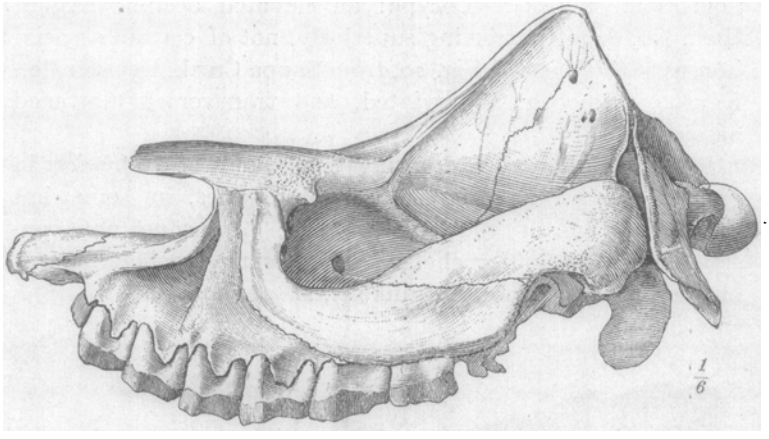

Fig 6. Type of *Aphelops (Peraceras) superciliosus* Cope. × $\frac{1}{6}$.

crochets on the premolars as in *A. malacorhinus* and *A. megalodus*. Anticrochets on the molars, but crochets not strongly developed. Nasals flattened, probably hornless.

A skull (Amer. Mus., No. 10872) belonging to this rare species was found in the summer of 1903 in typical Loup Fork deposits of the Little White River. Of somewhat younger age, the teeth are less worn than in the type and show: (1) less extreme hypsodonty than in *T. fossiger;* (2) p^1 small but well preserved, usually absent in *T. fossiger;* (3) p^2 relatively much larger than in *T. fossiger.*

Jaws (Amer. Mus., No. 10878) found in the same region as the above skull possibly belong to this species; as compared

with those of *T. fossiger* they exhibit (1) large canines, (2) a wide space between m_3 and the coronoid process, (3) forward pitch or inclination of the condyle and coronoid region, (4) somewhat less hypsodont molars. Portions of an associated skeleton exhibit a scapula, short but somewhat different in form from that of *A. fossiger*, also an atlas with relatively pointed transverse processes.

10. **Rhinoceros proterus** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1885, p. 33. *Aphelops fossiger* Leidy, fide Lucas, Trans. Wagner Free Inst., IV, 1896, p. 41.

Type: a last upper molar from Peace Creek, Florida. Coll. Nat. Mus.

Careful study of this type and associated material led F. A. Lucas to the conclusion that *R. proterus* may be considered at most as a sub-species of *Teleoceras fossiger*, distinguished by slightly smaller molars, with thinner crests, better development of the cingulum on p^3 and p^4, the bones of the foot averaging a little heavier and more rugose.

= *Teleoceras fossiger* Cope, var. *T. proterus.*

11. **Eusyodon maximus** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1886, p. 37, figs. 1, 2.

Type: a lower tusk found in Archer, Florida.

This species (Fig. 7) appears to have been based upon a lower tusk of *R. proterus*, which is a synonym of *T. fossiger*, Cope.

— *Teleoceras fossiger* Cope.

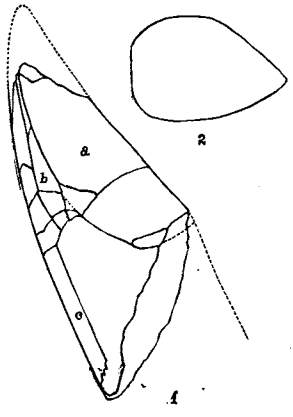

Fig. 7. Type of *Eusyodon maximus* Leidy. × ½. After Leidy. 1. Side view. 2. Cross section.

12. **Aceratherium acutum** *Marsh*, 1887.

Amer. Journ. Sci. (3), XXXIV, p. 325, figs. 3, 4.

Type: complete skull and lower jaws from the Upper

Miocene, Loup Fork, of Long Island, Phillips County, Kansas (Figs. 8, 9). Yale Museum.

This locality is rich in crania of *Teleoceras fossiger*, and this type represents a skull of that species.

= *Teleoceras fossiger* Cope.

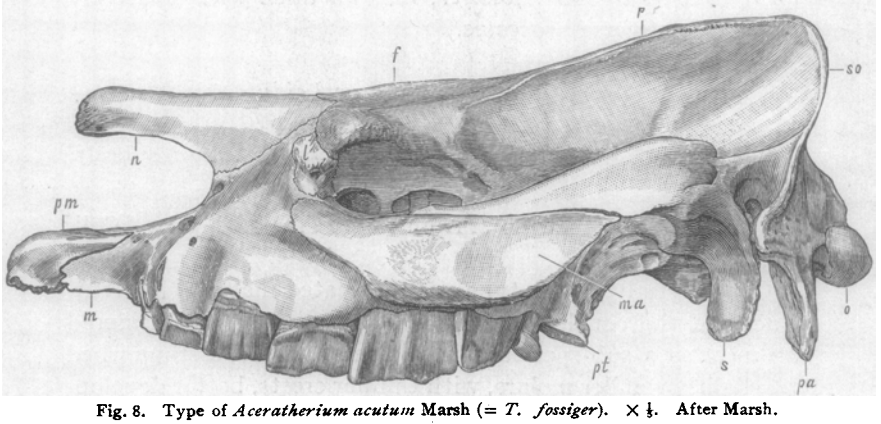

Fig. 8. Type of *Aceratherium acutum* Marsh (= *T. fossiger*). × ¼. After Marsh.

13. **Rhinoceros longipes** *Leidy.*

Proc. Acad. Nat. Sci. Phila., 1890, p. 183. = *Aphelops malacorhinus* Cope, *fide* Lucas, Trans. Wagner Free Inst., IV, Jan., 1896, p. 45.

Type: a lower canine and second and fourth metacarpal. Coll. Nat. Mus.

This species was identified by F. A. Lucas (*op. cit.*, p. 45) with *Aphelops malacorhinus* Cope, distinguished by the elongation of the limb and foot bones, but it now appears possible that *A. malacorhinus* was not a long-limbed type. If so, *R. longipes* may prove to be a valid species.

14. **Teleoceras major** *Hatcher.*

Amer. Geol., XIII, March, 1894, p. 148. Amer. Nat., XXVIII, 1894, p, 241, pl. ii, figs. 2, 6.

Type: greater portion of the skull and lower jaw, Princ. Mus., from the Loup Fork beds of Sheridan County, Nebraska, Upper Miocene.

A sagittal crest and a median horn situated on the extreme

point of the nasals, directed forward and upward, and extending considerably beyond the extremities of the nasals proper. This definition establishes the genus *Teleoceras*.

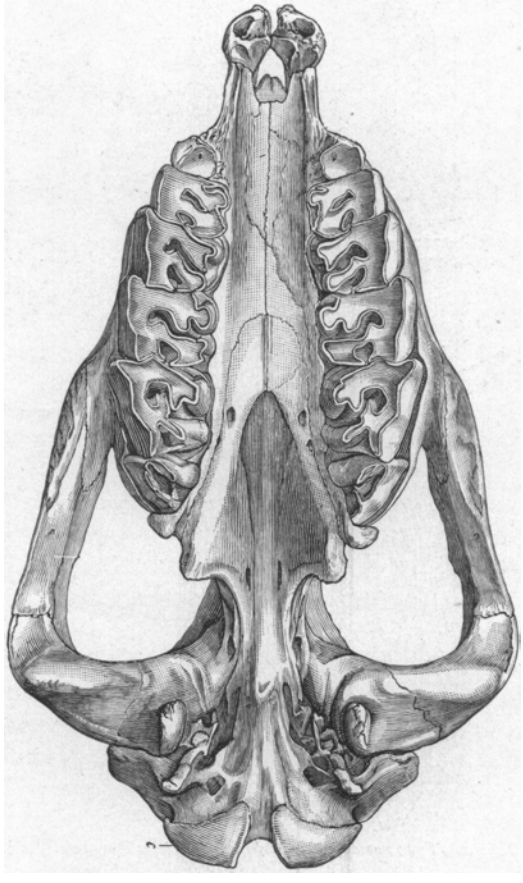

Fig. 9. Type of *Aceratherium acutum* Marsh (= *T. fossiger*). $\times \frac{1}{8}$. After Marsh.

This species may be distinguishable by its large size from Cope's type of *T. fossiger*. Unworn molars would show a crochet.

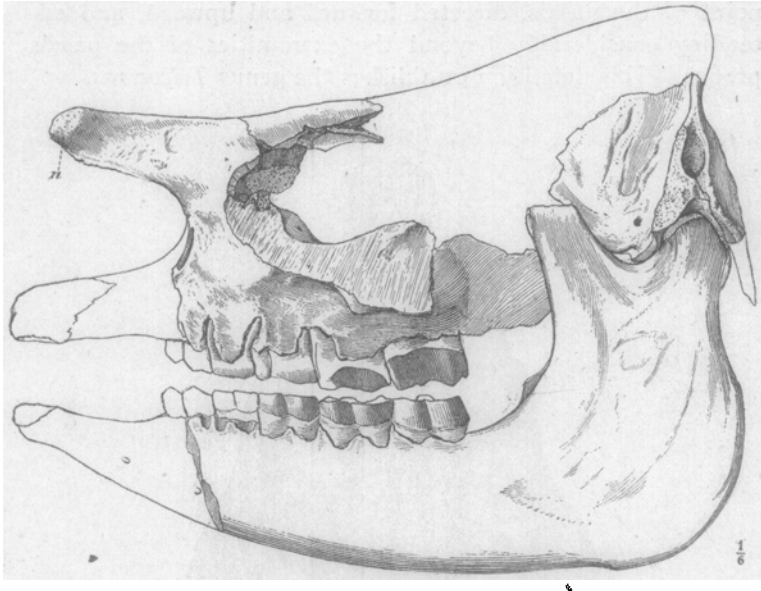

Fig. 10. Type of *Teleoceras major* Hatcher. × 1/6.

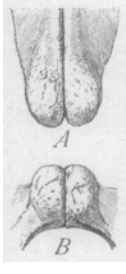

Fig. 11. Type nasals of *Teleoceras major* Hatcher. Superior and anterior views.

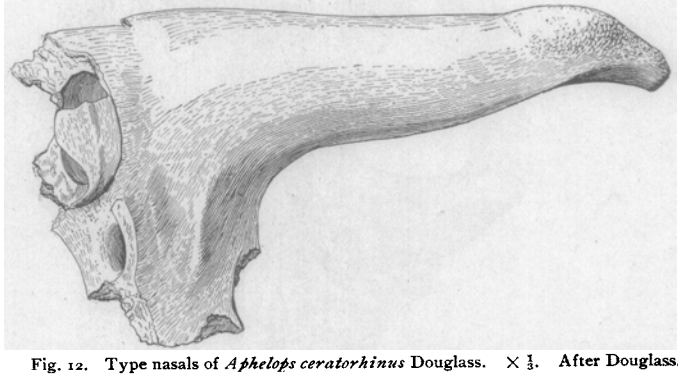

Fig. 12. Type nasals of *Aphelops ceratorhinus* Douglass. × 1/3. After Douglass.

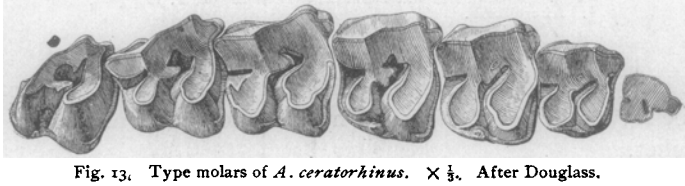

Fig. 13. Type molars of *A. ceratorhinus.* × 1/3. After Douglass.

15. **Aphelops ceratorhinus** *Douglass.*

New Vertebrates from the Montana Territory. Ann. Carnegie Mus., II, No. 2, 1903, pp. 145–200.

Type: part of skull, mandible, and limb bones, Carn. Mus., No. 857, from the Lower Madison Valley, Montana, Upper Miocene (Figs. 12–14).

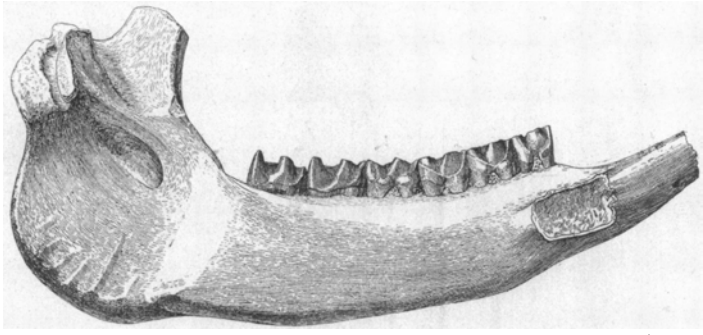

Fig. 14. Type lower jaw of *A. ceratorhinus*, inner view. × ⅛. After Douglass.

Size, large. Nasals elongate, flattened, with terminal horn rugosities. Mandible long and slender. Grinding series brachyodont. Full superior premolar-molar series; premolars with internal cingula; p^4–m^3 with crochets; m^{1-3} with reduced anticrochets; upper premolar-molar series = .268; lower premolar-molar series = .250.

A jaw and considerable part of the skeleton (Amer. Mus., No. 9745), found near the same locality in Montana, enable us to give some skeletal characters as follows: limb bones, metacarpals, and metatarsals elongate, hence to be compared with *R. longipes* Leidy.

16. **Aceratherium profectum** *Matthew.*

A provisional classification of the Freshwater Tertiary of the West. Bull. Amer. Mus. Nat. Hist., XII, Art. iii, Apr. 8, 1899, p. 71, footnote.

Type: A lower jaw, fragments of upper teeth, right squamosal region of skull, and atlas (Amer. Mus. No. 9082, Fig. 15).

This is an animal of small size, distinguished specifically by

the dentition: $\frac{3}{3}\frac{0}{0}\frac{4}{4}\frac{3}{3}$. Very narrow diastema. P_1–m_3 192 mm. Grinding teeth brachyodont. An anticrochet in superior molars. Postglenoid flaring widely, not in actual contact with posttympanic. Posterior portion of zygoma deep.

The generic reference is provisional at present.

= *Aphelops profectus*.

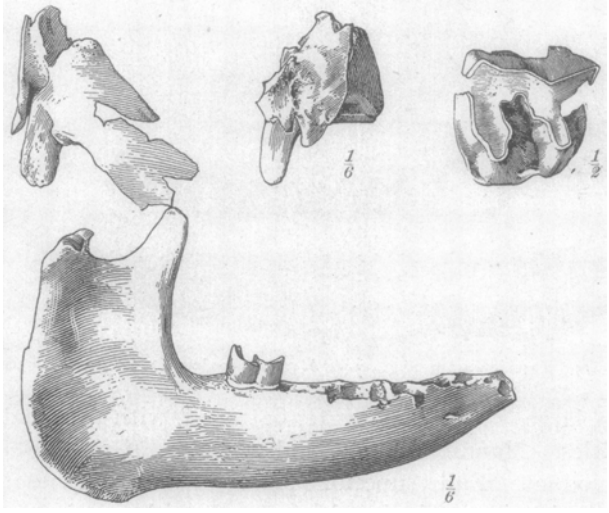

Fig. 15. Type of *Aceratherium profectum* Matthew (= *Aphelops? profectum*). Lower jaw (× ⅛); right squamosal region, side and rear views (× ⅛) and m^3 (× ½).

2. Descriptions of New Species.

Middle Miocene.

17. **Cænopus persistens,** sp. nov.

Type: Cranium and left superior grinding series, Amer. Mus., No. 9081, from the Middle Miocene of northeastern Colorado.

This is a surprisingly primitive animal Fig. 16, of small size, somewhat dolichocephalic, with sagittal crest, high, backwardly directed occiput, narrow posttympanic processes not connected with postglenoid processes, and therefore leaving auditory meatus open inferiorly, slender zygomatic arch, wide

space between orbits and narial notch, slender, laterally decurved nasals (of which the tip is wanting), molars brachyodont, with large anticrochet and no crochet.

The grinders preserved (p^2–m^2) measure only 172 mm.

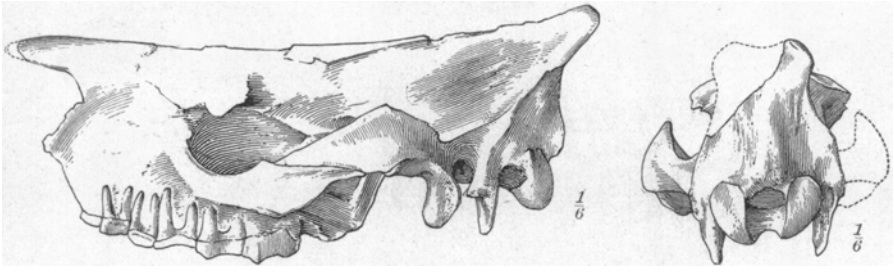

Fig. 16. Type of *Cænopus persistens*, sp. nov. × ⅙.

18. **Teleceras medicornutus,** sp. nov.

Type: skull lacking occiput, with jaws lacking angle, Amer. Mus., No. 9832. Collected by Albert Thomson in the Middle Miocene of eastern Colorado, about twenty-five miles north of Pawnee Buttes. The sex is somewhat doubtful because although the nasal horns are large, the lower canines are small. Cotype: skull and jaws, Amer. Mus., No. 9374, with complete occipital and parietal crests.

The name *medicornutus* refers to the presence of a small median horn rugosity on the frontals which reminds us of a similar rugose area doubtfully determined in the lower Miocene *T. aurelianensis* of France by Professor Gaudry.

The *Teleoceras* characters of this species are the laterally compressed nasals, terminal horn, median rugosity on the basioccipitals, premolars relatively reduced (108 mm.), molars hypsodont and expanded (153), protocone constricted. It is in some respects more primitive and is otherwise clearly distinguished from the Upper Miocene *T. fossiger* by: (1) much longer (138) free nasals, (2) longer space (95) between the narial notch and orbits, indicating less brachycephaly, (3) less prominent crochet on the molars, (4) much smaller lower canines, (5) premolars $\frac{4}{3}$. The jaw exhibits definitely only two premolars in the type; in the cotype a one-rooted p_2 is present. The lower series (p_3–m_3) measures 238mm. The

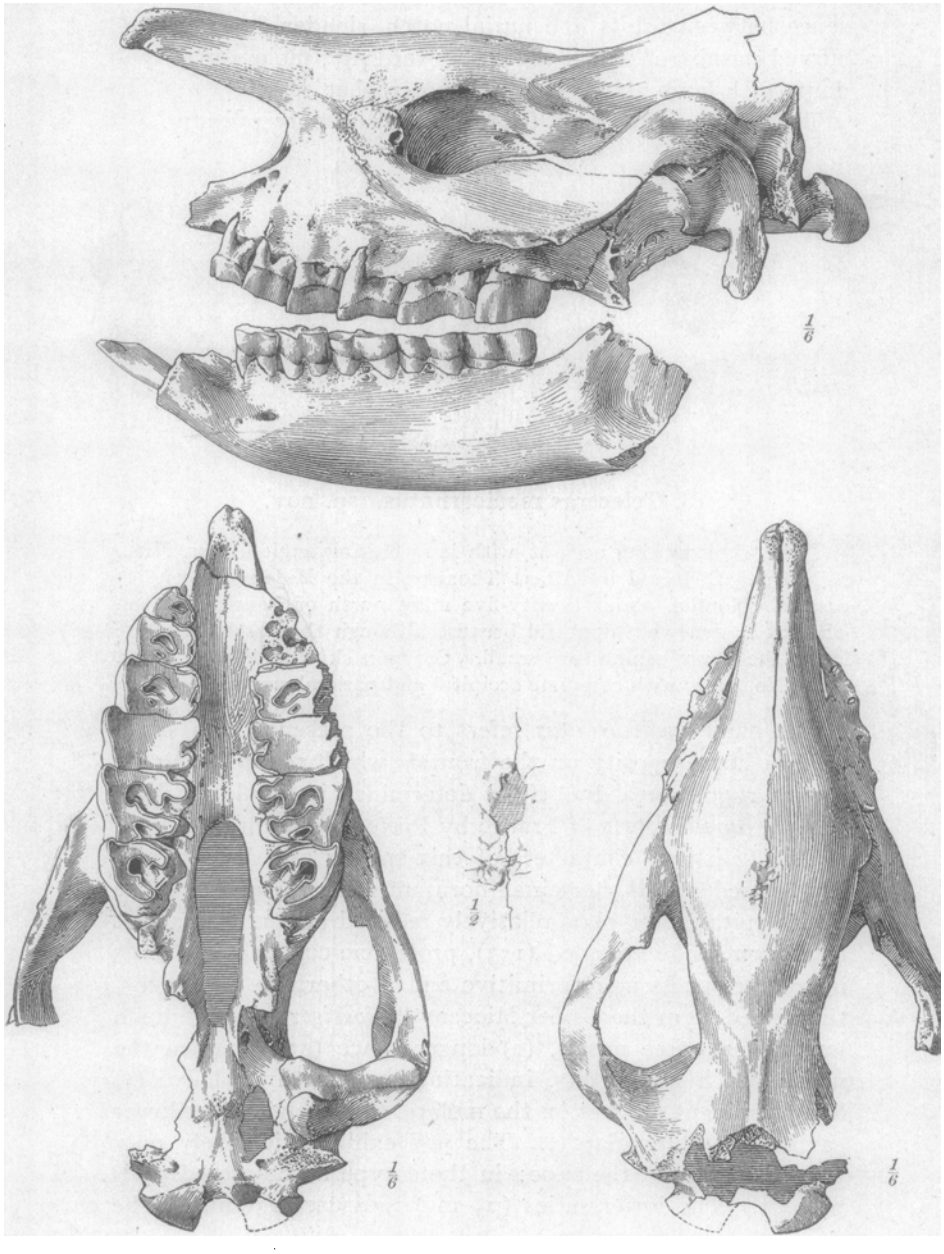

Fig. 17. Type of *Teleoceras medicornutus*, sp. nov. The larger figures × $\frac{1}{6}$, the smaller (detail of horn rugosity) × $\frac{1}{2}$

canine tusks are small, although the animal is probably a male. The cotype shows a low but well defined sagittal crest and an occiput relatively higher and narrower than that of *T. fossiger;* the deep zygomatic arch is well shown.

19. **Aphelops (? Peraceras) planiceps,** sp. nov.

Type: posterior portion of a cranium, Amer. Mus., No. 9369, from the Middle Miocene, Pawnee Buttes, of Colorado.

This broadly depressed and brachycephalic skull differs widely in base and top structure from that of other species as follows: (1) basioccipital flattened, with a sharp, low median keel; it lacks the convex median rugosity (for the

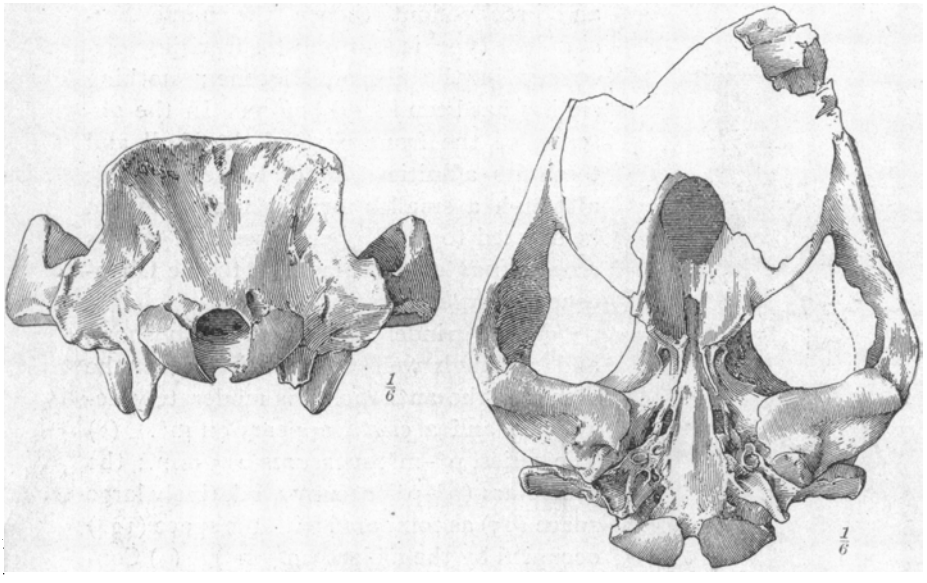

Fig. 18. Type of *Aphelops (? Peraceras) planiceps*, sp. nov. × ⅛.

rectus capitis muscles) of *T. medicornutus* and *T. fossiger*, or the paired rugosities of *A. megalodus* and *P. superciliosus*, (2) top of cranium depressed, with sagittal crest separated into two supratemporal ridges, (3) glenoid facets very broad

internally, (4) occiput very low, broad, with widely flaring postglenoid processes.

A skeleton (Amer. Mus., No. 9369) found near this skull, but not of certain association, indicates limbs somewhat longer than those of *T. fossiger*.

The affinities of this cranium are problematical; the resemblances are rather with *Peraceras superciliosus* than with *Teleoceras*.

Upper Miocene.

20. **Aphelops (? Diceratherium) brachyodus**, sp. nov.

Type: Base of cranium, palate, and full set of superior molars, Amer. Mus., No. 10873, from the Loup Fork Upper Miocene of the Little White River, South Dakota.

Fig. 19. Type of *Aphelops (? Diceratherium) brachyodus*, sp. nov. × ⅛.

This slender, primitive, dolichocephalic, and brachyodont (hence the name *brachyodus*) type is our most surprising discovery in the Upper Miocene; nothing similar has been found before. In the absence of the front part of the skull and teeth its affinities cannot be determined; although a smaller form it may prove to be related to the Upper Miocene *Aphelops ceratorhinus* of Douglass, or to the Oligocene *Diceratherium*.

(1) The grinders are all extremely short, and although well worn entirely lack the crochet; the anticrochet is moderately developed and a crista appears on m^3. (2) The series, p^2–m^3, measures 215 mm.; the premolars (p^2–p^4) occupy a relatively large space (95) as compared with the space (122) occupied by the molars (m^1–m^3). (3) Considering the diminutive teeth the skull is elongate, the distance from the occipital condyles to p^2 being 465 as compared with 555 in a large skull of *T. fossiger;* the space between the postglenoid and occipital condyles is very wide. (4) There is a low sagittal crest.

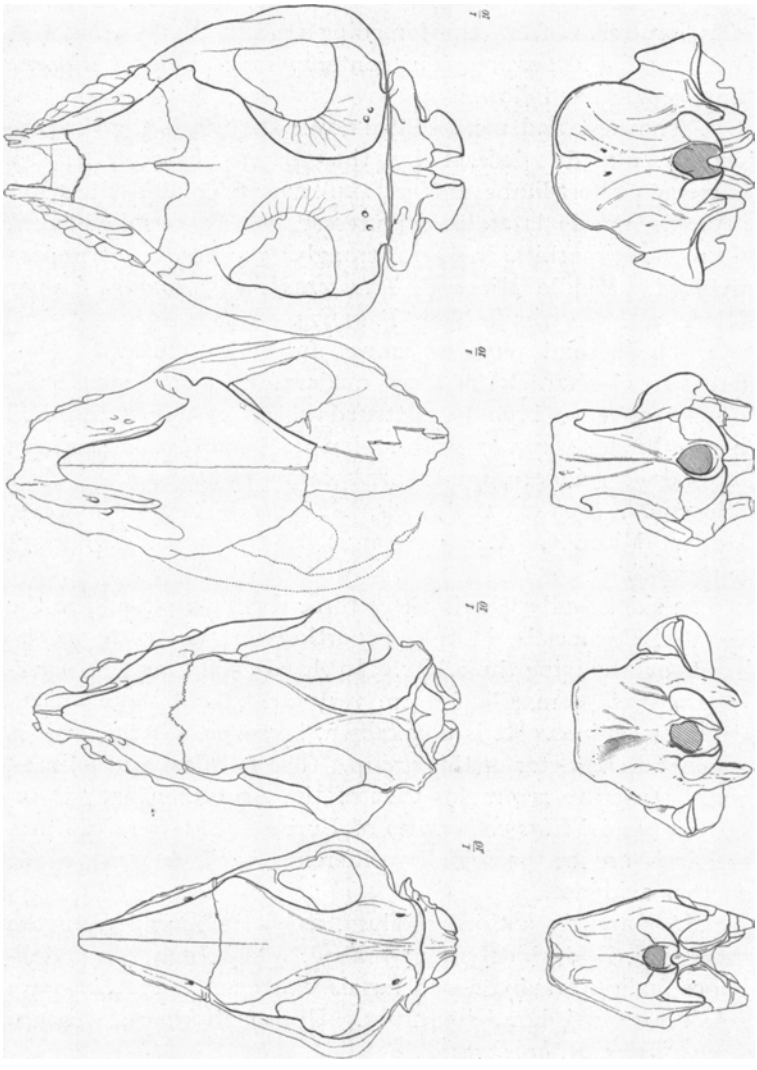

Fig. 20. Comparative series. × $\frac{1}{20}$.

3. Conclusions as to Phylogeny.

It is obvious from the foregoing studies that we have at least three and possibly four contemporary phyla of Miocene rhinoceroses, as follows:

1. The first and most fully known phylum is the Brachypodinæ, already defined by the writer, characterized by extremely short limbs and feet, skull mesaticephalic to brachycephalic, nasals laterally compressed, with a terminal horn, narrow supraorbital region, strongly hypsodont, premolars reduced. Middle Miocene, *Teleoceras medicornutus;* Upper Miocene, *Teleoceras fossiger*, *T. major.*

2. The second phylum cannot fully be defined at present. It is characterized by moderately short limbs, skull brachycephalic, broadly flattened nasals without terminal horn, broad supraorbital region and crests, moderately hypsodont grinders, upper premolars less reduced. Middle Miocene, *Aphelops megalodus*, *A.* (*Peraceras ?*) *planiceps;* Upper Miocene, *A.* (*Peraceras*) *superciliosus*, *Aphelops malacorhinus.*

The chief similarities in these three species are found in the form of the nasals, in the proportions of the teeth, in the crests overhanging the orbits. In *A. megalodus* and *P. superciliosus* the premaxillaries are very weak, and there are no superior canines. It is not known, however, whether this is a general character of this group. The hornless and pointed nasal structure resembles that of the Aceratheriinæ (*A. incisivum* and ? *Elasmotherium*) of Europe; but the skull proportions are so profoundly different that we must await further evidence.

3. Apparently a third phylum, as distinguished from the foregoing, is decidedly long-limbed, long-footed, skull dolichocephalic, brachyodont, nasals flattened, pointed, with small terminal horn rugotities. Upper Miocene, *Aphelops ceratorhinus*, *A. brachyodus.*

The association of these two species is provisional.

Much remains to be done from the more exhaustive study of the materials already in hand, as well as from the discovery

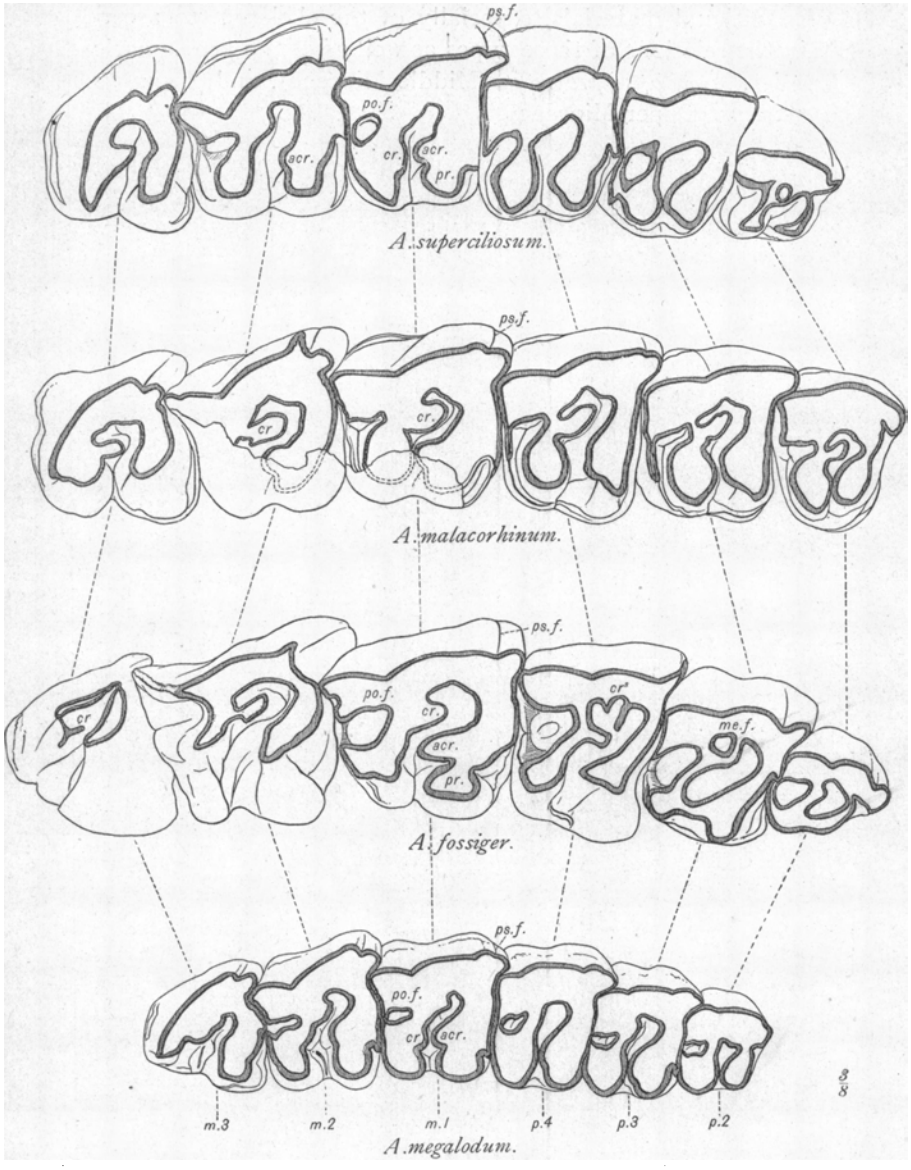

Fig. 21. Comparative series. Molars of *Aphelops megalodus* (below), *Teleoceras fossiger*, *Aphelops malacorhinus*, *A.* (*Peraceras*) *superciliosus*. × ⅜.

of additional materials, especially of the skeleton, to ascertain the relations of these types as well as of the problematic species, *Aphelops profectus* (Middle Miocene), and *Cænopus persistens* (Upper Miocene).