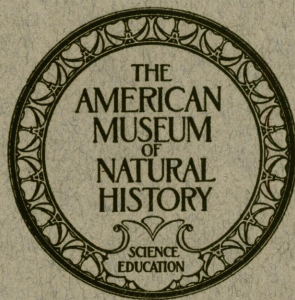


TICHOLEPTINAE

A NEW SUBFAMILY OF OREODONTS

BY C. BERTRAND SCHULTZ AND CHARLES H. FALKENBACH



BULLETIN

OF

THE AMERICAN MUSEUM OF NATURAL HISTORY

VOL. LXXIX, ART. I, pp. 1-105

New York

Issued December 31, 1941

Article I.—TICHOLEPTINÆ

A NEW SUBFAMILY OF OREODONTS¹

BY C. BERTRAND SCHULTZ² AND CHARLES H. FALKENBACH³

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² Director of the University of Nebraska State Museum.

³ Field Associate of the Frick Laboratory, American Museum of Natural History.

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INTRODUCTION

The present paper, the second in a series concerning a revision of the oreodonts (Merycoidodontidæ), deals with three closely related forms, *Ticholeptus* Cope and two new genera, *Ustatochoerus* and *Mediochoerus*, which are here included under the new subfamily, Ticholeptinæ. The writers plan to treat in separate reports each of the subfamilies of oreodonts, emphasizing lists of material, taxonomy, phylogeny, and geologic and geographic distribution. These papers will be followed by a detailed summary of the phylogeny and stratigraphic distribution of the entire family. The oreodont collections of the Frick Laboratory, American Museum of Natural History, and the University of Nebraska State Museum are being used as a basis for this work, which was begun in 1934.

All of the collecting localities of the oreodonts considered in this paper, with the exception of the Ricardo and Caliente Mountain areas of California and the John Day region of Oregon, have been visited by either one or both of the writers. Additional stratigraphic evidence, as well as an abundance of new fossil material, has been gathered for the Frick Laboratory by the following party leaders and their associates: Messrs. Joseph Rak, John C. Blick, Morris Skinner, Nelson J. Vaughan, Jack Wilson, Ralph Mefferd, Ted Galusha, William Chamberlain, and Charles H. Falkenbach. The collections of the University of Nebraska State Museum have included those made by Messrs. E. L. Blue, Thompson M. Stout, Grayson E. Meade, F. W. Johnson, Paul O. McGrew, Guy Johnson, Loren Toohey, C. Bertrand Schultz, and associates.

Four hundred and eighty-seven numbered skulls, mandibular rami, and skeletal elements¹ are here listed or described under the three named genera. Fifty of these specimens, representing seven species and seven varieties of *Ustatochoerus* (of which two species are new), six species and one variety of *Ticholeptus* (of which two species are new), and the two species of the new genus *Mediochoerus*, are illustrated in detail (including several refigured types) in the seventeen text-figures. The outline drawings are reproduced at one-third, and the shaded drawings at one-half actual size (excepting *Figure 17*, which is natural size).

The illustrations of *Ustatochoerus*, new genus, demonstrate the range in size, shape, and proportions of the skulls, mandibular rami, and skeletal elements. Noteworthy are the variations in skull size (see outline *Figure 1*), size of the dental series, and length and amount of retraction of the nasals. The drawings also show the complicated patterns of the premolars, which are characteristic of the genus. Skulls and mandibles of *U. major*, *U. medius*, and *U. medius novomexicanus* are figured for the first time.

The *Ticholeptus* illustrations show very slight differences in size and form of the skulls and mandibular rami. Characters of generic value are the slightly complicated inferior premolars and the long, light limbs. The skull and skeletal elements of *T. hypsodus* are shown for the first time.

¹ Unassociated phalanges, carpal and tarsal elements are excluded from count.

The figures of *Mediochoerus*, new genus, show variations in size and form of the skulls.

The writers wish to acknowledge their appreciation to: Mr. Childs Frick and Dr. Erwin H. Barbour for the privilege of continuing with the studies of the oreodonts and for helpful suggestions in the preparation of the manuscript; Mr. Charles W. Gilmore and Dr. C. Lewis Gazin of the United States National Museum, Mr. J. LeRoy Kay of the Carnegie Museum, Dr. Thomas Barbour and Dr. Alfred S. Romer of the Museum of Comparative Zoology of Harvard University, and Dr. Walter Granger of the American Museum of Natural History for the loan of various specimens listed in this paper; Dr. William K. Gregory of the American Museum of Natural History for suggestions; Mr. Morris Skinner of the Frick Laboratory for cooperation in stratigraphic studies; Mr. Ralph Mefferd of the Frick Laboratory for the illustrations, which he has carefully drawn under the supervision of Miss Hazel de Berard; Miss Jannette May Lucas for aid with references; Mr. Sydney E. Helprin for assisting in the editing of the manuscript; and Mrs. C. Bertrand Schultz and Mr. John Mercer for help in preparing the manuscript.

Thanks are also due: members of the Frick Laboratory, especially Messrs. Floyd Blair, Joseph Rooney, Charles Hoffman, and Frank Miller for the preparation and care of the oreodont collection; and Messrs. Henry Reider, Frank Bell, and Guy Johnson for supervising the preparation of the University of Nebraska specimens.

DESCRIPTION OF *Ticholeptinæ*, NEW SUBFAMILY (2)¹

The new subfamily, *Ticholeptinæ*, includes the genus *Ticholeptus*, and two new genera, *Ustatochoerus* and *Mediochoerus*. Medium to large size forms; skulls brachycephalic; supraoccipital wings incorporated in fan-shaped occipital region; tendency for a slight retraction of nasals (not to the same degree as in the *Merycochoerinae*); tympanic bullæ large and flattened; teeth large and moderately hypsodont; premolars complicated.

Remains of *Ticholeptus* have so far been reported only from geologic horizons which were more or less contemporary with W. D. Matthew's Sheep Creek and Lower Snake Creek. *Mediochoerus* is recorded from Marsland and "Lower Snake Creek." *Ustatochoerus* ranges through the Valentine and sh Hollow of the Great Plains area, and the late Tertiary of New Mexico and California. Specimens from the respective zones are distinguished by differences in size, proportions, and position of the nasals.

DISTINCTIVE CHARACTERS OF:

<i>Ustatochoerus</i> (p. 10)	<i>Ticholeptus</i> (p. 72)	<i>Mediochoerus</i> (p. 92)
Anterior tip of nasals retracted to region above P ¹ and P ³ .	Above C/.	Above M ¹ .
Infraorbital foramina above region of P ⁴ .	Above region of posterior portion of P ³ .	Above region of anterior portion of M ¹ .
Superior border of maxillæ below nasals with gradual rise to nasals.	Below nasals with abrupt rise to nasals.	Below nasals with rather abrupt rise to nasals.
Inferior border of ramus straight to slightly concave.	Slightly concave.	(Mandible unknown.)
Dentition moderately hypsodont.	Less hypsodont than in <i>Ustatochoerus</i> or <i>Mediochoerus</i> .	Moderately hypsodont.
Premolars with complex patterns.	With simpler patterns than in <i>Ustatochoerus</i> .	With simpler patterns than in <i>Ustatochoerus</i> .
Limbs comparatively robust.	Comparatively light.	(Limbs unknown.)

¹ Schultz, C. Bertrand, and Falkenbach, Charles H., 1940, Bull. Amer. Mus. Nat. Hist., LXXVII, Art. 5, p. 215 (Subfamily 1.—*Merycochoerinae*).

GEOGRAPHICAL DISTRIBUTION OF *Ustatochoerus*, *Ticholeptus*, AND *Mediochoerus*

	Calif.	N. M.	Tex.	Kans.	Nebraska	Nebraska	Mont.	Calif.	Tex.	Mont.	Ore.	Nev.																													
					Sioux Co.	Cherry Co.	Sioux Co.	Sioux Co.	Sioux Co.	Sioux Co.	Sioux Co.	Sioux Co.																													
	Kern Co. (Ricardo)	Barstow ("Hemicyon stratum")	Santa Fé and Rio Arriba Cos.	Potter Co.	Donley Co.	Norton Co.	Aphelops Draw	"Upper Snake Cr."	Kat Q. Channels	Leptarchus Q.	Hans Johnson Q.	Nenzel Q.	Burge Q.	Various localities	Brown Co.	Banner Co.	Sheridan Co.	Keya Paha Co.	Dawes Co.	Boyd Co.	Logan and Weld Cos.	Bennett Co.	Todd Co.	Mellette Co.	Tripp Co.	Lower Madison Valley (upper horizon)	Caliente Mt. region	San Jacinto Co.	"Lower Snake Cr."	Sioux Co.	Nebraska	Box Butte Co.	Smith River Valley	E. of New Chicago	Grant Co. (Mascall)	Virgin Valley					
Large:	X																																								
<i>U. californicus</i> (1)																																									
<i>U. c. raki</i> (1a)			X																																						
<i>U. major</i> (3)																																									
<i>U. m. texanus</i> (3a)				X																																					
Medium:																																									
<i>U. compressidens</i> (2)																																									
<i>U. prolectus</i> (5), (5a)						X																					X														
<i>U. p. espanolensis</i> (5b)																																									
<i>U. p. studei</i> (5c)																																									
<i>U. skinneri</i> (6), (6a)					X																																				
<i>U. s. santacruzensis</i> (6b)																																									
Small:																																									
<i>U. medius</i> (4), (4a), (4b)						X																																			
<i>U. m. mohavensis</i> (4c)																																									
<i>U. m. nonomexicanus</i> (4c)																																									
<i>U. ? schrammi</i> (7)																																									
<i>T. calimontanus</i> (1)																																									
<i>T. hypsodus</i> (2)																																									
<i>T. obliquidens</i> (3)																																									
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<i>T. zygomaticus</i> (6)																																									
<i>T. z. smithi</i> (6a)																																									
<i>T. species undet.</i> (7)																																									
<i>M. blichi</i> (1)																																									
<i>M. johnsoni</i> (2)																																									

¹ "Lower Snake Creek" quarries include Echo, Humbug, and Sinclair Draw (Q. 2, Q. 4, New Surface Q., W. Surface Q., Jenkins Q., and Version Q.). *M. blichi* only from New Surface Q. and Q. 2.

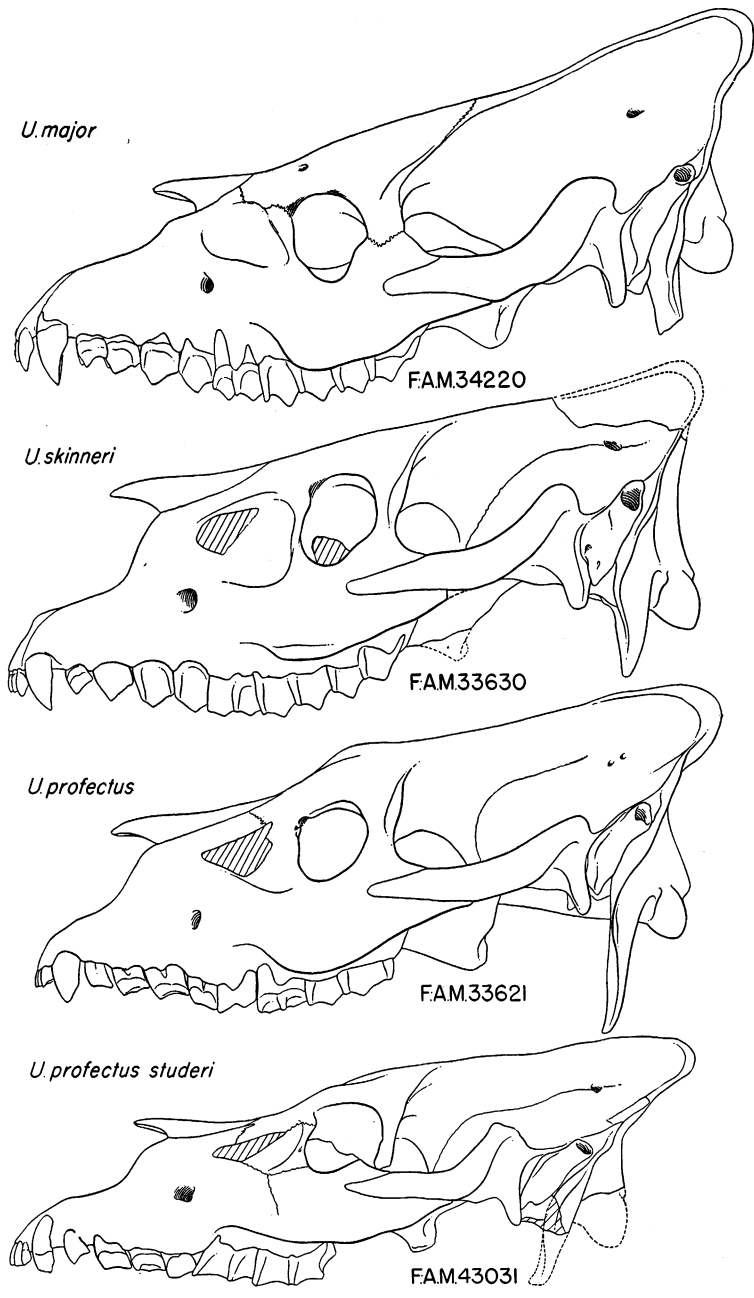
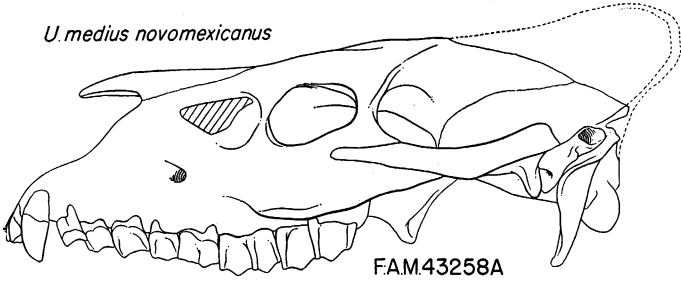


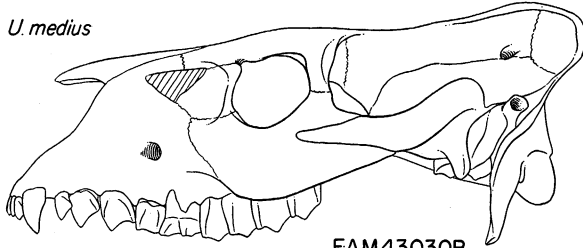
Fig. 1. Outlines of skulls representing four species and two varieties of *Ustatochoerus*, and one species each of *Mediochoerus* and *Ticholeptus*. (See opposite page.) $\times \frac{1}{3}$.

U. medius novomexicanus



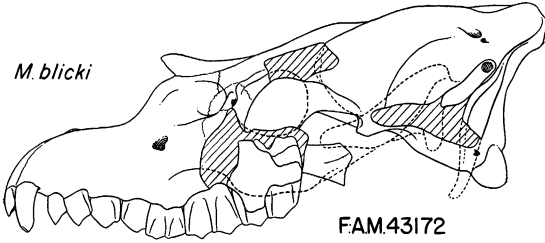
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U. medius



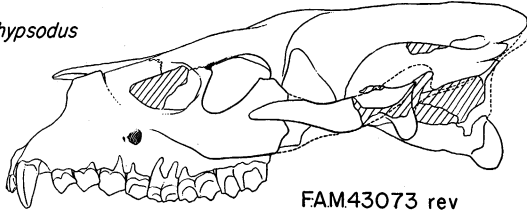
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M. blicki



FAM43172

T. hypsodus



FAM43073 rev

Fig. 1 (cont.). See legend, opposite.

I. USTATOCHOERUS,¹ NEW GENUS

GENOTYPE.—*Ustatochoerus profectus* (MATTHEW AND COOK)

GENERIC CHARACTERS

SKULL.—Medium to large size, ranging in length from approximately 220 mm. to 325 mm.; brachycephalic; occipital region fan-shaped (somewhat similar to *Brachycrus* Matthew); sagittal crest prominent; brain case moderately inflated; zygomatic arch moderately light for size of skull; orbits large (compared to *Brachycrus* and *Merycochoerus*), looking forward and upward; prelacrima pit moderately deep; prelacrima vacuity usually present; infraorbital foramina above region of P⁴ and M¹; slight to moderate retraction of nasals (not as great as in *Brachycrus* and *Merycochoerus*); premaxillae fused for short distance; paroccipital process long and wide at base, forming the lower part of the fan-shaped occipital region; postglenoid process narrow anteroposteriorly but prominent; bullae divided into two portions² with inflated area between the paroccipital and postglenoid processes and deflated area anterior to the paroccipital process.

MANDIBLE.—Shallow for size of the skull; inferior border of ramus almost parallel to the tooth series, with a slight downward curve below M₃.

DENTITION.—Moderately hypsodont; I₃³ very prominent, at least twice the size of I₂²; premolars complicated; superior premolars with a definite cusp on the anterior intermediate crest, and often with a small cusp on the center of the posterior crescent; internal and external cingula usually well developed on premolars; external styles of molars prominent; inferior premolars crowded, slightly grooved externally, with cusps situated internally at center of the anterior crests; M₃ with large heel.

LIMBS.—Moderately heavy (compared to those of most genera of oreodonts).

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

Matthew and Cook³ in 1909 described *Metoreodon* as a new subgenus of *Merychys* and established two new species of this subgenus, namely, *relictus* and *profectus*, the former from the Miocene (Sheep Creek) and the latter from the Pliocene ("Upper Snake Creek") of Sioux County, Nebraska. The subgenotype was not designated, but Hay⁴ and Thorpe⁵ considered *Merychys* (*Metoreodon*) *relictus* to be the subgenotype, since it preceded *profectus* in the original description. Matthew and Cook⁶ emphasized as a subgeneric character of

¹ Etymology.—*Ustatochoerus* = final (or last) hog.

² See illustrations, *Figures 2, 4, 5, and 9*; also Frick, Childs, 1937, *Bull. Amer. Mus. Nat. Hist.*, LXIX, Fig. 2A.

³ Matthew, W. D., and Cook, H. J., 1909, *Bull. Amer. Mus. Nat. Hist.*, XXVI, Art. 27, p. 391.

⁴ Hay, Oliver P., 1930, *Carn. Inst. Wash. Publ. No. 390*, II, p. 788.

⁵ Thorpe, Malcolm R., 1937, *Mem. Peabody Mus.*, III, Pt. 4, p. 202.

⁶ Matthew, W. D., and Cook, H. J., 1909, *op. cit.*, p. 391.

Merychys (*Metoreodon*) the fact that the inferior premolars were complicated and deeply grooved externally. The patterns of the premolars are complex in both *Merychys* (*Metoreodon*) *relictus* and "*Merychys* (*Metoreodon*) *profectus*" (see comparison of premolars, page 103, and *Figure 17*). Although the two species show certain similarities, they are definitely different in size and in other respects appear to be generically distinct. The present writers propose to consider the species, *profectus*, as the genotype of the new genus, *Ustatochoerus*. *Merychys* (*Metoreodon*) *relictus*, the smaller species, will be discussed in a later report concerning *Merychys* and closely related forms. In the Great Plains region, *Ustatochoerus* is limited to the Pliocene while *Merychys*¹ and *Merychys* (*Metoreodon*) are restricted to the Miocene.

In *Ustatochoerus* there is considerable variation in the size of the skulls, the length of the dental series, the depth of the ramus, and in the size and proportions of the limbs. Several skulls are exceptionally light and narrow but their dental series are equal in size to the teeth of more robust individuals. The writers consider these light specimens to be those of females. One example is figured for comparison with the heavier skulls which are thought to be those of males (*Figure 6*). The limbs of the supposed females are also definitely lighter than the males.

DISTRIBUTION

Ustatochoerus remains are widely distributed throughout the western United States. Seven species, seven specific varieties, and four geographic varieties are here recorded from the Pliocene deposits of California, Colorado, Kansas, Montana, Nebraska, New Mexico, South Dakota, and Texas. [See distribution chart, page 7; and *Figures 1* (in part), *2-12*, and *17* (in part).]

¹ Loomis (1924, Bull. Amer. Mus. Nat. Hist., LI, Art. 1, p. 31) considered *Merychys elegans* as coming from the Valentine (Pliocene) deposits but this was apparently due to a misinterpretation of the original geographic and geologic data concerning the holotype. This matter will be discussed in detail under *Merychys*.

SUMMARY OF SPECIES AND TYPES

Seven species and eleven¹ varieties of *Ustatochoerus*, new genus, from ten Pliocene localities are here recorded:

- (1) *Ustatochoerus californicus* (Merriam), 1919, from near Ricardo, Kern County, California.

HOLOTYPE.—Fragmentary skull, U.C.21351.²

- (1a) *Ustatochoerus californicus raki*, new variety, from the Santa Cruz area, Santa Fé County, New Mexico.

HOLOTYPE.—Partial mandible, F:A.M.42318. *Figure 3.*

- (2) *Ustatochoerus compressidens* (Douglass), 1901, from the lower Madison Valley, Gallatin County, Montana.

HOLOTYPE.—Partial left ramus, C.M.801. *Figure 3.*

- (3) *Ustatochoerus major* (Leidy), 1858, from the Niobrara River region, northern Nebraska, and referred remains from Banner, Brown, Cherry, Sheridan, and Sioux Counties, Nebraska. (Upper Ash Hollow or equal.)

HOLOTYPE.—Partial right maxilla, N.M.439. *Figure 9.*

- (3a) *Ustatochoerus major texanus*, new variety, from near Amarillo, Potter County, Texas.

HOLOTYPE.—Fragmentary skull, partial mandible, and skeletal elements, F:A.M.37563. *Figures 3, 11, 12.*

- (4) *Ustatochoerus medius* (Leidy), 1858, from the Niobrara River region, northern Nebraska; referred remains from Brown, Cherry, Dawes, Keya Paha, and Sheridan Counties, Nebraska, and Mellette and Todd Counties, South Dakota; and geographic varieties (4a) from Weld and Logan Counties, Colorado, and (4b) from Norton County, Kansas. (Valentine or equal.)

HOLOTYPE.—Partial left ramus, N.M.118. *Figure 2.*

- (4c) *Ustatochoerus medius mohavensis*, new variety, from the Barstow area, San Bernardino County, California.

HOLOTYPE.—Anterior portion of skull, F:A.M.34464. *Figure 10.*

- (4d) *Ustatochoerus medius novomexicanus* (Frick), 1929, from the Santa Cruz area, Santa Fé County, New Mexico, and referred remains from Rio Arriba County, New Mexico.

HOLOTYPE.—Right ramus, F:A.M.32051. *Figure 3.*

¹ Four geographic varieties are included in this count.

² List of abbreviations of institutions cited: A.M. = American Museum of Natural History; F:A.M. = Frick Collection; F:B:A.M. = Frick:Barbour Collection; A.C. = Amherst College; C.I.T. = California Institute of Technology; C.M. = Carnegie Museum of Pittsburgh; Col. M. = Colorado Museum of Natural History; M.C.Z. = Museum of Comparative Zoology, Harvard University; N.M. = U.S. National Museum; N.S.M. = University of Nebraska State Museum; U.C. = University of California Museum of Paleontology.

- (5) *Ustatochoerus profectus* (Matthew and Cook), 1909, genotype, from "Upper Snake Creek," Sioux County, Nebraska; referred remains from Brown, Cherry, and Keya Paha Counties, Nebraska, and Bennett and Todd Counties, South Dakota; and geographic variety (5a) from Norton County, Kansas. (Lower Ash Hollow or equal.)

GENOHOLOTYPE.—Partial left ramus, A.M.14055. *Figure 17.*

- (5b) *Ustatochoerus profectus espanolensis*, new variety, from the Santa Cruz area, Santa Fé County, New Mexico, and referred remains from Rio Arriba County, New Mexico.

HOLOTYPE.—Partial skull, F:A.M.33683. *Figure 10.*

- (5c) *Ustatochoerus profectus studeri*, new variety, from near Amarillo, Potter County, Texas, and referred remains from Donley County, Texas.

HOLOTYPE.—Skull and mandible, F:A.M.43031. *Figures 1, 7.*

- (6) *Ustatochoerus skinneri*, new species, from Turtle Buttes, Tripp County, South Dakota; referred remains from Brown and Cherry Counties, Nebraska, and geographic variety (6a) from Norton County, Kansas. (Ash Hollow or equal.)

HOLOTYPE.—Skull, mandible, and skeletal elements, F:A.M.33630. *Figures 1, 8, 12.*

- (6b) *Ustatochoerus skinneri santacruzensis*, new variety, from the Santa Cruz area, Santa Fé County, New Mexico, and referred remains from Rio Arriba County, New Mexico.

HOLOTYPE.—Anterior portion of skull, F:A.M.32050. *Figure 10.*

- (7) *Ustatochoerus? schrammi*, new species, from Boyd County, Nebraska, and questionably referred remains from Brown County, Nebraska, and Logan County, Colorado. (Valentine or equal.)

HOLOTYPE.—Partial right ramus, N.S.M.21-8-23H. *Figure 3.*

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

Ustatochoerus, total available specimens, 338(1) *Ustatochoerus californicus* (Merriam)

From the Pliocene Deposits near Ricardo, Kern County, California

Merycochoerus (*Pronomotherium*) *californicus* MERRIAM, 1917, Bull. Dept. Geol. Uni. Calif., X, p. 431 (name only).*Merycochoerus?* (*Pronomotherium?*) *californicus* MERRIAM, 1919, *ibid.*, XI, p. 575, Figs. 211-215.*Metoreodon californicus* (MERRIAM), MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, Art. 2, p. 182. THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 203, Figs. 146-147.

SPECIFIC CHARACTERS

SKULL.—Larger than that of *U. major*; malar very deep below the orbit.MANDIBLE.—Known only from symphysis; larger than that of *U. major*.DENTITION.—Dental series longer and more robust than in *U. major*.

LIMBS.—Unknown.

MEASUREMENTS.—Table I.

DISCUSSION

The holotype and paratypes are fragmentary and badly distorted by crushing, but there is enough evidence to refer the material to the genus *Ustatochoerus* and to show that the size is definitely greater than that of *U. major*.

Five specimens are here recorded:

HOLOTYPE.—Fragmentary skull with P ³ -P ⁴ alv. and M ¹ -M ³ (M ² -M ³ br.). (w) ¹	U.C.21351	From U.C. collecting locality 1955, Melrose District, near Ricardo, Kern County, California. Figured by Merriam, 1919, Figs. 211 and 213; Thorpe, 1937, Figs. 146-147.
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REFERRED FROM TYPE LOCALITY.—

Partial right maxilla with C/-P ¹ alv. and P ³ -P ⁴ . (w+)	23128	Figured by Merriam, 1919, Fig. 212.
Right M ¹ -M ² . (w+)	21353	Fig. 214.
Symphysis with P ₁ -P ₄ rt.	21567	Fig. 215.

The three specimens were associated with the holotype and were considered as paratypes by Merriam (1919).

TENTATIVELY REFERRED FROM TYPE AREA.—

Right and left M ₃ . (w)	F:A.M.34489	Collected by Joseph Rak, 1923.
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These molars are tentatively referred because of their small size, which is approximately equal to that of *U. major*.

¹ Abbreviations used in descriptions: alv. = alveolus or alveoli; br. = broken; erupt. = erupting; rt. = root or roots.
Stage of wear of teeth: (i) = immature; (m) = mature; (w) = worn.

(1a) *Ustatochoerus californicus raki*,¹ new variety

From the Pliocene of Santa Fé County, New Mexico

VARIETAL CHARACTERS

SKULL.—Unknown.

MANDIBLE.—Slightly more massive than that of *U. californicus* and decidedly more so than that of *U. major*.DENTITION.—Superior series not known; length of inferior series somewhat longer than in *U. californicus* (in comparison with the superior series of that species); decidedly longer and more massive than in *U. major*.

LIMBS.—Unknown.

MEASUREMENTS.—Table I.

DISCUSSION

The unusual size of the ramus and the massiveness of the dental series suggest that this specimen is either a distinct species or a large individual of *U. californicus*.

One recorded specimen:

HOLOTYPE.—Partial mandible with	F:A.M.42318	From 1st Wash, Santa Cruz
I ₁ -M ₃ . (w††)		Area, Santa Fé County,
		New Mexico; collected by
		John C. Blick and William
		Klaus, 1938.

Figure 3.

The specimen is a very old individual but the cusps of P₂ and P₃, which are characteristic of the genus, are still traceable. The spaces between the teeth (see *Fig. 3*) are due to the age of the individual and not to distortion.

(2) *Ustatochoerus compressidens* (Douglass)

From the Pliocene Deposits of the Lower Madison Valley, Gallatin County, Montana

Merycochoerus compressidens DOUGLASS, 1901, Amer. Jour. Sci., (4), XI, p. 79, Fig. 4.*Metoreodon compressidens* (DOUGLASS), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 204, Fig. 148.

SPECIFIC CHARACTERS

SKULL.—Unknown.

MANDIBLE.—Similar to that of *U. profectus*.DENTITION.—Superior series unknown; /C heavy; P₁-P₄ crowded and overlapping.

LIMBS.—Unknown.

MEASUREMENTS.—Table I.

¹ Named in honor of the late Joseph Rak, who collected fossils in the Santa Fé deposits for the Frick Laboratory, 1924-1930.

DISCUSSION

Douglass¹ stated that the remains of *U. compressidens*, *Brachycrus laticeps*, and *B. madisonius* were all from beds of the same age. It is now evident, however, that the holotype of *U. compressidens* came from the higher deposits (Pliocene) which are also exposed in lower Madison Valley.²

One recorded specimen:

HOLOTYPE.—Partial left ramus with /C(rt.)—M ₃ (br.). (w+)	C.M.801	From lower Madison Valley, Galatin County, Montana; collected by Earl Douglass. Figured by Douglass, 1901, Fig. 4; Thorpe, 1937, Fig. 148. Figure 3.
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(3) *Ustatochoerus major* (Leidy)

From the Upper Part of the Ash Hollow Formation, Nebraska

Merychys major LEIDY, 1858, Proc. Acad. Nat. Sci. Phila., X, p. 26; 1869, Jour. Acad. Nat. Sci. Phila., (2), VII, Pl. XI, Figs. 15–16.

Metoreodon major (LEIDY), MATTHEW, 1924, Bull. Amer. Mus. Nat. Hist., L, Art. 2, p. 181. THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 205, Pl. xxxvii, Figs. 12–13.

SPECIFIC CHARACTERS

SKULL.—Larger than that of *U. profectus*; elongated posterior to orbits; malar moderately deep; nasals short and retracted considerably more than those of *U. profectus*; anterior tip of nasals retracted to region above P³; postglenoid process very large in comparison with that of *U. profectus*.

MANDIBLE.—Typical of genus; larger and more robust than in *U. profectus*; smaller and lighter than in *U. californicus espanolensis*.

DENTITION.—Well-developed cusps in superior and inferior premolars, more so than in *U. medius*; tendency for presence of cingula on superior molars; inferior premolars crowded and grooved on internal side.

LIMBS.—Longer and heavier than in examples of *U. profectus*.

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

The holotype (N.M.439) of *Ustatochoerus major* was found by F. V. Hayden while he was with G. K. Warren's Expedition of 1857. It was reported that this specimen came from the "sands of the Niobrara River,"³ but an exact locality

¹ Douglass, Earl, 1901, op. cit., p. 79.

² At the meeting of the Paleontological Society of America in December, 1938, Horace E. Wood 2d reported the presence of both Miocene and Pliocene deposits in lower Madison Valley. Falkenbach also contributed additional evidence concerning the diversity of age of these sediments, basing his conclusions on recent field work of the Frick Laboratory in Montana.

³ Leidy, Joseph, 1869, op. cit., pp. 115, 380.

was not designated. The greater portion of the referred material of *U. major* listed in this paper was found north of the Niobrara River a few miles east of the mouth of Minnechaduza Creek, in Cherry County, Nebraska. The Warren Expedition stopped at this locality on October 23 and 24, 1857,¹ so it is entirely possible that the holotype came from this vicinity, especially since its fossilization is similar to that of the referred specimens from the same area. The Cherry County site, furthermore, is the only known locality along Warren's entire Niobrara River route where upper Ash Hollow fossils could possibly have been found in any abundance. In most areas in northern Nebraska the upper Ash Hollow deposits are absent or covered by talus.

The holotype consists only of a partial right maxilla and heretofore it has been difficult to assign any material to this species. Matthew² considered *U. profectus* to be synonymous with *U. major* although he had previously established the former species.³ Thorpe,⁴ however, pointed out that distinct specific differences exist between *U. major* and *U. profectus*. The large amount of material now available for study confirms Thorpe's contention and suggests that the two forms are restricted to different stratigraphic horizons, *U. major* to the upper and *U. profectus* to the lower Ash Hollow. The present writers consider the associated skull and mandible, F:A.M.34220 (*Figure 9*), from the Kat Quarry channels of northeastern Cherry County, Nebraska, as the best example of *U. major* and have based additional characters of the species on this well-preserved specimen.

U. major is the largest species of *Ustatochoerus* known from the Great Plains and represents the last reported survivor of the oreodonts in that region. It is surpassed in size, however, by *U. californicus* from California and *U. californicus raki* from New Mexico, intimating that the oreodonts may have survived longer in southwestern United States than in the Great Plains.

The F:A.M. specimens, except where otherwise stated, were collected by Morris Skinner, Ralph Mefferd, and Gordon Fletcher, 1930-1939.

Seventy specimens are here recorded:

HOLOTYPE.—Partial right maxilla ⁵ with P ² -M ² . (w)	N.M.439	From the Ogallala deposits of the Niobrara River region, Nebraska; collected by F. V. Hayden, 1857. Figured by Leidy, 1869, Pl. xi, Figs. 15-16; Thorpe, 1937, Pl. xxxvii, Figs. 12-13. <i>Figure 9.</i>
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¹ Hayden, F. V., 1869, Jour. Acad. Nat. Sci. Phila., (2), VII, map.

² Matthew, W. D., 1924, op. cit., p. 181.

³ Matthew, W. D., and Cook, Harold J., 1909, Bull. Amer. Mus. Nat. Hist., XXVI, Art. 27, p. 394.

⁴ Thorpe, Malcolm R., 1937, op. cit., p. 206.

⁵ The cast (A.M. 9954) of the holotype in the American Museum of Natural History is approximately 9 mm. shorter than the original specimen.

REFERRED.—

(A) FROM THE KAT¹ QUARRY CHANNELS, S. OF SPARKS, ON THE N. SIDE OF THE NIOBRARA RIVER, CHERRY COUNTY, NEBRASKA:

TWO SKULLS, ETC.

Complete skull and mandible with I ₁ ¹ -M ₃ ³ . <i>Figures 1, 9</i>	L.K.	(w)	F: A. M. 34220
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The teeth of the skull so nearly duplicate those of the holotype, N.M.439, that the writers have based additional specific characters on this well-preserved specimen.

Skull with I ¹ -I ² alv. and I ³ -M ³ , lacking nasals.....	E.K.	(w)	34219
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CRANIUM

Posterior portion of skull.....	W.L.K.		34479
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SEVEN PARTIAL MAXILLÆ

Two right maxillæ with P ⁴ (erupt.)-M ²	W.L.K.	(-m)	43137
C/-dP ² -dP ³ (C/germ and P ¹ alv.).....	Q.L.K.	(i)	34382

Five left maxillæ with I ¹ -I ³ alv. and C/-P ³ (br.) (P ¹ alv.).....	K.	(w+)	33622
P ¹ -P ² alv. and P ³ -M ² (br.).....	K.	(-m)	33629
P ¹ (alv.)-P ³	W.L.K.	(w)	34229
M ¹ -M ² alv. and M ³	K.	(w+)	34230
P ¹ -P ³ (alv.).....	E.K.	(m)	34478

TWELVE MANDIBULAR RAMI

Two partial right rami with P ₁ (rt.)-M ₃ (P ₂ alv.).....	E.K.	(w+)	34237
M ₁ (alv.)-M ₃	W.L.K.	(w)	43138

Four right rami, immature, with P ₁ (alv.)-dP ₄ -M ₁ (br.) (P ₂ br.).....	K.	(i)	33628
P ₁ -dP ₄ -M ₃ (erupt.) (P ₂ -P ₃ germs).....	W.L.K.	(i)	34236
P ₁ -M ₂ (P ₂ -P ₃ alv. and P ₄ erupt.).....	Q.L.K.	(-m)	34383
I ₂ -P ₁ alv. and dP ₂ -M ₁ (erupt.).....	E.K.	(i)	34477

Three partial left rami with M ₁	W.L.K.	(w+)	34245
P ₁ -M ₃ (P ₃ alv. and M ₂ -M ₃ br.).....	E.K.	(w+)	34249
M ₃	E.K.	(w+)	34475

Three partial left rami, immature, with P ₂ -P ₃ alv. and dP ₄	W.L.K.	(i)	34246
P ₁ (erupt.)-dP ₂ -dP ₄	C.K.	(i)	34351
dP ₂ -dP ₄	E.K.	(i)	34476

¹ The following abbreviations are used: K. = Kat Quarry Channel; E.K., C.K., W.K., L.K., Q.L.K., W.L.K., E.L.K., T.S.K. = East, Connection, West, Line, Quarter Line, West Line, East Line, Trail Side Kat Quarry channels.

LIMBS		F. A. M.
Tibia. (<i>Figure 12</i>).....	E.K.	34379
Distal portion of tibia.....	W.L.K.	43201
Radius. (<i>Figure 12</i>).....	T.S.K.	37148
Metacarpal III. (<i>Figure 12</i>).....	T.S.K.	34354
Metacarpal.....	L.K.	43202A

(A') FROM THE LEPTARCTUS QUARRY, S. OF SPARKS, ON THE N. SIDE OF THE NIOBRARA RIVER, CHERRY COUNTY, NEBRASKA (same stratigraphic level as the Kat Quarry channels):

FOUR SKULLS, ETC.

Skull with I ¹ -I ³ alv. and C/-M ³ (P ¹ alv.) (lacking right zygomatic arch).....	(M)	34221
Skull with I ¹ -M ³	(w±)	34223
Anterior portion of skull with I ¹ (alv.)-M ³	(w)	34225
Partial skull with I ¹ -M ³ and mandible with I ₁ -I ₃ alv. and /C-M ₃ ..	(w+)	34232

CRANIUM, IMMATURE

Posterior portion of skull.....	(-M)	34224
This specimen is narrower than other examples, and may represent a female.		

FOUR MAXILLÆ

Right maxilla with C/-M ³ (M ¹ alv.).....	(w)	34226
Three partial left maxillæ with		
P ² -M ³ (P ⁴ br.).....	(w±+)	34227
M ² -M ³	(w+)	34228
P ⁴ -M ³ (br.) (M ¹ br.).....	(w+)	34350

THIRTEEN MANDIBULAR SPECIMENS

Mandible with I ₁ -M ₃	(M+)	34231
Seven right rami with		
/C-M ₃ (br.).....	(w+)	34233
P ₁ (br.)-M ₃ (P ₂ br.).....	(w±)	34234
I ₁ -P ₁ alv. and P ₂ -M ₃	(w±)	34235
P ₂ -P ₄ alv. and M ₁ -M ₃	(M+)	34238
P ₁ (br.)-M ₂ (P ₂ -P ₄ alv.).....	(M)	34239
/C-P ₄ alv. and M ₁ -M ₂	(M)	34240
P ₁ (br.)-P ₄ (P ₂ alv.).....	(w)	34241
Three partial left rami with		
I ₂ -P ₁ alv. and P ₂ -M ₃	(w±)	34243
P ₃ -M ₂	(w±)	34244
/C-P ₄ alv. and M ₁ -M ₂	(M)	34248
Two partial left rami, immature, with		
P ₁ -M ₂ (P ₂ germ and P ₃ -P ₄ alv.).....	(i)	34247
dP ₂ -dP ₃	(i)	34353

(A'') FROM THE HANS JOHNSON QUARRY, S. OF SPARKS, ON THE N. SIDE OF THE NIOBRARA RIVER, CHERRY COUNTY, NEBRASKA (same stratigraphic level as the Kat Quarry channels):

	CRANIUM		F:A.M.
Posterior portion of skull.....		(M)	34367
	TWO MANDIBULAR SPECIMENS, IMMATURE		
Mandible with I ₁ -/C alv. and P ₁ -dP ₄ -M ₃ (erupt.) (P ₃ germ).....		(I)	34349
Right ramus with dP ₃ (br.)-M ₁ (br.).....		(I)	33627
	METATARSAL		
Metatarsal III. <i>Figure 12</i>			37299

(A''') FROM THE XMAS QUARRY, S. OF SPARKS, ON THE N. SIDE OF THE NIOBRARA RIVER, CHERRY COUNTY, NEBRASKA (approximately same stratigraphic level as the Kat Quarry channels):

	FEMUR		
Femur. <i>Figure 12</i>			33664

(A''''') FROM VARIOUS LOCALITIES, CHERRY COUNTY, NEBRASKA:

F:A.M. collections:

Partial right maxilla with P ¹ alv. and P ² -P ³ erupt.	F:A.M.34366	From Spring Canyon, at mouth of Bear Creek.
Left ramus with P ₃ -M ₁ . (w) P ₃ -P ₄ large, M ₁ small.	34373	From 1½ mi. below Boiling Spring Bridge.

N.S.M. collections:

Partial right ramus, imma- ture, with dP ₄ -M ₂ . (I)	N.S.M.3-21-6-32 N.P.	From N. and E. of Burge Post Office, on the S. side of the Nio- brara River.
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(B) FROM BROWN COUNTY, NEBRASKA:

	MAXILLA, ETC.	
Partial right maxilla with P ⁴ - M ¹ br. and M ² -M ³ , and partial mandible with M ₁ - M ₃ . (w†) P ⁴ very small.	F:A.M.34377	From S. of Fairfield Creek.

THREE MANDIBULAR SPECIMENS

Mandible, immature, with P ₁ - dP ₂ -M ₂ . (I)	34376	From Plum Creek.
Two left rami with P ₁ -M ₃ (P ₃ alv.). (w+) P ₄ very large.	33624	From Plum Creek.
P ₂ (alv.)-M ₃ . (w+) Massive P ₃ -P ₄ .	33626	From J. Wilson Quarry, Plum Creek.

(C) FROM TURTLE CANYON, S. AND E. OF HAY SPRINGS, SHERIDAN COUNTY, NEBRASKA (collected by John Lynch and Charles H. Falkenbach, 1930):

	SKULL		F:A.M.
Anterior portion of skull with C/-M ³ (br.) (P ⁴ small).....		(w)	33681

	MANDIBULAR RAMUS		
Partial right ramus with I ₁ -C(alv.) and P ₁ -M ₃ (br.).....		(w††)	33679

(C') FROM TURTLE CANYON (collected by University of Nebraska State Museum field party, 1937):

	MANDIBULAR RAMUS		N.S.M.
Partial left ramus with I ₁ -C alv. and P ₁ -M ₃ (M ₂ br.).....		(w††)	2-31-7-37
This specimen is smaller than typical examples of <i>U. major</i> and approaches the size of large <i>U. profectus</i> .			S.P.

(D) FROM HARRISBURG LOCALITY A, QUARRY 2, E. OF HARRISBURG, S.W. OF BIG HORN MOUNTAIN, BANNER COUNTY, NEBRASKA (collected by University of Nebraska State Museum, 1937):

	MAXILLA		
Partial left maxilla with P ¹ -P ² (br.).....		(w)	11-26-6-37 S.P.

	TWO MANDIBULAR RAMI		
Two partial right rami with			
P ₃ (rt.)-M ₂ (br.).....		(w†)	9-26-6-37 S.P.
P ₂ (br.)-M ₁ (br.) (P ₃ and P ₄ alv.).....		(w††)	10-26-6-37 S.P.

(E) FROM THE "UPPER SNAKE CREEK" DEPOSITS, SIOUX COUNTY, NEBRASKA:

From Quarry 1, *Aphelops* Draw; collected by Albert Thomson and associates, 1918:

	PARTIAL SKULL		A.M.
Anterior portion of skull with I ¹ (rt.)-P ³ (C/-P ¹ br.).....		(w)	17589

From general area; collected by Harold J. Cook, 1908:

	MANDIBULAR RAMUS		
Partial right ramus with P ₁ -P ₄		(w†)	14059

The two above-listed specimens, although from the same area as the holotype of *U. profectus*, more nearly approach *U. major* in size and form. This would suggest that both lower and upper Ash Hollow deposits are represented in the "Upper Snake Creek." This is the first recorded evidence of *U. major* in the Sioux County area.

(3a) *Ustatochoerus major texanus*, new variety

From the Pliocene Deposits, North of Amarillo, Potter County, Texas

VARIETAL DESCRIPTION

SKULL.—Known only from fragment with M^3 and left zygomatic arch; zygomatic arch very light; postglenoid process light in comparison with that of *U. major*.

MANDIBLE.—Approximately same length as average examples of *U. major*, but shallower.

DENTITION.—Superior series known from an M^3 only; M^3 indicates a length of series approximating that of *U. major*; inferior series equal to that of large *U. major*.

LIMBS.—About the size and proportions of those of *U. profectus*; decidedly shorter than in *U. major*.

MEASUREMENTS.—Table I and II.

DISCUSSION

The holotype of this new variety, although incomplete, displays characters which are distinct from *U. major*. The size of the dentition of *U. major texanus* is nearly equal to that of *U. major* but the limbs approach in size those of *U. profectus*, a smaller species.

The specimens of *U. major texanus* here listed were collected by Nelson J. Vaughan, John Lynch, and Charles H. Falkenbach in 1938.

Two specimens are here recorded:

HOLOTYPE.— M^3 (br.) and left zygomatic arch, partial mandible with I_3 – M_3 (br.) (P_1 – P_3 rt.), 2 radii (1 partial), 2 ulnae (1 partial), femur, tibia, and manus and pes elements. (w+)

F:A.M.37563

From N. of Amarillo, Potter County, Texas.
Figures 3, 11, 12.

REFERRED FROM TYPE AREA:

PARTIAL SKULL, IMMATURE
Anterior portion of skull with I^1 – dP^4 – M^3 br., partial mandible with I_1 – dP_4 – M_3 , and skeletal fragments..... (1)

F:A.M.

37502

(4) *Ustatochoerus medius* (Leidy)

From the Valentine Formation, Nebraska; Referred Specimens from South Dakota; and Geographic Varieties (4a) from Colorado and (4b) from Kansas

Merychys medius LEIDY, 1858, Proc. Acad. Nat. Sci. Phila., X, p. 26; 1869, Jour. Acad. Nat. Sci. Phila., (2), VII, Pl. XI, Figs. 12-14; 1870, Proc. Acad. Nat. Sci. Phila., XXII, p. 109.
Metoreodon? medius (LEIDY), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 206, Pl. XXI, Fig. 3; Pl. XXXVII, Figs. 14-16.

Merycochoerus coenopus SCOTT, 1890, Morpholog. Jahrb., XVI, p. 346, Pl. XVI, Figs. 33-34.

SPECIFIC CHARACTERS

SKULL.—Smaller than that of *U. profectus* but larger than that of *U. schrammi*; nasals longest of genus (in proportion to size of skull); anterior tip of nasals retracted to region above P¹-P².

MANDIBLE.—Typical of genus; similar to that of *U. profectus* except for smaller size.

DENTITION.—Cusps on superior and inferior premolars not as well developed as in *U. major* or *U. profectus*.

LIMBS.—Smaller than those of *U. profectus*.

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

The holotype of *Ustatochoerus medius* was discovered by F. V. Hayden in 1857 in the "sands of the Niobrara River,"¹ but a definite collecting locality was not mentioned. It appears to have been found sometime during the period from September 23 to October 25, 1857, when the G. K. Warren Expedition, which Hayden accompanied, was in the vicinity of what is now Cherry County, Nebraska. There are many localities along this route where the Valentine formation, which contains the remains of *U. medius*, is well exposed.

The holotype consists only of a partial left ramus. Leidy² suggested that "*Merychys medius*" (= *Ustatochoerus medius*) and "*Merycochoerus rusticus*" (= *Brachycrus rusticus*) were very closely related forms. The present writers find that *B. rusticus* is from the Miocene³ and *U. medius* from the Pliocene. Both species are now represented by much additional material, including skulls, mandibles, and skeletal elements.

Four partial skeletons of *U. medius* were found in one field block (F:A.M. 43030A-D) in the lower Valentine formation near Long Pine, Brown County, Nebraska, and a second group of six associated individuals (F:A.M. 33591-33596) was collected from the lower Valentine deposits of Devil's Gulch, Brown County (see page 25 for detailed list of specimens). These examples, together

¹ Leidy, Joseph, 1869, op. cit., pp. 115, 380.

² Leidy, Joseph, 1870, op. cit., p. 109.

³ Schultz, C. Bertrand, and Falkenbach, Charles H., 1940, Bull. Amer. Mus. Nat. Hist., LXXVII, Art. 5, p. 218.

with the specimens from other localities, aid considerably in better understanding the characters of *U. medius*. The following comparative measurements of the adult individuals of the two above-mentioned groups illustrate to some extent the individual variation found within this species:

	Wear	Interorbital width (min.)	Height of skull above M ²	Posterior portion of nasals	Length C/-M ³
Associated skulls					
F:A.M.43030A	(w+)	72.	72.	Medium	120.
43030B	(w+)	69.	74.	Light	122.
43030D	(w)	69.	72.	Light	122.
Associated skulls					
F:A.M.33591	(w)	70.	77.	Light	122.
33595	(m)	82.	84.	Heavy	125.
33596	(w+)	...	...	...	126.

Some specimens of *U. medius* are larger and more robust than any of those cited above, but most of the larger forms occur at somewhat higher levels within the Valentine formation. Such variation in size in specimens from different levels within a single formation is, of course, to be expected. The holotype of *U. medius* is intermediate in size to the largest and smallest examples of the species.

The description of *Merycochoerus coenopus* Scott was based on the distal end of an ulna and a partial manus and pes (M.C.Z.9156) which were collected by Samuel Garman of Harvard University in 1882 near the head of Wolf Creek, Nebraska. The type material, as well as Samuel Garman's original data concerning these specimens, was loaned to the writers by Dr. Thomas Barbour and Dr. Alfred S. Romer. Field parties from the University of Nebraska State Museum under the direction of Thompson M. Stout and C. Bertrand Schultz made small collections of Pliocene mammal remains from the head of Wolf Creek along the Nebraska-South Dakota boundary line. So far as could be determined, the only fossils found along the banks of Wolf Creek near its head are of Pliocene (Valentine) age, and the fossilization of these remains is much the same as that of Garman's material. Furthermore, the holotype of *M. coenopus* compares well with skeletal elements of *U. medius* from the Valentine of northern Nebraska. The writers regard *M. coenopus* as a synonym of *U. medius*.

Eighty-eight specimens are here recorded:

HOLOTYPE.—Partial left ramus N.M.118
with M₁-M₃. (w±)

From Niobrara River valley, Nebraska; collected by Lieutenant G. K. Warren, 1857.

Figured by Leidy, 1869, Pl. XI, Figs. 12-14; Thorpe, 1937, Pl. xxxvii, Figs. 14-16.

Figure 2.

REFERRED.—

(A) FROM BROWN COUNTY, NEBRASKA (collected by Morris Skinner, Ralph Mefferd, Gordon Fletcher, and associates, 1933-1940):

From N. and E. of Long Pine:

FOUR ASSOCIATED SKULLS, ETC.		F:A.M.
Skull with I ¹ -M ³ and mandible with I ₁ -M ₃ . <i>Figures 1, 2</i>	(w+)	43030B
Skull (lacking right zygomatic arch) with I ¹ -M ³ (I ² alv.) and mandible with I ₁ -M ₃	(w)	43030A
Skull with I ¹ -M ³ and partial mandible with I ₁ -P ₁ alv. and P ₂ -M ₃	(w+)	43030D
Skull (lacking nasal region), immature, with I ¹ (alv.)-dP ² -M ² and mandible with I ₁ -dP ₃ -M ₂	(i)	43030C
3 partial humeri, 8 radii (3 partial), 7 ulnæ, 3 femora, 6 tibiae (2 partial), various manus and pes elements, and vertebræ. <i>Figures 11, 12</i> (in part).....		43030A-D
The above four skulls and miscellaneous material were found associated in one field block (see discussion, p. 23).		

From Devil's Gulch, N. and E. of Ainsworth:

SIX ASSOCIATED SKULLS, ETC.		
Anterior portion of skull with I ¹ -M ³ and partial mandible with I ₁ -I ₃ alv. and /C-M ₃	(w)	33591
This specimen may represent a female.		
Anterior portion of skull with I ¹ -M ³ and partial mandible with P ₁ (br.)-M ₃ (br.).....	(w)	33595
Right anterior portion of skull with I ¹ (alv.)-M ³ and partial mandible with P ₁ -M ₃	(w+)	33596
Anterior portion of skull, immature, with I ¹ -I ³ alv. and C/-dP ¹ -M ² and partial mandible with P ₁ -dP ₂ -M ₂	(i)	33592
Anterior portion of skull, immature, with I ¹ -I ³ alv. and C/-dP ² -M ² and partial mandible with I ₁ -I ₃ alv. and /C-dP ₂ -M ₂	(i)	33593
Anterior portion of skull, immature, with I ¹ -C/alv. and dP ¹ -M ² , and partial left ramus with dP ₄ -M ₂	(i)	33594
Distal end of humerus, partial radius, and manus.....		33591-6
The above six partial skulls and miscellaneous material were found associated in one field block. The mature specimens show marked individual variation (see discussion and measurements, pp. 23-24).		

From Devil's Gulch Horse Quarry, W. of above-listed six skulls:

MAXILLA, IMMATURE		
Left maxilla, immature, with P ¹ -dP ³ -M ² (P ² germ).....	(i)	33615
THREE MANDIBULAR RAMI		
Partial right ramus with P ₂ -M ₂	(w)	34357
Partial right ramus, immature, with I ₁ -P ₂ alv. and dP ₃ -dP ₄ ..	(i)	34372
Partial left ramus with I ₁ -M ₃ (br.) (I ₃ -/C alv.).....	(M)	33608

From Fairfield Creek area:

TWO SKULLS

Skull (lacking nasals) with I ¹ (rt.)-M ³ (dP ⁴ present on right side).....	(-M)	F:A.M. 33607
This specimen is slightly larger than any of the associated skulls, F:A.M.43030A-C, which are listed above.		
Partial skull with I ¹ -I ³ alv. and C/-M ³	(w‡)	33599

TWO MAXILLÆ

Partial right maxilla with P ⁴ -M ³	(w‡+)	33610
Partial left maxilla with I ² -I ³ alv. and C/(br.)-P ⁴	(w‡+)	43139

TWO MANDIBULAR RAMI

Mandible with I ₁ -M ₃	(w‡)	33606
The dentition of this specimen is robust.		
Partial right ramus with P ₁ -M ₃ (br.).....	(w)	33601

From Fairfield Falls Quarry:

MAXILLA

Left maxilla with P ¹ (alv.)-M ³	(w)	33611
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TWO MANDIBULAR RAMI

Partial mandible with P ₁ -M ₃	(w+)	43131
Partial right ramus with P ₂ (alv.)-M ₁	(w‡)	34369

From various localities in Brown County:

SKULL, ETC.

Anterior inferior portion of skull with C/-M ³ , partial humerus, ulna, radius, and manus and pes elements. (w‡)	F:A.M.33598	From Jones Canyon, Dutch Creek.
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FIVE MANDIBULAR RAMI

Mandible with I ₁ -M ₃ . The dentition of this specimen is robust.	(w‡) 33613	From Jones Canyon, Dutch Creek.
Partial right ramus with M ₂ -M ₃ and distal end of humerus. (w)	34359	From Hulbert Canyon, Plum Creek drainage.
Partial left ramus with M ₁ -M ₂ . (w)	34370	From N. of Long Pine.
Partial left ramus with M ₃ . (w‡)	34371	From Bone Creek.
Partial left ramus, immature, with I ₂ -I ₃ rt. and /C-dP ₂ -dP ₄ (P ₁ germ). (t)	34352	From near Devil's Gulch Horse Quarry.

FEMUR

Femur.	34380	From Moore Creek.
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(A') FROM BROWN COUNTY, NEBRASKA (collected by University of Nebraska State Museum field parties, 1913-1920):

THREE MAXILLARY SPECIMENS

N.S.M.		
Right and left maxillæ with I ² -P ³ . (w+)	32A-15-6-20 S. and W.	From near Ainsworth.
Two partial right maxillæ with I ² -I ³ alv. and C/-P ³ (br.). (w)	3-7-11-13W.	From Bone Creek.
C/-P ³ . (M)	32B-15-6-20 S. and W.	From near Ainsworth.

MANDIBULAR RAMUS

Partial right ramus with I ₂ -/C alv. and P ₁ -M ₃ . (w†)	42-16-6-20 W. and S.	From near Ainsworth.
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(B) FROM CHERRY COUNTY, NEBRASKA (collected by Morris Skinner, Ralph Mefferd, Gordon Fletcher, and associates, 1933-1940):

From Nenzel Quarry:

MAXILLA		F:A.M.
Partial right maxilla with M ² -M ³	(w†+)	34360

FOUR MANDIBULAR RAMI

Four partial left rami with I ₁ -/C alv. and P ₁ -M ₃	(w†)	33602
P ₄ -M ₁ (br.).....	(w)	37232
M ₃	(w†)	37233
dP ₄ (br.)-M ₂	(i)	34361

From Burge Quarry:

MAXILLA		
Partial left maxilla with M ¹ -M ² (br.).....	(w)	43132

TWO MANDIBULAR RAMI

Right ramus with I ₁ -I ₂ alv. and I ₃ -M ₃ (/C alv.).....	(M)	33603
Partial left ramus with P ₄ -M ₂	(w†)	34358

The above specimen possesses a very heavy tooth series.

METATARSAL

Metatarsal.....		43202B
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From Midway Quarry:

TWO MANDIBULAR RAMI

Partial right ramus, immature, with P ₁ (br.)-M ₁ (P ₂ -P ₄ germs)	(i)	34378
Partial left ramus with P ₃ -M ₃	(w†)	33600

HUMERUS

Humerus.....		34356
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From various localities in Cherry County:

THREE SKULLS, ETC.

Skull (lacking posterior right side) with I ¹ -M ³ , 2 radii, 2 ulnæ, 2 partial tibiæ, 2 calcanea, 2 astragali, manus and pes elements, and 3 cervical vertebræ. (M)	F:A.M.37226	From N. side of Minnechaduza Creek, N.W. of Valentine.
Fragments of skull with P ⁴ -M ² (M ¹ alv.), mandible with I ₁ (alv.)-M ₃ , 2 partial scapulæ, 2 partial humeri, 2 radii, 2 ulnæ, partial femur, partial tibia, and various manus and pes elements. (w)	43042	From W. side of Snake River, N. of Burge Quarry.
Partial skull with C/-M ³ (P ¹ -P ² absent, M ² -M ³ br.), partial right ramus with I ₁ (rt.)-M ₁ , and pes elements. (w+)	43136	From N. side of Niobrara River, between Crane and Garner Bridges.

FOUR MANDIBULAR RAMI

Partial right ramus with M ₁ -M ₂ . (w‡)	34375	From 1½ mi. below Boiling Spring Bridge.
Partial right ramus, immature, with P ₃ (germ)-dP ₄ -M ₂ (br.). (i)	34362	From "Devil's Jump Off," below Boiling Spring Bridge.
Partial left rami with I ₂ -I ₃ alv. and /C-M ₃ (P ₃ alv.). (M)	33612	From Railway Quarry A.
Partial left ramus, immature, with dP ₂ -M ₂ . (i)	37229	From W. of Nenzel Quarry, N. side of Niobrara River.

(B') FROM CHERRY COUNTY, NEBRASKA (collected by University of Nebraska State Museum field parties, 1915-1935):

From Railway Quarry A:

TWO MAXILLÆ, IMMATURE

Partial right and left maxillæ with P ¹ -dP ³ -M ¹	(i)	N.S.M. 54-12-7-30
Partial left maxilla with P ¹ -dP ² -M ¹ (P ³ absent).....	(i)	N.P. 22-17-6-32 N.P.

THREE MANDIBULAR RAMI

Partial right ramus, immature, with I ₁ -P ₂ alv. and dP ₃ -M ₁ (br.)	(i)	11-8-6-33 N.P.
Partial left ramus with P ₃ (alv.)-M ₃ (br.).....	(w+)	59-11-8-15 B., H., W.
Partial left ramus, immature, with I ₁ -/C alv. and P ₁ (germ)-dP ₂ -dP ₄	(i)	3-23-8-30 N.P.

From various localities in Cherry County:

SKELETON		
Skull with P ¹ -M ³ (erupt.), mandible with P ₂ -M ₃ (erupt.), and skeleton (mounted). (-M)	N.S.M. 1-24-6-35 N.P.	From E. side of Snake River.
The above specimen is not fully mature. M ₃ ^s are erupting and the epiphyses of the various skeletal elements are loose.		

THREE MANDIBULAR RAMI

Two partial right rami, im- mature, with dP ₄ -M ₂ (P ₄ germ). (i)	13-11-6-34 N.P.	From E. of Railway Quarry A, 40 feet above quarry level.
I ₁ -/C alv. and P ₁ (germ)- dP ₂ -P ₄ (alv.). (i)	22-21-6-35 N.P.	From E. side of Snake River.
Partial left ramus, immature, with P ₁ (germ)-dP ₄ -M ₁ . (i)	14-1-9-31 N.P.	From U.S. Game Preserve, N.E. of Valentine.

(C) FROM HAY SPRINGS AREA, SHERIDAN COUNTY, NEBRASKA:

SKULL, ETC.		
Skull with I ¹ -M ³ , partial tibia, calcaneum, 2 astrag- ali and partial manus. (w+)	F:A.M.37225	From S. side of the Niobrara River, S. of Hay Springs; col- lected by Ted Galusha, 1937.
This specimen is larger than typical examples of <i>U. medius</i> but smaller than the typical <i>U. profectus</i> material.		

MANDIBULAR RAMUS

Partial right ramus with P ₂ (alv.)-M ₂ . (w+)	33680	From south side of Niobrara River, S. of Hay Springs; col- lected by John Lynch and Charles H. Falkenbach, 1930.
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(C') FROM SHERIDAN COUNTY, NEBRASKA (collected by Samuel Garman, Harvard University, 1882):

Distal end of ulna, partial manus, and partial pes.	M.C.Z.9156	From near the head of Wolf Creek, N. of Hay Springs. Figured by Scott, 1890, Pl. xvi, Figs. 33-34; Thorpe, 1937, Pl. xxxI, Fig. 3.
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The above specimen is the holotype of "*Merycochoerus coenopus*" Scott (see discussion, p. 24).

(C'') FROM SHERIDAN COUNTY, NEBRASKA (collected by University of Nebraska State Museum field party, 1933):

Partial left maxilla with P ⁴ - M ³ (br.), partial mandible with P ₁ -M ₃ (br.). (w ⁺)	N.S.M. 4-19-7-33 N.P.	From Pine Creek, S. of Rushville.
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(D) FROM PEBBLE CREEK DRAINAGE, DAWES COUNTY, NEBRASKA (collected by Ted Galusha, 1938):

Partial right ramus with /C(alv.)-M ₃ (br.) (P ₁ br., P ₂ -P ₃ alv.)..	(w+)	F:A.M. 43198
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(E) FROM TODD COUNTY, SOUTH DAKOTA (collected by Morris Skinner and Ralph Mefferd, 1937):

Anterior portion of skull with I ¹ -M ³ (C/-M ¹ rt.), mandible with I ₁ (rt.)-M ₂ (br.), 2 partial humeri, 2 radii (1 partial), distal end of femur, partial tibia, and manus and pes elements.	F:A.M.37300	From E. end of Hay Stack Butte E. of Mission.
(w††)		

(F) FROM JOE THIN ELK GRAVEL PITS, N.E. OF MISSION, MELLETTTE COUNTY, SOUTH DAKOTA (collected by Morris Skinner, Ralph Mefferd, and Gordon Fletcher, 1940):

	MAXILLA		F:A.M.
Partial left maxilla with M ¹ -M ³ (br.).....	(w+)		43134
	MANDIBLE		
Partial mandible with I ₁ (rt.)-M ₂ (P ₄ alv.).....	(w††)		43133

(4a) GEOGRAPHIC VARIETY FROM LOGAN AND WELD COUNTIES, COLORADO.—

(G) FROM PAWNEE CREEK AREA, WELD COUNTY, COLORADO (collected by John C. Blick and William Klaus, 1931-1933):

From "Horse Quarry":

	SKULL AND MANDIBLE		
Anterior portion of skull with C/-M ³	(w+)		33501
Partial mandible with I ₃ -M ₃	(w+)		33501A

The partial skull and mandible were found closely associated and probably belong to one individual.

	MAXILLA		
Partial right maxilla with C/-M ³ (P ¹ br. and P ⁴ alv.).....	(w+)		33694

	TWO MANDIBULAR RAMI		
Partial right ramus with P ₄ -M ₃	(w)		33695
Partial left ramus with P ₄ -M ₂	(w††)		33507

From "Mastodont Quarry":

	PARTIAL SKULL		
Anterior portion of skull (with left zygomatic arch) with I ¹ -I ² alv. and I ³ -M ³	(w†)		33693

THREE MANDIBULAR RAMI

Three partial right rami with		F:A.M.
P ₁ -M ₃ (br.).....	(w)	33505
P ₁ and M ₁ -M ₃ (br.).....	(w)	33506
I ₂ (rt.)-M ₃ (br.) (dI ₂ -dI ₃ rt. and /C erupt.).....	(-m)	33503

From general area:

	MAXILLA	Col.M.
Partial left maxilla ¹ with I ³ -P ¹ (C/br.) and P ⁴ -M ³	(w+)	2-10
	MANDIBULAR RAMUS	F:A.M.
Partial left ramus with P ₃ (alv.)-M ₁	(w‡)	43313

(H) FROM CEDAR CREEK AREA, LOGAN COUNTY, COLORADO:

THREE SKULLS, ETC.

Posterior portion of skull with M ² (br.)-M ³ , partial left ramus with M ₁ (br.)-M ₃ , humerus, ulna, tibia, and astragalus. (w‡)	A.M.9050	Collected by H. T. Martin, 1908. Figured by Matthew, ² 1901, Fig. 28 (in part).
Anterior portion of skull with I ¹ -M ³ and partial mandible (attached) with I ₂ -M ₃ . (w‡)	A.M.9469	Collected by Barnum Brown, 1901.
Composite skeleton (mounted in Amherst College Museum), skull with I ¹ -M ³ .	A.C.19-104	Collected by F. B. Loomis, 1919. Figured by Loomis, 1920, Figs. 1-3; Thorpe, 1937, Figs. 142-143, Pl. XLVII, Fig. 1.

Loomis³ referred the above specimen to "*Ticholeptus rusticus*" (= *Brachycrus rusticus*), apparently comparing it with other material from Colorado which Matthew⁴ had provisionally referred to *B. rusticus*. The present writers⁵ have found that Matthew's Colorado specimens, as well as the Amherst skeleton, are generically distinct from *Brachycrus* and are definitely referable to the new genus, *Ustatochoerus*. In the skull, A.C.19-104, the nasals are not noticeably retracted and the infraorbital foramen is on the side of the face above the posterior premolar region as in *Ustatochoerus*, while in *Brachycrus rusticus* there is a pronounced retraction of the nasals and the infraorbital foramen is above the central molar region within the facial depression.

¹ Collected by Colorado Museum of Natural History field party, 1922.

² Matthew, W. D., 1901, Mem. Amer. Mus. Nat. Hist., I, Pt. 7, Fig. 28.

³ Loomis, F. B., 1920, Amer. Jour. Sci., (4), L, p. 281.

⁴ Matthew, W. D., 1901, op. cit., p. 412, specimens No. A.M.9049, 9050, 9056, and 9115A (the last was sent to the University of California on exchange).

⁵ Schultz, C. Bertrand, and Falkenbach, Charles H., 1940, op. cit., pp. 219-220.

TWO MANDIBULAR SPECIMENS, ETC.

Mandible with I ₁ -M ₃ . (w††)	A.M.9056	From Sand Canyon; collected by Barnum Brown, 1898. Figured by Matthew, ¹ 1901, Fig. 27.
Posterior portion of left ramus, radius, partial ulna, calcaneum, astragalus, and partial manus.	A.M.9049	Collected by Barnum Brown, 1898.

(4b) GEOGRAPHIC VARIETY FROM NORTON COUNTY, KANSAS.—

(I) FROM 2 MI. S. OF DENSMORE (collected by George Sternberg, 1933):

	SKULL, ETC.	F:A.M.
Skull with I ¹ -M ³ , mandible with I ₂ -M ₃ , and distal end of humerus.....	(w††)	33696

(4c) *Ustatochoerus medius mohavensis*,² new variety

From the Pliocene Deposits, North of Barstow, San Bernardino County, California

VARIETAL DESCRIPTION

SKULL.—Known only from anterior portion; palate narrower than that of *U. medius*.

MANDIBLE.—Unknown.

DENTITION.—Superior series longer than average examples of *U. medius* and approximately same length as that of *U. medius novomexicanus*, but with pre-molars somewhat lighter.

LIMBS.—Unknown.

MEASUREMENTS.—Table I.

DISCUSSION

The holotype of this variety comes from the "*Hemicyon Stratum*" of the First Division.³ No examples of *Ustatochoerus* have been reported from the Miocene deposits underlying the "*Hemicyon Stratum*" which contain the remains of *Brachycrus* and *Merychys*.

One recorded specimen:

HOLOTYPE.—Anterior portion of skull with I ¹ -I ³ alv. and C/-M ³ (br.) (P ¹ alv.). (w+)	F:A.M.34464	From the " <i>Hemicyon Stratum</i> ," Barstow area, San Bernardino County, California; collected by Joseph Rak, 1923.
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Figure 10.

¹ Matthew, W. D., 1901, op. cit., Fig. 27.

² Named after the Mohave Desert of California, the type locality of this variety.

³ Frick, Childs, 1926, Bull. Amer. Mus. Nat. Hist., LVI, Art. 1, p. 34; Schultz, C. Bertrand, and Falken-ach, Charles H., 1940, Bull. Amer. Mus. Nat. Hist., LXXVII, Art. 5, p. 224.

(4d) *Ustatochoerus medius novomexicanus* (Frick)

From the Pliocene Deposits, North of Santa Fé, New Mexico

Merychys medius race *novomexicanus* FRICK, 1929, Nat. Hist., XXIX, No. 1, p. 107.*Metoreodon novomexicanus* (FRICK), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 207, Figs. 150-151.*Metoreodon* species FRICK, 1937, Bull. Amer. Mus. Nat. Hist., LXIX, p. 23, Fig. 2A.

VARIETAL CHARACTERS

SKULL.—Slightly larger and more robust than typical examples of *U. medius*.MANDIBLE.—Larger and more robust than *U. medius*.DENTITION.—Superior and inferior series longer and more robust than average examples of *U. medius*.LIMBS.—Typical of *U. medius*.

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

The name *novomexicanus* was proposed by Frick¹ in his account of the discovery of a group of three immature oreodont skeletons (F:A.M.33662, 33662A, and 33662B) from the Santa Fé area of New Mexico. The specimens were skillfully prepared and left in position in the original matrix as found, and are now on exhibition in the American Museum of Natural History.

Thorpe,² in describing this form, designated a ramus, F:A.M.32051, and a partial skull, F:A.M.32050, as cotypes, but pointed out that the ramus was much smaller than the skull. The collection of *Ustatochoerus* material from the Santa Fé area has been greatly increased since 1937, the date of Thorpe's publication, and the evidence now available shows that four distinct forms of *Ustatochoerus* are present in this area. The ramus (F:A.M.32051), which Thorpe used as a cotype, belongs to a much smaller species than the skull (F:A.M.32050), which was the other cotype. The three skeletons mentioned above in connection with the original naming of *novomexicanus* are of the same form as the ramus, but their immaturity prevents adequate evaluation. The present writers have chosen to consider the ramus (F:A.M.32051) as the holotype of *U. medius novomexicanus* Frick, and propose that the partial skull (F:A.M.32050), which is much larger than the ramus, be considered the holotype of a new variety of *U. skinneri* to be named later in this paper (see page 48).

Fifty specimens are here recorded:

HOLOTYPE.—Right ramus with I ₂ (alv.)—M ₃ . (w†)	F:A.M.32051	From S.E. of Espanola, Santa Fé County, New Mexico; collected by Joseph Rak, 1930. Figured by Thorpe, 1937, Figs. 150-151. <i>Figure 3.</i>
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¹ Frick, Childs, 1929, op. cit., p. 107.² Thorpe, Malcolm R., 1937, op. cit., p. 207.

REFERRED.—

- (A) FROM SANTA CRUZ AREA, SANTA FÉ COUNTY, NEW MEXICO
(collected by Joseph Rak, Charles H. Falkenbach, and associates,
1924–1930, and by John C. Blick, William Klaus, and associates,
1933–1937):

THREE SKELETONS, IMMATURE		F:A.M.
Three skeletons, immature (on exhibit in the Amer. Mus. of Nat. Hist.).....	(i)	33662 33662A 33662B

SIX SKULLS, ETC.

Four skulls, etc.

Skull with I ¹ -M ³ , mandible with I ₁ (rt.)-M ₃ (dP ₄ present on left side), 2 tibiæ, partial manus, and pes elements. Figured by Frick, 1937, Fig. 2A (in part).....	(-M)	33663
Anterior portion of skull with I ¹ -I ³ alv. and C/-M ³	(w±)	33684
Anterior portion of skull with I ¹ -M ³	(w)	33685
Skull (lacking left zygomatic arch and premaxillary region) with C/-M ³ and partial mandible with I ₁ -M ₃	(w±+)	33698

Two partial skulls, immature

Skull (lacking occipital region) with I ² -dP ² -M ²	(i)	33692
Anterior portion of skull with C/(rt.)-dP ¹ -M ¹ (br.).....	(i)	34398

SEVEN MAXILLÆ

Two partial right maxillæ with

C/(br.)-P ⁴	(w)	34393
M ¹ -M ² and partial left maxilla with C/-P ³ (br.).....	(w±)	43334

Three partial right maxillæ, immature, with

P ¹ -dP ² -M ¹ (br.).....	(i)	34396
dP ¹ -dP ⁴	(i)	34399
C/(germ)-dP ¹ -dP ⁴	(i)	43322
Left maxilla with P ⁴ -M ³ (br.).....	(w)	34397
Partial left maxilla, immature, with P ¹ -dP ² -dP ⁴	(i)	43335

SEVEN MANDIBULAR SPECIMENS

Four partial mandibles with

I ₁ -/C alv. and P ₁ -M ₃	(w+)	33686
I ₁ (rt.)-M ₃ (br.) (/C germ).....	(M)	33689
I ₁ -I ₃ rt. and /C-M ₃ (P ₂ rt., P ₄ alv., M ₁ -M ₃ br.).....	(w)	43325
This specimen is smaller than average examples.		
/C-P ₁ erupt. and P ₂ -dP ₄	(i)	43323

Two partial right rami with

I ₁ -M ₃ (br.) (I ₁ -P ₁ and P ₃ rt.).....	(w±)	34387
P ₄ -M ₃ (br.).....	(w)	34394

(A') FROM POJUAQUE BLUFF AREA, SANTA FE COUNTY, NEW MEXICO (collected by John C. Blick and William Klaus, 1936):

MAXILLARY SPECIMEN, IMMATURE

Right and left maxillæ with I²-dP²-M¹..... (I) F:A.M. 34395

MANDIBULAR RAMUS, IMMATURE

Partial right ramus with /C(germ)-dP₁ and dP₃-dP₄ rt. (I) 43324

(B) FROM RIO ARRIBA COUNTY, NEW MEXICO (collected by John C. Blick and William Klaus, 1938-1940):

From Chama-El Rito area:

ELEVEN SKULLS, ETC.

Anterior portion of skull with I¹-M³, ulna, radius, and vertebræ (M+) 37531

Inferior portion of skull with I¹-M³, partial mandible with I₃-M₃, partial radius, partial ulna, partial tibia, and pes elements..... (M) 37532

Fragmentary skull with P¹-M¹ br. and M²-M³, and mandible (attached) with P₁-M₃..... (w+) 37533

Inferior portion of skull (lacking zygomatic arches) with P¹-M³ and partial mandible (attached) with P₁(br.)-M₃..... (w+) 37534

Partial right maxilla with P⁴(br.)-M³ and right ramus with I₃-P₁ br. and P₂-M₃..... (w±) 37535

Posterior portion of skull (lacking zygomatic arches) with M²(br.)-M³..... (w±±) 37537

Skull with I¹-M³, mandible with I₁-M₃, and associated skeleton. *Figures 1, 4, 11, 12*..... (w+) 43258A

Partial skull with M²-M³, partial mandible with M₂-M₃ br., and associated skeleton. *Figures 11, 12* (in part)..... (w+) 43258B

The above two individuals (F:A.M.43258A and 43258B) were found associated. The variation in the length of the limbs is illustrated in *Figures 11* and *12*. Although there is a noticeable difference in the lengths of the illustrated limb elements, the fore and hind feet of the two individuals are nearly equal. The nasals of the first specimen (43258A) extend more posteriorly than other examples and the supra-orbital foramina are between the nasals and the orbits, instead of posterior to the nasals.

Partial skull with I³-C/rt. and P¹-M³(br.) and partial mandible with I₁-M₃..... (w+) 43260

Partial skull with I²-M³, partial mandible with P₁-M₃, radius, ulna, partial atlas, etc..... (w±±) 43262

Skull with I¹(alv.)-M³, fragmentary right ramus, partial radius, partial ulna, and partial manus..... (w±) 43345

THREE SKULLS, IMMATURE

Anterior portion of skull with C/-dP¹-M¹(br.) and partial mandible with P₁(erupt.)-dP₁-M₁..... (I) 37536

Partial skull with I¹-dP¹-M²(erupt.)..... (I) 43259

Skull with I¹-dP²-M², mandible with I₁-P₁(erupt.)-dP₂-M₂, and fragmentary skeletal parts..... (I) 43321

	MANDIBLE	F:A.M.
Partial mandible with I ₁ (alv.)-M ₃ (br.) (I ₂ -P ₃ rt., P ₄ , M ₁ -M ₂ br.)	(w††)	43331

From Ojo Caliente area:

THREE ASSOCIATED SKULLS, ETC.

Skull with I ¹ -M ³ , partial humerus, partial femur, 2 tibiae, astragalus, and calcaneum.....	(w†)	43332A
Skull with I ¹ (alv.)-M ³ and partial skeleton.....	(w†)	43332B
Skull, immature, with I ¹ -dP ² (br.)-dP ³ (br.).....	(i)	43332C

The above three individuals were found associated in the field. The two mature skulls show the same supposed sex variations as illustrated (*Figures 5 and 6*) in the examples of *U. profectus*, the lighter-constructed and narrower skull being considered that of a female.

THREE SKULLS, ETC.

Skull with I ¹ -M ³ , mandible with I ₁ -M ₃ and skeletal elements..	(w)	37234
Skull with I ² -M ³ , partial mandible with I ₁ -M ₂ (br.), and 2 partial tibiae.....	(w+)	43344
Partial skull with C/-M ³ , mandible with I ₁ -M ₃ , and partial manus.....	(w††)	43348

SKULL, IMMATURE

Anterior portion of skull with I ³ -dP ² -M ² (erupt.) and partial manus.....	(i)	43346
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MAXILLA, ETC.

Left maxilla with I ¹ -P ¹ rt. and P ² (br.)-M ³ , and partial mandible with P ₂ -M ₃ (br.) (M ₁ -M ₂ br.).....	(w+)	43333
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TWO MANDIBULAR SPECIMENS

Partial mandible with I ₁ -M ₃ (br.) (P ₁ -M ₁ br.).....	(w††)	43347
Mandible with I ₁ -M ₃ , humerus, femur, tibia, pes, etc.....	(w)	43355

(5) *Ustatochoerus profectus* (Matthew and Cook), genotype

From the Lower Part of the Ash Hollow Formation, Nebraska; Referred Specimens from South Dakota; and a Geographic Variety (5a) from Kansas

Merychyus (Metoreodon) profectus MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, Art. 27, p. 395, Fig. 15.

Metoreodon relictus profectus MATTHEW AND COOK, COOK, 1912, Nebr. Geol. Surv., VII, Pt. 5, p. 45.

Metoreodon profectus MATTHEW AND COOK, BARBOUR AND COOK, 1917, Nebr. Geol. Surv., VII, Pt. 18, p. 165, Figs. 1-3. THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 209, Figs. 152-153; Pl. xxx; Pl. xxxi, Fig. 1.

SPECIFIC CHARACTERS

SKULL.—Smaller than that of *U. major* and larger than that of *U. medius*; fan-shaped occipital region not as wide as in *U. major*; brain case slightly more inflated than in *U. major*; nasals shorter than in *U. medius* and decidedly longer than in *U. major*, and with less retraction than in the latter species; anterior tip of nasals retracted to region above P²; paroccipital process long and tapered; postglenoid process not as heavy as in *U. major*.

MANDIBLE.—Typical of the genus, intermediate in size between those of *U. medius* and *U. major*.

DENTITION.—Superior and inferior series intermediate in length between those of *U. medius* and *U. major*.

LIMBS.—Shorter and lighter than in *U. major*; longer and heavier than in *U. medius*.

MEASUREMENTS.—Table I, II, and IX.

DISCUSSION

Matthew,¹ in reviewing the oreodonts from the "Sheep Creek" and "Snake Creek" deposits of Nebraska, proposed that *U. profectus* be regarded as synonymous with *U. major*. Present available material from the Ash Hollow formation indicates, however, that *U. profectus* is specifically distinct from *U. major*.

Matthew and Cook² referred a maxilla (A.M.14066) and a third upper molar (A.M.14068) to "*Merychys (Metoreodon) profectus*" and Thorpe³ considered them as paratypes of the same species. The present writers,⁴ however, have referred these two specimens to *Brachycrus*, since the maxilla shows evidence of a facial depression above P⁴-M¹ and M³ has a pronounced split heel. There is no information in the catalogue or field records of the American Museum of Natural History to indicate that these two specimens came from the "Upper Snake Creek" deposits, as did the genoholotype of *U. profectus*.

Cook⁵ in 1912, regarded *U. profectus* as a variety of *Metoreodon relictus* [see page 10 for discussion of *Merychys (Metoreodon) relictus* and "*M. (Metoreodon) profectus*"] but later,⁶ together with Barbour, described a skull, N.S.M.6-7-11-13, and mandible, N.S.M.5-7-11-13, from Nebraska, and referred them to "*Metoreodon profectus*." Thorpe⁷ called these two specimens plesiotypes of "*Metoreodon profectus*." The mandible compares favorably with the holotypic ramus of *U. profectus* but the skull is from a relatively smaller individual than either of the two rami. According to the data at hand the skull comes from deposits of somewhat earlier age than most of the material referred to *U. profectus*.

¹ Matthew, W. D., 1924, Bull. Amer. Mus. Nat. Hist., L, Art. 2, p. 181.

² Matthew, W. D., and Cook, Harold J., 1909, op. cit., p. 395.

³ Thorpe, Malcolm R., 1937, op. cit., p. 209.

⁴ Schultz, C. Bertrand, and Falkenbach, Charles H., 1940, Bull. Amer. Mus. Nat. Hist., LXXXVII, Art. 5, p. 246.

⁵ Cook, Harold J., 1912, op. cit., p. 45.

⁶ Barbour, Erwin H., and Cook, Harold J., 1917, op. cit., p. 165.

⁷ Thorpe, Malcolm R., 1937, op. cit., p. 209.

Nevertheless, the present writers have referred the skull to *U. profectus* because it falls within the range of individual variation in that species.

U. profectus is intermediate in size between *U. medius* and *U. major* and occurs in deposits that are intermediate in age to the deposits yielding the two latter species. The majority of the specimens here referred to *U. profectus* come from the lower Ash Hollow formation but it is possible that some of the smaller individuals may have been found in the uppermost Valentine deposits, which immediately underlie the Ash Hollow sediments.

U. compressidens, from Montana, is a form very closely related to *U. profectus* but more material of the former species is necessary before any definite relationship can be established.

Seventy-five specimens are here recorded:

GENOHOLOTYPE.—Partial left ramus with I ₂ -M ₃ (/C br. and P ₄ alv.). (w+)	A.M.14055	From the "Upper Snake Creek" deposits, Sioux County, Nebraska; collected by Amer. Mus. field party, 1908. Figured by Matthew and Cook, 1909, Fig. 15; Barbour and Cook, 1917, Fig. 3; Thorpe, 1937, Fig. 152, Pl. xxxi, Fig. 1. <i>Figure 17.</i>
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REFERRED FROM (A) SIOUX, (B) AND (B') BROWN, (C) AND (C') CHERRY, AND (D) KEYA PAHA COUNTIES, NEBRASKA; (E) TODD AND (F) BENNETT COUNTIES, SOUTH DAKOTA; AND (G) NORTON COUNTY, KANSAS.—

(A) FROM TYPE AREA, OLCOTT HILL QUARRY, SIOUX COUNTY, NEBRASKA (collected by Jack Wilson and Carl Long, 1936):

TWO MANDIBULAR RAMI

Two partial right rami with /C(alv.)-P ₃ (br.).....	(w)	F:A.M. 34346
P ₁ -M ₂ (br.).....	(w†)	43200

(B) FROM BROWN COUNTY, NEBRASKA (collected by Morris Skinner, Ralph Mefferd, Gordon Fletcher, and associates, 1928-1940):

From E. side of Plum Creek:

SKULL

Posterior portion of skull with P ³ -M ³	(w)	33619
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From Plum Creek:

SKULL, ETC.

Skull with I ¹ -C/ br. and P ¹ -M ³ , mandible with I ₁ -/C br. and P ₁ -M ₃ , partial humerus, 2 ulnæ (1 partial), 2 radii (1 partial), 2 partial femora, 2 tibiæ, manus elements, and vertebræ....	(w††)	37243
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From Deep Creek, Plum Creek drainage:

TWO SKULLS, ETC.

Skull (lacking anterior portions of nasals) with I ¹ -M ³ , mandible with I ₁ -M ₃ , 2 humeri, 2 radii, 2 ulnæ, 2 tibiæ, astragalus, calcaneum, etc. <i>Figures 6, 11, 12</i> (w±)	F:A.M. 33617
This specimen is considered to be an example of a female.	
Posterior portion of skull, mandible with I ₁ -M ₃ , partial tibia, astragalus, and calcaneum..... (w±+)	33620

THREE MANDIBULAR SPECIMENS

Mandible, immature, with I ₁ -dP ₂ -M ₂ (I)	34374
Partial left ramus with M ₁ -M ₃ (w+)	33616
Left ramus, immature, with I ₂ -dP ₃ -dP ₄ (I ₃ -/C and P ₂ alv.).. (I)	34365

From 2d Fork of Deep Creek, Plum Creek drainage:

SKULL

Anterior portion of skull with I ¹ -M ³ and partial mandible with M ₁ -M ₃ (w±±)	33609
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From Horse Thief Canyon No. 1, Plum Creek:

MANDIBULAR RAMUS

Partial left ramus with I ₁ -P ₂ alv. and P ₃ (br.)-M ₂ (w+)	33625
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From Quinn Ranch, Plum Creek drainage:

FOUR MANDIBULAR SPECIMENS

Partial mandible, ¹ immature, with I ₁ (rt.)-dP ₃ -M ₂ (/C br.)... (I)	Col. M. 1-37
Partial left ramus ¹ with /C-P ₄ alv. and M ₁ -M ₃ (w±+)	1-38
Two partial right rami with /C(br.)-dP ₃ -M ₁ (P ₂ alv.)..... (I)	F:A.M. 33604
I ₂ -M ₁ alv. and M ₂ -M ₃ br..... (w±)	33623

From Clayton Quarry, Quinn Ranch, Plum Creek drainage:

THREE MAXILLÆ

Partial left maxilla with P ¹ (alv.)-P ³ (erupt.)..... (-M)	43199
Partial right maxilla, immature, with dP ³ -dP ⁴ (I)	43141
Partial left maxilla, immature, with dP ⁴ -M ¹ (I)	43140

SEVEN MANDIBULAR RAMI

Partial right ramus with /C-M ₃ (P ₂ alv.)..... (w±±)	43142
Two partial right rami, immature, with P ₃ (alv.)-dP ₄ -M ₂ (br.)..... (I)	43143
I ₁ -I ₃ alv. and /C-dP ₃ -dP ₄ (I)	43144

¹ Collected by Colorado Museum of Natural History field party, 1930.

	F:A.M.
Left ramus with /C-M ₃ (P ₂ -P ₃ alv.).....	(w+) 43145
Three partial left rami, immature, with	
dP ₄ -M ₃ (germ).....	(i) 43146
P ₁ (rt.)-dP ₂ -M ₁	(i) 43147
P ₁ -P ₃ (germ)-dP ₄ -M ₃ (erupt.) (P ₂ alv. and P ₄ germ).....	(i) 43148
LIMB ELEMENTS	
Partial radius.....	43149
Metatarsal.....	43150
From East Clayton Quarry:	
PARTIAL SKULL	
Anterior-inferior portion of skull with C/-M ³	(w ⁺) 43151
THREE MAXILLÆ	
Partial right maxilla with P ¹ (alv.)-P ⁴	(w+) 43152
Left maxilla with I ² -I ³ alv. and C/(br.)-M ³	(w ⁺) 43153
Partial left maxilla with M ¹ -M ²	(w+) 43154
EIGHT MANDIBULAR RAMI	
Three partial right rami with	
P ₂ (rt.)-M ₃	(w ⁺) 43155
P ₄ (rt.)-M ₃	(w ⁺) 43156
Immature, /C-P ₂ alv. and dP ₃ -dP ₄	(i) 43157
Three partial left rami with	
I ₁ -/C alv. and P ₁ -M ₃ (P ₃ -P ₄ br.).....	(w ⁺) 43158
M ₁ -M ₃ (br.).....	(w) 43159
M ₁ -M ₂	(w ⁺) 43160
Two partial left rami, immature, with	
P ₁ -P ₂ alv. and P ₃ (germ)-dP ₄ -M ₂ (P ₄ germ).....	(i) 43161
I ₂ -/C alv. and P ₁ (erupt.)-dP ₃ -M ₁ (P ₂ alv.).....	(i) 43162

From White Cliffs, Plum Creek:

SKULL, ETC.

Anterior portion of skull with I ¹ -I ³ alv. and C/-M ³ (P ³ -P ⁴ and M ³ erupt.), partial mandible with P ₁ (br.)-M ₃ (P ₄ and M ₃ erupt.), partial humerus, ulna, and radius. <i>Figure 5</i> (in part).....	(-M) 33597
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The tooth characters of the above specimen are of special interest, particularly the superior premolars (*Fig. 5*), because in P² there is a double medium crest which may be said to form a posterior and an anterior medium crest which in turn join the corresponding crescents; in P³ the medium crest joins the cingulum instead of the anterior crescent, thus dividing the tooth into two parts; and in P³ and P⁴ the anterior cusps are as well developed as in *U. major*.

(B') FROM BROWN COUNTY, NEBRASKA (collected by University of Nebraska State Museum field parties, 1913):

SKULL		
Skull with I ¹ -M ³ , lacking occipital region and right zygomatic arch. (w)	N.S.M. 6-7-11-13	From Devil's Gulch. Figured by Barbour and Cook, 1917, Figs. 1-2; Thorpe, 1937, Fig. 153, Pl. xxx. <i>Figures 5, 17</i> (in part).

The above specimen is smaller than typical examples of *U. profectus* and field data indicate that it may have come from the upper part of the Valentine. This form is intermediate between *U. profectus* and *U. medius*, but closer to the former species.

TWO MAXILLÆ, IMMATURE		
Two partial maxillæ, immature Right, with C/-dP ¹ -dP ³ . (i)	1-7-11-13W.	From Bone Creek.
Left, with C/-dP ¹ -P ² (br.). (i)	2-7-11-13W.	From Bone Creek.

MANDIBLE		
Partial mandible with I ₁ -I ₃ alv. and /C(germ)-M ₃ . (-M)	5-7-11-13	From Plum Creek. Figured by Barbour and Cook, 1917, Fig. 1. <i>Figures 5, 17</i> (in part).

(C) FROM CHERRY COUNTY, NEBRASKA (collected by Morris Skinner, Ralph Mefferd, Gordon Fletcher, and associates, 1933-1940):

From Bear Creek Quarry:

FOUR MANDIBULAR RAMI		
Three partial left rami with M ₁ (br.)-M ₃	(w†)	F:A.M. 34222
M ₁ -M ₃	(w† ⁺)	34242
I ₁ -P ₄	(w+)	43168
Left ramus, immature, with P ₁ -dP ₄ -M ₂ (P ₂ -P ₃ alv.).....	(i)	34364

From 1½ mi. below Crookston Bridge:

THREE MANDIBULAR RAMI		
Two partial right rami with M ₂ -M ₃	(w+)	43169
I ₃ (rt.)-P ₂ (germ).....	(i)	43170
Partial left ramus, immature, with dP ₃ -dP ₄ (br.).....	(i)	43171

From various localities in Cherry County:

TWO PARTIAL SKULLS, ETC.

Posterior portion of skull with M^2-M^3 (br.), partial left ramus with M_3 br., and partial pes. (w†)	F:A.M.34381	From S.E. of Eli.
Partial skull, immature, with dP^1 (br.)- M^2 (germ), mandible with I_1-P_1 (germ)- dP_2-M_1 , and partial scapula. (i)	43036	From S. side of Niobrara River, S.E. of Crane Bridge.

TWO MAXILLÆ, ETC.

Partial right and left maxillæ with $C/-M^3$, partial mandible with I_1-M_3 , distal ends of 2 tibiae, 2 astragali, calcaneum, and skeletal fragments. (w+)	33618	From 1 mi. E. of Garner Bridge.
Partial right maxilla with P^4-M^1 . (w†)	34363	From S. and W. of Merriman.

SIX MANDIBULAR RAMI

Two partial right rami with I_2/C alv. and P_1-M_3 (br.). (w†)	F:A.M.43037	From E. of Crane Bridge.
I_1-P_1 alv. and P_2 (br.)- P_4 (br.). (w)	43039	From S. of Crookston Bridge.
Two partial right rami, immature, with dP_4 (br.)- M_2 . (i)	34368	From E. of Boiling Spring Bridge.
$I_3-dP_2-M_2$ (germ). (i)	43040	From Wade Quarry.
Partial left ramus with P_3-M_2 . (w†)	43038	From S. of Cody.
Partial left ramus, immature, with $P_1-dP_2-M_2$. (i)	43041	From Bolling Quarry, N. of Garner Bridge.

(C') FROM CHERRY COUNTY, NEBRASKA (collected by University of Nebraska State Museum field parties, 1932-1935):

From Oreodont Quarry, S.W. of Valentine:

N.S.M.

Partial right maxilla with I^3-M^3 (P^1 and M^3 br.).....	(w†)	5-21-6-32N.P.
Partial left ramus with I_2-P_4	(w†+)	4-21-6-32N.P.
Mandibular symphysis with I_1-P_4 br.....		7-21-6-32N.P.

From W. side of Snake River:

Anterior portion of skull with I^1-M^3	(w)	1-6-7-35N.P.
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(D) FROM E. OF TUNNEL ROCK, KEWA PAHA COUNTY, NEBRASKA
(collected by Morris Skinner and Ralph Mefferd, 1931):

Skull with I¹-M³, mandible with I₁-M₃ (I₃ alv.), astragalus,
and 2 metapodials. *Figures 1, 5, 12*..... (w††) F.A.M.
33621

(E) FROM HOLLOW HORN BEAR QUARRY, N. OF LITTLE WHITE
RIVER, ROSEBUD INDIAN RESERVATION, TODD COUNTY, SOUTH
DAKOTA (collected by Morris Skinner and Gordon Fletcher,
1940):

PARTIAL SKULL, IMMATURE

Anterior portion of skull with I¹-dP²-M¹ (C/ erupt. and P¹
alv.)..... (I) 43163

THREE MANDIBULAR RAMI

Mandible with I₁-P₂ alv. and P₃-M₃..... (w+) 43164

Two partial left rami, immature, with
P₂-P₄ germs and M₁-M₂..... (-M) 43165
dP₃-M₁..... (I) 43166

METACARPAL

Metacarpal III..... 43167

(F) FROM BIG SPRINGS, S.W. OF MARTIN, BENNETT COUNTY,
SOUTH DAKOTA (collected by Morris Skinner and Gordon Flet-
cher, 1940):

Partial left ramus with M₂..... (w+) 43319
Radius..... 43320

(5a) GEOGRAPHIC VARIETY FROM NORTON COUNTY, KANSAS.—

(G) FROM S.E. OF DENSMORE (collected by George Sternberg,
1933):

Partial skull with P³-M³, partial mandible with P₃-M₃, and
skeletal fragments..... (w††) 33697

(5b) *Ustatochoerus profectus espanolensis*,¹ new variety

From the Pliocene Deposits, North of Santa Fé, New Mexico

VARIETAL DESCRIPTION

SKULL.—Approximately same length as that of *U. profectus*; nasals longer than in *U. profectus*, but with an equal amount of retraction.

¹ Named after the town of Espanola, the headquarters for the Frick Laboratory field parties in the Santa Fé area, New Mexico.

MANDIBLE.—Approximately same size as that of *U. profectus*.

DENTITION.—Length of superior and inferior dental series slightly longer than average examples of *U. profectus*.

LIMBS.—Unknown.

MEASUREMENTS.—Tables I and IX.

DISCUSSION

Each of the superior third premolars of the holotype of *Ustatochoerus profectus espanolensis* has a prominent projection or shelf at its anterior base, but this undoubtedly represents individual variation since it does not occur in the referred specimens.

The holotype and the referred specimens were collected by Joseph Rak, John C. Blick, William Klaus, Charles Christman, and Charles H. Falkenbach, 1925–1940.

Twelve specimens are here recorded:

HOLOTYPE.—Skull with I¹–I³ alv. F:A.M.33683 From Santa Cruz area, Santa Fé County, New Mexico.
and C/–M³. (w†) *Figure 10.*

REFERRED.—

(A) FROM TYPE LOCALITY, SANTA FÉ COUNTY:

TWO ASSOCIATED SKULLS, ETC.

Partial skull with C/(rt.)–M ³ (br.) (P ¹ –P ² br.) and partial mandible with P ₂ (alv.)–M ₃	(w+)	F:A.M. 43263A
This specimen may be that of a female.		
Anterior portion of skull, immature, with C/–dP ² –M ¹ (erupt.) and partial mandible with P ₁ –dP ₂ –M ₁	(i)	43262B

THREE MAXILLÆ, ETC.

Premaxilla and right maxilla with I ¹ –M ³ (C/, P ³ –M ¹ br.)....	(w+)	34389
Right maxilla with I ¹ –I ³ alv. and C/(rt.)–M ³ (br.) (P ¹ rt. and P ² –P ³ br.).....	(w†)	37544
Partial left maxilla with M ¹ (br.)–M ³	(w+)	37545

TWO MANDIBLES

Two partial mandibles with		
P ₁ (rt.)–M ₃ (br.).....	(w††)	43326
I ₁ –C rt. and P ₁ (erupt.)–dP ₂ –M ₂ (br.).....	(i)	34392

(B) FROM RIO ARRIBA COUNTY, NEW MEXICO:

From Santa Clara Canyon, W. of Santa Clara:

PARTIAL SKULL, IMMATURE

Anterior portion of skull with I ¹ –dP ² –M ¹	(i)	34391
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TWO MANDIBULAR RAMI, IMMATURE

Partial mandible with I ₁ -I ₂ rt. and I ₃ -P ₁ (erupt.)-dP ₂ -M ₁ (germ)..... (1)	F:A.M. 43336
Partial left ramus with I ₁ -dP ₂ -dP ₄ (1)	43328

From E. of Black Mesa:

MANDIBULAR RAMUS

Partial right ramus with P ₄ (br.)-M ₃ (br.)..... (w†)	34390
--	-------

(5c) *Ustatochoerus profectus studeri*,¹ new variety

From the Pliocene Deposits of Northern Texas

VARIETAL DESCRIPTION

SKULL.—Smaller than that of typical *U. profectus*; longer and narrower than largest examples of *U. medius*; fan-shaped occipital region extended farther posteriorly than in other varieties of *U. profectus*; retraction of nasals greater than in *U. medius* and similar to that in *U. profectus*; postglenoid process very light.

MANDIBLE.—Smaller than typical examples of *U. profectus*.

DENTITION.—Superior and inferior series not as heavy as in *U. profectus* but nearly equal in length to the smallest referred specimen of this species; both series longer than in *U. medius*.

LIMBS.—Known from referred material only; somewhat shorter than those of *U. profectus*.

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

The specimen, F:A.M.43031, which is chosen by the writers as the holotype of *U. profectus studeri*, is the most complete skull and mandible of this form available at the present time. Although the skull is abnormal in that M¹ is missing on the left side and an alveolus for a fourth molar is present on the right (*Figure 7*), the right dental series P¹-M³ is normal and compares readily with the referred dentition, F:A.M.43033, which is illustrated in the same figure. The left M¹ was probably lost early in the life of the individual, resulting in a crowding forward and an enlargement of the remaining molars and a crowding backward and a slight enlargement of the premolars, thus completely filling the space of M¹. It is also of interest to note that seven incisors are present in the mandible (*Figure 7*).

The holotype of this new variety is probably an example of a female since it corresponds in form to certain other specimens² of *Ustatochoerus* which are con-

¹ Named in honor of Mr. Floyd Studer of Amarillo, Texas, who has given much aid to paleontological explorations in northern Texas.

² See specimens designated as females in the lists under *Ustatochoerus medius*, *U. profectus*, and *U. skinneri*; also *Figure 6*.

sidered to be of the same sex. The referred specimens of *U. profectus studeri* are thought to be males since they are definitely more robust than the holotype.

Seventeen specimens are here recorded:

HOLOTYPE.—Skull with I ¹ -M ³ (br.) and mandible with I ₁ -M ₃ . (w† ⁺)	F:A.M.43031	From 20 mi. N.E. of Amarillo, Potter County, Texas; collected by N. J. Vaughan, John Lynch, and Charles H. Falkenbach, 1940. <i>Figures 1, 7.</i>
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REFERRED.—

(A) FROM TYPE LOCALITY, POTTER COUNTY, TEXAS:

Partial skull with I ¹ -P ¹ rt. and P ² (br.)-M ³ , and partial mandible with P ₂ -M ₃ (br.).....	(w† ⁺)	F:A.M. 43318
Partial right maxilla with M ² -M ³ (br.).....	(w)	43256
Tibia.....		43257

(B) FROM DONLEY COUNTY, TEXAS:

From "Spade Flats," N.E. of Clarendon; collected by Nelson J. Vaughan, Everett DeGroot, and William Chamberlain, 1938-1939:

TWO PARTIAL SKULLS

Anterior portion of skull with I ¹ -I ³ rt. and C/-M ³ (P ¹ -P ² rt.)	(w† ⁺)	37242
Anterior portion of skull with I ¹ -M ³	(w†)	43032

TWO MAXILLARY SPECIMENS

Partial right and left maxillæ, immature, with dP ³ (br.)-M ¹ ...	(r)	43261
Partial left maxilla with P ² -P ³	(w†)	43317

MANDIBLE

Partial mandible with I ₁ (alv.)-M ₃ (P ₁ rt.).....	(w†)	43255
--	------	-------

LIMBS

Radius and ulna. <i>Figure 11</i>		43034
Tibia. <i>Figure 12</i>		43035
Calcaneum.....		43356

Several manus and pes elements from "Spade Flats" are also represented in the F:A.M. collection.

From MacAdams Quarry, N. of Clarendon; collected by Nelson J. Vaughan, John Lynch, and Everett DeGroot, 1934-1939:

MAXILLA

Left maxilla with C/-M ³ . <i>Figure 7</i>	(w+)	43033
---	------	-------

THREE MANDIBULAR RAMI

Two partial right rami with		F:A.M.
P ₁ -P ₂ rt. and P ₃ -M ₃	(w \ddagger)	37560
I ₁ (alv.)-M ₃ (I ₃ alv.).....	(w \ddagger)	42319
Left ramus with P ₃ -M ₃	(w+)	33633

From Lull Quarry, W. of MacAdams Quarry; collected by John Lynch, 1934:

MAXILLA

Partial right maxilla with I ³ -P ³ (P ¹ alv.).....	(w \ddagger)	33632
--	-----------------	-------

(6) *Ustatochoerus skinneri*,¹ new species

From the Ash Hollow Formation of Tripp County, South Dakota;
Referred Remains from the Ash Hollow Formation of Nebraska,
and Geographic Variety (6a) from Kansas

DESCRIPTION

SKULL.—Differs from *U. major*, the nearest form, in somewhat smaller size; occipital flare not as wide; nasals much longer and less retracted (anterior tip of nasals above region of P²); palate not extended as far posteriorly.

MANDIBLE.—Not quite as long as that of *U. major*.

DENTITION.—Superior and inferior series of approximately same length as examples of *U. major*; inferior canine smaller and P₁ lighter than in *U. major*; P₄ usually lacks deep internal groove found in *U. major*.

LIMBS.—Heavier and shorter than those of *U. major*; nearly same length as those of *U. profectus*.

MEASUREMENTS.—Tables I, II, and IX.

DISCUSSION

The exact stratigraphic position of the remains referred to *U. skinneri* from the Ash Hollow of South Dakota and Nebraska has not been definitely determined but field evidence indicates that they are found above the level of the majority of *U. profectus* specimens from Nebraska and South Dakota and below those of *U. major* from Nebraska. *U. skinneri* also possesses characters which are intermediate between those of *U. profectus* and *U. major*.

The holotype and referred material from Nebraska were collected by Morris Skinner, Ralph Mefferd, and Gordon Fletcher, 1931-1940.

Six specimens are here recorded:

HOLOTYPE. —Skull (lacking left zygomatic arch) with I ¹ -M ³ , mandible with I ₁ -M ₃ , partial humerus, femur, and partial tibia. (w+)	F:A.M.33630	From Turtle Buttes, N.W. of Wewela, Tripp County, South Dakota; 1931. <i>Figures 1, 8, 12.</i>
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¹ Named in honor of Mr. Morris Skinner, who has directed the Frick Laboratory expeditions in the Valentine area of Nebraska and South Dakota.

REFERRED FROM (A) CHERRY AND (B) BROWN COUNTIES, NEBRASKA;
AND (C) NORTON COUNTY, KANSAS.—

(A) FROM CHERRY COUNTY, NEBRASKA:

From S. side of Niobrara River, below mouth of Leander Creek,
1937:

SKULL, ETC.

Skull with I¹-M³, partial mandible with I₃(br.)-M₃, 2 partial
ulnae, partial radius, and atlas vertebra..... (M) F:A.M.
37227

The above specimen is considered by the writers to be an
example of a female of the species. The skull is lighter and
narrower than the holotype, but the dental series of the two
specimens are approximately equal in size. The limbs of the
referred example are somewhat lighter than those of the
holotype.

From S. of Eli, 1937:

Partial femur, distal portion of tibia, astragalus, calcaneum,
and pes. *Figure 12* (in part)..... 43081

(B) FROM HORSE THIEF CANYON No. 2, PLUM CREEK, BROWN
COUNTY, NEBRASKA, 1940:

TWO MANDIBULAR RAMI

Partial right ramus with P₂-P₃..... (w) 43135
Left ramus with I₁-/C alv. and P₁-M₃(br.)..... (w+) 43130

(6a) GEOGRAPHIC VARIETY FROM KANSAS.—

(C) FROM S.W. OF LENORA, NORTON COUNTY, KANSAS (collected
by George Sternberg, 1933):

MANDIBLE, ETC.

Mandible with I₁-M₃ (P₁-P₂ br.), partial humerus, 2 radii, 2
ulnae, and manus and pes elements..... (w†+) 42331

The teeth of the above specimen are somewhat more mas-
sive than those of the holotype.

(6b) *Ustatochoerus skinneri santacruzensis*,¹ new variety

From the Pliocene Deposits, North of Santa Fé, New Mexico

VARIETAL DESCRIPTION

SKULL.—Approximately same size as that of *U. skinneri*; nasals longer than
in *U. skinneri* or *U. major*; retraction of maxillary notch of the sigmoid curve
(below the nasals) less than in either *U. skinneri* or *U. major*.

MANDIBLE.—Known from referred rami only; approximately equal to that of
U. skinneri.

¹ Named after the Santa Cruz district, Santa Fé County, New Mexico.

DENTITION.—Superior and inferior series approximately same length as in *U. skinneri*.

LIMBS.—Unknown.

MEASUREMENTS.—Tables I and IX.

DISCUSSION

The referred skull, F:A.M.34400, is badly crushed, but the length of the nasal, which is absent from the holotype, is observable.

It is of interest to note that remains of *Ustatochoerus* from the Santa Fé area range in size from that of *U. medius* from the Valentine to examples slightly larger than *U. major* from the upper Ash Hollow.

The holotype and the referred specimens were collected by Joseph Rak, John C. Blick, Charles Christman, and Charles H. Falkenbach, 1924–1931.

Six specimens are here recorded:

HOLOTYPE.—Anterior portion of skull with I ¹ –M ³ . (w+)	F:A.M.32050	From 1st Wash, Santa Cruz, Santa Fé County, New Mexico; 1924.
		Figured by Thorpe, 1937, Fig. 149; Pl. xxxi, Fig. 2.
		<i>Figure 10.</i>

This specimen was designated as a cotype of "*Metoreodon novomexicanus*" by Thorpe¹ (see page 33 for discussion).

REFERRED.—

(A) FROM TYPE AREA, SANTA FÉ COUNTY, NEW MEXICO, 1927–1928:

	F:A.M.
Distorted skull with I ¹ –M ³ (w†+)	34400
Partial mandible with I ₁ –P ₁ alv. and P ₂ –M ₂ (w†+)	33687

(B) FROM RIO ARRIBA COUNTY, NEW MEXICO, 1930–1931:

From N. of Santa Clara:

Partial mandible with I ₁ –M ₃ (br.) (/C–P ₁ br.)..... (w†)	34386
Partial left ramus with P ₂ –M ₃ (w†+)	34384

From Ojo Caliente:

Partial right ramus with M ₂ –M ₃ (w†)	34385
--	-------

(7) *Ustatochoerus? schrammi*,² new species

From the Valentine Formation, Boyd County, Nebraska;

Referred Material from Brown County, Nebraska, and Logan County, Colorado

DESCRIPTION

SKULL.—Unknown.

¹ Thorpe, Malcolm R., 1937, Mem. Peabody Mus., III, Pt. 4, p. 207, Fig. 149; Pl. xxxi, Fig. 2.

² Named in honor of Professor E. F. Schramm of the University of Nebraska. Professor Schramm was one of the first collectors to secure material from the Valentine area for the University of Nebraska State Museum.

MANDIBLE.—Smallest of the genus; lighter and shallower than examples of *U. medius*.

DENTITION.—Inferior series smaller than those of *U. medius* but larger than in any known species of *Ticholeptus*; P_2 and P_3 with cusps typical of *Ustatochoerus* but P_4 with these cusps only slightly developed.

LIMBS.—Unknown.

MEASUREMENTS.—Table I.

DISCUSSION

This new species is here tentatively referred to the genus *Ustatochoerus*. The holotype approaches large examples of *Ticholeptus* in size but the tooth characters are more like those of *Ustatochoerus*. A skull or possibly a few limb elements of this form would undoubtedly show sufficient characters to permit definite generic classification.

Ustatochoerus? schrammi appears to be restricted to the basal part of the Ogallala deposits (lower Valentine) in Nebraska and Colorado, while *U. medius*, a closely related species, is found throughout the Valentine. This latter form is definitely larger and distinct from *U.? schrammi*.

Four specimens are here recorded:

	N.S.M.	
HOLOTYPE.—Partial right ramus with /C(alv.)- M_3 (br.). (w+)	21-8-23H	From lower Ogallala deposits, near Lynch, Boyd County, Nebraska; collected by William T. Hall.
		<i>Figure 3.</i>

QUESTIONABLY REFERRED FROM (A) BROWN COUNTY, NEBRASKA; AND
(B) LOGAN COUNTY, COLORADO.—

(A) FROM DEVIL'S GULCH HORSE QUARRY, BROWN COUNTY,
NEBRASKA (collected by Morris Skinner and Ralph Mefferd,
1933):

MANDIBULAR RAMUS

Partial right ramus with F:A.M.33614
 I_2 -/C alv. and P_1 - M_2 (P_2
alv.). (w†)

The above specimen differs slightly from the holotype in that P_2 is more diagonally placed in the ramus and P_4 is grooved internally.

(B) FROM PAWNEE CREEK AREA, LOGAN COUNTY, COLORADO
(collected by John C. Blick, 1933):

TWO MANDIBULAR RAMI

Partial right ramus with 33508 From N. of Pawnee Buttes.
 P_1 - P_3 . (w+)

Partial left ramus with 33504 From Pawnee Creek area.
 P_4 - M_3 (br.). (w)

The P_4 of the above specimen differs from the holotype in that it is grooved internally.

TABLE I.—*Ustatocroerus*, NEW GENUS. COMPARATIVE MEASUREMENTS¹ OF SKULLS AND RAMI

	<i>U. cati-</i> <i>formicus</i> (Merriam)	<i>U. cati-</i> <i>formicus raki</i> , n. var.	<i>U. com-</i> <i>pressidens</i> (Douglass)	<i>U. major</i> (Leidy)		<i>U. major</i> <i>tezanus</i> , n. var.		<i>U. medius</i> (Leidy)		
	HOLOTYPE ² U.C. 21851 (w+)	HOLOTYPE F.A.M. 42318 (w++)	HOLOTYPE C.M. 801 (w+)	HOLOTYPE N.M. 439 (w)	REFERRED F.A.M. 34220 (w)	HOLOTYPE F.A.M. 37563 (w+)	HOLOTYPE N.M. 118 (w+)	REFERRED F.A.M. 4030B (w)		
SKULL										
Stage of wear of teeth.....
Length (including supraorbital crest and incisors).....
Basal length (from anterior notch of foramen magnum to posterior base of P ₁).....
Width (max.).....
Width of brain case (max.).....
Width, ineroorbital (min.).....
Distance from anterior rim of orbit to anterior base of canine.....
Distance from anterior rim of orbit to supraorbital crest.....
Length of nasal.....
Width of muzzle at infraorbital foramina.....
Width across canines (max.).....
Width of palate between fourth premolars.....
Width of palate between canines.....
Length, C/-M ₃ incl.....
Length, P ₁ -M ₃ incl.....
Length, M ₁ -M ₃ incl.....
Length of M ₃ (max.).....
Depth of malar below orbit.....
RAMUS										
Stage of wear of teeth.....
Length (max., including incisors).....
Length, /C to condyle incl.....
Depth of jaw under coronoid.....
Depth of jaw below anterior edge of M ₃
Length, /C-M ₃ incl.....
Length, P ₁ -M ₃ incl.....
Length, P ₁ -P ₄ incl.....
Length, M ₁ -M ₃ incl.....
Length of M ₃ (max.).....
Depth of malar below orbit.....

1 () approximate; (()) estimated. All measurements in millimeters.
 2 Measurements taken from cast in the American Museum.
 3 Pa-M₁² = 94; referred specimen (F.A.M. 34220), P₂-M₂² = 94 ±.
 4 Length of M₃ = 44.

TABLE II.—*Ustatochoerus*, NEW GENUS. COMPARATIVE MEASUREMENTS OF SKELETAL ELEMENTS

	<i>U. major</i> (Leidy)	<i>U. major</i> <i>texanus</i> , n.var.	<i>U. medius</i> (Leidy)	<i>U. medius</i> <i>novomexicanus</i> (Frick)	<i>U. profectus</i> (Matthew & Cook)	<i>U. profectus</i> <i>studei</i> , n.var.	<i>U. skinneri</i> , n.sp.
	REFERRED	HOLOTYPE	REFERRED	REFERRED	REFERRED	REFERRED	HOLOTYPE & REFERRED
	F:A.M.	F:A.M.	F:A.M.	F:A.M.	F:A.M.	F:A.M.	F:A.M.
	37563	37563	43030A-D	43258A	181. 33617	148. 43034	...
Length of humerus (articular).....	...	...	(153.)	157.	...	...	...
Length of radius (articular).....	170. 37148	152.	126.	131.	159. 33617	148. 43034	...
Length of ulna (max.).....	...	(210.)	182.	189.	(220.) 33617	((200.) 43034	...
Length of metacarpal III (max.)...	87. 34354	82.	65.	66.	80. 33621	...	...
Length of femur (articular).....	242. 33664	(200.)	170.	188.	...	...	223. 33630
Length of tibia (articular).....	185. 34379	(170.)	145.	134.	168. 33617	156. 43035	...
Length of metatarsal III (max.)....	94. 37299	...	71.	68.	86. 33621	...	92. 43081
Length of calcaneum (max.).....	...	...	62.	64.	74. 37243	61. 43356	(78.) 43081

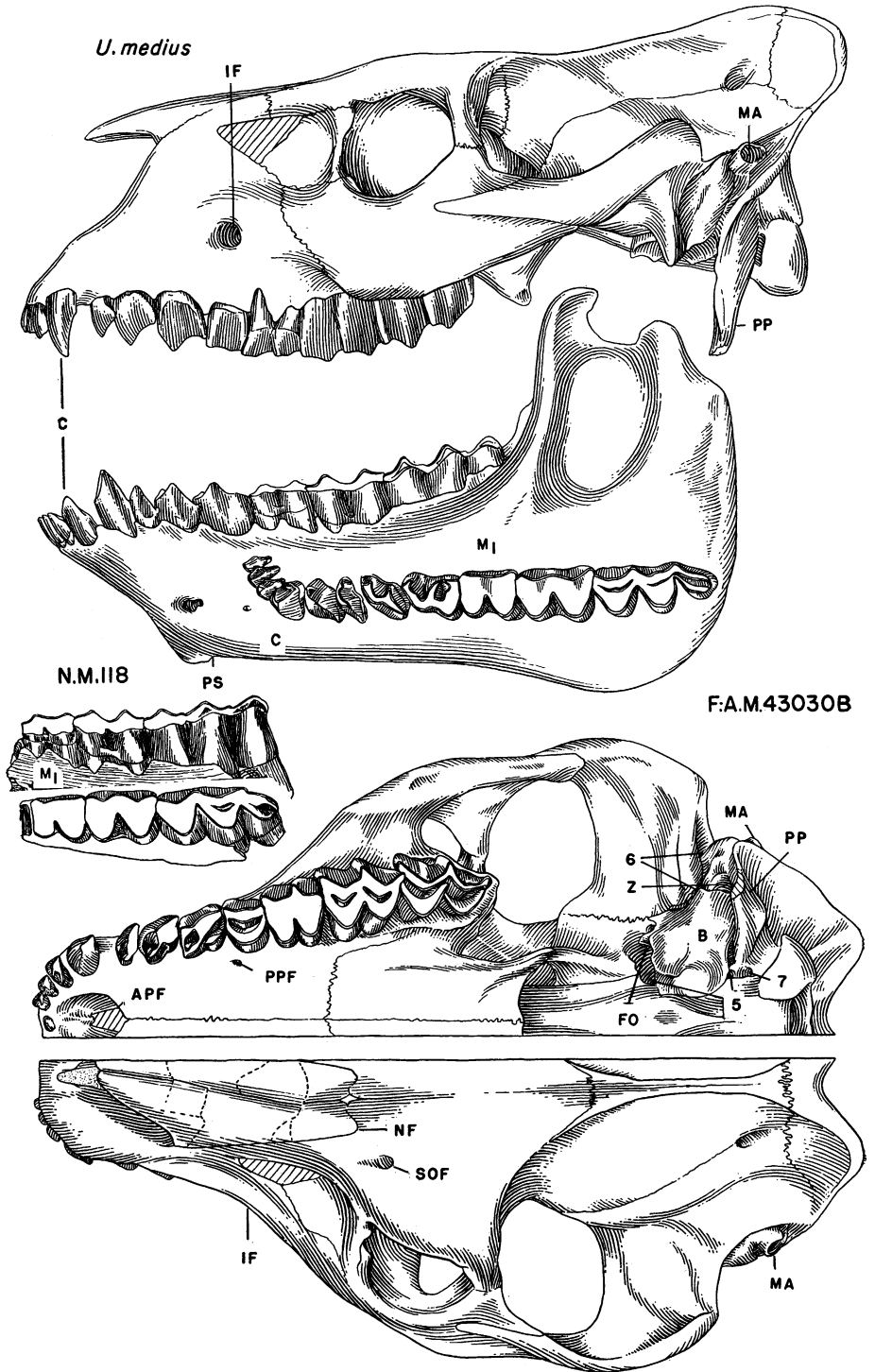


Fig. 2. *Ustatochoerus medius* (Leidy), HOLOTYPE, N.M.118, partial ramus, and REFERRED, F:A.M.43030B, skull and ramus, Valentine deposits, Brown County, Nebraska. $\times \frac{1}{2}$.

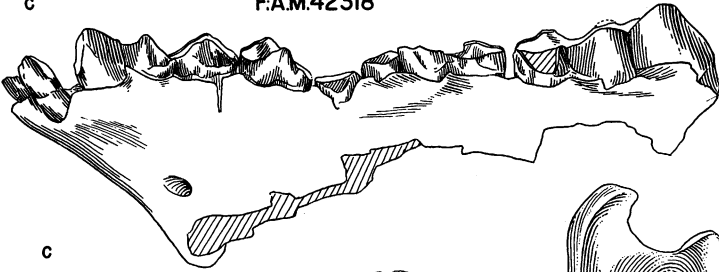
APF = anterior palatine foramen; B = auditory bulla; FO = foramen ovale; IF = infraorbital foramen; MA = external auditory meatus; NF = nasal-frontal contact; PP = paroccipital process; PPF = anterior palatine foramen; PS = posterior border of symphysis; SOF = supraorbital foramen; Z = depression for tympanohyal; 5 = lacerated foramina; 6 = glenoid foramina; 7 = condylar foramen.

U. californicus raki



c

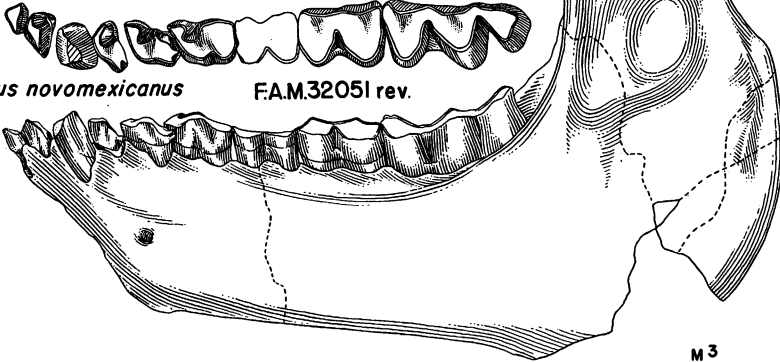
F.A.M.42318



c

U. medius novomexicanus

F.A.M.32051 rev.



U. major texanus



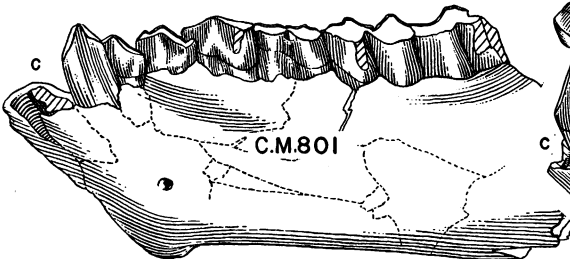
c

F.A.M.37563 rev.

M³



U. compressidens



c

C.M.801



U.? schrammi

c

NSM21-8-23 rev.

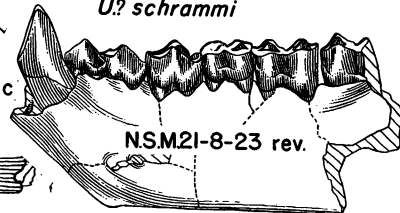
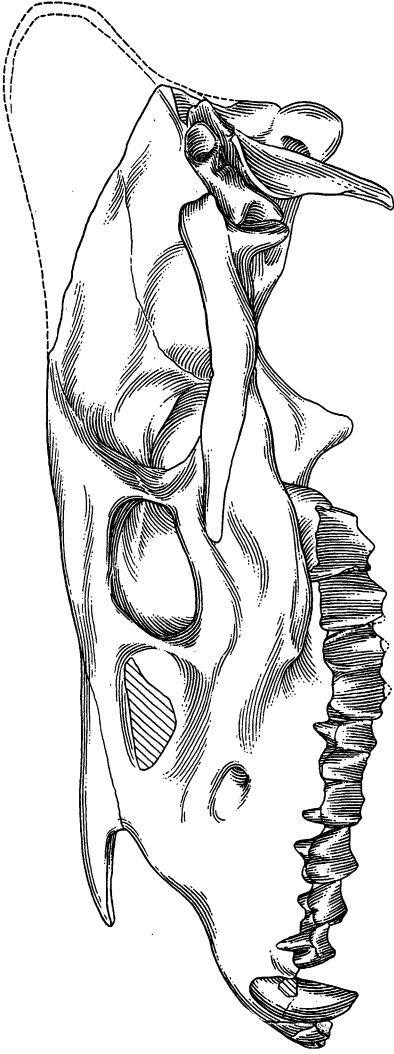
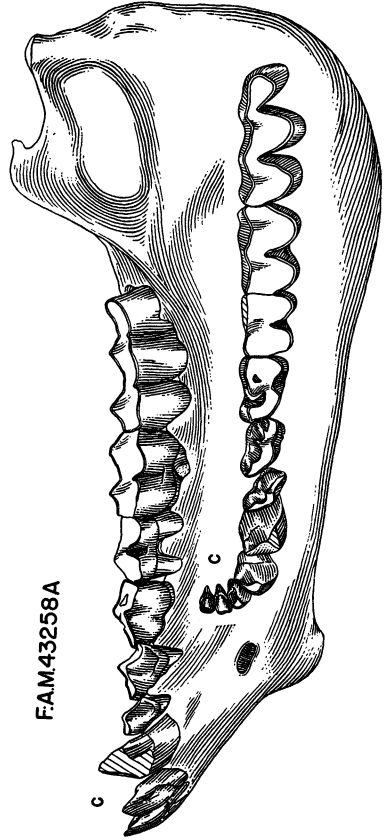


Fig. 3. *Ustatochoerus californicus raki*, n.var., HOLOTYPE, F:A.M.42318, ramus, Santa Fé Co., N. Mex.; *U. medius novomexicanus* (Frick), HOLOTYPE, F:A.M.32051, ramus, Santa Fé Co., N. Mex.; *U. major texanus*, n.var., HOLOTYPE, F:A.M.37563, M³ and ramus, Potter Co., Tex.; *U. compressidens* (Douglass), HOLOTYPE, C.M.801, ramus, Gallatin Co., Mont.; *U.? schrammi*, n.sp., HOLOTYPE, N.S.M.21-8-23, ramus, Valentine deposits, Boyd Co., Nebr. $\times \frac{1}{2}$.

U. medius novomexicanus



F.A.M.43258A



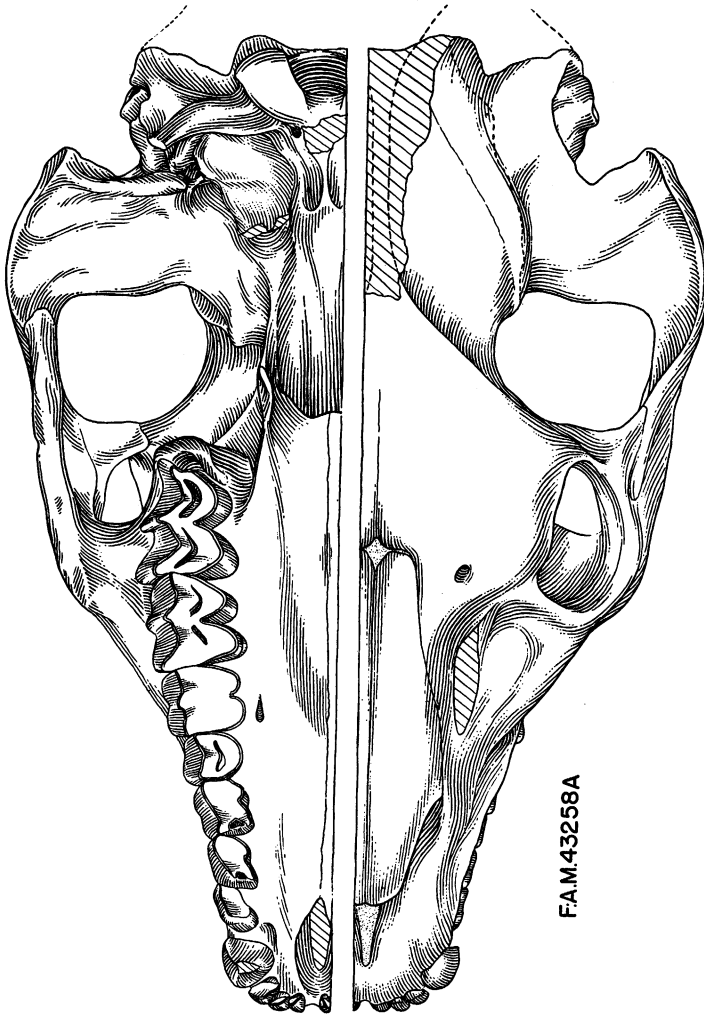
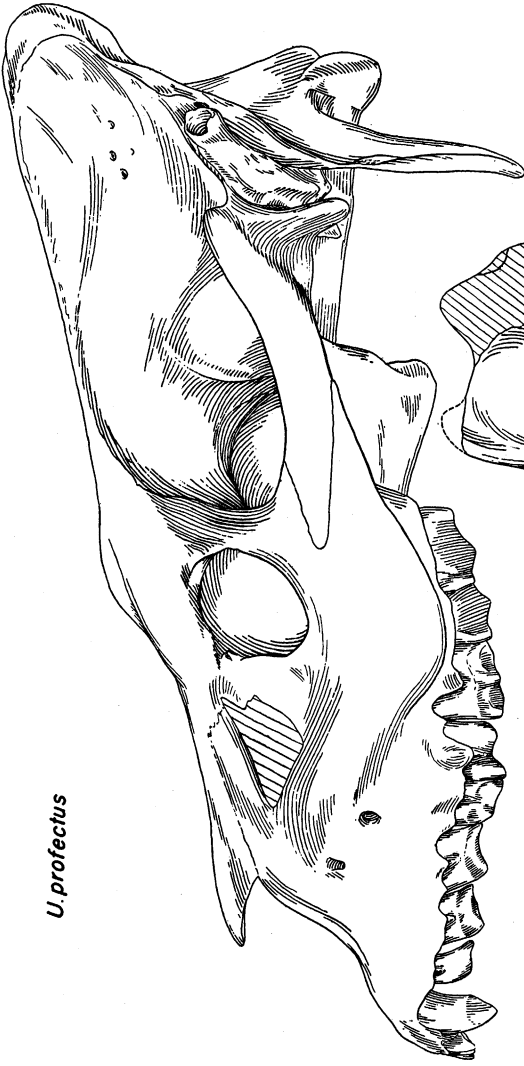
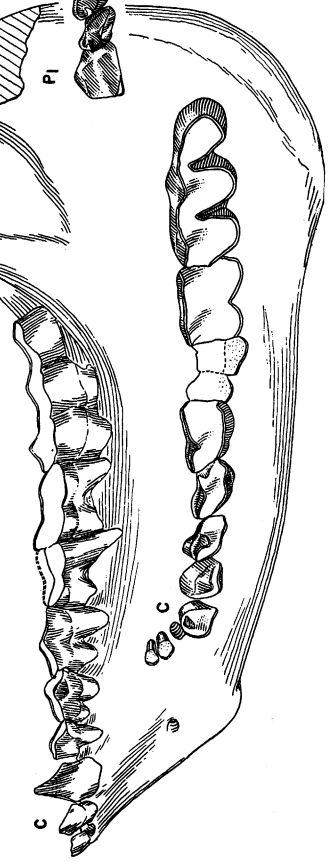


Fig. 4. *Ustatochoerus medius novomericanus* (Frick), REFERRED, F.A.M.43258A, skull (P1-P2 from opposite side) and ramus, from Rio Arriba County, New Mexico. $\times \frac{1}{4}$.

U. profectus



F.A.M.33621



C

C



NSM5-7-II-13 rev.

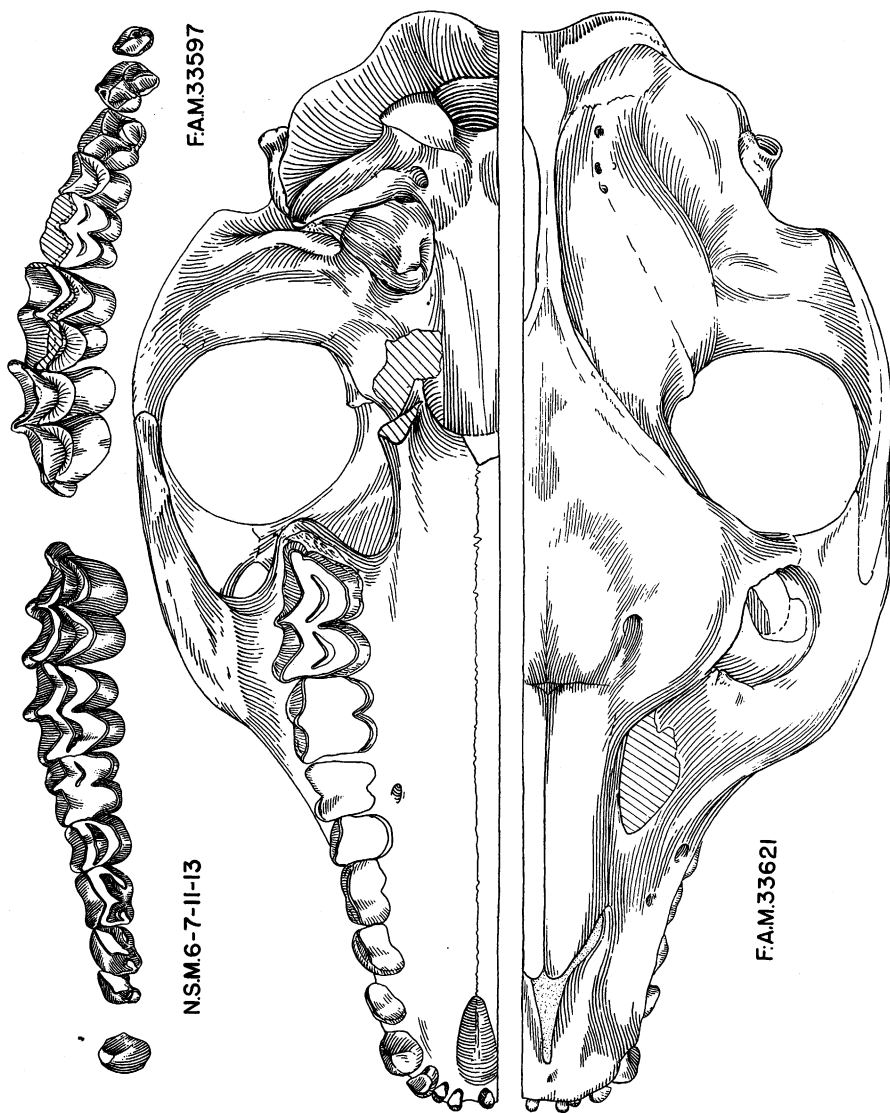
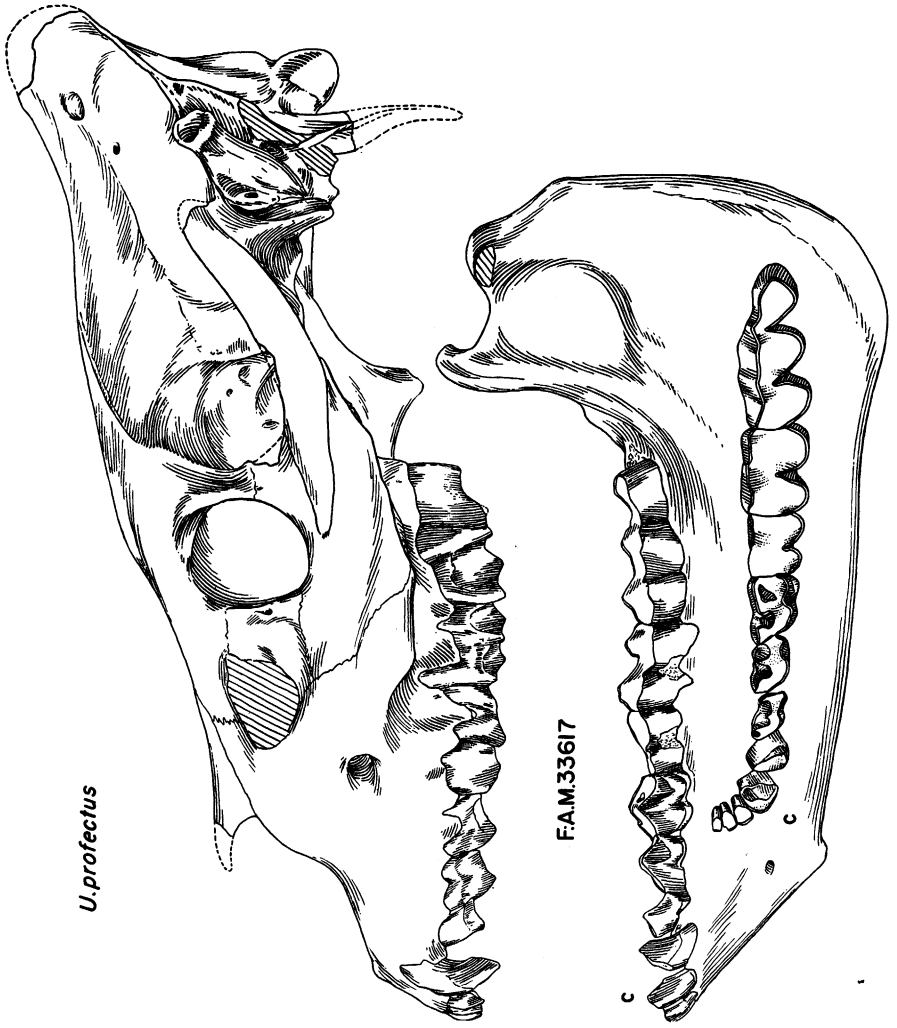


Fig. 5. *Ustatochoerus profectus* (Matthew and Cook), REFERRED, F:A.M.33621, skull and ramus (male, dental series, composite from opposite sides), from Ash Hollow deposits, Keya Paha County, Nebraska; F:A.M.33597 and N.S.M.6-7-11-13, superior dental series, and N.S.M.5-7-11-13, inferior dental series, from Ash Hollow deposits, Brown County, Nebraska. X $\frac{1}{2}$.



U.profectus

F.A.M.33617

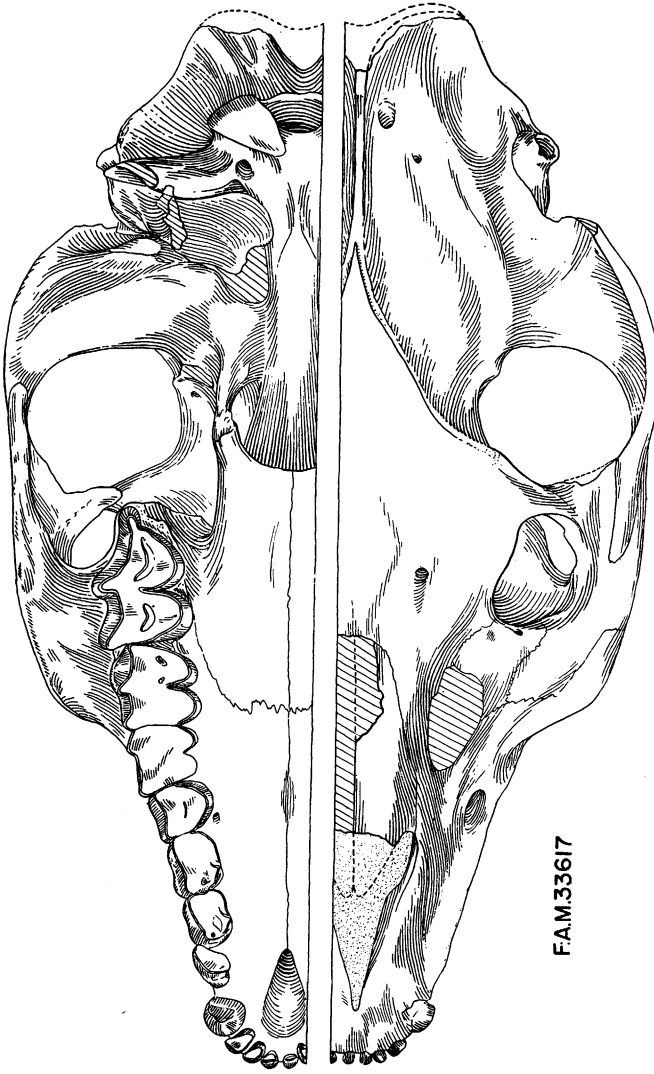
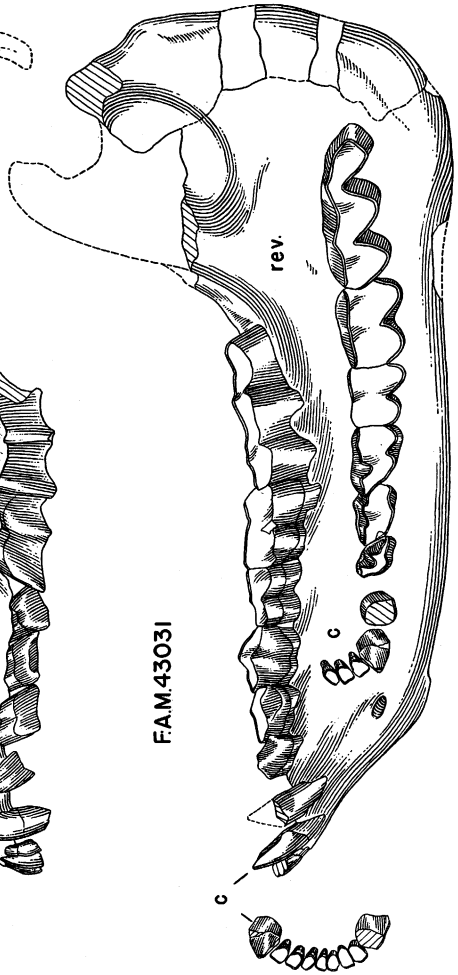


Fig. 6. *Ustatochoerus propectus* (Matthew and Cook), REFERRED, F.A.M.33617, skull and ramus (female), from Ash Hollow deposits, Brown County, Nebraska. $\times \frac{1}{2}$.



U. profectus studeri



F.A.M.43031

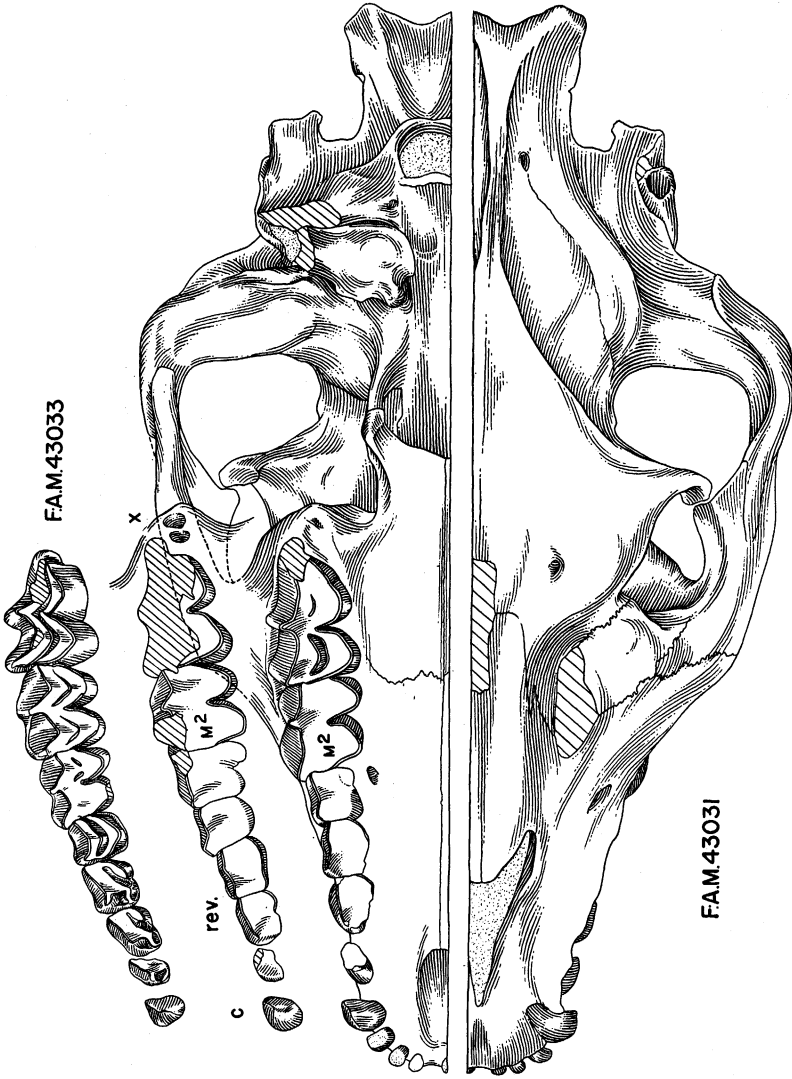
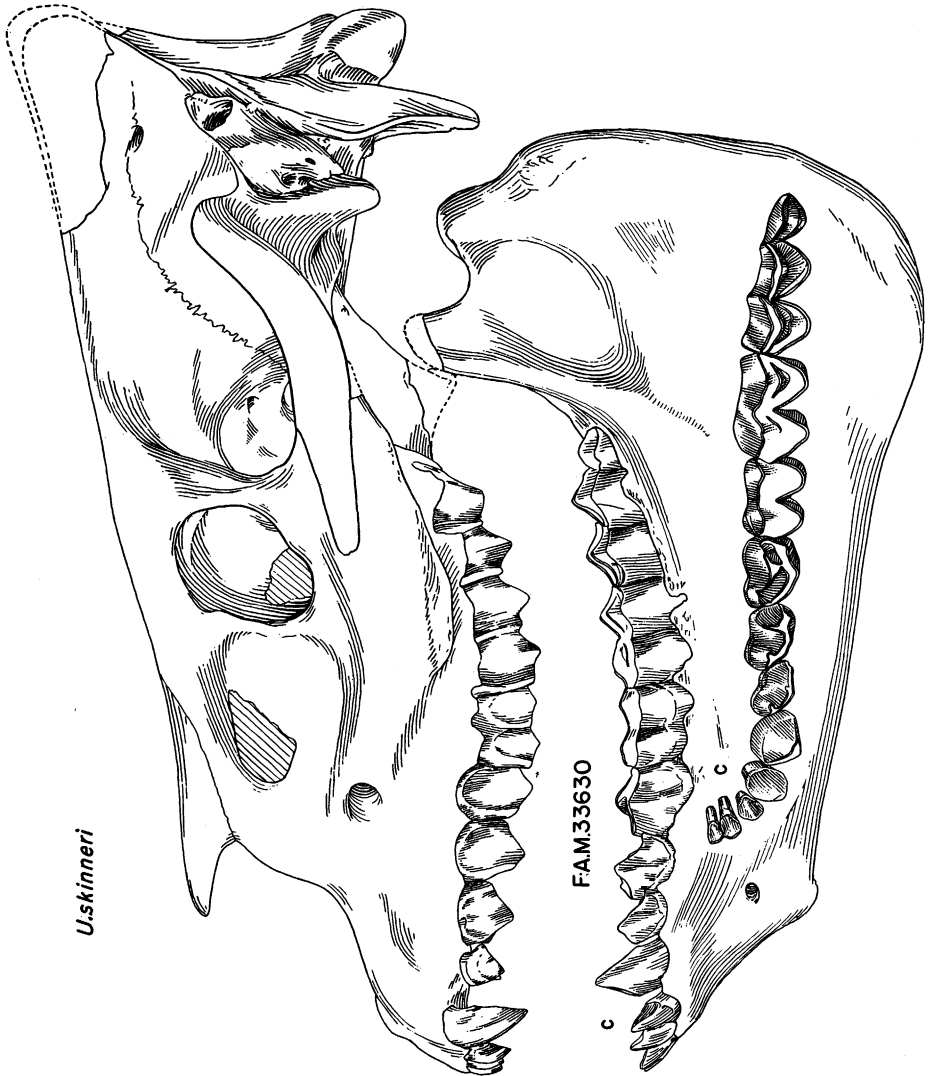


Fig. 7. *Ustatochoerus profectus studeri*, new variety, Holotype, F. A. M. 43031, skull and ramus (P₂ from opposite side; note seven lower incisors and absence of right M₁; X = accessory alveolus of right superior dentition), from Potter County, Texas; REFERRED, F. A. M. 43033, maxilla, from Donley County, Texas. X $\frac{1}{2}$.



U. skinneri

F.A.M.33630

c

c

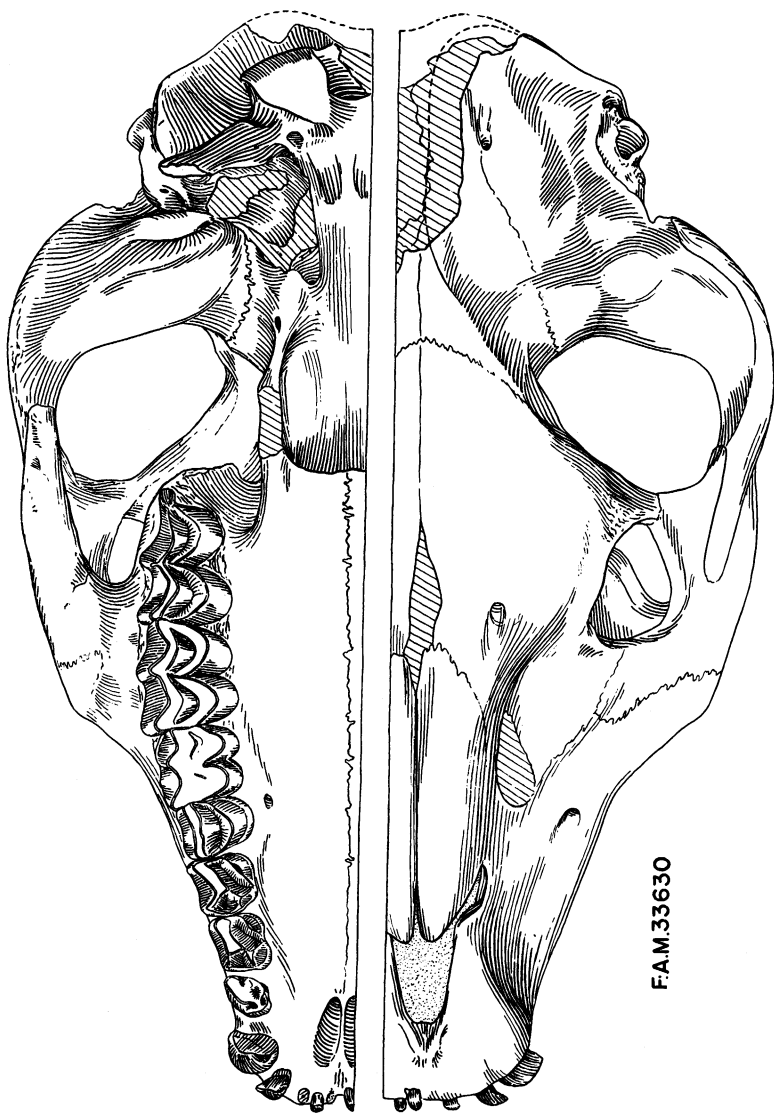
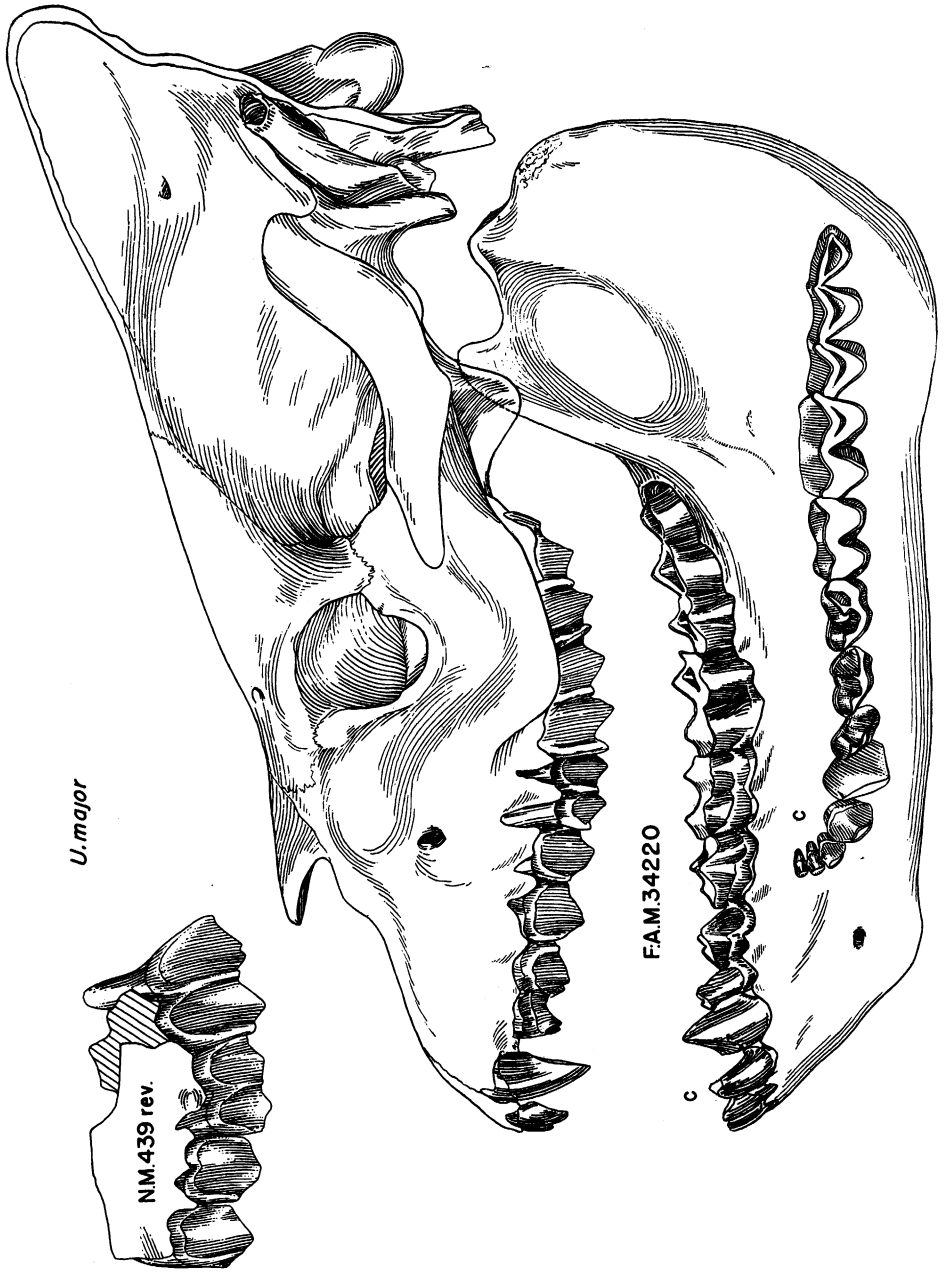


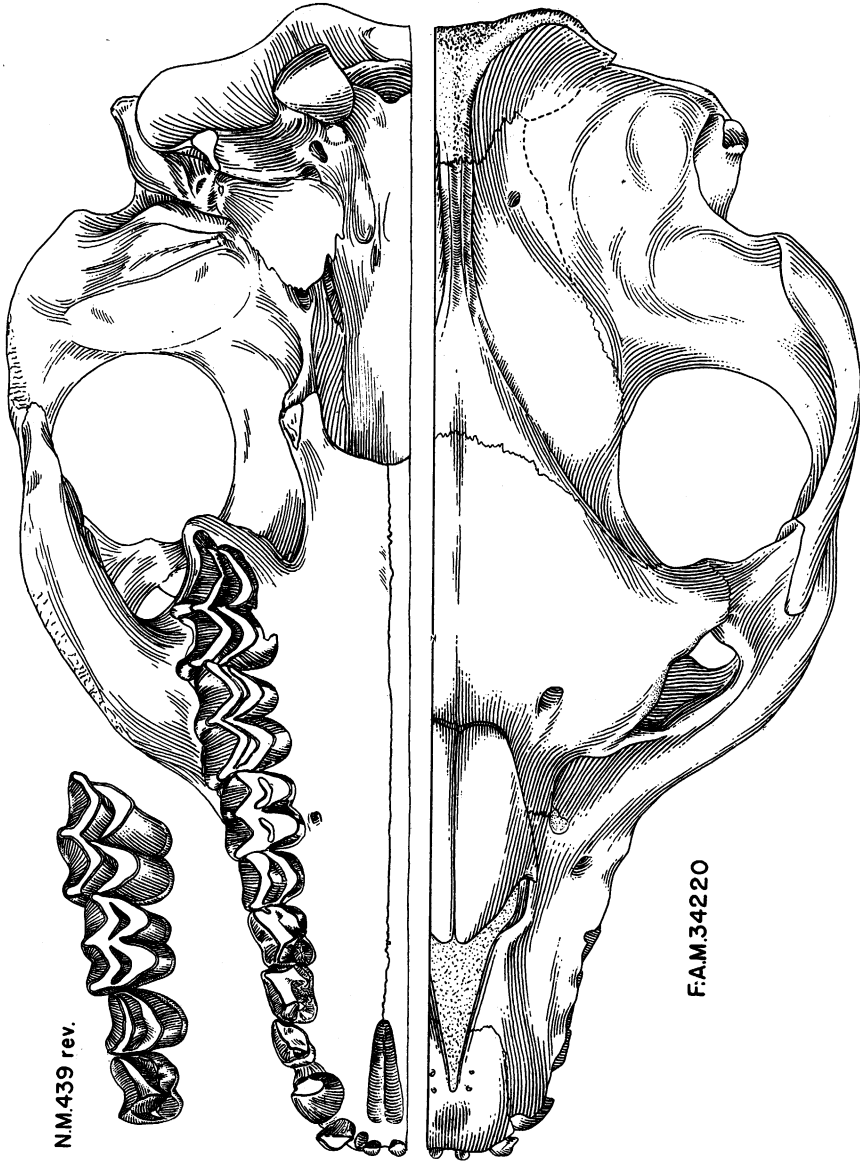
Fig. 8. *Ustatochoerus skinneri*, new species, HOLOTYPE, F. A. M. 33630, skull and ramus, from Ash Hollow deposits, Tripp County, South Dakota. $\times \frac{1}{2}$.



U. major

NM.439 rev.

F.A.M.34220

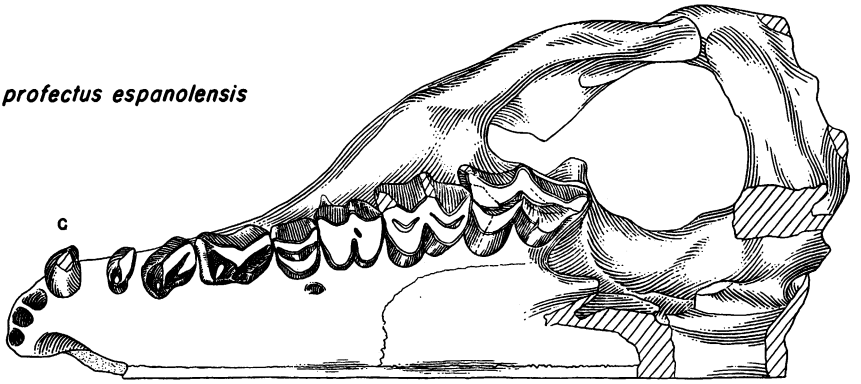


N.M.439 rev.

F.A.M.34220

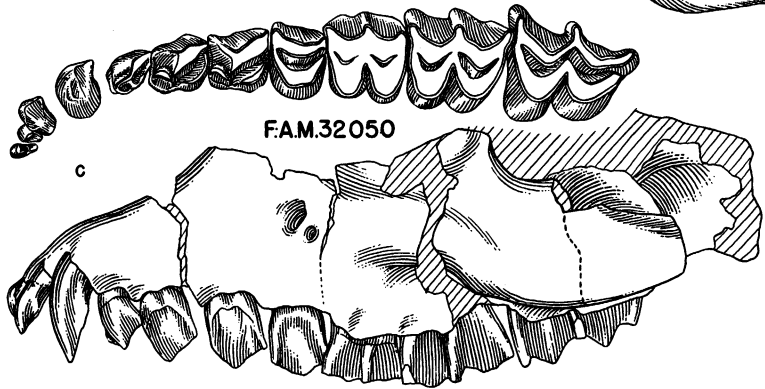
Fig. 9. *Ustatochoerus major* (Leidy), Holotype, N.M.439, partial maxilla, from Ash Hollow deposits, Nebraska; REFERRED, F.A.M.34220, skull and ramus, from Ash Hollow deposits, Cherry County, Nebraska. X $\frac{1}{2}$.

U. profectus espanolensis

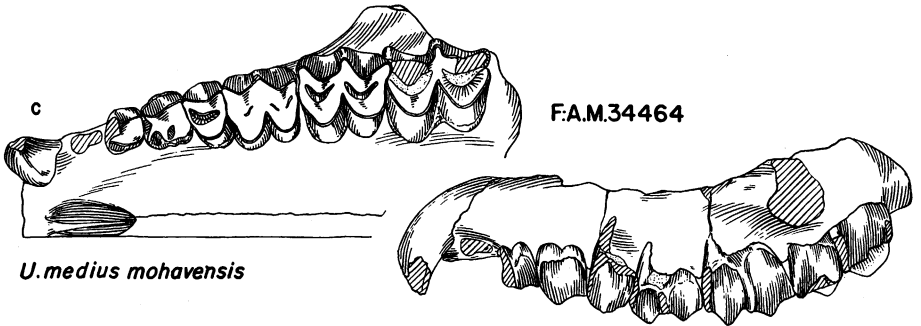


F.A.M.33683 rev.

U. skinneri santacruzensis



F.A.M.32050



F.A.M.34464

U. medius mohavensis

Fig. 10. *Ustatochoerus profectus espanolensis*, n.var., HOLOTYPE, F:A.M.33683, partial skull (dentition, composite of both sides), Santa Fé Co., N. Mex.; *U. skinneri santacruzensis*, n.var., HOLOTYPE, F:A.M.32050, partial skull, Santa Fé Co., N. Mex.; *U. medius mohavensis*, n.var., HOLOTYPE, F:A.M.34464, partial skull, "Hemicyon Stratum," Barstow area, Calif. $\times \frac{1}{2}$.

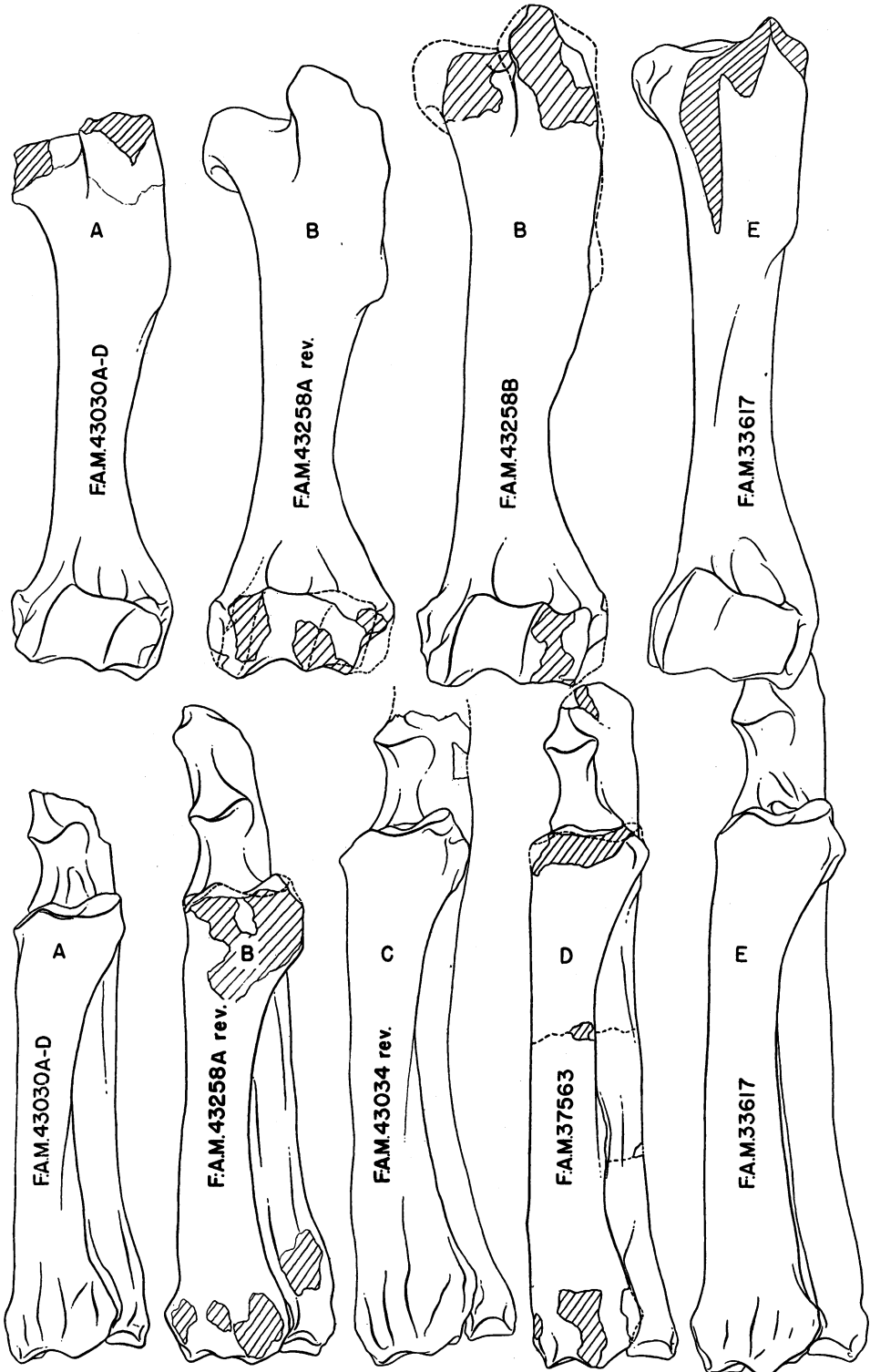
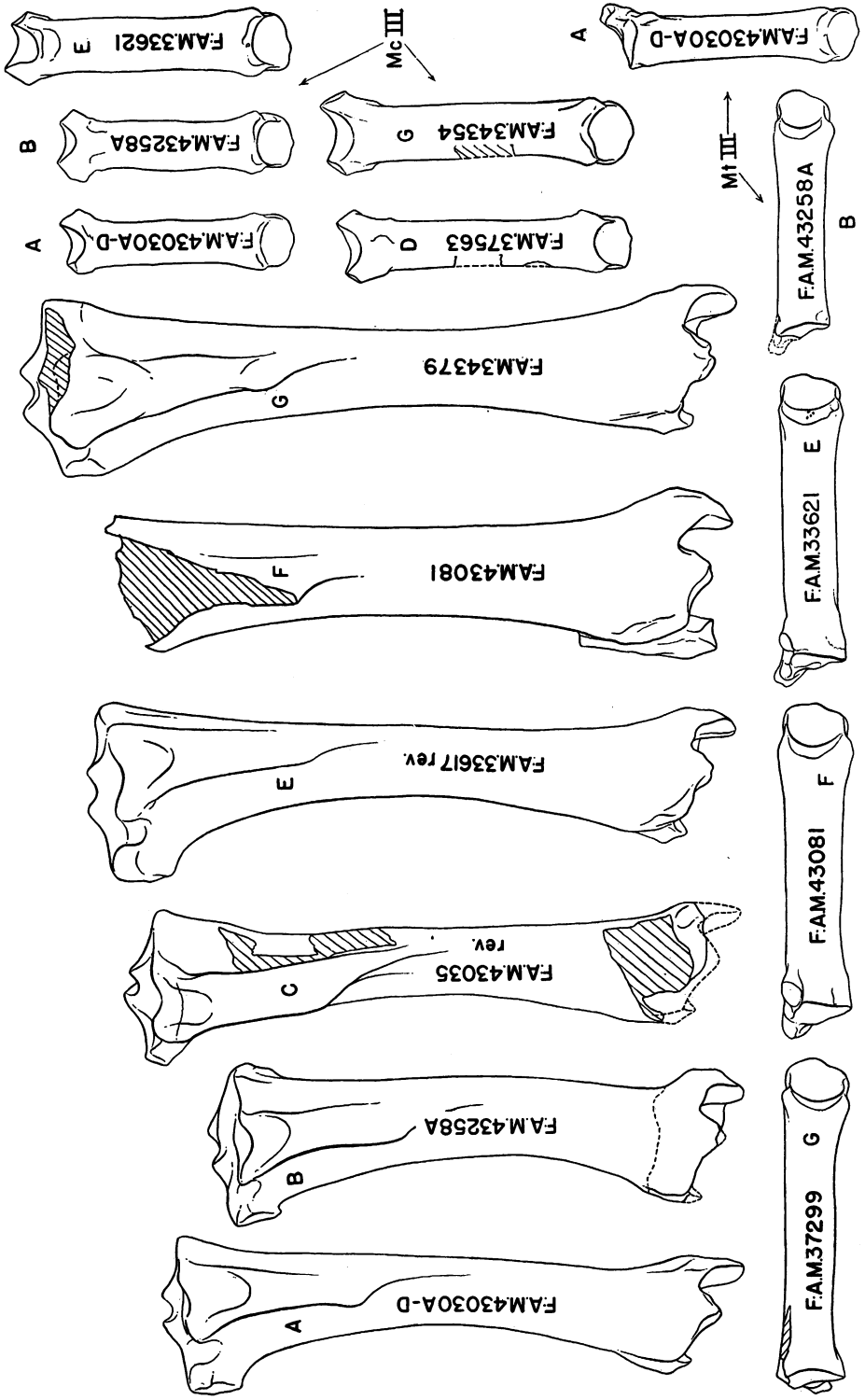


Fig. 11. *Ustatochoerus*, new genus, comparison of skeletal elements. A = *U. medius* (Leidy); B = *U. medius novomexicanus* (Frick); C = *U. profectus studeri*, n.var.; D = *U. major texanus*, n.var.; E = *U. profectus* (Matthew and Cook). $\times \frac{1}{2}$.



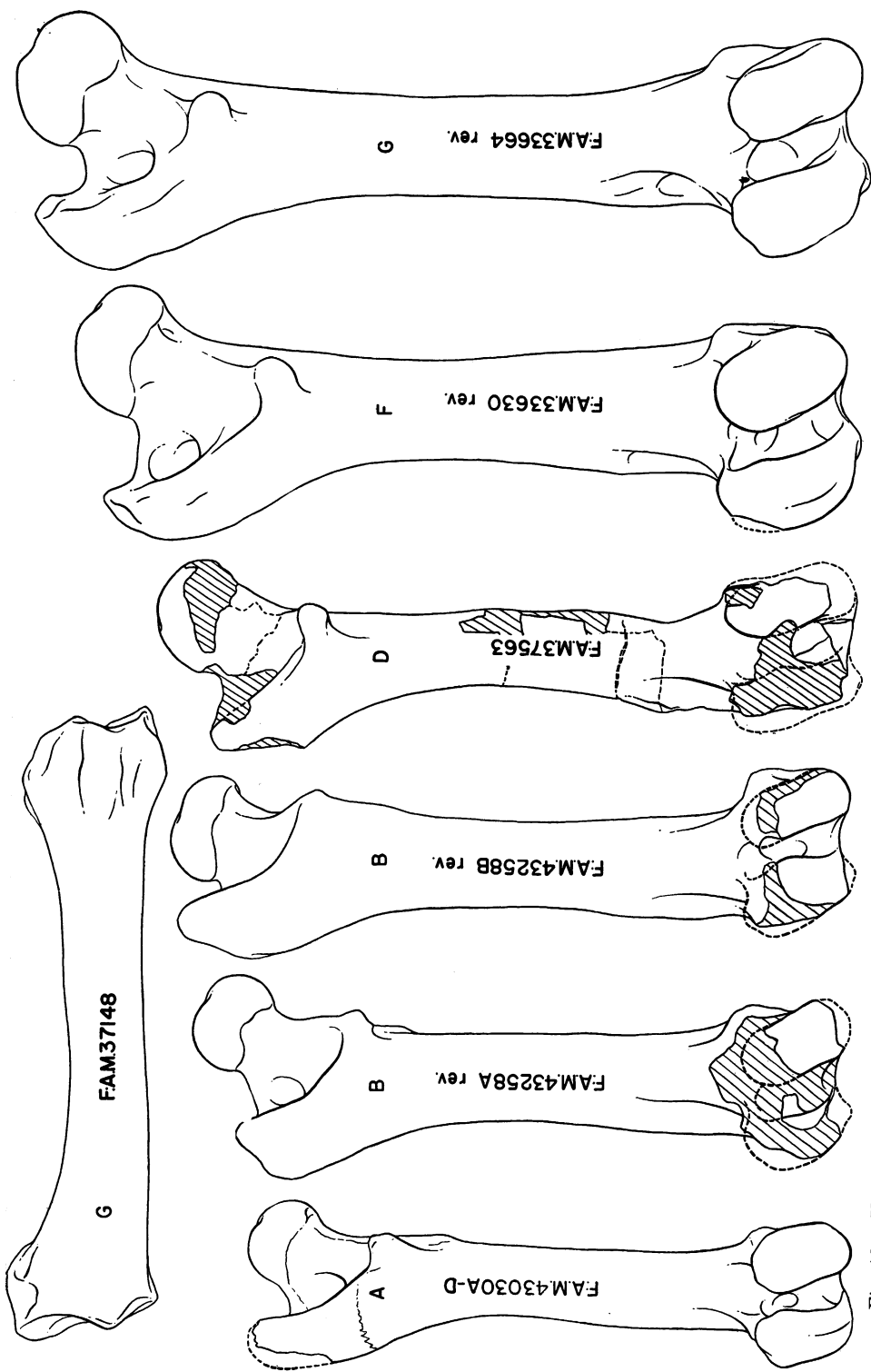


Fig. 12. *Ustatochoerus*, new genus, comparison of skeletal elements. A = *U. medius* (Leidy); B = *U. medius novomexicanus* (Frick); C = *U. profectus studeri*, new variety; D = *U. major tezanus*, new variety; E = *U. profectus* (Matthew and Cook); F = *U. skinneri*, new species; G = *U. major* (Leidy). $\times \frac{1}{2}$.

II. TICHOLEPTUS COPE

Ticholeptus COPE, 1878, Amer. Nat., XII, p. 129 (preliminary notice); 1878, Bull. U. S. Geol. Geog. Surv. Terr., IV, (2), p. 380 (amplified description).
Poatrephes DOUGLASS, 1903, Ann. Carn. Mus., II, p. 176.

GENOTYPE.—*Ticholeptus zygomaticus* COPE.

GENERIC CHARACTERS

SKULL.—Medium-sized, ranging in length from approximately 210 mm. to 250 mm.; mesocephalic to brachycephalic; occipital region fan-shaped, similar to that of *Ustatochoerus*; brain case inflated; malar prominent anterior to orbit (starting above posterior premolar region), causing a broad facial depression in the lacrimal region embracing the facial vacuity; zygomatic arch of light construction; nasals moderately long with slight retraction; infraorbital foramen above P³-P⁴; muzzle square and broad; occipital condyles light; postglenoid processes large and more robust than in *Ustatochoerus*; bullæ semi-depressed, similar to those of *Ustatochoerus*.

MANDIBLE.—Medium-sized; inferior border of ramus similar to that of *Ustatochoerus*; inferior region of angle with pronounced internal curve.

DENTITION.—Slightly hypsodont; lighter than in *Ustatochoerus* and not as hypsodont; small cusp on interior-posterior portion of P³; inferior premolars not as crowded as in *Ustatochoerus*; M₁ small; pronounced heel on M₃.

LIMBS.—Known only from referred examples of *T. hypsodus* and from partial limbs of the holotypes of *T. rileyi* and *T. tooheyi*; proportionately lighter than *Brachycrus* and *Ustatochoerus*; decidedly longer and more robust than in *Merychys*.

MEASUREMENTS.—Tables III, IV, and IX.

DISCUSSION

Until 1937 the holotype (A.M.8112) of *T. zygomaticus* was only partially prepared and the skull and mandible were still attached in the original matrix with the tooth characters almost entirely obscured. Permission to separate the skull from the mandible was granted to the present writers by Dr. Walter Granger, Curator of Fossil Mammals at the American Museum of Natural History. When the teeth were completely exposed it was found that they were of light proportions and were distinctly different in form from the teeth of "*T.*" *ban-nackensis*, "*T.*" *brachymelis*, "*T.*" *breviceps*, and "*T.*" *petersoni*, four species which Thorpe¹ had listed under *Ticholeptus*. These species will be included under a separate subfamily in a later report.

The skull of the holotype of *T. zygomaticus* appears to be narrow and high but when proper allowance is made for the extensive lateral crushing, it has considerable width and is rather low.

¹ Thorpe, Malcolm R., 1937, Mem. Peabody Mus., III, Pt. 4, pp. 187-193.

Complete skulls and skeletal elements representing the genus *Ticholeptus* are rare. The species *T. hypsodus*, from the "Lower Snake Creek" deposits of Nebraska, is the best represented in the collections at hand. This species is very similar to *T. zygomaticus* in both size and form, and when more material is available from Montana it may be necessary to consider *T. hypsodus* as a variety or, indeed, as a synonym of *T. zygomaticus*.

An uncrushed skull of *T. hypsodus* shows the presence of a facial vacuity and rather long nasals. The presence or absence of these characters is not observable in the holotype of *T. zygomaticus* because the anterior portion of the skull is badly crushed and partly missing.

In 1903 Douglass¹ described a new genus and species of oreodont, "*Poatrephes paludicola*," and designated specimen C.M.845 as the holotype. This skull is so badly crushed dorsoventrally that it is difficult to make a comparison with the holotype of *T. zygomaticus*, which is crushed laterally, but when allowances are made for these distortions the skulls of the two species are found to be approximately equal in size and shape. The present writers, therefore, consider "*Poatrephes paludicola*" to be a synonym of *T. zygomaticus*. In his description of "*Merychys smithi*" Douglass² further stated that this species and "*Poatrephes paludicola*" had many similar characters and that both came from the same geologic beds east of New Chicago, Montana. In 1936 Falkenbach collected two mandibular rami from this same area and these specimens are here listed as *T. zygomaticus*.

The amount of specific variation within the genus *Ticholeptus* seems to be small in comparison with that found in the apparently less conservative genera *Brachycrus*, *Merycochoerus*, and *Ustatochoerus*. Even the size differences among the various species of *Ticholeptus* are not marked.

DISTRIBUTION

Six species and one variety are here recognized from the Miocene of California, Colorado, Nebraska, Montana, Oregon, Texas, and Nevada. The greater portion of the 148 specimens comes from Dawes and Sioux Counties, Nebraska. [See distribution chart, page 7; and *Figures 1* (in part), *13-15*, and *17* (in part).]

¹ Douglass, Earl, 1903, op. cit., p. 176.

² Idem, p. 179.

SUMMARY OF SPECIES AND TYPES

Six species and one variety of *Ticholeptus* from nine Miocene localities are here recorded:

- (1) *Ticholeptus calimontanus* (Dougherty), 1940, from Caliente Mountain region, San Luis Obispo County, California.
HOLOTYPE.—Partial skull, C.I.T.2543.
- (2) *Ticholeptus hypsodus* Loomis, 1924, from the "Lower Snake Creek" deposits, Sioux Country, Nebraska, and referred remains from Dawes County, Nebraska.
HOLOTYPE.—Partial right ramus, A.M.14057. *Figure 13.*
- (3) *Ticholeptus obliquidens* (Cope), 1886, from Cottonwood Creek, John Day River, Oregon.
HOLOTYPE.—Right ramus, A.M.8192.
- (4) *Ticholeptus rileyi*, new species, from the Cold Springs area, San Jacinto County, Texas.
HOLOTYPE.—Mandible and partial femur, F:A.M.42329. *Figure 15.*
- (5) *Ticholeptus tooheyi*, new species, from the Hemingford area, Box Butte County, Nebraska (correlated with "Sheep Creek").
HOLOTYPE.—Anterior portion of skull, partial mandible, and skeletal parts, N.S.M.1-15-9-36S.P. *Figures 14, 15.*
- (6) *Ticholeptus zygomaticus* Cope, 1878, genotype, from the Smith River area, Montana, and referred remains from Granite County, Montana.
GENOHOLOTYPE.—Skull and mandible, A.M.8112. *Figure 15.*
- (6a) *Ticholeptus zygomaticus smithi* (Douglass), 1903, from east of New Chicago, Granite County, Montana.
HOLOTYPE.—Partial skull and mandible, C.M.766.
- (7) *Ticholeptus* species undetermined (Merriam), 1911, from Virgin Valley, Nevada.
EXAMPLE.—Detached molars, U.C.12606 and 11825.

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

Ticholeptus, total available specimens, 148.

(1) *Ticholeptus calimontanus* (Dougherty)

From the Miocene Deposits of the Caliente Mountain Region,
San Luis Obispo County, California

Merychys calimontanus DOUGHERTY, 1940, Carn. Inst. Wash. Publ. No. 514, p. 137, Pl. VI, Figs. 1-6a.

SPECIFIC CHARACTERS

SKULL.—Known only from palate and fragmentary maxilla; smallest form of the genus.

MANDIBLE.—Known only from fragmentary specimen.

DENTITION.—Smallest dental series of the genus.

LIMBS.—Known only from foot bones.

MEASUREMENTS.—Table III.

DISCUSSION

The writers have not had an opportunity to study the specimens upon which the species "*Merychys calimontanus*" was based, but the excellent illustrations, descriptions, and measurements published by Dougherty indicate that this form belongs to the genus *Ticholeptus* rather than to *Merychys*.

Four specimens are here recorded:

HOLOTYPE.—Partial skull with I ¹ -M ³ , right calcaneum, left astragalus, metatarsal, and proximal phalanx. (w+)	C.I.T.2543	From the Caliente Mountain region, San Luis Obispo County, California. Figured by Dougherty, 1940, Pl. VI, Figs. 1-5.
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REFERRED BY DOUGHERTY FROM TYPE LOCALITY.—

C.I.T.

Fragmentary left maxilla with P ⁴ -M ³		2545
Palate, immature, with P ⁴ -M ³	(i)	2546
Fragmentary left ramus with P ₄ -M ₃ ; figured by Dougherty, 1940, Pl. VI, Figs. 6-6a.....	(w±)	2544

(2) *Ticholeptus hypsodus* Loomis

From the Miocene Deposits ("Lower Snake Creek" Horizon¹) of Sioux County, Nebraska;
Referred Remains from Dawes County, Nebraska

Ticholeptus hypsodus LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., LI, Art. 1, p. 35, Fig. 25.
THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 191, Fig. 140.

SPECIFIC CHARACTERS

SKULL.—Slightly shorter, but approximately same width as that of *T. zygomaticus*; frontals robust above orbits.

MANDIBLE.—Similar to *T. zygomaticus*; slightly smaller.

DENTITION.—Superior and inferior series approximately same length as those of *T. zygomaticus*, but somewhat lighter.

LIMBS.—Heavier than those of *T. rileyi* and *T. tooheyi*.

MEASUREMENTS.—Tables III, IV, VII, and IX.

DISCUSSION

Although Loomis² reported that the dentition of the holotype of *T. hypsodus* was definitely hypsodont, an examination of this specimen has shown that the teeth are not in their proper position in the alveoli but have been drawn outward, thus giving the appearance of hypsodonty. Loomis also observed that in P₄ of the holotype the basin did not become completely inclosed until the tooth was well worn. Additional material now available, however, shows a large amount of individual variation in the wear of the premolars and in the formation of the basin.

Some of the generic characters of *Ticholeptus hypsodus* listed in this paper are based on three referred skulls from Nebraska (F:A.M.43073, F:A.M.43043, and N.S.M.42-1-9-40) because these specimens show little distortion and are more complete than the genoholotype (A.M.8112), which was found in Montana.

T. hypsodus occurs at the same geologic level in the "Lower Snake Creek" deposits as does *Brachycrus siouense*, and has never been found associated with *B. wilsoni*.³

One hundred and thirty-three specimens are here recorded:

HOLOTYPE.—Partial right ramus with /C-P ₂ alv. and P ₃ -M ₃ . (w)	A.M.14057	From "Lower Snake Creek" deposits, Sioux County, Nebraska; collected by Albert Thomson, 1908. Figured by Loomis, 1924, Fig. 25; Thorpe, 1937, Fig. 140. <i>Figure 13.</i>
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¹ The "Lower Snake Creek" is considered by the writers to be a part of the Sheep Creek formation [Lugn, 1938, Amer. Jour. Sci., (5), XXXVI, p. 226] but the term "Lower Snake Creek" of Matthew (1924, Bull. Amer. Mus. Nat. Hist., L, Art. 2, p. 61; Schultz and Falkenbach, 1940, *ibid.*, LXXVII, Art. 5, p. 220) will be retained for convenience in the present paper.

² Loomis, F. B., 1924, *op. cit.*, p. 35.

³ Schultz, C. Bertrand, and Falkenbach, Charles H., 1940, Bull. Amer. Mus. Nat. Hist., LXXVII, Art. 5, pp. 217 and 220 (chart showing distribution of *B. siouense* and *B. wilsoni*).

REFERRED.—

(A) FROM TYPE AREA (collected by Jack Wilson, Carl Long, and associates, 1935-1940):

From West Sinclair Draw:

MAXILLA		F:A.M.
Partial right maxilla with I ¹ -I ³ alv. and C/-P ³ (br.).....	(w†)	33589

TWO MANDIBULAR RAMI

Partial right ramus with M ₂ -M ₃	(w)	33521
Partial left ramus with M ₁ -M ₃	(w+)	33512

From West Surface Quarry, West Sinclair Draw:

TWO MAXILLÆ

Two partial left maxillæ with M ¹ -M ³	(w†)	37186
C/-P ³ (premolars large).....	(w††)	37187

SIX MANDIBULAR RAMI

Four partial right rami with M ₁ (br.)-M ₃ (br.).....	(M+)	33510
I ₁ -/C alv. and P ₁ -M ₂ (P ₂ alv.) (P ₄ large).....	(w††)	37165
P ₁ -P ₄	(w+)	37171
dP ₃ -M ₁	(i)	37167

Two partial left rami with

I ₁ -I ₃ alv. and /C-M ₃ (premolars small).....	(w††)	37175
I ₁ -/C alv. and P ₁ -P ₄	(w†)	37180

From East Sinclair Draw:

THREE MANDIBULAR RAMI

Partial right ramus with P ₁ -M ₃	(w+)	33539
Two partial left rami with /C-M ₁ alv. and M ₂ (br.)-M ₃ (br.).....	(w+)	33522
I ₁ -/C alv. and P ₁ -M ₃ (br.) (P ₁ rt.).....	(w††)	33537

From Sinclair Draw:

Partial right ramus with M ₁ -M ₂ (br.).....	(w+)	43312
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From Quarry 2, Sinclair Draw:

SKULL

Skull (lacking postoccipital region) with I ¹ (alv.)-M ³ . <i>Figures 1, 13</i>	(w)	43073
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FOUR MAXILLÆ

Two partial right maxillæ with C/-M ¹	(w†)	43082
P ¹ -P ⁴	(w†)	43083

Two partial left maxillæ with		F:A.M.
M ¹ -M ²	(w±)	43074
P ¹ -P ³ (br.).....	(w±)	43217

THREE MANDIBULAR RAMI

Two partial right rami with		
P ₃ -M ₃ (P ₃ large).....	(w+)	43075
M ₂ (alv.)-M ₃	(w±)	43253
Partial left ramus with /C(alv.)-P ₄	(w+)	43084

From Quarry 4, Sinclair Draw:

MANDIBULAR RAMUS

Partial left ramus with P ₂ -M ₂	(w)	33535
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From Jenkins Quarry, Sinclair Draw:

TWO PARTIAL SKULLS

Partial skull with I ¹ -I ³ alv. and C/-M ³	(w±)	43043
Anterior portion of skull with I ¹ -I ³ alv. and C/-M ³ (premolars large). <i>Figure 17</i> (in part).....	(M+)	43044

TWO MAXILLÆ

Two partial right maxillæ with		
P ¹ -M ³ (M ¹ alv.).....	(w)	43045
M ² -M ³	(w+)	43046

TWENTY-ONE MANDIBULAR RAMI

Nine partial right rami with		
I ₁ -/C alv. and P ₁ -M ₃	(w±)	43052
I ₁ -I ₃ alv. and /C(br.)-M ₃	(w±)	43053
I ₂ -I ₃ alv. and /C-M ₃ . <i>Figure 13</i>	(w± ⁺)	43054
M ₁ -M ₃	(w+)	43055
/C(alv.)-M ₃ . <i>Figure 17</i>	(w)	43056
M ₁ (br.)-M ₃	(w+)	43057
M ₁ -M ₃	(M+)	43058
/C(alv.)-P ₄	(w)	43059
P ₄ -M ₂	(w+)	43061
Three partial right rami, immature, with		
I ₂ -I ₃ alv. and /C(germ)-dP ₃ -M ₂ (P ₂ and P ₄ alv.).....	(I)	43062
P ₁ -P ₃ alv. and P ₄ (germ)-M ₃	(I)	43063
dP ₂ -M ₃ (erupt.).....	(I)	43064
Eight partial left rami with		
P ₁ (br.)-M ₃ (P ₂ alv.).....	(w)	43047
I ₁ -/C alv. and P ₁ -M ₃ (br.).....	(w± ⁺)	43048
P ₃ -M ₃ (br.).....	(w+)	43049
P ₁ (rt.)-M ₃ (br.).....	(w+)	43050
M ₁ (alv.)-M ₃	(w+)	43051

		F:A.M.
P ₁ -P ₄ alv. and M ₁ -M ₂	(m)	43060
P ₄ -M ₃	(w±)	43065
This specimen is smaller than most examples of <i>T. hypso-</i> <i>odus</i> .		
P ₁ (br.)-M ₃ (P ₄ absent).....	(w+)	43215
Two partial left rami, immature, with		
I ₂ -I ₃ rt. and /C-dP ₂ -M ₃ (erupt.).....	(i)	43066
dP ₃ -M ₁ (erupt.).....	(i)	43071

EIGHT SKELETAL ELEMENTS

Two humeri. (<i>Figure 15</i> , 43068B).....		43068A-B
Radius.....		43216B
Femur. (<i>Figure 15</i>).....		43067
Two tibiæ. (<i>Figure 15</i> , 43069A).....		43069A-B
Tibia.....		43216A
Metatarsal III. (<i>Figure 15</i>).....		43070

From New Surface Quarry, Sinclair Draw:

TWO MAXILLÆ

Two partial right maxillæ with		
M ¹ (alv.)-M ² (M ² br.).....	(w+)	37550
P ¹ (alv.)-M ¹	(w)	43072

TWO MANDIBULAR RAMI

Partial right ramus with P ₄ (alv.)-M ₃	(w)	37547
Partial left ramus with M ₁ -M ₃	(w)	37548
The two above-listed specimens may represent one individual.		

From Version Quarry, Sinclair Draw:

THREE MANDIBULAR RAMI

Three partial right rami with		
I ₁ -/C alv. and P ₁ -P ₄ (alv.).....	(w)	34345
P ₂ -M ₂ (br.) (premolars small).....	(w± ⁺)	43085
M ₁ -M ₃ (br.).....	(w)	43086

TIBIA

Tibia.....		43267
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From Echo Quarry, Antelope Draw:

TWO MAXILLÆ

Partial right maxilla with P ⁴ -M ²	(w)	33530
Partial left maxilla with P ¹ -M ¹ (br.).....	(w± ⁺)	43203

EIGHTEEN MANDIBULAR RAMI

		F:A.M.
Ten partial right rami with		
I ₁ -C alv. and P ₁ -M ₁	(w+)	33511
P ₄ (erupt.)-M ₂	(-M)	33515
M ₂ -M ₃	(M)	33519
M ₁ -M ₃	(w+)	33536
I ₂ -C alv. and P ₁ -M ₃	(w+)	33538
M ₂ -M ₃	(w†+)	34288
P ₁ (br.)-M ₁ (br.).....	(w+)	36231
P ₁ -P ₂ alv. and P ₃ -M ₁	(w+)	43204
M ₂ -M ₃	(w)	43205
M ₂ -M ₃	(w+)	43311
Eight partial left rami with		
M ₂ -M ₃	(w†+)	33526
P ₁ -P ₄ alv. and M ₁ -M ₃	(w†)	33533
P ₄ -M ₃	(w†)	33534
M ₁ -M ₃ (br.).....	(w)	37181
M ₂ -M ₃	(w†)	43206
I ₁ -C alv. and P ₁ -M ₁ (br.) (P ₁ exceptionally heavy).....	(w†+)	43207
I ₃ -C alv. and P ₁ -dP ₄ -M ₃ (germ).....	(i)	37176
I ₁ -P ₂ alv. and dP ₃ -dP ₄ (br.).....	(i)	43310

From Humbug Quarry, Ranchhouse Draw:

SKULL

Anterior portion of skull with C/-P ⁴	(w†+)	43208
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FOUR MANDIBULAR SPECIMENS

Partial mandible with I ₁ -I ₃ alv. and P ₁ (br.)-M ₃	(w†+)	43210
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Three partial right rami with

M ₂ -M ₃	(w+)	43209
P ₁ -M ₃	(w†)	43211
I ₁ -P ₁ alv. and P ₂ -dP ₄	(i)	43212

METATARSAL

Metatarsal.....		43214
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(A') FROM TYPE LOCALITY, "LOWER SNAKE CREEK" DEPOSITS, SIOUX COUNTY, NEBRASKA (collected by W. D. Matthew, Albert Thomson, and Harold Cook, 1908; Whitford and Stoll, 1916; and Albert Thomson, 1921):

SKULL, ETC.

Anterior portion of skull with C/(br.)-M ² (br.) (pre-molars small) and partial mandible with M ₂ -M ₃ .	A.M.17311	1916
(w†)		

Matthew¹ referred the above specimen to "*Metoreodon relictus*."

¹ Matthew, W. D., 1924, Bull. Amer. Mus. Nat. Hist., L, Art. 2, p. 182.

THREE MAXILLÆ

Partial right maxilla with P ⁴ (br.)-M ³ (M ¹ alv.). (w‡)	A.M.14067	1908
Left maxilla with C/(rt.)-M ³ (P ¹ -P ² and P ⁴ br.). (w+)	14065	1908
Partial left maxilla with P ³ - M ¹ (br.). (w+)	17313	1916

THREE MANDIBULAR RAMI

Partial right ramus with P ₂ - P ₃ alv. and P ₄ -M ₃ . (w+)	14058	1908
Two partial left rami with M ₂ -M ₃ . (w)	14060	1908
P ₁ -M ₃ . (w‡)	18343	1921

Matthew and Cook,¹ under the discussion of *Merychyus* cf. *relictus*, noted a form larger than typical *M. relictus* and reported,

"A large variety or distinct species is indicated by several lower jaws or part jaws, Nos. 14060, 14058 and 14064. Two upper jaws, Nos. 14065, 14067 may be correlated with these."

In the table of measurements accompanying this quotation, ramus, A.M.14057, is also mentioned as of the larger form. Loomis² later designated ramus, A.M.14057, as the holotype of *T. hypsodus*, but did not refer any of Matthew and Cook's larger specimens to the new species of *Ticholeptus*. The present writers refer specimens, A.M.14065, 14067, 14068, and 14060, to *T. hypsodus* Loomis. The partial ramus, A.M.14064, is referable to *Merychyus*, sp. indet.

(B) FROM HAY SPRINGS AREA, DAWES COUNTY, NEBRASKA (collected by Ted Galusha and associates, 1935-1938:

From Survey Quarry:

	THREE MAXILLÆ	F:B:A.M.
Partial right maxilla with P ⁴ -M ³	(w+)	33641
Left maxilla with C/-M ³	(w+)	33642
Partial left maxilla with P ¹ (br.)-P ⁴ (premolars small).....	(w‡)	34291

From Observation Quarry:

	SEVEN MAXILLÆ	
Five partial right maxillæ with		
P ¹ (br.)-P ⁴	(w‡‡)	33502
I ² -P ⁴ (C/ br.).....	(w‡‡)	34295
M ¹ -M ²	(w)	34308
P ³ -M ³ (br.).....	(w+)	34333
P ⁴ -M ²	(w‡‡)	34348
Two partial left maxillæ with		
C/(br.)-M ² (br.).....	(w+)	34292
P ¹ -M ³ (P ² -M ¹ br.).....	(w+)	34315

¹ Matthew, W. D., and Cook, Harold J., 1909, Bull. Amer. Mus. Nat. Hist., XXVI, Art. 27, p. 393.

² Loomis, F. B., 1924, op. cit., p. 35.

FIFTEEN MANDIBULAR RAMI

		F:B:A.M.
Six partial right rami with		
/C(alv.)-M ₃ (M ₃ with additional heel).....	(w+)	34297
I ₁ -/C alv. and P ₁ -M ₃ (P ₂ alv.).....	(w)	34298
M ₁ -M ₃ (M ₃ with additional heel).....	(w)	34299
P ₁ -M ₁ (P ₄ small).....	(w+)	34300
P ₄ -M ₃ (P ₄ small).....	(w±)	34331
dP ₃ -M ₁	(i)	34311
Nine partial left rami with		
M ₃	(w±)	34301
P ₁ -M ₃	(w+)	34302
P ₁ -M ₃ (P ₄ small).....	(w+)	34303
I ₂ -/C alv. and P ₁ -M ₃ (br.) (M ₃ with additional heel).....	(w+)	34304
P ₁ (rt.)-M ₃ (br.) (P ₂ br.) (P ₄ small).....	(w+)	34305
P ₄ -M ₃	(w)	34306
/C-P ₄ alv. and M ₁ -M ₃	(w±+)	34307
P ₁ -M ₂ (P ₂ -P ₄ alv.).....	(w)	34310
P ₁ -dP ₂ -dP ₄	(i)	34309

FOUR METAPODIALS

Two metacarpals III. (<i>Figure 15</i> , 43076A).....	43076A-B
Two metatarsals III.....	43077A-B

From Pepper Creek area:

THREE MANDIBULAR RAMI

Partial mandible with M ₁ -M ₃	(m+)	34293
Partial right ramus with P ₃ -M ₁	(w+)	34296
Partial left ramus with P ₃ -M ₃ (M ₁ br.).....	(w±)	34294

(B') FROM SAND CANYON LOCALITY, DAWES COUNTY, NEBRASKA
(collected by University of Nebraska State Museum field party,
1940):

Posterior portion of skull with P ³ (br.)-M ³ (M ¹ br.), mandible with I ₁ -M ₃ , partial scapula, 2 radii, 2 ulnae, 2 tibiae (1 partial), manus, pes, and vertebrae.....	(w±)	N.S.M. 42-1-9-40
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(3) *Ticholeptus obliquidens* (Cope)

From the Miocene Deposits (Mascall), Grant County, Oregon¹

Merycochoerus obliquidens COPE, 1886, Amer. Nat., XX, p. 368; 1886, Proc. Amer. Philos. Soc., XXIII, p. 359.

Promerycochoerus obliquidens (COPE), HAY, 1930, Carn. Inst. Wash., Publ. No. 390, II, p. 785.

Ticholeptus obliquidens (COPE), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 192, Pl. XXIX, Figs. 5-6.

¹ Gazin (1932, Carn. Inst. Wash., Publ. No. 418, p. 81, Fig. 15a) reported the occurrence of a mandibular fragment of an oreodont from the Miocene of Malheur County, Oregon, and referred it to "*Ticholeptus?* sp." Thorpe (1937, op. cit., p. 170), however, listed this specimen under "*Pronotherium* species." The present writers agree with Gazin's generic identification but are not listing the specimen in question because it is too incomplete for definite specific identification.

SPECIFIC CHARACTERS

SKULL.—Unknown.

MANDIBLE.—Similar to those of *T. zygomaticus* and *T. hypsodus*; slightly smaller and shallower than in *T. zygomaticus* but nearly equal in size to small examples of *T. hypsodus*.

DENTITION.—Superior series unknown; inferior series slightly heavier and of less length than that of *T. zygomaticus*, and approximately equal in size and form to that of *T. hypsodus*.

LIMBS.—Unknown.

MEASUREMENTS.—Table III.

DISCUSSION

The writers agree with Thorpe¹ in that *T. obliquidens* and *T. hypsodus* resemble each other very closely. The mandibular rami of the two species cannot be readily differentiated and additional material is necessary in order to establish or discredit possible synonymy. Thorpe suggested that the similarity might have been due to parallel development.

One recorded specimen:

HOLOTYPE.—Right ramus with /C (rt.)—M ₂ (P ₁ —P ₂ br.). (w+)	A.M.8192	From Cottonwood Creek, John Day River area, Grant County, Oregon. Figured by Thorpe, 1937, Pl. xxix, Figs. 5–6.
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(4) *Ticholeptus rileyi*,² new species

From the Miocene Deposits of the Cold Springs Area, San Jacinto County, Texas

DESCRIPTION

SKULL.—Unknown.

MANDIBLE.—Approximate size of that of *T. hypsodus*; ramus shallow (even shallower than in *T. obliquidens* and *T. tooheyi*); ascending ramus shallow and narrow anteroposteriorly; condyle light.

DENTITION.—Superior series unknown; inferior series approximate size of those of *T. zygomaticus* and *T. hypsodus*.

LIMBS.—Known only from a partial femur; lighter than examples of *T. hypsodus*.

MEASUREMENTS.—Table III.

¹ Thorpe, Malcolm R., 1937, op. cit., p. 192.

² Named in honor of Mr. Claude Riley, the collector of the holotype.

DISCUSSION

In many respects this species is very close to *T. hypsodus*, but enough differences are present to warrant the naming of a new species.

One recorded specimen:

HOLOTYPE.—Mandible with I ₁ (alv.)—M ₃ (w+)	with I ₁ F:A.M.42329 and partial femur.	From Cold Springs area, San Jacinto County, Texas; collected by Claude Riley, 1938. <i>Figure 15.</i>
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(5) *Ticholeptus tooheyi*,¹ new species

From the Hemingford Area, Box Butte County, Nebraska
(Correlated with the Lower Part of the "Sheep Creek" Formation)

DESCRIPTION

SKULL.—Smaller and lighter construction throughout than examples of *T. hypsodus*; nasals longer than in *T. hypsodus* but with approximately the same amount of retraction; premaxillæ joined somewhat lower than in *T. hypsodus*; muzzle narrow; palate narrow.

MANDIBLE.—Smaller and lighter construction than examples of *T. hypsodus*.

DENTITION.—Superior and inferior dental series shorter than in *T. hypsodus* and premolars more crowded.

LIMBS.—Lighter than those of *T. hypsodus*.

MEASUREMENTS.—Tables III and IV.

DISCUSSION

Ticholeptus tooheyi is the smallest known species of the genus and probably represents an earlier stage of development than *T. hypsodus*. The remains of this species were found in a horizon (correlated with the "Sheep Creek") which is lower than that reported for the occurrence of *T. hypsodus*.

One recorded specimen:

HOLOTYPE.—Anterior portion of skull with I ¹ —M ³ , partial mandible with I ₁ —M ₃ , partial humerus, 2 partial radii, 2 partial tibiae, 2 calcanea, astragalus, manus and pes elements, and skeletal fragments. (w+)	N.S.M. 1-15-9-36S.P.	From the Hemingford area (correlated with the "Sheep Creek" formation), 5 mi. E. and 5½ mi. N. of Hemingford, Box Butte County, Nebraska; collected by University of Nebraska State Museum field party, 1936. <i>Figures 14, 15.</i>
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¹ Named in honor of Mr. Loren Toohey, who has aided the University of Nebraska State Museum in collecting specimens and geological data in the Hemingford area.

(6) *Ticholeptus zygomatiscus* Cope, genotype

From the Miocene Deposits of Smith River Valley, Montana

Ticholeptus zygomatiscus COPE, 1878, Amer. Nat., XII, p. 129 (preliminary notice); 1878, Bull. U. S. Geol. Geog. Surv. Terr., IV, Pt. 2, p. 380 (amplified description). THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 198, Pl. xxix, Figs. 1-2.

Merychyus zygomatiscus (COPE), SCOTT, 1893, Trans. Amer. Phil. Soc., XVIII, Pt. 10, p. 146, Pl. v, Fig. 45.

Poatrephes paludicola DOUGLASS, 1903, Ann. Carn. Mus., II, p. 176, Fig. 18. THORPE, 1937, op. cit., p. 200, Fig. 145, Pl. xxvii, Figs. 1-2.

SPECIFIC CHARACTERS

SKULL.—Slightly longer but approximately same width as that of *T. hypsodus*; zygomatic arch similar to that of *T. hypsodus* and more robust than in *T. tooheyi*; postglenoid process slightly lighter than in *T. hypsodus*.

MANDIBLE.—Equal to some examples of *T. hypsodus*.

DENTITION.—Superior and inferior series approximately equal to large examples of those of *T. hypsodus*, but slightly heavier and longer than average of that species.

LIMBS.—Unknown.

MEASUREMENTS.—Table III.

DISCUSSION

The skull of the holotype is badly distorted by lateral crushing, and the nasals, most of the frontals, part of the zygomatic arches, and a portion of the occipital region are missing. There are no indications as to the length of the nasals, the limits of the frontals, the depth of the malar below the orbits, or the presence or absence of a facial vacuity.

The synonymy of "*Poatrephes paludicola*" with *Ticholeptus zygomatiscus* is suggested on page 73, under the discussion of the genus *Ticholeptus*.

Four specimens are here recorded:

GENOHOLOTYPE.—Crushed skull (lacking nasals, frontals, and a portion of the occipital region) with I ¹ -M ³ (P ¹ br.) and mandible with I ₁ -M ₃ . (w+)	A.M.8112	From Smith River Valley, N.E. of Helena, Lewis and Clark Co., Montana. Figured by Scott, 1893, Pl. v, Fig. 45; Thorpe, 1937, Pl. xxix, Figs. 1-2. <i>Figure 15</i> (in part).
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REFERRED.—

From E. of New Chicago, Granite County, Montana:

Crushed skull (lacking nasals and right zygomatic arch) with I ¹ -P ¹ alv. and P ² -M ³ (P ² and M ¹ br.). (w+)	C.M.845	Collected by Earl Douglass. Figured by Douglass, 1903, Fig. 18; Thorpe, 1937, Fig. 145, Pl. xxvii, Figs. 1-2.
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The above specimen is the genoholotype of "*Poatrephes paludicola*" Douglass.

Partial right ramus with P ₁ -M ₃ (br.). (w+)	F:A.M.34316	Collected by Charles H. Falkenbach, 1936.
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Partial left ramus with P₁-P₂ F:A.M.34289 Collected in 1936.
rt. and P₃-M₂. (w₊⁺⁺)

The holotype of *Ticholeptus zygomaticus smithi* was also found E. of New Chicago (see discussion, below).

(6a) ***Ticholeptus zygomaticus smithi*** (Douglass)

From the Miocene Deposits, East of New Chicago, Granite County, Montana

Merychys smithi DOUGLASS, 1903, Ann. Carn. Mus., II, p. 179, Fig. 19.

Ticholeptus smithi (DOUGLASS), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 197, Fig. 144.

VARIETAL CHARACTERS

SKULL.—Somewhat smaller than that of *T. zygomaticus*, but posterior portion of zygomatic arch heavier than in that species.

MANDIBLE.—Similar to that of *T. zygomaticus* but slightly smaller and of less depth anterior to M₃.

DENTITION.—Superior and inferior series slightly shorter and somewhat lighter than in *T. zygomaticus*, and M₃ noticeably lighter.

LIMBS.—Unknown.

MEASUREMENTS.—Table III.

DISCUSSION

The holotypic skull and mandible of *T. zygomaticus smithi* were not separated from the original matrix until this writing, and some of the characters which have heretofore been obscured show decided similarities to those of *T. zygomaticus*.

One specimen is here recorded:

HOLOTYPE.—Partial skull with C/ (br.)-M ³ and partial mandible with P ₂ -M ₃ . (w+)	C.M.766	From E. of New Chicago, Granite County, Montana; collected by Earl Douglass. Figured by Douglass, 1903, Fig. 19; Thorpe, 1937, Fig. 144.
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(7) ***Ticholeptus* species undetermined** (Merriam)

From Virgin Valley, Nevada

Merychys(?) species MERRIAM, 1911, Bull. Dept. Geol. Uni. Calif., VI, p. 276, Figs. 48-49.

Ticholeptus species (MERRIAM), THORPE, 1937, Mem. Peabody Mus., III, Pt. 4, p. 199.

TWO DETACHED MOLARS

M ²	(w+)	U.C. 12606
M ₃ (br.).....	(w+)	11825

The two specimens are inadequate for definite generic identification. The teeth are slightly larger than examples of *Ticholeptus* and approach those of *Ustatochoerus? schrammi* in size.

TABLE III.—*Ticholeptus* COPE. COMPARATIVE MEASUREMENTS OF SKULLS AND RAMI

	<i>T. californianus</i> (Dougherty)	<i>T. hypsodus</i> Loomis	<i>T. obliquidens</i> (Cope)	<i>T. rileyi</i> , n.sp.	<i>T. tooleyi</i> , n.sp.	<i>T. zygomaticus</i> Cope		<i>T. zygomaticus</i> <i>smithi</i> (Dougherty)
	HOLOTYPE C.I.I. 2543 (w†)	REFERRED F.A.M. 43073 (w) (225.)	HOLOTYPE A.M. 8192 (w+)	HOLOTYPE F.A.M. 42329 (w+)	HOLOTYPE N.S.M. 1-15-9-36NP (w+) (210.)	GENO- HOLOTYPE A.M. 8112 (w+) (245.)	REFERRED C.M. 845 (w+) (250.)	HOLOTYPE C.M. 766 (w+) ...
SKULL								
Stage of wear of teeth.....
Length (including supraorbital crest and incisors).....	189.	.....	.....	.....	.....	.....	.....
Basal length (from anterior notch of foramen magnum to posterior base of I).....	(148.)	.....	.....	.....	.....	.....	.....
Width (max.).....	68.	.....	.....	.....	.....	.....	.....
Width of brain case (max.).....	59.	.....	.....	.....	.....	.....	.....
Width, interorbital (min.).....	(83.)	.....	.....	.....	.....	.....	.....
Distance from anterior rim of orbit to anterior base of canine.....	(141.)	.....	.....	.....	.....	.....	.....
Distance from anterior rim of orbit to supraorbital crest.....	56.5	.....	.....	.....	.....	.....	.....
Length of nasal.....	72.	.....	.....	.....	.....	.....	.....
Length of muzzle at infraorbital foramina.....	50.	.....	.....	.....	.....	.....	.....
Width across canines (max.).....	41.5	.....	.....	.....	.....	.....	.....
Width of palate between fourth premolars.....	26.	.....	.....	.....	.....	.....	.....
Width of palate between canines.....	102.	.....	.....	.....	.....	.....	.....
Length, P ₁ -M ₁ incl.....	92.2	88.5	.....	.....	.....	.....	.....	.....
Length, P ₁ -P ₄ incl.....	81.9 ¹	40.5	.....	.....	.....	.....	.....	.....
Length, M ₁ -M ₃ incl.....	49.	.....	.....	.....	.....	.....	.....
Width of M ₃ (max.).....	16.	.....	.....	.....	.....	.....	.....
Depth of malar below orbit.....	20.	.....	.....	.....	.....	.....	.....
RAMUS								
Stage of wear of teeth.....
Length (max., including incisors).....	(w)	.....	.....	.....	.....	.....	.....
Length, /C to condyle incl.....
Depth of jaw under coronoid.....	37.	.....	.....	.....	.....	.....	.....
Depth of jaw below anterior edge of M ₃
Length, /C-M ₃ incl.....	(98.)	.....	.....	.....	.....	.....	.....
Length, P ₁ -M ₃ incl.....	(42.)	.....	.....	.....	.....	.....	.....
Length, P ₁ -P ₄ incl.....	56.	.....	.....	.....	.....	.....	.....
Length, M ₁ -M ₃ incl.....

¹ After Dougherty: P₁-M₃ = 65.

TABLE IV.—*Ticholeptus* COPE. COMPARATIVE MEASUREMENTS OF SKELETAL ELEMENTS

	<i>T. hypsodus</i> Loomis		<i>T. tooheyi</i> , n.sp.
	REFERRED	REFERRED	HOLOTYPE
	F:A.M.	N.S.M.	N.S.M.
Length of humerus (articular).....	((157.)) 43068A	42-1-9-40	1-15-9-36SP
Length of radius (articular).....	...	131.	...
Length of ulna (max.).....	...	(182.)	...
Length of metacarpal III (max.).....	63. 43076A	68.	62.
Length of femur (articular).....	178. 43067	...	...
Length of tibia (articular).....	165. 43069A	171.	...
Length of metatarsal III (max.).....	73. 43070	74.	72.
Length of calcaneum (max.).....	...	63.	59.

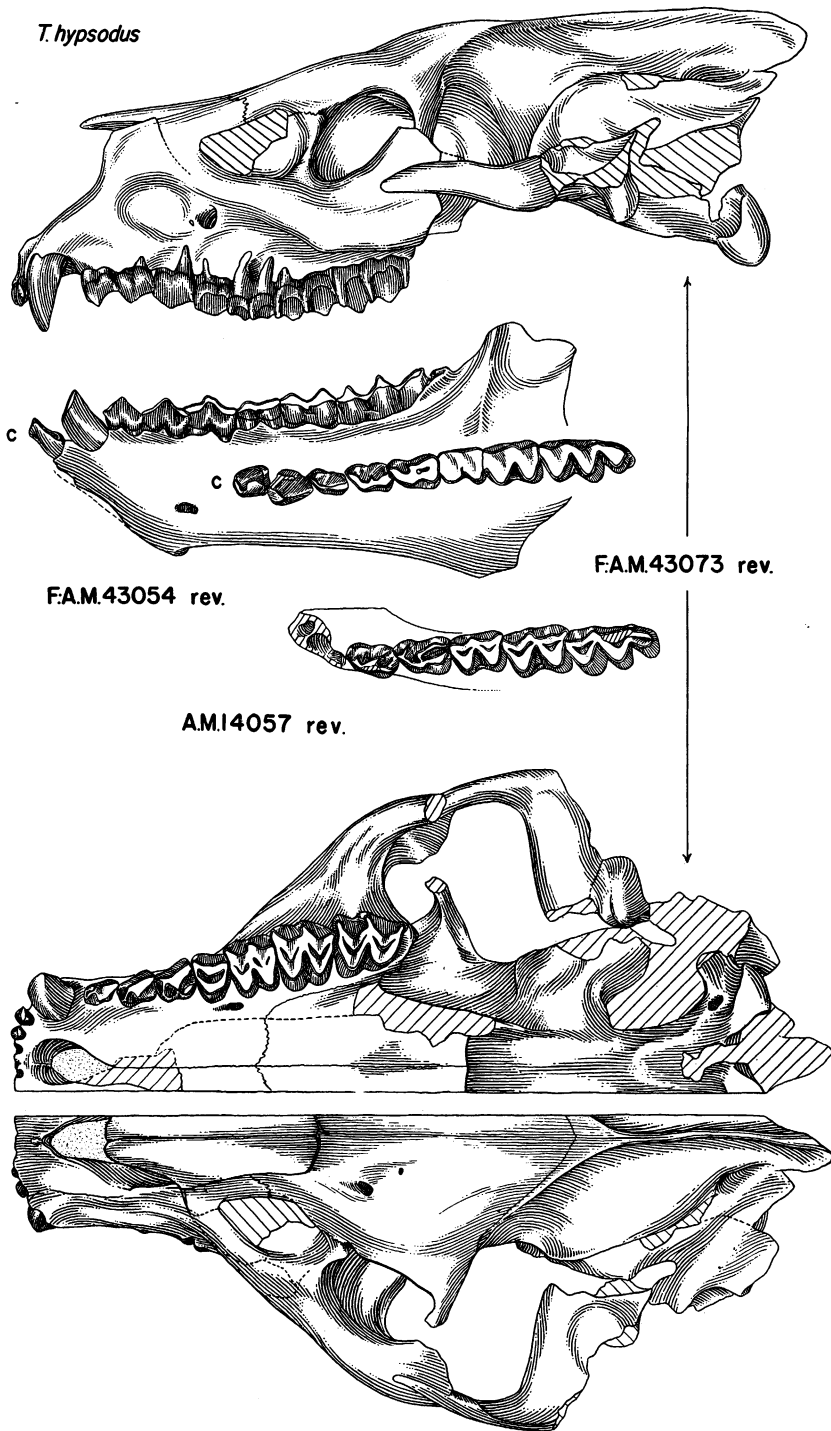
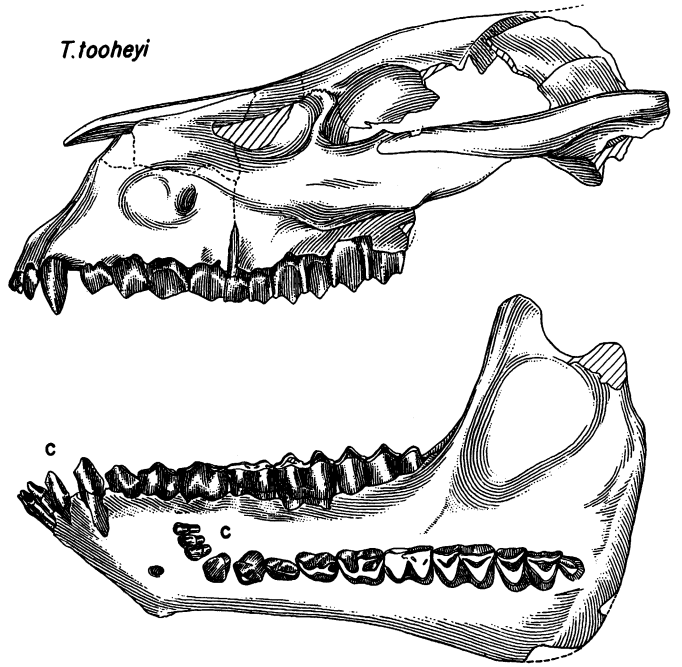


Fig. 13. *Ticholeptus hypsodus* Loomis, HOLOTYPE, A.M.14057, partial ramus; REFERRED, F:A.M.43073, skull, and F:A.M.43054, partial ramus, from "Lower Snake Creek" horizon, Sioux County, Nebraska. $\times \frac{1}{2}$.



N.S.M.I-15-9-36

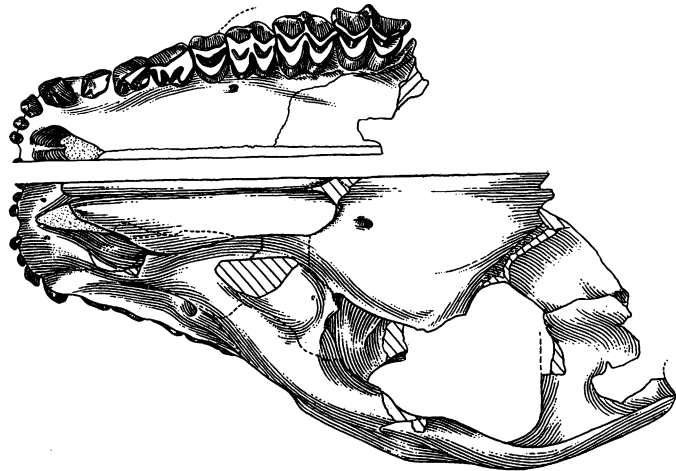


Fig. 14. *Ticholeptus tooheyi*, new species, HOLOTYPE, N.S.M.1-15-9-36, partial skull and ramus (P² from opposite side), from Hemingford area (correlated with the "Sheep Creek" deposits), Box Butte County, Nebraska. $\times \frac{1}{2}$.

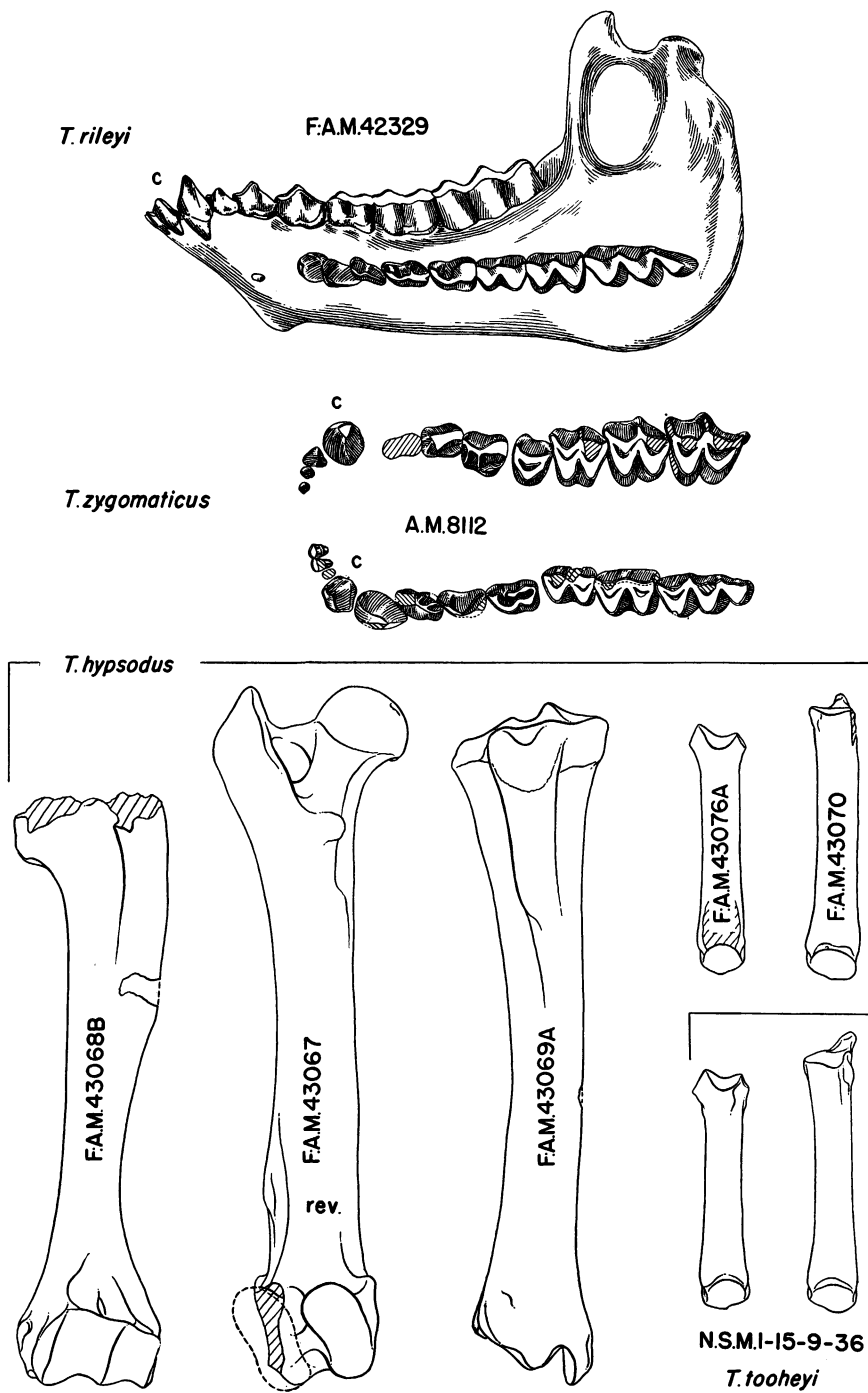


Fig. 15. *Ticholeptus rileyi*, n.sp., HOLOTYPE, F:A.M.42329, ramus, San Jacinto Co., Tex.; *T. zygomaticus* Cope, GENOHOLOTYPE, A.M.8112, superior and inferior dental series, Lewis and Clark Co., Mont.; *T. hypsodus* Loomis, ref., skeletal elements, "Lower Snake Creek" deposits, Sioux Co., Nebr.; *T. tooheyi*, n.sp., HOLOTYPE, N.S.M.I-15-9-36, skeletal elements, Hemingford area (correlated with the "Sheep Creek" deposits), Box Butte Co., Nebr. $\times \frac{1}{2}$.

III. MEDIOCHOERUS,¹ NEW GENUS

GENOTYPE.—*Mediochoerus blicki*, NEW GENUS AND SPECIES.

DESCRIPTION

SKULL.—Medium size, ranging in length from approximately 220 mm. to 240 mm.; brachycephalic; occipital region fan-shaped (similar to *Brachycrus*, *Ustatochoerus*, and *Ticholeptus*); brain case inflated; zygomatic arch similar to *Ticholeptus*; prelacrima shallow; nasals similar to those of *Merycochoerus*, shorter and more retracted than in *Ticholeptus*, but not as retracted as those in *Brachycrus*; anterior tip of nasals retracted to region above M¹; infraorbital foramina above region of M¹; postglenoid process moderately robust, compressed anteroposteriorly; posterior portion of palate greatly extended toward pterygoid region (somewhat the same as in *Ustatochoerus* and *Ticholeptus*).

MANDIBLE.—Unknown.

DENTITION.—Moderately hypsodont (much more hypsodont than *Ticholeptus*, similar to *Ustatochoerus*); heavier than examples of *Ticholeptus*; C/ large; small cusps on the interior-posterior of P² and P³ but not pronounced as in *Ustatochoerus*; inferior series unknown.

LIMBS.—Unknown.

MEASUREMENTS.—Tables V and IX.

DISCUSSION

The new genus, *Mediochoerus*, may be considered to be an intermediate form between *Brachycrus* and *Ustatochoerus* so far as certain important characters are concerned. This should not imply, however, that *Mediochoerus* is the connecting link between *Brachycrus* and *Ustatochoerus*, for these genera represent distinct phylogenetic lines in the oreodonts. The characters which *Mediochoerus* has in common with *Ustatochoerus* and *Brachycrus* probably represent parallel development, at least in the case of the latter genus. *Mediochoerus*, however, has much more in common with *Ustatochoerus* than with *Brachycrus*, and is, therefore, placed in the same subfamily with the former.

The position of the cusps² of P² and P³, the fan-shaped occipital region, and the absence of the typical facial cavity of *Brachycrus* are characteristic of both *Ustatochoerus* and *Mediochoerus*. At the same time the retracted nasals and the fan-shaped occipital flare of *Mediochoerus* would strongly suggest a close relationship to *Brachycrus*.

DISTRIBUTION

The two species of *Mediochoerus* here recorded are restricted to the Miocene deposits (Hemingford group) of Nebraska. [See distribution chart, page 7; and *Figures 1* (in part), *16*, and *17* (in part).]

¹ Etymology.—*Mediochoerus* = middle (or intermediate) pig.

² See p. 103 for discussion of premolars and *Figure 17* for comparisons.

SUMMARY OF SPECIES AND TYPES

Two species of *Mediochoerus*, new genus, from two Miocene localities are here recognized:

- (1) *Mediochoerus blicki*, new genus and species, from the "Lower Snake Creek" deposits, Sioux County, Nebraska.

GENOHOLOTYPE.—Partial skull, F:A.M.43172. *Figures 1, 16, 17.*

- (2) *Mediochoerus johnsoni*, new species, from the upper part of the Marsland formation, Hemingford area, Dawes County, Nebraska.

HOLOTYPE.—Skull, N.S.M.2-11-8-36N.P. *Figure 16.*

DETAILED LISTS OF TYPES AND REFERRED SPECIMENS

Mediochoerus, total available specimens, 4

- (1) *Mediochoerus blicki*,¹ new genus and species

From the Miocene Deposits ("Lower Snake Creek" Horizon) of Sioux County, Nebraska

DESCRIPTION

SKULL.—Approximately same size as that of *Brachycrus siouense*; malar very deep below orbit; nasal greatly retracted and almost as wide as long; anterior portion of nasal with upward curve.

MANDIBLE.—Unknown.

DENTITION.—Superior series longer than in *M. johnsoni* and approximately same length as in *Ustatochoerus medius*; inferior series unknown.

LIMBS.—Unknown.

MEASUREMENTS.—Tables V and IX.

DISCUSSION

This species is the rarest of the "Lower Snake Creek" oreodonts. It is known only from three specimens. The genoholotype and referred examples were collected by Jack Wilson and associates, 1938.

Three specimens are here recorded:

GENOHOLOTYPE.—Skull (lacking zygomatic arch and orbital region) with I ¹ –I ² alv. and I ³ –M ³ . (w)	F:A.M.43172	From New Surface Quarry, Sinclair Draw, Sioux County, Nebraska. <i>Figures 1, 16, 17.</i>
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¹ Named in honor of Mr. John C. Blick, Field Associate, Frick Laboratory, American Museum of Natural History. Mr. Blick and Charles H. Falkenbach made a reconnaissance of the Sheep Creek-Snake Creek area, Sioux County, Nebraska, previous to the intensive exploration carried on since 1932 by Jack Wilson and associates.

REFERRED FROM TYPE LOCALITY.—

From Quarry 2, Sinclair Draw:

Anterior portion of skull with I ¹ -I ³ alv. and C/(br.)-M ³ (P ¹ alv.).....	(w+)	F:A.M. 43173
Partial right maxilla with P ¹ (alv.)-P ⁴	(w†+)	43252

(2) *Mediochoerus johnsoni*,¹ new species

From the Upper Part of the Marsland Formation, Hemingford Area, Dawes County, Nebraska

DESCRIPTION

SKULL.—Maximum length approximately equal to that of *M. blicki*, but basal length longer with distance posterior of M³ decidedly greater; malar not as deep below the orbit as in *M. blicki*; nasals not retracted as much nor muzzle joined as high as in *M. blicki*; anterior nasal opening large and oval in shape.

MANDIBLE.—Unknown.

DENTITION.—Superior series less hypsodont and of less length than in *M. blicki*; I³ small and C/ robust in comparison with those of *M. blicki*; inferior series unknown.

LIMBS.—Unknown.

MEASUREMENTS.—Table V.

DISCUSSION

The dental series of *Mediochoerus johnsoni* compares very favorably with examples of *M. blicki*, except for slightly shorter length. The frontals and the nasals are missing in the holotype of *M. johnsoni*, but the superior border of the maxilla is present and indicates less retraction of the nasals than in *M. blicki*.

The writers believe that the variation in basal length between *M. johnsoni* and *M. blicki*, which is mentioned under the description, is due to the shortening of the posterior portion of the skull and the greater retraction of the nasals of *M. blicki*.

One recorded specimen:

HOLOTYPE.—Skull (lacking occipital region, frontals, and nasals) with I ¹ -M ³ . (w†)	N.S.M. 2-11-8-36N.P.	From 100 yds. N. of Hemingford Quarry 24, N. and E. of Hemingford in Dawes County, Nebraska.
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Figure 16.

¹ Named in honor of Mr. Guy Johnson, who has aided the University of Nebraska State Museum in collecting specimens and geological data in the Hemingford area of Nebraska.

TABLE V.—*Mediochoerus*, NEW GENUS. COMPARATIVE MEASUREMENTS OF SKULLS

	<i>M. blicki</i> , n.g. and sp.	<i>M. johnsoni</i> , n.sp.
	GENO- HOLOTYPE	HOLOTYPE
	F:A.M.	N.S.M.
	43172	2-11-8-36NP
	(w)	(w†)
SKULL		
Stage of wear of teeth.....	222.	...
Length (including supraoccipital crest and incisors).....		
Basal length (from anterior notch of foramen magnum to posterior base of I ¹).....	182.	195.
Width (max.).....	((165.))	169.
Width of brain case (max.).....	(74.)	82.
Distance from anterior rim of orbit to anterior base of canine.....	...	86.
Width of muzzle at infraorbital foramina.....	79.5	(65.)
Width across canines (max.).....	44.	46.
Width of palate between fourth premolars.....	32.	35.
Width of palate between canines.....	20.5	20.
Length, C/-M ³ incl.....	116.5	104.
Length, P ¹ -M ³ incl.....	103.5	89.5
Length, P ¹ -P ⁴ incl.....	42.	39.
Length, M ¹ -M ³ incl.....	63.	51.5
Width of M ³ (max.).....	22.	20.5
Depth of malar below orbit.....	...	25.

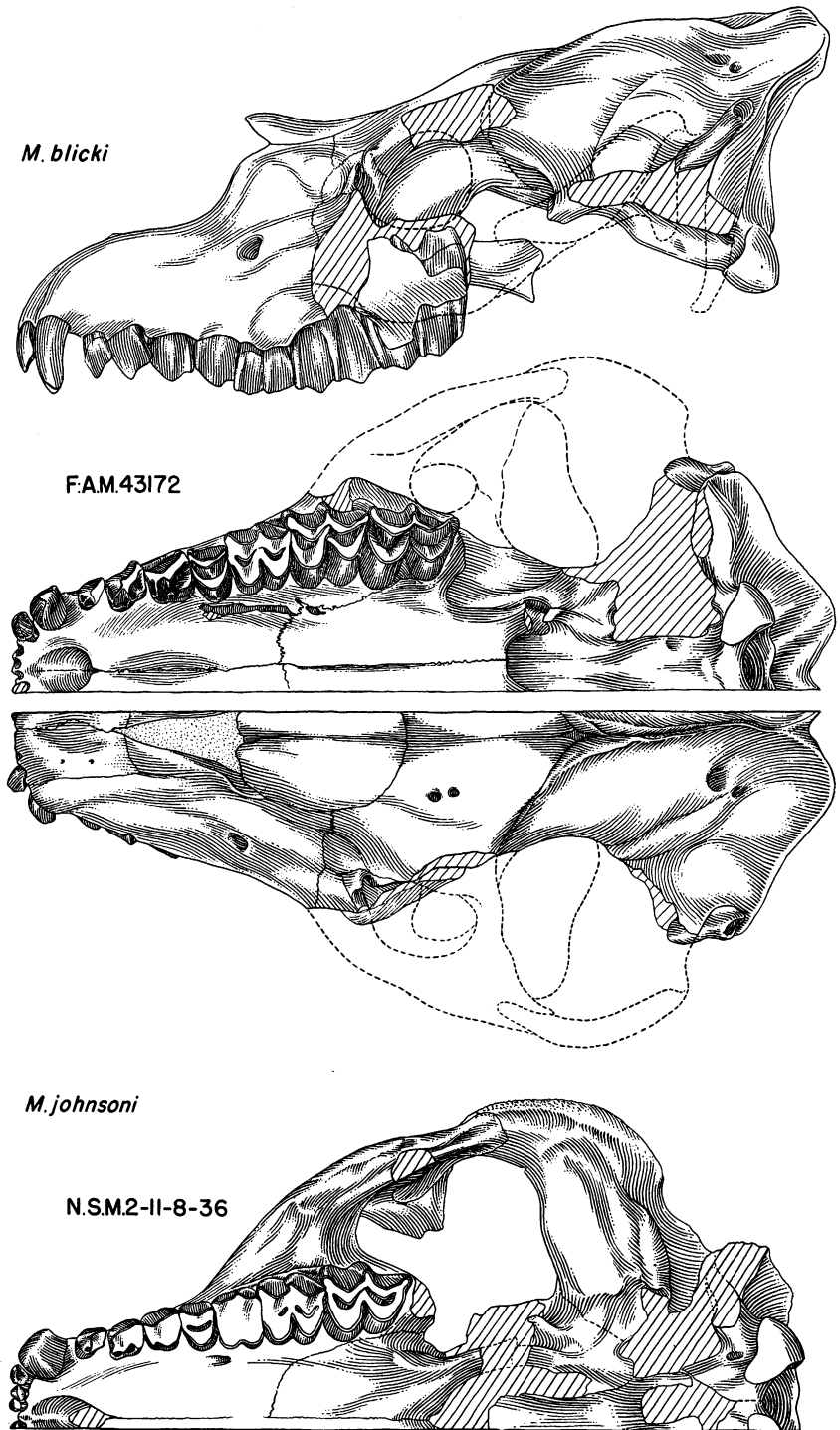


Fig. 16. *Mediochoerus blicki*, n.g. and sp., GENOHOLOTYPE, F:A.M.43172, partial skull (composite of both sides), "Lower Snake Creek" deposits, Sioux Co., Nebr.; *M. johnsoni*, n.sp., HOLOTYPE, N.S.M.2-11-8-36, partial skull, Marsland deposits, Dawes Co., Nebr. $\times \frac{1}{2}$.

INDIVIDUAL VARIATION

Brief discussions of individual variations and dental characters of certain genera and species of oreodonts, supplemented by figures and tables, are given here.

APPARENT VARIATION WITHIN A SPECIES

Variation within one species of oreodonts may be either contemporary or chronological. In the following tables (VI–VIII) the high degree of individual variation in three contemporaneous genera from one geological level is shown by the measurements of twenty-three mandibular rami of *Brachycrus siouense* (Sinclair), fifteen of *Ticholeptus hypsodus* Loomis, and eighteen of *Merychylus (Metoreodon) relictus* Matthew and Cook. Remains of all three genera and species have been found in Humbug Quarry.

Tables VI–VIII show that considerable variation exists within any given set of measurements. Any single measurement does not seem to be indicative of the proportions of any other part of the same specimen, i.e., an example with the longest molar series does not necessarily have the longest P_4 or the widest M_3 . The stage of wear of the teeth affects the anteroposterior length of the dental series as well as the depth of the ramus, but here again there is a certain amount of variation.

Variation in size due to chronological development within specific limits is best illustrated by the distribution of the remains of *Ustatochoerus medius* (Leidy) in the Valentine formation (see Table IX). Specimens from the lower part of this formation are on the average smaller than those from the upper levels. The larger forms of this species approach in size specimens from the lower part of the overlying Ash Hollow formation referred to *U. profectus* (Matthew and Cook) (see Table IX). Changes in size and form seem to have been slow in some genera, as, for example, in *Ticholeptus* Cope and *Merychylus* Leidy, and comparatively rapid in others, such as *Brachycrus* Matthew, *Merycochoerus* Leidy, and *Ustatochoerus*, new genus.

TABLE VI.—COMPARATIVE MEASUREMENTS OF MANDIBULAR RAMI OF *Brachycrus siouense* (SINCLAIR), FROM HUMBUG QUARRY¹

F:A.M.	Wear	P ₁ -M ₃	P ₁ -P ₄	M ₁ -M ₃	/Ps /Ms	P ₄		M ₃		Depth below M ₃
						Length	Width	Length	Width	
42432	w††	...	(47.5)	...	...	14.5	12.	...	...	60.
42441	w	129.5	53.	76.5	.69	15.	12.	37.5	14.5	55.
42431	w	122.5	49.5	74.	.66	15.5	12.	34.5	12.5	56.
42429	w††	131.	53.5	77.5	.69	16.	12.5	41.	18.5	...
42435	w+	132.5	51.5	81.	.63	16.	12.	40.	14.	55.
42411	w†+	(126.)	(47.5)	78.5	(.60)	16.5	12.5	41.	17.5	...
42453	w	128.5	53.5	75.5	.70	16.5	12.	36.	14.5	53.5
42409	w†	...	...	...	...	16.5	12.	...	...	...
37538	w†	125.	48.5	76.5	.63	16.5	13.	37.	12.5	61.
42436	w+	135.	52.	83.	.62	16.5	12.5	39.	14.	62.
42433	w†	141.5	59.	83.	.71	16.5	12.	39.	14.5	54.5
37539	w	...	54.5	...	...	17.	13.	...	...	...
42412	w†	134.5	56.5	78.5	.72	17.	12.5	39.5	17.	...
42413	w†	(128.)	(50.5)	77.5	.65	17.	11.5	39.5	16.	...
42415	w†+	131.	55.	76.	.72	17.	13.	39.	19.	55.
42440	w+	...	...	...	...	17.	14.5	...	...	...
37540	w+	130.	55.	75.	.73	17.5	12.5	36.5	14.	62.
42443	w†	...	...	82.	...	17.5	13.	44.	...	...
42414	w†+	...	...	76.5	...	...	...	43.	17.5	58.5
42410	w†	...	...	77.	...	...	...	40.	19.	56.5
42444	w	...	...	...	...	...	...	42.5	13.5	...
42452	w†+	131.5	...	...	...	...	...	43.	18.5	58.5
42454	w+	...	...	...	...	...	...	45.	18.5	...
MIN.		122.5	47.5	74.	.60	14.5	11.5	34.5	12.5	53.5
MAX.		141.5	59.	83.	.73	17.5	14.5	45.	19.	62.
MIN.										
MAX.		.86	.80	.89	.82	.82	.79	.76	.81	.86

¹ Schultz, C. Bertrand, and Falkenbach, Charles H., Bull. Amer. Mus. Nat. Hist., LXXVII, Art. 5, p. 238.

TABLE VIII.—COMPARATIVE MEASUREMENTS OF MANDIBULAR RAMI OF
*Merychys (Metoreodon) relictus*¹ MATTHEW AND COOK, FROM JENKINS QUARRY

F:A.M.	Wear	P ₁ -M ₃	P ₁ -P ₄	M ₁ -M ₃	$\frac{/Ps}{/Ms}$	P ₄		M ₃		Depth below M ₃
						Length	Width	Length	Width	M ₃
43111	w	...	...	45.5	...	10.	8.	20.5	8.5	25.5
43112	w‡	...	33.	...	...	10.5	8.5	...	...	...
43110	w‡	...	...	48.5	...	10.5	8.5	23.	10.5	28.
43104	w‡	...	31.5	...	...	10.5	8.	...	...	...
43091	w	(78.)	(31.)	47.	.65	11.	7.5	21.5	8.5	29.
43099	w‡‡	...	32.5	...	...	11.	8.5	...	11.	26.5
43101	w‡‡+	...	...	48.5	...	11.	8.	25.5	10.5	27.
43103	w‡	...	...	...	...	11.	8.	...	9.5	26.5
43107	w‡	80.5	33.5	47.	.71	11.	8.5	22.	10.	29.
43113	w+	...	30.	...	...	11.	7.5	...	...	...
43197	w‡	80.	31.	49.	.63	11.	8.	23.	10.5	...
43098	w‡	77.	30.	47.	.63	11.5	8.	23.	9.5	28.
43102	w‡	...	...	47.	...	11.5	9.	23.5	...	28.5
43106	w‡	...	...	...	...	11.5	9.	...	...	...
43114	w+	...	...	...	...	12.	8.	...	...	...
43115	w+	...	...	...	...	12.5	8.	...	...	...
43196	w+	82.	34.	48.	.70	...	...	22.5	9.	26.5
43105	w‡	...	...	47.	...	...	...	23.5	11.5	27.
MIN.		77.	30.	47.	.63	10.	7.5	20.5	8.5	25.5
MAX.		82.	34.	49.	.71	12.5	9.	25.5	11.5	29.
MIN.										
MAX.		.93	.88	.95	.88	.80	.83	.80	.73	.84

¹ The specimens cited in this table will be listed and described in detail by the writers in a forthcoming bulletin.

TABLE IX.—COMPARATIVE MINIMUM AND MAXIMUM MEASUREMENTS OF SPECIES OF *Ustatochoerus*, N.C., *Ticholephus* COPE, AND *Mediochoerus*, N.G.

		SKULLS													
No. of spec.	Stage of wear	Depth of malar below orbit		P ¹ -M ³		P ¹ -P ⁴		M ¹ -M ³		P ^s /M ^s					
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.				
	M-w†	30.	38.	79	151.	162.	.93	55.	62.	.88	80.	89.	.89	.68	.70
	M-w††	24.5	34.	.72	106.	116.	.91	44.	48.5	.90	60.	72.	.83	.73	.67
	M-w††	(24.)	36.	.66	113.5	122.5	.92	47.	68.5	.68	61.	75.	.81	.77	.91
	-M-w†††	26.5	33.	.80	113.	130.	.86	49.	58.	.84	63.	77.	.81	.75	.75
	w+-w†	32.	32.	...	125.5	130.	.96	52.	57.5	.90	72.	79.	.91	.72	.73
	w-w††	27.	29.	.93	113.	118.5	.95	49.5	51.	.97	69.	72.	.95	.72	.71
	M-w+	28.5	31.	.92	133.	140.	.95	55.	59.5	.92	80.	82.5	.96	.68	.72
	w+-w††	31.	(42.)	.73	138.	150.	.92	57.	59.5	.95	85.	91.	.93	.67	.65
	M+-w††	...	...	...	87.5	99.5	.87	38.	50.	.76	47.	55.5	.84	.80	.90
	w-w+	29.5	29.5	...	102.	103.5	.99	42.	42.	...	61.	63.	.96	.69	.67
<i>U. major</i>															
<i>U. medius</i>															
<i>U. medius nonomexicanus</i> ..															
<i>U. profectus</i>															
<i>U. profectus espanolensis</i> ..															
<i>U. profectus studeri</i>															
<i>U. skinneri</i>															
<i>U. skinneri santacruzensis</i>															
<i>T. hypsodus</i>															
<i>M. blacki</i>															

TABLE IX (continued)

		MANDIBULAR RAMI											
No. of spec.	Stage of wear	Depth below M ₃		P ₁ -M ₃		P ₁ -P ₄		M ₁ -M ₃		/Ps /Ms			
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.		
	M+-w†††	42.5	54.5	139.	155.	55.	63.	83.	96.	.66	.65		
18	M+-w†††	38.	47.	110.	125.5	42.	54.5	66.	78.	.63	.69		
27	M-w†††	40.	52.5	114.	132.	44.	54.	67.	80.5	.65	.67		
15	M-w†††	32.5	50.	115.5	138.	42.	54.5	66.5	90.	.63	.65		
22	M-w†††	...	...	...	...	...	...	80.5	(86.5)	.93	...
2	w†	37.	48.	122.	126.	46.5	50.	73.5	79.5	.92	.63		
4	w+-w††	44.	52.	145.5	151.	54.	59.	86.5	95.	.91	.62		
4	M-w††	...	...	146.	146.	56.	56.	87.5	90.	.97	.64
3	w†-w††	28.5	39.	93.5	109.	42.	48.5	50.	60.5	.82	.69		
52	M-w††										.80		

TOOTH CHARACTERS OF CERTAIN OREODONTS

Examples of the premolars and the third molars of seven species of oreodonts, representing six genera and one subgenus, are illustrated in *Figure 17*. The teeth of the specimens used for the figures are all approximately at the same stage of wear. The third molars vary from brachyodont in *Merycochoerus* to moderately hypsodont in *Ustatochoerus* and *Mediochoerus*.

The parts of the premolars which are most important in the comparisons of the above-mentioned genera and species of oreodonts are: the pseudoparaconid (or anterior-interior accessory column), the posterior accessory column (or blade), and the pseudoentoconid in the lower series; and an anterior-interior accessory column, a pseudohypocone, and an anterior-intermediate crest (or blade) in the upper series.

Some of the cusps, columns, blades, or folds, although characteristic of certain genera and species, are not always developed to the same degree and sometimes are even absent. The amount of wear also determines the prominence of some of these characters and in well-worn examples they may be altogether lost. In *Ustatochoerus*, new genus, the pseudoparaconid of the lower premolars and the anterior-interior accessory column of the upper premolars are always developed, even in very old individuals. These columns are also present in *Merychyus* (*Metoreodon*) but are less discernible. A pseudoentoconid is sometimes present in examples of *Merycochoerus* and *Merychyus* (*Metoreodon*) but this is not characteristic of these forms.

In the lower premolars there are anterior and posterior crescents¹ or folds which tend to divide the individual teeth into two sections. This may represent a propensity toward the molarization of these teeth. The same may be said of the first three superior premolars.

¹ Loomis (1924, Bull. Amer. Mus. Nat. Hist., LI, Art. 1, p. 2, Fig. 1) discussed and proposed names for various cusps, blades, and folds of the premolars of oreodonts.

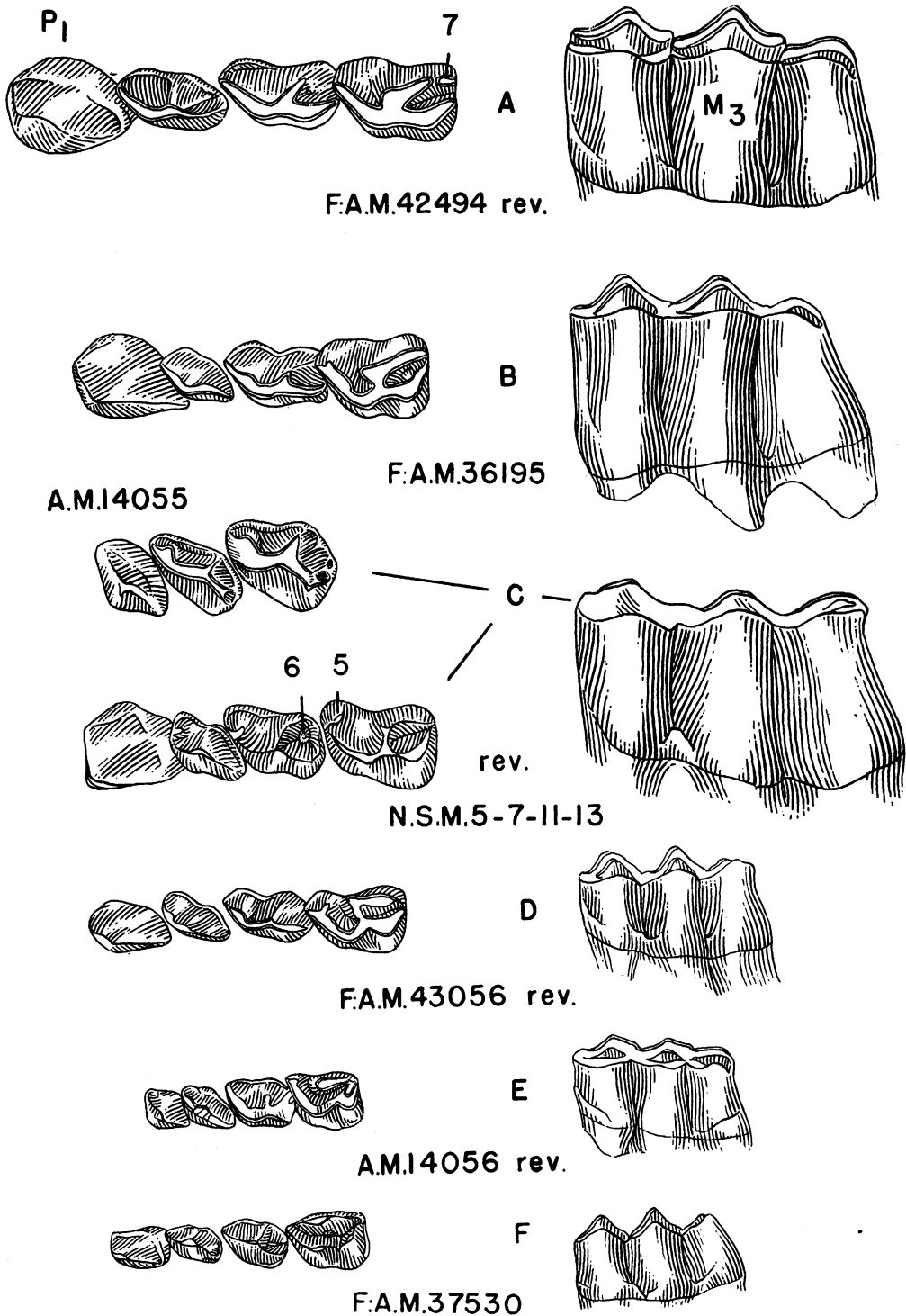


Fig. 17. Examples of inferior and superior premolars, and molar 3s (wear w); (see page 103): A = *Merycochoerus matthewi* Loomis; B = *Brachycrus siouense* (Sinclair); C = *Ustatochoerus profectus* (Matthew and Cook); D = *Ticholeptus hypsodus* Loomis; E = *Merychys (Metoreodon) relictus* Matthew and Cook; F = *Merychys siouxensis* Loomis; G = *Mediochoerus blicki*, n.g. and sp. (See opposite page.) $\times 1$.

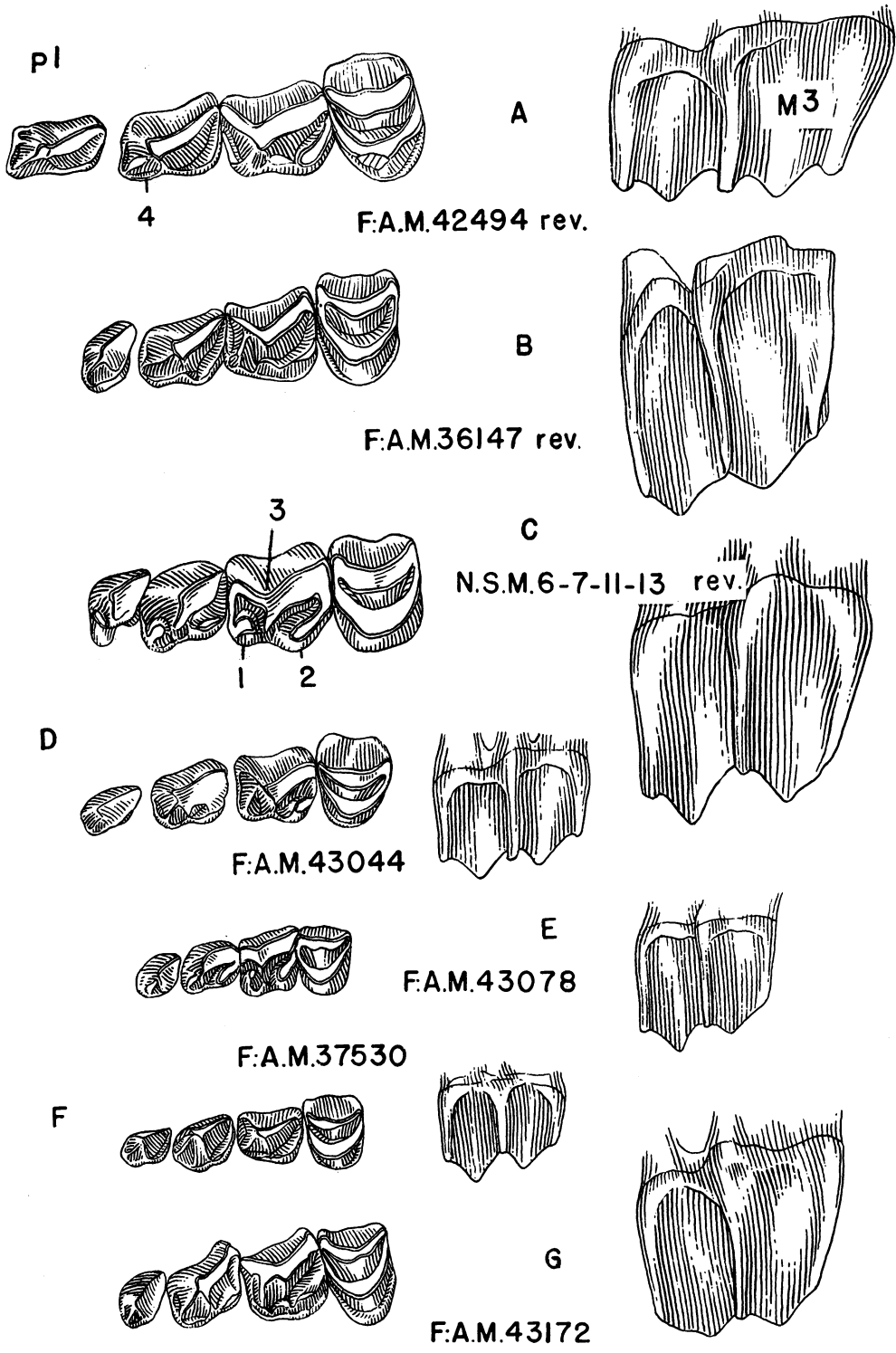


Fig. 17 (cont.). See legend, opposite.

1=antero-interior accessory column; 2=pseudohypocone; 3=primary cusp (paracone); 4=antero-intermediate crest (or blade); 5=antero-interior accessory column (pseudoparaconid); 6=posterior accessory column (or blade); 7=pseudoentoconid.

