MERYCHYINAE, A SUBFAMILY OF OREODONTS

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CONTRIBUTION TO THE REVISION OF THE OREODONTS (MERYCOIDODONTIDAE), NUMBER 3

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INTRODUCTION

THE PRESENT PAPER, the third in a series concerning a revision of the oreodonts (Merycoidodontidae), deals with five closely related genera and subgenera, *Merychyus* Leidy, *Merychyus* (*Metoreodon*) Matthew and Cook, *Paramerychyus*, new genus, *Oreodontoides* Thorpe, and *Oreodontoides* (*Paroreodon*) (Thorpe), all of which are here included under the subfamily Merychyinae.[1]

One thousand one hundred and twenty-seven numbered skulls, mandibular rami, and skeletal elements are here listed or described under the three named genera (of which one is new) and two subgenera. Fifty-nine of these specimens, representing 13 species and four subspecies[2] (of which two species and four subspecies are new), are illustrated in detail (including 10 refigured types) in 17 text figures. The outline drawings are reproduced at one-third, and the shaded drawings at one-half, actual size.

The illustrations of Merychyinae demonstrate the range in size, shape, and proportions of the skulls, rami, and skeletal elements. Noteworthy are the constant characters (within a genus) of the occipital region, bulla, postglenoid process, height of crowns of teeth, and the uniform length of dental series regardless of the age of the individual.

The writers wish to acknowledge their appreciation to: Mr. Childs Frick for the privilege of continuing the study of the oreodonts and for helpful suggestions in the preparation of the manuscript; Chancellor C. S. Boucher, Dr. E. H. Barbour, and Prof. E. F. Schramm of the University of Nebraska for stimulation in the continuation of this research; Mr. Thompson M. Stout of the University of Nebraska and Mr. Morris F. Skinner of the Frick Laboratory for cooperation in stratigraphic studies; the late Mr. Charles W. Gilmore of the United States National Museum and Dr. C. Lewis Gazin of the same institution, Dr. J. LeRoy Kay of the Carnegie Museum, Dr. Carl O. Dunbar of the Yale Peabody Museum, the late Dr. Walter Granger and Dr. George G. Simpson of the American Museum of Natural History for the loan of various specimens listed in this paper; Dr. D. D. Whitney of the University of Nebraska, and Dr. Richard Goldschmidt and Dr. G. L. Stebbins of the University of California for helpful discussions; Mrs. Elizabeth Bell and Mr. Ralph Mefferd of the Frick Laboratory for the illustrations which were drawn under the supervision of Miss Hazel de Berard; Miss Marjorie Shanafelt and Mr. Nathan Mohler of the University of Nebraska for the arrangement and preparation of the illustrations; Mr. Sydney E. Helprin of the Frick Laboratory for editorial suggestions; Miss Iona May of the University of Nebraska State Museum for help in typing and for preliminary editorial assistance; and Mrs. Charles H. Falkenbach and Mrs. C. Bertrand Schultz for encouragement and aid in the preparation of the manuscript. To all of these and many others the writers are grateful for making the present report possible.

The abundance of new material used in this study along with stratigraphic data has been gathered by the following party leaders and their associates for the Frick Laboratory: Messrs. John C. Blick, Ted Galusha, Morris Skinner, Nelson J. Vaughan, Jack Wilson, and Charles H. Falkenbach; and for the University of Nebraska State Museum: Messrs. E. L. Blue, W. R. Horney, Guy Johnson, Grayson E. Meade, Thompson M. Stout, Loren M. Toohey, and C. Bertrand Schultz. The Frick and the University of Nebraska collections have served as the basis for the revision of the oreodonts.

Thanks are also due members of the Frick Laboratory, especially Messrs. Floyd Blair, Frank Miller, and Joseph Rooney, for preparation and care of the oreodont collection; and Messrs. Guy Johnson, John Mercer, and Henry Reider for supervising the preparation of the specimens in the University of Nebraska State Museum.

[1] The name Merychyinae was proposed by Simpson, 1945, Bull. Amer. Mus. Nat. Hist., vol. 85, pp. 149, 264. The writers, however, have used the name Merychyinae independently in manuscript since 1940.

[2] In this paper the term "subspecies" is used in its true sense to indicate osteological differences, as distinguished from "variety," which may indicate variation due to geologic or geographic occurrence.

The following is a list of abbreviations of institutions cited:

A.C., Amherst College
A.M., American Museum of Natural History
A.N.S.P., Academy of Natural Sciences of Philadelphia
Aug.C., Augustana College
C.I.T., California Institute of Technology
C.M., Carnegie Museum of Pittsburgh
C.N.H.M., Chicago Natural History Museum
Col.M., Colorado Museum of Natural History
F:A.M., Frick Collection American Mammals (American Museum of Natural History)
F:B:A.M., Frick: Barbour Collection
U.C., University of California
U.M., University of Montana
U.N.S.M., University of Nebraska State Museum
U.S.N.M., United States National Museum
Y.P.M., Yale University, Peabody Museum

METHOD OF APPROACH

The problem of revision has been approached by the writers in the same manner as in the previous two papers, i.e., with emphasis on taxonomy, phylogeny, variation, and geologic and geographic distribution.

The establishment of a hypothetical phylogenetic line demands a geologic approach, this entailing a knowledge of the exact or approximate geologic occurrence of the types and referable material, not only the location of the exposures yielding the fossils, but also the level or horizon in the exposure and its correlation with other deposits of known geologic age. Since 1934 the writers have used a convenient method to study oreodont phylogeny based upon geologic distribution. Typical examples of various oreodonts have been arranged according to geologic level upon a large laboratory table, 8 feet by 24 feet, which has served as a working exhibit. The geologic section of the Great Plains has been used as a basis. The table has been divided into sections representing the formations of the White River, Arikaree, Hemingford, and Ogallala groups, and minor subdivisions. Properly prepared specimens with adequate field data have been placed on the table at the proper niche in the geologic section. Fortunately an abundance of material has been available from all the formations of the Great Plains and adjacent areas. Where examples were wanting from certain horizons, field work was planned and material collected. Specimens with similar characters in different formational zones on the table then were selected and aligned in perpendicular phylogenetic columns. Forms with like characters from adjacent formations were especially studied, and soon closely related forms could be traced through several different geologic levels. Missing links, of course, often occurred, but many of these were found later. Continued study revealed that certain characters remained constant during a long geologic interval, while other characters showed distinct changes and therefore were more diagnostic and of morphologic value. This approach has facilitated the determination of the hypothetical lines of development and the establishment of the various subfamilies.

Each specimen from outside the Great Plains area also was placed in the proper phylogenetic line on the table, close to the particular geologic niche evidenced by its stage of development. When the comparison of specimens with similar generic characters but from geographically separated areas was made, it became apparent that independent development had taken place in certain lines. Several closely related lines may have developed paralleling one another, but with differences not sufficient to warrant recognition as separate genera or even subgenera. Such parallel development appears to be demonstrated in the genus *Brachycrus*[1] by three species from the Sweetwater River area of Wyoming and two species from the Sheep Creek-Snake Creek area of Nebraska. These species apparently developed independently, in the two localities, from a common ancestor. Other examples of independent geographic development are apparent from the Great Plains and from the John Day region of Oregon.

The majority of the generic breaks in the oreodonts occur at formational contacts.

[1] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 223.

This is to be expected since the formations are separated by unconformities of one type or another which represent hiatuses of varying lengths of time. Other areas outside the central Great Plains, however, may provide the missing links between genera which are necessary to complete the phylogenetic story of the oreodonts, but so far this has not been demonstrated. Strong evidence has suggested that periods of extensive erosion in the central Great Plains were contemporaneous with analogous erosional cycles over much of western North America.

The difficult aspect of the approach to the present study of the oreodonts has been the scarcity of definite field data accompanying the individual specimens in many of the collections throughout the United States. This is especially true in the older collections which include many of the types. In many instances the types are of little value from a geologic or phylogenetic standpoint. To counterbalance this, the collecting localities of the types have been visited and, wherever possible, additional collections with sufficient geologic data have been made. As a result, good examples of most of the types have been secured from the type localities, thus permitting the placement of the types in their proper geologic positions.

With the exception of the Tick Canyon region of California and the John Day area of Oregon, all of the collecting localities considered in this paper have been visited by one or both of the writers.

The use of oreodont material is ideal for a phylogenetic study based on detailed geological data as well as on morphological characters. Some of the reasons for this are briefly listed below:

1. Oreodonts, so far as now known, were entirely North American. They had a fairly long geologic history, with their first appearance in the Eocene and their extinction near the end of the Pliocene. The history of the oreodonts appears to have been a continuous one on this continent and was not interrupted by migrations to or from other parts of the world, which seems to have been the case in so many other groups.

2. Oreodont remains are the most common of the mammalian macrofossils found in the Oligocene and lower Miocene continental sediments and are comparatively abundant in the upper Miocene and Pliocene formations. Well-preserved skulls and mandibles, frequently associated with skeletal elements, are available for study.

3. Examples of the oreodonts are sufficiently large so that most morphological characters are readily distinguishable.

4. The oreodonts include a great diversity of forms. Development in many of the phylogenetic lines seems to have been rapid; thus, the osteological characters of the species occurring in the different geological levels are distinct from each other. The oreodonts, therefore, may be considered as good "index fossils" in the Tertiary deposits of North America. The numerous contemporaneous phylogenetic lines also make possible the study of the comparative rate of development.

In the early study of the oreodonts it soon became apparent to the writers that development took place by minute steps (microgenesis). This was confirmed again and again by work on the "phylogeny table" in the laboratory when specimens from many different horizons in a single formation were available. The division between species, therefore, is often an arbitrary one as the characters of one species grade into those of the next; hence, it frequently is necessary to disregard the existent taxonomy in preliminary work. In forthcoming papers the writers will consider the various problems involving the geologic history of the oreodonts in detail.

Variation also has been an important factor in the present revision of the oreodonts. The following five types of variation have been considered: (1) age, (2) sex, (3) individual, (4) geographic, and (5) geologic. This is discussed on page 262 and is indicated on charts 1–4.

DESCRIPTION OF MERYCHYINAE, SUBFAMILY 3[1]

THE SUBFAMILY MERYCHYINAE includes the genera *Merychyus*, *Paramerychyus*, *Oreodontoides*, and the subgenera *Merychyus* (*Metoreodon*) and *Oreodontoides* (*Paroreodon*). Oreodonts of small to medium size; skulls mesocephalic; occipital region showing much variation with the supraoccipital wings incorporated into a fan-shaped occipital; orbits large for size of skull; tendency for slight retraction of the nasals (anterior tip above C/); tympanic bulla well inflated and large, with a round to somewhat flattened inferior surface; teeth moderately large, brachyodont to subhypsodont (all the teeth in Merychyinae are in reality brachyodont, and the terms subhypsodont and brachyodont used in this paper are strictly comparative terms), premolars with simple to complicated patterns, the latter type found in the later Miocene species; P^1–P^3 with anterior intermediate crest and P_3 with posterior intermediate crest.

Remains of *Merychyus* are known from the Harrison and Marsland formations and deposits of equivalent age; of *Merychyus* (*Metoreodon*) from the "Lower Snake Creek" and "Sheep Creek" beds; of *Paramerychyus*, *Oreondontoides*, and *Oreodontoides* (*Paroreodon*) from either the Harrison formation or formations of approximately the same geologic age.

[1] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 215 (subfamily 1, Merycochoerinae); 1941, *ibid.*, vol. 79, art. 1, p. 1 (subfamily 2, Ticholeptinae).

DISTINCTIVE CHARACTERS[2]

Merychyus (P. 171, figs. 1–7, 13, 14, 17)	*M.* (*Metoreodon*) (P. 232, figs. 1, 8, 10, 11, 14–17)	*Paramerychyus* (P. 247, figs. 1, 9, 10, 14)	*Oreodontoides* (P. 250, figs. 1, 10, 11, 15–17)	*O.* (*Paroreodon*) (P. 255, figs. 1, 11, 12, 14–16)
Infraorbital foramina above region of P^3–P^4	P^3–P^4	P^3	P^3	P^3–P^4
Supraoccipital wings incorporated in fan-shaped occipital region, flare not so large as in *Ustatochoerus*	Completely fan-shaped as in *Ustatochoerus*	Supraoccipital wings produced slightly posteriorly, but incorporated in semi-fan-shaped occipital region; external edge of flare notched	Semi-fan-shaped, similar to *Paramerychyus*	Semi-fan-shaped, oblong in outline, vertical axis
Superior border of maxilla with abrupt rise to nasals above region of P^1–P^2	Region above P^2	Region above P^1–P^2	Region above P^1	Region above P^1
Prelacrimal vacuity present	Present	Present	Absent	Present
Inferior border of ramus more or less straight, slight downward curve posterior of M_3	Slightly concave, gradual downward curve below M_3	Unknown	Straight, abrupt downward curve posterior of M_3	Straight, abrupt downward curve posterior of M_3
Dentition advanced brachyodont to subhypsodont	Subhypsodont	Brachyodont	Brachyodont, extremely light	Brachyodont, light
Premolars simple pattern	Slightly complex pattern	Tendency of slightly complex pattern	Simple pattern	Simple pattern
Limbs light to moderately heavy	Light	Unknown	Light	Light

[2] Compare with Schultz, C. Bertrand, and Charles H. Falkenbach, 1940 and 1941, *ibid.*, pp. 216 and 6, respectively.

GEOGRAPHICAL DISTRIBUTION OF *MERYCHYUS*, *MERYCHYUS* (*METOREODON*), *PARAMERYCHYUS*, *OREODONTOIDES*, AND *OREODONTOIDES* (*PARAOREODON*)

	Calif.	Nebraska			N. Mex.	Calif.	Colo.		Idaho	Nebraska						Mont.	Wyoming				South Dakota				Oreg.
		Sioux Co.[1]																							
	San Bernardino Co.	"Lower Snake Creek"	"Sheep Creek"	Dawes Co.	Santa Fe Co.	Los Angeles Co.	Logan Co.	Weld Co.	Lemhi Co.	Box Butte Co.	Cherry Co.	Dawes Co.	Morrill Co.	Sheridan Co.	Sioux Co.	Silver Bow Co.	Goshen Co.	Lincoln Co.	Niobrara Co.	Platte Co.	Bennett Co.	Shannon Co.	Washabaugh Co.	Washington Co.	John Day Area
Merychyus (*Metoreodon*) *relictus* (1)		T		X																					
M. (*M.*) *relictus fletcheri* (1a)	T[2]																								
M. (*M.*) *relictus taylori* (1b)			T																						
M. (*M.*) species undetermined (2)					X																				
Merychyus elegans (4)							X	X		X	X	T			X										
M. elegans bluei (4b)								X		T		X													
M. minimus (5)												X		X	T		X		X	X		X			
M. arenarum (1)													X		X		X			T	X				
M. arenarum idahoensis (1a)									T																
M. calaminthus (2)						T																			
M. siouxensis (6)															T	X	X		X						
M. crabilli (3)										T		X	X						X						
M. species undetermined (7)																		X							
Paramerychyus harrisonensis (1)																			T						
Paramerychyus relictus (2)																								T	
Oreodontoides oregonensis (1)																									T
?O. curtus (2)																							T		
Oreodontoides (*Paroreodon*) *marshi* (1)																									T
O. (*Paroreodon*) *stocki* (2)																									T

[1] "Lower Snake Creek" quarries include Echo, Humbug, East Ravine, Sheep Creek of 1921, Sinclair Draw (Q.2, Q.3, Q.4, Q.8, Q.9, Sand Q., Version Q., New Surface Q., West Surface Q., East Sinclair Draw, and West Sinclair Draw), and Grass Root Q.; "Sheep Creek" quarries include Long Q., Greenside Q., Thomson Q., Hilltop Q., and Thistle Q.; Dawes Co. localities include Pepper Creek area, Observation Q., and Ginn Q.

[2] T, Locality of holotype (and referred specimens when known).

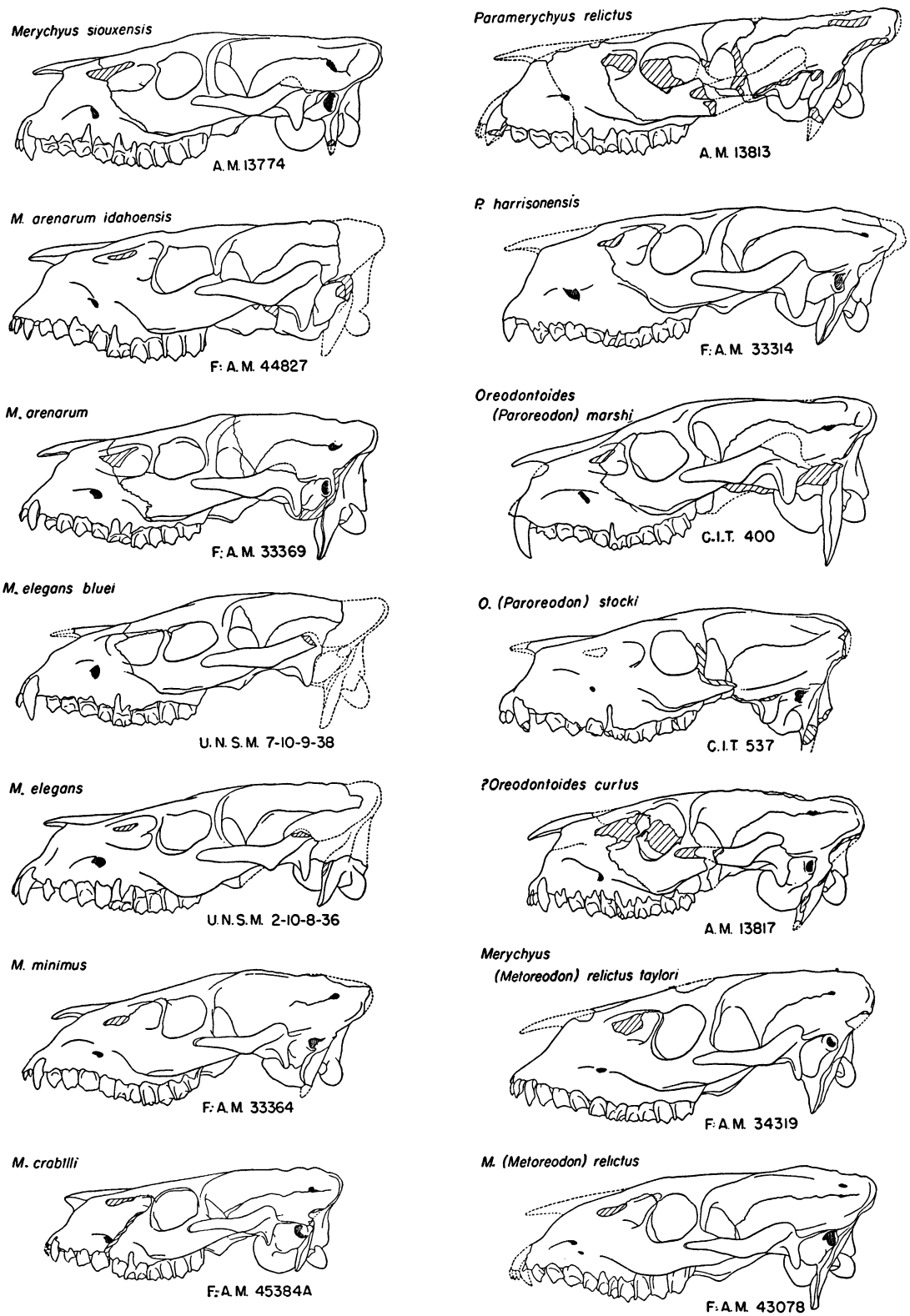

FIG. 1. Outlines of skulls representing five species and two subspecies of *Merychyus*, one species and one subspecies of *Merychyus* (*Metoreodon*), two species of *Paramerychyus*, one species of *Oreodontoides*, and two species of *Oreodontoides* (*Paroreodon*). $\times\frac{1}{3}$.

I. MERYCHYUS[1] LEIDY

Merychyus LEIDY, 1858, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 25; 1869, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 115. LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 30.

GENOTYPE: *Merychyus elegans* Leidy.

GENERIC CHARACTERS

SKULL: Small, basal length ranging from 123 mm. to 178 mm.; mesocephalic; supraoccipital wings fan-shaped, widely spread, and incorporated in the occipital flare, but the flare not so pronounced as in the genus *Ustatochoerus;* exoccipital pits roundish in outline but not so large as in *Ustatochoerus;* base of paroccipital process not completely incorporated in the fan-shaped region as in *Ustatochoerus* or *Merychyus* (*Metoreodon*) (see fig. 14); sagittal crest prominent but not high; brain case inflated; zygomatic arch light to medium light; lacrimal fossa prominent in Harrison forms and shallow in later species; prelacrimal vacuity present; infraorbital foramen either above posterior portion of P^3 or above P^4; nasals slightly retracted, extending posterior to the anterior of the orbits; premaxillae fused for a short distance; paroccipital process moderately long and heavy for size of skull; postglenoid process wide transversely, narrow anteroposteriorly, and long vertically; occipital condyles medium in size, but varying greatly in dimensions; bullae[2] with various degrees of flattening.

MANDIBLE: Small; moderately deep for size of skull; inferior border nearly straight with a slight downward curve just posterior to M_3; condyle of moderate size; symphysis prominent, posterior point below region of P_3–P_4.

DENTITION: Advanced brachyodont to subhypsodont; I_1^1 and I_2^2 approximately equal in size, with I_3^3 larger; superior canines vary in size from small to large; P_1 may be small or large.

LIMBS: Light to moderately heavy.

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1–7, 13 (skulls, mandibles, and dentitions); 14 (occipital regions of skulls); 15–17 (limbs).

DISCUSSION

The genus *Merychyus* has been a "catch all" for the smaller oreodonts from the Miocene. Forms with both subhypsodont and brachyodont dentitions have been referred to this genus. To add to the difficulties in the treatment of this group, the holotype of *M. elegans* Leidy, the genotypic species, is not complete, and, furthermore, the specimen itself is divided between the United States National Museum and the Academy of Natural Sciences of Philadelphia. The geologic age for the type specimen has been considered by many as Ogallala (Pliocene), but the large Frick and University of Nebraska State Museum collections from the Ogallala of Nebraska contain no examples of *Merychyus.* The writers believe that the type specimen came from the upper Marsland formation and base this belief on the fossilization of the type material compared with examples of the same species from the upper Marsland in the collections of the Frick Laboratory and the University of Nebraska State Museum.

The holotype of *M. elegans* was found by members of an expedition led by Lt. G. K. Warren in 1857. According to Hayden's report,[3] Warren's expedition reached the Niobrara River for the first time on August 10 and traveled along the river to the west until August 14 when their camp was 50 miles from their point of contact with the river. The map with the report, however, shows the distance between the camps of August 10 and 14 to be about 20 miles. The geologic deposits encountered between these camps were of both Miocene and Pliocene age. After August 14 the area through which the expedition passed contained chiefly Miocene sediments, and was the region from which the holotype of *Merycochoerus proprius*[4] came.

This suggests that *M. elegans* may have come from the area close to the locality of *Merycochoerus proprius*, which was near the

[1] Scott, W. B., 1890, Morph. Jahrb., vol. 16, pp. 340, 347, considered *Ticholeptus* a synonym of *Merychyus.*

[2] The bullae are rarely preserved. Perhaps a series of complete bullae would prove to be of diagnostic value.

[3] Hayden, F. V., 1863, Trans. Amer. Phil. Soc., new ser., vol. 12, p. 13.

[4] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 277.

present town of Marsland. It is also possible that the holotype was found farther east later in the same season, but, again, this would place the expedition along Antelope Creek, near what is now the Cherry-Sheridan county line, and in an area including some Miocene deposits.

The evidence now available indicates that the true *Merychyus* line is restricted to the middle portion of the Miocene (Harrison and Marsland formations or their equivalents). The absence of *Merychyus* in any of the present collections from the Gering and Monroe Creek formations may indicate that its ancestors migrated during late Harrison times into the regions here discussed.

The genus is represented by the subgenus *Metoreodon* in the later Miocene formations, such as the "Sheep Creek" and "Lower Snake Creek" deposits of Nebraska.

The two species of *Merychyus* from the lower Marsland, namely, *M. minimus* and *M. arenarum*, are difficult to differentiate when numerous skulls of both are considered. The former species is known throughout the lower Marsland and the latter from only the upper part of the lower Marsland. Although *M. minimus* is the smaller form, the measurements of the skulls and dentitions overlap those of the smallest examples of *M. arenarum*. The associated skeletal elements, however, indicate that *M. minimus* had lighter limbs than *M. arenarum*. These two species may represent forms close to the branching point of the main line of development, perhaps in late Harrison or very early lower Marsland times. This more progressive line (*M. arenarum*) with the heavier limbs gradually became distinct and separate from the more conservative, true *Merychyus*, light-limbed forms (*M. minimus* from the lower Marsland, and *M. elegans* from the upper Marsland deposits).

The remains of *Merychyus* show considerable individual variation in the size of the C/ and P_1, of the premolars, and of the limbs. The writers have tried to group the referred specimens into Group I (small premolars) and Group II (large premolars). The presence of large premolars does not necessarily mean that the over-all length of the dental series is greater than in examples with smaller premolars. The premolars in some specimens may be crowded and set more obliquely in the skull or ramus, resulting in a shortening of the total length. The grouping of the available material has been difficult because the dentitions are not always complete. Either group may have large or small C/ and P_1, and comparatively heavy or light limbs, which may indicate sex differences, the lighter limbs representing the females. In figure 13, four upper dentitions of *M. arenarum* show variations in the size of canines and premolars. Specimen F: A.M. 43277 illustrates a small C/ with large premolars, F:A.M. 43279 a large C/ with small premolars, F:A.M. 44581 a large C/ with large premolars, and F:A.M. 33392 a small C/ with small premolars.

Joseph Leidy,[1] in a discussion of the distinctive characters of *"Oreodon," Merycochoerus*, and *Merychyus* pointed out the following:

"MERYCHYUS.—Teeth as in Merycochoerus. Facial cone intermediate in character to the latter and Oreodon (?) Infraorbital foramen situated above the last premolar, or in a position intermediate to that of Oreodon and Merycochoerus."

G. T. Bettany,[2] who did not agree with Leidy's observations concerning the validity of *Merychyus*, made the following statement:

"Since the position of the infraorbital foramen varies in different species, the genus *Merychyus* may very well be dropped, as it is founded upon this single character. The teeth and portions of jaws assigned to *Merychyus elegans* and *medius* . . . appear to belong to *Oreodon*, while the teeth figured under the name *Merychyus major* are referable on equally good grounds to *Merycochoerus*."

In 1890, W. B. Scott[3] reported the abundance of *Merychyus* in the "Loup Fork" but failed to list any material. He did mention that the Garman collection in the Museum of Comparative Zoölogy at Harvard University contained some portions of the skeleton of *Merychyus* but, again, he did not specifically refer to any particular specimens.

[1] Leidy, Joseph, 1873, Rept. U. S. Geol. Surv. Terr., vol. 1, pt. 1, pp. 201–202.

[2] Bettany, G. T., 1876, Quart. Jour. Geol. Soc. London, vol. 32, p. 262.

[3] Scott, W. B., 1890, Bull. Mus. Comp. Zool., vol. 20, no. 3, pt. 2, pp. 72–76.

Later W. D. Matthew,[1] in a reconsideration of the validity of the genus *Merychyus*, concluded:

"This genus was constituted by Dr. Leidy in 1858 to embrace three species of Oreodonts from the Loup Fork of Nebraska, distinguished from *Oreodon* by the hypsodont teeth, and from *Merycochoerus* by the position of the infraorbital foramen. The subsequent reference to Leidy's genus *Merycochoerus* by Bettany and Cope of species now distinguished as *Promerycochoerus* seemed to show that the position of the infraorbital foramen was not a valid generic character. Mr. Bettany in consequence united *Merycochoerus* and *Merychyus*, and Prof. Cope, whose more complete material demonstrated the distinctness of the two, redefined the genus *Merychyus*, basing it on the presence of a larmier (lachrymal vacuity),—a character not known in any of Leidy's species, but found in two species from the Deep River of Montana and Wyoming. As is shown on a preceding page, the posterior position of the infraorbital foramen in the true *Merycochoerus* is correlated with the reduction of the nasals and other important skull changes caused by the presence of a proboscis. It seems to be a valid distinction, and in this case Dr. Leidy's original definition will hold good. The generic characters of chief importance will then be:

"1. Nasals unreduced (infraorbital foramen above p^3 or anterior end of p^4); premaxillae coössified.

"2. Skull rather short with slender zygomata and moderate occipital crests.

"3. Teeth hypsodont, muzzle more or less rounded, canines not large.

"4. Facial vacuity at junction of maxillary, frontal, and lachrymal bones (not known in type species).

"5. Limbs and feet slender, manus adaptively reduced."

At the time of the foregoing discussion, the type material, which was very incomplete, included about all of the available specimens. Later collections, however, show that *Merychyus elegans* does have a lacrimal pit, and that the two species "*M.*" *medius* and "*M.*" *major* do not belong to *Merychyus*, but to a distinct genus, *Ustatochoerus*.[2] The material also reveals that the position of the infraorbital foramina varies but slightly within one species.

In March, 1945, the writers had the opportunity of studying the types and reported oreodonts in the various Pacific coast collections. Several of the questionable oreodont specimens were observed and the following conclusions are here reported:

Referred to Cervids

Oreodont cf. *Merychyus*, Maxson, 1930, Carnegie Inst. Washington Publ., no. 404, p. 111, fig. 18a–18b

Posterior portion of left ramus with M_1 (br.[3]) and M_3	(M+[4])	U.C. coll. loc. 3555

Ticholeptus (?) sp., Dougherty, 1940, Carnegie Inst. Washington Publ., no. 514, p. 139, pl. 7, fig. 1

Badly crushed skull and mandible	(W)	C.I.T. 2550

Merycoidodont sp. *a*, Dougherty, *ibid.*, no. 514, p. 140, pl. 7, figs. 2–2a

A single M_2	(W‡)	C.I.T. 2548

Referred to Merycoidodontidae

Merycoidodont sp. *b*, Dougherty, *ibid.*, no. 514, p. 141, pl. 7, figs. 3–3a

A single M_1 with limb fragments	(W‡)	C.I.T. 2587

This specimen appears to be oreodont, but is too fragmentary for reference to a genus.

[1] Matthew, W. D., 1901, Mem. Amer. Mus. Nat. Hist., vol. 1, pt. 7, p. 418.
[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, *ibid.*, vol. 79, art. 1, pp. 16, 23.
[3] Abbreviations used in descriptions: alv., alveolus or alveoli; br., broken; erupt., erupting; rt., root or roots.
[4] Stage of wear of teeth: (I), immature; (M), mature; (W), worn.

Distribution

Merychyus remains are widely distributed. Six species and two subspecies are here recorded from middle Miocene deposits (Harrison and Marsland formations or their approximate equivalents) of California, Colorado, Idaho, Nebraska, Montana, South Dakota, and Wyoming. The subgenus *M. (Metoreodon)* is known from upper Miocene deposits ("Sheep Creek" and "Lower Snake Creek" or their approximate equivalents) of California, Nebraska, and New Mexico. (See distribution chart, p. 169.)

Summary of Species and Types

Six species and two subspecies of *Merychyus* from 16 Miocene localities are here recorded (of these only one species and one subspecies are from west of the Continental Divide):

1. *Merychyus arenarum* Cope, from east of Laramie Peak,? Platte County, Wyoming; referred remains from Platte and Goshen counties, Wyoming, Sioux County, Nebraska, and Bennett County, South Dakota; tentatively referred from Morrill County, Nebraska. (Lower Marsland or equivalent.)

Holotype: Partial skull, mandible, and skeletal fragments, A.M. 8146. Figures 2, 15, 17 (in part).

1a. *Merychyus arenarum idahoensis*, new subspecies, from Lemhi County, Idaho. (Approximate Marsland equivalent.)

Holotype: Skull and skeletal elements, F:A.M. 44827. Figures 1, 3, 15, 16, 17 (in part).

2. *Merychyus calaminthus* Jahns, from Los Angeles County, California. (Approximate Harrison equivalent.)

Holotype: Partial skull, C.I.T. 1383. Figure 13.

3. *Merychyus crabilli*, new species, from Morrill County, Nebraska; referred remains from Dawes County, Nebraska, and Niobrara County, Wyoming. (Harrison.)

Holotype: Skull, F:A.M. 45384A. Figures 1, 6, 14.

4. *Merychyus elegans* Leidy, from "the sands of the Niobrara River," Nebraska; referred remains from Box Butte, Cherry, and Dawes counties, Nebraska; and (4a) geographic variety from Weld and Logan counties, Colorado; tentatively referred from Sioux County, Nebraska. (Upper Marsland or approximate equivalent.)

Holotype: Anterior portion of skull and mandible, U.S.N.M. 121 or 438, A.N.S.P. 11289–11290. Figure 13.

4b. *Merychyus elegans bluei*, new subspecies, from Box Butte County, Nebraska; referred remains from Dawes County, Nebraska; tentatively referred from Weld County, Colorado. (Upper Marsland or approximate equivalent.)

Holotype: Partial skull, mandible, and skeletal elements, U.N.S.M. 7-10-9-38. Figures 1, 4, 15, 16, 17.

5. *Merychyus minimus* (Peterson), from Sioux County, Nebraska; referred remains from Sioux, Dawes, and Sheridan counties, Nebraska, Niobrara, Goshen, and Platte counties, Wyoming, and Shannon County, South Dakota. (Lower Marsland or equivalent.)

Holotype: Skull, mandible, and skeletal elements, C.M. 1466. Figure 5.

6. *Merychyus siouxensis* Loomis, from Sioux County, Nebraska; referred remains from Niobrara and Goshen counties, Wyoming; and (6a) geographic variety from Silver Bow County, Montana. (Harrison or approximate equivalent.)

Holotype: Skull, A.M. 13774. Figures 1, 7.

7. *Merychyus* species undetermined, from Lincoln County, Wyoming.

Example: Partial skull and mandible, Aug.C. V.120. Figure 7.

DETAILED LISTS[1] OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

MERYCHYUS

TOTAL AVAILABLE SPECIMENS[2]: 887

1. **Merychyus arenarum** Cope

From the lower Marsland of Platte County, Wyoming; referred specimens from Goshen County, Wyoming, Sioux County, Nebraska, and Bennett County, South Dakota; and tentatively referred from Morrill County, Nebraska

Merychyus arenarum COPE, 1884, Amer. Nat., vol. 18, p. 282 (no description or illustration); 1888, *ibid.*, vol. 22, pl. 27, fig. 1. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 217, fig. 160, pl. 32, figs. 1–3. SCOTT, 1890, Morph. Jahrb., vol. 16, pl. 13, fig. 7, pl. 16, figs. 30–32.

Merychyus arenarum arenarum COPE, 1884 (1885), Proc. Amer. Phil. Soc. Philadelphia, vol. 21, p. 540.

Merychyus arenarum leptorhynchus COPE, 1884 (1885), Proc. Amer. Phil. Soc. Philadelphia, vol. 21, p. 537. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 218, pl. 32, figs. 4–8.

Merychyus euryops (Cope) (*nomen nudum* Cope *in* Matthew), MATTHEW, 1899, Bull. Amer. Mus. Nat. Hist., vol. 12, art. 3, p. 73. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 228.

SPECIFIC CHARACTERS

SKULL: Larger and more massive than other species of genus; malar on the average deeper than that of *M. minimus;* postglenoid process narrow anteroposteriorly, but heavier than in *M. minimus;* occipital condyles varying in size, with average larger than in that species.

MANDIBLE: Longer, deeper, and more massive than average examples of *M. minimus;* condyle large; ascending ramus with less abrupt rise posterior to M_3 than in the above-mentioned species.

DENTITION: Superior and inferior series heavier and longer than in *M. minimus.*

LIMBS: Longer and more massive than in *M. minimus.*

MEASUREMENTS: Tables 1 and 2.
ILLUSTRATIONS: Figures 1–3, 13–17.

DISCUSSION

Average examples of this species and of *M. minimus* may be separated on the basis of the size of the skulls and mandibular rami. In actual measurements of the skulls and mandibles there is some overlapping, but when the limbs of an individual are present the two forms are readily separated. *M. arenarum* occurs mostly in the upper part of the lower Marsland, while *M. minimus* has been found throughout the lower Marsland. (See discussion, p. 172, of *M. arenarum* and *M. minimus* representing parallel lines.)

The massive limbs of *M. arenarum* seem to indicate the end of a line of development, i.e., from the lighter-limbed *M. minimus* and *M. elegans.* The writers have found no skull or dental characters upon which to base specific differences between *M. minimus* and *M. arenarum,* except for size. The similar characters and the stratigraphic occurrences of these two species may indicate the nearness to the point of division of the two lines (light and heavy limbed) with the light-limbed forms remaining the more conservative group and the heavy-limbed forms becoming more progressive, at least in size.

Diligent search for the name "*Merychyus euryops* Cope" has revealed that the first usage was in W. D. Matthew's list of the Cope Collection made in Philadelphia. The list is filed in the records of the American Museum of Natural History under the title, "Collection from Laramie Peak, by J. C. Isaac, 1880." Four specimens (A.M. 8142, 8143,[3] 8144, and 8145) are listed under the name "*Merychyus euryops*" and apparently were numbered after the collection arrived at the American Museum of Natural History in 1902.

Matthew[4] included "*Merychyus euryops*" in his classification, perhaps because of a note or name which Cope may have placed with the four specimens. Cope may have intended

[1] In many instances notations referring to individual variation or significant geologic data follow the listing of a specimen.

[2] A specimen includes all known associated material which definitely represents one individual. A single catalogue number is assigned to each specimen.

[3] Specimen A.M. 8143 was not located by the writers.

[4] Matthew, W. D., 1899, Bull. Amer. Mus. Nat. Hist., vol. 12, art. 3, p. 72.

to describe the material at some future time.

The U.N.S.M. oreodonts were collected by field parties from the University of Nebraska State Museum; the F:A.M. material was collected by John Lynch, Everett DeGroot, Gene Roll, Nelson J. Vaughan, and Charles H. Falkenbach; and other specimens were collected by persons noted in the descriptions of the localities.

Two hundred and four specimens are here recorded:

HOLOTYPE

Skull with P^3–M^3 (lacking portion anterior of P^3, and left zygomatic arch), partial mandible with I_1–M_3,[1] partial radius, partial ulna, partial tibia, and pes elements. (w+) — A.M. 8146 — From "East of Laramie Peak," ?Platte County, Wyoming; collected by J. C. Isaac
Figured by Cope, 1888, pl. 27, fig. 1; Thorpe, 1937, fig. 160, pl. 32, figs. 1–3
This paper, figs. 2, 15, 17 (in part)

The location "East of Laramie Peak," to which Cope referred in his type description, is probably the area north of Wheatland in Platte County, Wyoming. The Frick Laboratory has a large collection from this area referable to this species. The fossilization of the Frick specimens is similar to that of the material found by J. C. Isaac.

Fragments of an immature individual also are listed in the American Museum catalogue as belonging to the holotype, A.M. 8146. These fragments include the occipital wings of a skull, partial radius, ulna, and pes, together with other scraps.

The holotype is considered to belong to Group II (large premolars).

REFERRED FROM (A) TYPE AREA, (A′) WHEATLAND AREA, AND (A″) GUERNSEY AREA, PLATTE COUNTY, (B) GOSHEN COUNTY, WYOMING; (C) SIOUX COUNTY, NEBRASKA; (D) SOUTH DAKOTA; AND (E) TENTATIVELY REFERRED FROM MORRILL COUNTY, NEBRASKA

A. FROM TYPE LOCALITY
(Collected by J. C. Isaac)

GROUP I (SMALL PREMOLARS)

3 SKULLS, ETC.

Skull with I^1–M^3 (lacking left zygomatic arch) and mandible with I_1–M_3 (C/ and P_1 medium size). Figured by Thorpe, 1937, pl. 32, figs. 4–8. This paper, fig. 3 . . . . . (w+) — A.M. 8149

This specimen is the holotype of *M. arenarum leptorhynchus* Cope, but the writers consider it as belonging to Group I (small premolars) of *M. arenarum*. The skull compares favorably with referred material of *M. arenarum*, and is well within the expected individual variation of the species. As to the narrowness of the skull, some of this is due to crushing, but the referred material shows considerable variation in this character. The small premolars, compared with the larger ones of the holotype, illustrate the difference found throughout the *Merychyus* group, i.e., two groups, I, small premolars, and II, large premolars. The narrower skulls, including this specimen, suggest females, This has been observed in other oreodonts.[2] In *Merychyus*, however, most of the material is crushed so that the width of the skulls is of little value in making comparisons. The lighter limbs within a species seem to indicate females. In either group the C/ and P_1 may be large or small and the limbs light or heavy.

Partial skull with P^4–M^3, partial right ramus with I_3–/C rt. and P_1(br.)–M_3 (P_1 large), and fragments . . . . . (w‡‡) — 8169

[1] Until recently the right ramus was incorrectly restored in that no allowance was made for P_2. (See Thorpe, 1937, pl. 32, fig. 3.) The remaining portion of the left ramus, which has been missing for many years, has been located in the American Museum collection.

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 11, fig. 6.

		A.M.
Partial right maxilla with P^4(alv.)–M^1(br.) and partial mandible with /C–M_3 (P_1 large), partial radius, partial ulna, and fragments	(w)	8151

2 MANDIBULAR SPECIMENS

Partial mandible with I_3–M_2 (P_1 large)	(w)	8158
Partial left ramus with I_1–I_3 alv. and /C–P_4 (P_1 small)	(w+)	8160

GROUP II (LARGE PREMOLARS)

4 PARTIAL SKULLS, ETC.

Partial skull with C/–M^3(br.), partial mandible with I_1–M_3 (C/ and P_1 small), 3 partial scapulae, 3 partial humeri, 3 partial radii, 2 partial ulnae, femur, 2 tibiae (1 partial), manus and pes elements, etc.	(M+)	8142
Two individuals are represented under this number. Although the limbs are not completely prepared, enough is exposed to show individuals of slightly different limb lengths. The two specimens, however, are within the individual variation expected within a species.		
Partial skull with I^1–M^3 (C/–P^3 rt.) (C/ large), partial humerus, partial ulna, partial tibia, and manus and pes elements	(w+)	8145
Partial right and left maxillae with C/–M^2, partial mandible with I_2–M_3 (C/ and P_1 small), partial humerus, 2 radii (1 partial), partial ulna, partial femur, partial tibia, manus and pes elements, pelvis, and vertebrae	(w‡)	8152
Partial left maxilla with P^2–P^3	(w‡)	8163

GROUP QUESTIONABLE

FRAGMENTARY SKULL AND SKELETAL ELEMENTS

Fragments of skull and mandible (no dentition), partial radius, partial ulna, partial tibia, etc.		8168

6 PARTIAL SKULLS, ETC., IMMATURE

Partial skull with C/–dP^1–M^2, partial right ramus with dP_4(br.)–M_2, and limb fragments	(I)	8144
Anterior portion of skull with I^1–I^3 alv. and C/–dP^1–M^1, partial left ramus with I_1–I_3 alv. and /C(rt.)–dP_2–M_1 (P_1 alv.), and fragments	(I)	8148
Partial skull with dP^3(br.)–M^2, partial mandible with I_1(alv.)–dP_3–M_2 (erupt.) (I_2–P_2 rt.), and limb fragments	(I)	8155
Partial left and right maxillae with C/–P^2(erupt.)–M^2 (P^3–P^4 absent), partial mandible with P_3–P_4(germ)–M_2, and limb fragments	(I)	8156
Left premaxilla and partial left maxilla with I^1–I^3 alv. and C/–dP^1–M^1(br.) and partial mandible with /C–dP_2–M_2	(I)	8165
Partial right and left maxillae with dP^1(br.)–M^2(br.)	(I)	8166

3 MANDIBULAR SPECIMENS, IMMATURE

Partial mandible with dP_2–M_2(br.) and limb fragments	(I)	8150
Two partial right rami with		
P_1–dP_2–M_2	(I)	8161
dP_3–M_2(germ)	(I)	8162

A′. FROM UVA BREAKS, NEAR WHEATLAND, PLATTE COUNTY, WYOMING, 1932–1933 AND 1938

GROUP I (SMALL PREMOLARS)

9 SKULLS, ETC.

		F:A.M.
Skull with I^1–M^3 and mandible with I_3(rt.)–M_3 (C/ medium size). Figs. 1, 2, 14	(w+)	33369
Partial skull with C/–M^3 (C/ large)	(w‡)	33372

		F:A.M.
Partial skull with I^1–M^3 (C/ medium size)	(w‡)	33374
Partial skull with I^1–M^3 (C/ medium size)	(w‡‡)	33375
Posterior portion of skull with P^3–M^3	(M+)	34404
Partial skull with P^4–M^3	(W+)	34408
Very small individual.		
Posterior portion of skull with M^2(alv.)–M^3, partial mandible with I_1–I_3 alv. and /C–M_3 (P_1 small), astragalus, and calcaneum	(w‡+)	44584
Partial skull with C/(br.)–M^3(br.) (P^1–P^2 rt.), partial mandible with /C–M_3 (C/ and P_1 small), partial humerus, 2 radii, 2 partial ulnae, 2 partial femora, partial tibia, manus and pes elements, etc.	(w‡‡)	44625
Partial skull with P^1–M^3, partial mandible with /C–M_3 (P_1 small), partial humerus, 2 partial radii, 2 partial ulnae, partial femur, partial tibia, and pes elements	(W)	44627

2 MANDIBULAR SPECIMENS

2 partial mandibles with		
I_1–M_2(br.) (M_1 rt.) (P_1 small)	(w‡)	44416
I_1–M_3 (P_1 small)	(w‡)	44417

GROUP II (LARGE PREMOLARS)

9 SKULLS, ETC.

Partial skull with I^1–M^3, partial right ramus with I_2–M_3 (C/ and P_1 medium size), and limb fragments	(W)	33370
Skull with I^1–M^3 (C/ large)	(–M)	33377
Partial skull with C/–P^2 rt. and P^3–M^3 and partial mandible with P_4–M_3	(M)	34403
Partial right and left maxillae with M^1–M^3	(W)	44412A
Partial left ramus with P_3–M_3	(w‡)	44412B
The above two specimens were found associated.		
Posterior portion of skull with M^3 (rt.) and partial mandible with I_1–M_3 (P_1 large)	(M+)	44414
Left premaxilla and maxilla with C/–M^3 (C/ medium size)	(W)	44415
Partial skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 large), partial radius, partial ulna, and fragments of pes. Figure 13 (in part)	(M+)	44581
Anterior portion of skull with I^1(br.)–M^2 and partial mandible with I_1–M_3 (C/ and P_1 medium size)	(W)	44582
Partial skull with I^3–M^3 and mandible with /C(rt.)–M_3 (C/ and P_1 large)	(W+)	44583

4 MANDIBULAR SPECIMENS

3 partial mandibles with		
P_1(alv.)–M_3 (P_2 rt. and P_3 br.)	(M)	44568
/C–M_3 (P_1 large)	(M+)	44585
I_2–M_3 (P_1 large)	(W)	44586
Partial right ramus P_3–M_3	(w‡+)	44587

GROUP QUESTIONABLE

SKELETAL ELEMENTS

Radius, partial ulna, femur, 2 tibiae (1 partial), and pes elements		44418
Most of the skeleton, lacking skull and mandible		44526

4 SKULLS, ETC., IMMATURE

Inferior anterior portion of skull with C/–dP^1–M^2 and partial mandible with P_1(rt.)–dP_2–M_2	(I)	44645
Inferior anterior portion of skull with I^1–C/(erupt.)–dP^1–dP^4 and partial left ramus with dP_4–M_1	(I)	44646

		F:A.M.
Partial skull with P^1–dP^2–M^2(erupt.)	(I)	44647
Inferior anterior portion of skull with C/–dP^2–M^2(erupt.) and mandible with /C–dP_2–M_2(erupt.)	(I)	44649

4 MANDIBULAR SPECIMENS, IMMATURE

Partial mandible with M_1–M_3(germ), partial humerus, 2 radii (1 partial), 2 partial ulnae, and manus elements	(I)	44644
2 partial mandibles with		
I_1–dP_2–M_2	(I)	44648
P_1(br.)–dP_2–M_2	(I)	44659
Partial left ramus with I_2–I_3 alv. and /C–dP_2–M_2	(I)	44643

A″. FROM GUERNSEY AREA, PLATTE COUNTY, WYOMING, 1940–1941

GROUP I (SMALL PREMOLARS)

3 SKULLS, ETC.

		F:A.M.
Anterior portion of skull with I^1–M^2 (C/ small), radius, ulna, partial femur, partial tibia, pes elements, and pelvis	(w)	44433
Skull with C/–M^3 (C/ large), partial humerus, radius, partial ulna, etc.	(w)	44435
Partial skull with I^1–M^3 (C/ medium size) and partial tibia	(w+)	44596

GROUP II (LARGE PREMOLARS)

2 SKULLS, MANDIBULAR SPECIMENS, AND SKELETAL ELEMENTS

Skull I^1–M^3, partial left ramus with M_2(br.)–M_3 (C/ large), partial scapula, partial humerus, radius, ulna, partial tibia, and astragalus	(w‡)	44432
Partial skull with C/–M^3 (P^1–P^2 absent), partial mandible with P_1–M_3 (C/ and P_1 large), partial humerus, partial tibia, etc.	(w‡+)	44595

2 MANDIBULAR RAMI

Partial mandible with /C–M_3(br.) (P_1 large)	(w‡‡)	44440
Partial right ramus with P_1(rt.)–M_3	(w+)	44443

B. FROM GOSHEN COUNTY, WYOMING

FROM 12–15 MI. DISTRICT, 1931–1933:

GROUP I (SMALL PREMOLARS)

3 PARTIAL SKULLS, ETC.

		F:A.M.
Partial skull with P^3–M^3	(w+)	33386
Partial skull with I^1–M^3 (I^2 alv.) and partial mandible with P_3–M_3 (C/ and P_1 small). Fig. 13 (in part)	(w)	33392
Anterior portion of skull with C/–M^3 (P^1 alv.) (C/ medium size)	(w‡+)	34425

2 MANDIBLES, ETC.

2 partial mandibles with		
P_2(br.)–M_3	(w+)	44420
I_1–M_3 (P_1 small) and astragalus	(w‡+)	44590

GROUP II (LARGE PREMOLARS)

4 SKULLS, ETC.

Skull with I^1–I^2 alv. and I^3–M^3 and partial mandible with I_3–M_3 (C/ and P_1 large)	(w+)	33399
Anterior portion of skull with I^2–M^3 and partial mandible with I_3–M_3 (C/ and P_1 large)	(w)	44855

		F:A.M.
Skull with I^1–M^3, mandible with I_2–M_3 (C/ and P_1 large), 2 partial scapulae, 2 partial humeri, 2 radii, ulna, 2 femora (1 partial), 2 tibiae (1 partial), pes elements, partial pelvis, and vertebrae	(w)	44598
M^3 has a suggestion of an extra lobe on the posterior-internal side.		
Anterior portion of skull with P^1(br.)–M^3 and partial mandible with P_1–M_3	(w)	45368

MANDIBLE

Partial mandible with /C–P_1 rt. and P_2–M_3	(w‡)	444589

GROUP QUESTIONABLE

3 SKULLS

Partial skull with P^4–M^3	(w‡+)	43268
2 partial skulls, immature, with		
dP^2(br.)–M^3(germ)	(1)	44730
P^1–dP^2–M^2	(1)	44731

MANDIBLE

Partial mandible with I_1–I_3 rt. and /C–dP_2–M_3(erupt.)	(1)	44732

FROM THE 16 MI. DISTRICT, 16 MI. S.E. OF LUSK, E. SIDE OF U. S. HIGHWAY NO. 85, 1930–1939:

From the middle portion of the exposures:

GROUP I (SMALL PREMOLARS)

3 SKULLS, ETC.

Skull with C/–M^3 and mandible with /C–M_3 (C/ and P_1 large)	(w)	44533A
Anterior portion of skull with C/–M^3 and partial mandible with I_1–M_3 (C/ and P_1 large)	(w)	44533B
Radius, ulna, partial femur, 2 tibiae (1 partial), and manus and pes elements		44533A-B
The three foregoing listings were found associated in the field.		
Anterior portion of skull with I^1–C/ rt. and P^1–M^3(br.)	(w)	44553

2 MANDIBULAR RAMI

Partial mandible with I_1–M_3 (P_1 large)	(–M)	44541
Partial right ramus with I_2(rt.)–M_3 (I_3 alv. and /C rt.)	(w)	44609

From the high portions of the exposures:

GROUP I (SMALL PREMOLARS)

10 SKULLS, ETC.

Complete skull with I^1–M^3, complete mandible with I_1–M_3 (C/ and P_1 large), humerus, radius, ulna, 2 femora, tibia, manus and pes elements, pelvis, and vertebrae. Figures 13, 15, 16, 17 (in part)	(w‡+)	43279
Partial skull with P^2–M^3, partial mandible with /C–M_3 (P_1 small), partial scapula, 2 partial femora, 2 tibiae (1 partial), pes elements, pelvis, and vertebrae	(w‡‡)	43280
Complete skull with I^1–M^3, mandible with I_3(rt.)–M_3 (C/ and P_1 medium size), humerus, 2 radii, 2 ulnae, 2 femora (1 partial), 2 tibiae, manus and pes elements, partial pelvis, and vertebrae	(w+)	43282
Anterior portion of skull with I^3–M^3 (P^1 alv.), partial mandible with /C–M_3 (C/ and P_1 small), partial radius, partial ulna, manus elements, and vertebrae	(w‡+)	43283
Partial skull with I^1–M^3, partial right ramus with P_3–M_3 (C/ large), partial tibia, and fragments	(w+)	43284
Skull with I^3–M^3 (C/ large)	(w)	43285

		F:A.M.
Partial skull with P^2–M^3, partial mandible with I_3–M_3 (P_1 small), partial humerus, partial radius, partial femur, 2 tibiae (1 partial), etc.	(w‡+)	43288
Partial skull with C/–M^3, mandible with P_1–M_3 (C/ and P_1 large), partial humerus, partial radius, partial ulna, 2 partial femora, 2 partial tibiae, pes elements, and partial pelvis	(M)	43329
Right premaxilla and maxilla with I^2–M^3, partial mandible with I_1–M_3 (C/ and P_1 large), partial radius, partial ulna, partial femur, tibia, and pes	(W+)	44534
Posterior portion of skull with M^2–M^3, partial mandible with I_2–/C rt. and P_1–M_3 (P_1 small), 2 partial scapulae, 2 humeri, 2 radii, 2 ulnae, and manus elements	(w‡)	44535

Group II (Large Premolars)

14 skulls, etc.

Crushed skull with I^1–C/ rt. and P^1–M^3 and partial mandible with M_1(rt.)–M_3	(w)	43270
Crushed skull with I^1–I^3 alv. and C/–M^3 (C/ large)	(M+)	43272
Partial skull with C/–M^3, partial mandible with P_1–M_3 (C/ and P_1 large), astragalus, and calcaneum	(w)	43273
Posterior portion of skull with M^1(br.)–M^3, mandible with /C–M_3 (P_1 large), 2 partial femora, 2 tibiae (1 partial), metatarsal, etc.	(w)	43274
Skull with I^1(alv.)–M^3 (C/ large) and vertebrae	(w‡+)	43276
Skull with I^3–M^3, mandible with I_1–M_3 (C/ and P_1 large), 2 humeri, 2 radii, 2 ulnae, femur, tibia, manus and pes elements, pelvis, and vertebrae. Figures 13, 15, 16, 17 (in part)	(W+)	43277
Skull with I^1–M^3, partial mandible with I_1–M_3 (C/ and P_1 small), partial radius, 2 partial ulnae, partial femur, tibia, pes elements, and pelvis	(w‡+)	43281
Skull with I^1(alv.)–M^3, mandible with P_2–M_3 (C/ large), radius, partial ulna, and partial manus	(w‡)	43289
Partial right and left maxillae with P^2–M^3	(W+)	44422
Inferior portion of skull with C/–M^3 (C/ medium size), partial radius, partial ulna, partial femur, partial tibia, and partial pes	(w)	44569
Partial right and left maxillae with C/(rt.)–M^3 (P^3 rt.), partial mandible with /C–M_3 (P_1 small), partial scapula, 2 partial humeri, partial radius, partial ulna, femur, partial manus, and partial pelvis	(W+)	44571
Partial right and left maxillae with C/–M^3 and partial right ramus with P_1–M_2 (C/ large)	(W+)	44622
Anterior portion of skull with I^1–I^2 alv. and I^3–M^3 (P^1–P^2 absent) (C/ large)	(w‡‡)	44623
Fragments of skull with P^2(br.)–M^1(br.) and partial mandible with P_3(br.)–M_3 and limb fragments	(w‡)	44624

5 mandibular rami, etc.

2 partial mandibles with		
I_1–M_3 (P_1 large), partial humerus, partial radius, partial ulna, and partial tibia	(w)	44570
P_1(br.)–M_3 (P_1 large), partial femur, partial tibia, astragalus, and calcaneum	(M)	44572
Partial right ramus with P_4–M_3 and partial radius	(M+)	44536
2 partial left rami with		
P_1–M_3 (P_1 large)	(–M)	43351
I_2–P_2 alv. and P_3–M_3(br.)	(w)	43352

Group Questionable

partial skull and partial mandibular rami

Posterior portion of skull with M^2–M^3 and partial left ramus with M_3	(w)	43271

6 SKULLS, ETC., IMMATURE

		F:A.M.
Skull with dI^1–I^3–C/(germ)–dP^1–M^1 and mandible with P_1–dP_2–M_1, partial femur, partial tibia, etc.	(I)	44701
Skull with I^1–dP^1–M^2(germ)	(I)	44733
Partial skull with C/–dP^2–M^2	(I)	44734
Partial skull with C/–dP^2–M^2(erupt.) and partial mandible with /C–dP_2–M_2(br.)	(I)	44735
Partial skull with I^1–dP^1–M^1, mandible with I_1–P_1(erupt.)–dP_2–M_2(germ), 2 partial radii, 2 partial tibiae, manus and pes elements, etc.	(I)	44736
Partial skull with I^3–dP^2–M^3(germ), mandible with I_1–I_3(erupt.)–dP_2–M_3(germ), partial femur, tibia, pes, and partial pelvis	(I)	44762

MANDIBLE

Partial mandible with dI_1–P_1–dP_2–M_2br.	(I)	44737

FROM THE 18 MI. DISTRICT, 18 MI. S.E. OF LUSK, E. SIDE OF U. S. HIGHWAY NO. 85, 1932–1939:

From the middle portion of the exposures:

GROUP I (SMALL PREMOLARS)

3 SKULLS, ETC.

Partial skull with C/–M^3 and partial right ramus with M_1(br.)–M_3 (C/ large)	(W)	44425
Partial skull with P^2–M^3, partial mandible with P_3(br.)–M_3(br.) and metapodial fragments	(W)	44427
Partial skull with I^2–M^3, mandible with /C–M_3 (C/ and P_1 large), partial scapula, partial humerus, radius, partial ulna, 2 tibiae, manus and pes elements, and vertebrae	(W‡)	44579

GROUP II (LARGE PREMOLARS)

SKULL AND MANDIBLE

Skull with I^1–M^3 and mandible with I_3–M_3 (C/ and P_1 large)	(W‡)	44577

From the high portion of these exposures:

GROUP I (SMALL PREMOLARS)

3 PARTIAL SKULLS, ETC.

Partial skull with C/–M^3 and mandible with /C–M_3 (C/ and P_1 small)	(W)	44424
Partial skull with I^1–M^3 (P^3 alv.), mandible with P_1–M_3 (C/ and P_1 small), partial scapula, partial femur, partial tibia, etc.	(W)	44591
Anterior portion of skull with C/–M^3 (P^1 alv.) (C/ large), partial humerus, radius, ulna, partial femur, tibia, manus and pes elements, vertebrae, and pelvis	(W+)	45369

MANDIBLE

Partial mandible with I_1–M_3 (P_1 medium size)	(W‡+)	44580

GROUP II (LARGE PREMOLARS)

9 SKULLS, ETC.

Partial right and left maxillae with C/(rt.)–M^3 (P^1 alv.) and partial mandible with P_1–M_3 (P_1 medium size)	(W‡+)	34420
Partial skull with P^2(br.)–M^3 and partial mandible with P_4–M_3	(W‡)	44428
Left side of skull with I^2–M^3 (C/ large)	(M)	44429
Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 large), partial radius, partial ulna, manus elements, and vertebrae	(W)	44573

		F:A.M.
Anterior portion of skull with I^1–M^3 and partial mandible with /C–M_3(br.) (C/ and P_1 medium size)	(M)	44574
Partial skull with I^1–M^3 (I^2 alv., M^1 br.) (C/ medium size)	(W‡)	44575
Partial skull with P^2–M^3, partial humerus, and fragments	(W)	44576
Partial skull with P^1–M^3, partial mandible with /C–M_2 (P_1 large), 2 radii, 2 ulnae (1 partial), and 2 partial manus	(M)	44578
Partial skull with C/–P^2 br. and P^3–M^3, tibia, and partial pes	(W+)	44619

GROUP QUESTIONABLE

2 PARTIAL SKULLS AND MANDIBLES, IMMATURE

Partial skull with I^1–dP^1–M^2 and partial left ramus with /C–dP_2–M_2	(I)	44738
Anterior portion of skull with C/–dP^1–M^2 and partial mandible with /C–dP_2–M_2	(I)	44739

MANDIBLE

Partial mandible with dP_3–M_2(germ)	(I)	44693

From questionable level of these exposures:

GROUP I (SMALL PREMOLARS)

3 SKULLS, MANDIBLES, ETC.

Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 large), 2 humeri, 2 radii (1 partial), 2 ulnae (1 partial), partial femur, tibia, manus and pes elements, and vertebrae	(W‡)	33379
Skull with I^3–M^3, mandible with I_3–M_3 (C/ and P_1 large), partial humerus, partial ulna, tibia, and pes elements	(W)	34419
Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 large), 2 partial scapulae, 2 partial humeri, 2 radii, 2 ulnae, 2 partial femora, 2 tibiae (1 partial), manus and pes elements, partial pelvis, etc.	(W)	44542

GROUP II (LARGE PREMOLARS)

SKULL, MANDIBLE, ETC.

Skull with C/–M^3, mandible with /C–M_3, (C/ and P_1 large), 2 partial scapulae, 2 humeri (1 partial), 2 radii, 2 ulnae, femur, tibia, manus and pes elements, pelvis, vertebrae, and ribs	(W‡)	44617

FROM QUESTIONABLE LEVEL IN THE JAY EM DISTRICT, S.E. OF LUSK, E. SIDE OF U. S. HIGHWAY NO. 85, 1931–1941:

GROUP I (SMALL PREMOLARS)

2 MANDIBLES, ETC.

2 partial mandibles with /C(rt.)–M_3 (P_1 medium size)	(M+)	34422
/C–M_3 (P_1 small), partial humerus, and atlas	(W)	44421

GROUP II (LARGE PREMOLARS)

14 SKULLS, ETC.

Partial skull with I^1–I^2 rt. and I^3–M^3 (C/ large), partial humerus, partial radius, partial ulna, and fragments	(W)	33371
Skull with C/–M^3 (C/ medium size)	(W)	33373
Partial skull with I^1–M^3 and partial left ramus with P_4–M_3 (C/ large)	(W+)	33385
Partial skull with I^1–M^3 (P^1 rt.), partial mandible with I_1–M_3 (P_1–P_2 alv.) (C/ large), and fragmentary limb elements	(M)	33389
Partial skull with I^3–M^3 and partial mandible with I_2–M_3 (C/ and P_1 large)	(W‡+)	33390
Anterior portion of skull with I^2–M^3(br.) (C/ large) and partial pes	(W)	33398

		F:A.M.
Partial skull with I^1–M^3 and partial right ramus with P_4–M_3 (C/ medium size)	(w‡⁺)	34402
Partial skull with I^3–M^3 (C/ br.) and partial mandible with P_1–M_3 (C/ and P_1 large)	(M)	34427
Partial skull with I^1–M^3 (C/ br.) (C/ medium size)	(W+)	43240
Skull with I^1–M^3 (C/ br.), partial mandible with /C–M_3 (P_1 large), limb fragments, astragalus, and calcaneum	(W+)	43275
Partial skull with I^1–M^3, partial mandible with I_1–M_3(br.) (C/ br.), (C/ and P_1 very large), radius, partial ulna, partial manus, and vertebrae	(w‡⁺)	44607
Partial skull with I^1–I^2 rt. and I^3–M^3 (C/ medium size)	(–M)	44608A
Posterior portion of skull and partial mandible with I_1–M_3 (P_1 small)	(W+)	44608B
The above two specimens were found associated.		
Anterior portion of skull with P^1–M^2	(W)	44769

5 MANDIBULAR RAMI

3 partial mandibles with		
P_1–M_3 (P_1 large)	(W+)	34416
I_1–M_3 (P_1 medium size)	(w‡⁺)	34417
I_1–M_3(br.) (P_1 large)	(W+)	44630
Partial right ramus with P_1–M_3 (P_1 medium size)	(w‡⁺)	44430
Partial left ramus with /C(rt.)–M_3 (P_1 large)	(W)	44771

GROUP QUESTIONABLE

3 PARTIAL SKULLS

Fragments of skull with M^2(br.)–M^3	(M+)	44745
2 partial left maxillae with		
M^1–M^3	(W)	44766
P^4–M^3	(w‡‡)	44768

MANDIBULAR RAMUS

Partial left ramus with M_1–M_3	(W+)	44777

7 SKULLS, ETC., IMMATURE

Partial skull with C/(erupt.)–dP^1–M^1	(I)	44740
Skull with I^1–dP^1–M^2(erupt.) and mandible with /C–dP_2–M_2(erupt.)	(I)	44741
Skull with C/(rt.)–dP^1–M^2	(I)	44742
Partial skull with dP^1–M^2(erupt.)	(I)	44743
Skull with I^3–dC/–M^2, mandible with I_1–dP_4–M_3 (P_2–P_3 absent), partial scapula, partial humerus, partial radius, partial ulna, and partial manus	(I)	44744
Anterior portion of skull with C/–dP^1–M^2, partial mandible with P_1(alv.)–dP_2(rt.)–dP_3, partial scapula, partial humerus, and metacarpal	(I)	44746
Partial skull with P^1–dP^2–M^2	(I)	44748

2 MANDIBLES, IMMATURE

Partial mandible with I_1–I_3 alv. and /C(rt.)–dP_2–dP_4	(I)	44747
Partial mandible with P_1(br.)–dP_4–M_2 (P_2–P_3 absent) and partial manus	(I)	44682

FROM 25 MI. DISTRICT, 16 MI. S. AND 9 MI. E. OF LUSK, 1936:

GROUP I (SMALL PREMOLARS)

SKULL, ETC.

Partial skull with P^2–M^3, partial mandible with P_3–M_3, partial scapula, partial humerus, partial femur, 2 tibiae (1 partial), pes elements, etc.	(w‡)	34431

GROUP II (LARGE PREMOLARS)

3 SKULLS, ETC.

Partial skull with I^1–M^3 (C/ small)	(M)	43278

Partial skull with C/–M^3 (P^1–P^2 alv.) and partial mandible with I_1–M_3(br.) (P_1–M_2 absent) (C/ large)	(w‡)	F:A.M. 44588
Skull with I^3–M^3 (C/ br.), mandible with P_1–P_3 alv. and P_4–M_3, partial scapula, partial humerus, partial pes, and vertebrae	(w)	45376

GROUP QUESTIONABLE

PARTIAL SKULL AND MANDIBULAR RAMUS

Fragments of skull with M^1–M^3(br. and erupt.) and partial left ramus with M_1–M_3(erupt.)	(–M)	44758

SKULL AND MANDIBLE, IMMATURE

Partial skull with dP^1–M^2(erupt.) and partial mandible with dP_3(br.)–M_2	(I)	44749

FROM SAND GULCH (QUESTIONABLE LEVEL OF EXPOSURES), 18 MI. S.E. OF LUSK, W. SIDE OF U. S. HIGHWAY NO. 85, 1931:

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL

Anterior portion of skull with C/–M^3 (C/ large)	(w‡+)	44567

FROM RAWHIDE CREEK AREA; COLLECTED BY T. F. OLCOTT, 1906:

2 SKULLS AND MANDIBLES		C.N.H.M.
Crushed skull with I^2–P^1 rt. and P^2–M^3 and partial mandible with P_4–M_3	(w)	P 12230
Partial skull with P^1–M^3 and mandible with I_1(alv.)–M_3 (I_2–C/ rt.)	(w+)	P 12247

C. FROM SIOUX COUNTY, NEBRASKA

FROM S. OF HARRISON, 1937–1938:

GROUP I (SMALL PREMOLARS)

4 SKULLS, ETC.

Inferior anterior portion of skull with I^1–M^3, partial mandible with I_1–M_3 (C/ and P_1 large), partial radius, partial ulna, and partial manus	(w‡)	F:A.M. 44539
Partial skull with I^1–I^2 alv. and I^3–M^3 and partial right ramus with I_1–I_3 alv. and /C–M_3 (M_1 absent) (C/ and P_1 large)	(w‡)	44592
Partial skull with I^1–I^2 alv. and I^3–M^3, partial mandible with P_1–M_3 (C/ and P_1 small), radius, and partial ulna	(w‡)	44594
Partial skull with I^1–M^3, partial mandible with P_3(br.)–M_3 (C/ large), partial radius, 2 partial tibiae, and pes elements	(w‡)	44620

GROUP II (LARGE PREMOLARS)

MANDIBLE, ETC.

Partial mandible with P_1–M_3 (P_1 large), partial humerus, partial radius, partial ulna, partial tibia, and fragments	(w+)	44593

GROUP QUESTIONABLE

2 SKULLS, ETC., IMMATURE

Partial skull with dP^2–M^1	(I)	44751
Partial right and left maxillae with dP^3–M^1 and partial mandible with /C–P_1(erupt.)–dP_2–M_1	(I)	44752

MANDIBLE

Mandible with I_3–dP_4–M_2	(I)	44750

FROM N. OF AGATE, 1940:

GROUP I (SMALL PREMOLARS)

SKULL AND MANDIBLE

		U.N.S.M.
Partial skull with I^1–M^3 and partial mandible with I_1–M_3	(w‡)	5-10-9-40

The basal length of this skull is rather short.

D. FROM 2 MI. BELOW BIG SPRING, LITTLE WHITE RIVER, BENNETT COUNTY, SOUTH DAKOTA

(Collected by W. D. Matthew, 1903)

GROUP II (LARGE PREMOLARS)

SKULL, MANDIBLE, ETC.

		A.M.
Partial skull with P^1–M^3, partial left ramus with P_2–M_3 and skeletal elements not prepared	(w)	10885

E. TENTATIVELY REFERRED FROM N. OF BRIDGEPORT, MORRILL COUNTY, NEBRASKA

(Collected by University of Nebraska State Museum field parties, 1935–1937)

FROM BRIDGEPORT QUARRY 1:

2 MAXILLAE

		U.N.S.M.
2 partial right maxillae with		
P^1(alv.)–P^3)	(w‡+)	12-1-7-37 S.P.
M^2–M^3	(w‡)	13-1-7-37 S.P.

2 MANDIBULAR RAMI

2 partial left rami with		
P_2(rt.)–M_1	(w‡+)	25-1-7-37 S.P.
dP_2–M_1(alv.)	(r)	25-6-35 S.P.

FROM BRIDGEPORT QUARRY 5:

MAXILLA

Partial right maxilla with M^1–M^2	(w‡)	12-26-6-34 S.P.

FROM BRIDGEPORT QUARRY 11:

2 MANDIBULAR RAMI

2 partial left rami with		
P_1(alv.)–M_3 (M_2 br.) (Group II, large premolars)	(w)	6-10-9-40
I_1–P_3 alv. and P_4(br.)	(w‡)	7-10-9-40

1a. **Merychyus arenarum idahoensis,** new subspecies

From Miocene deposits (approximately equal in age to the Marsland of the Great Plains), Lemhi Valley, Lemhi County, Idaho

SUBSPECIFIC DESCRIPTION

SKULL: Characters similar to those in *M. arenarum*, but larger than average examples of that species.

MANDIBLE: Similar to that of *M. arenarum;* postsymphysis below anterior portion of P_4 (in *M. arenarum*, usually below posterior portion of P_3).

DENTITION: Series longer than average of *M. arenarum;* P^1–P^3 more laterally compressed and overlapping than in examples of that species.

LIMBS: Size and construction within the variation found in examples of *M. arenarum;* definitely of the robust line, not as in the lighter *M. elegans* group.

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1, 3, 15–17.

DISCUSSION

The new subspecies, although from west of the Continental Divide, does not differ greatly from *M. arenarum* of the Great Plains. The holotype, F:A.M. 44827, of this

subspecies was secured from the lower part of the deposits along the Lemhi Valley and a larger example, F:A.M. 44828, came from the same exposure, 25 feet above the site of the holotype. The holotype is larger than average examples of *M. arenarum*, and the referred specimen (F:A.M. 44828) is as large as any examples of this species from the Great Plains. A third specimen, belonging to Mr. Ralph Nichols of Salmon, Idaho, and deposited in the Montana State University at Missoula, is slightly smaller than the holotype. The geologic level of the third example is not known to the writers.

As far as the writers have been able to determine, this is the first time that fossils, resembling those of the Marsland, have been reported from the Lemhi Valley of Idaho. Mr. Ralph Nichols, while a student at the Montana State University, collected the first known material from this area. Dr. Charles Deiss of the University showed this collection to Charles H. Falkenbach and granted the Frick Laboratory the privilege of collecting in the Idaho area. At a later date it was found that Dr. John A. Wilson also had collected in the same area.

Associated with the material collected by Ralph Nichols was a maxilla referable to *Merycochoerus*. The specimen is not complete enough for specific identification.

Remains from Lemhi Valley in the Frick Laboratory collections were collected by Nelson J. Vaughan, Joseph Rooney, and Charles H. Falkenbach, 1942.

Six specimens are here recorded:

HOLOTYPE

Skull (lacking most of occipital region) with I^1–M^3, 2 humeri (1 partial), 2 radii (1 partial), partial ulna, partial manus, partial femur, tibia, partial pes, pelvis, and skeletal fragments. (w+) — F:A.M. 44827 — From Lemhi Valley, Lemhi County, Idaho. Figs. 1, 3, 15, 16, 17 (in part)

The holotype has a small C/, large premolars, and an abnormal M^3. The M^3 has an extra lobe or ridge on the posterior, internal side of the tooth. This, however, does not increase the length of the dental series, and is not considered as of specific value. (See fig. 3.)

REFERRED FROM TYPE AREA

SKULL AND SKELETAL ELEMENTS

Crushed inferior portion of skull with I^1–M^3 (C/ rt.), partial tibia, astragalus, and calcaneum. Large C/ and premolars.	(w‡+)	F:A.M. 44828

SKULL AND SKELETAL ELEMENTS, IMMATURE

Partial skull with I^1–dP^2–M^3(germ) (I^2 alv.), 2 partial humeri, 2 partial radii, 2 partial ulnae, partial tibia, calcaneum, partial manus, and skeletal fragments	(i)	44829

SKULL

Posterior portion of skull with M^3	(w‡+)	45419

MANDIBULAR RAMUS AND SKELETAL ELEMENTS

Fragment of right ramus with P_4, astragalus, partial calcaneum, atlas, and fragments	(w‡)	44830

SKULL AND MANDIBLE

Skull (lacking occipital region and right zygomatic arch) with I^1–I^2 alv. and I^3–M^3 and partial mandible with I_1–M_3 (M_1 br.). Fig. 3 (in part). Large C/ and small premolars.	(w)	U.M.

2. **Merychyus calaminthus** Jahns

From the Miocene deposits, Tick Canyon formation (approximately equal in age to the Harrison of the Great Plains), Los Angeles County, California

Merychyus calaminthus JAHNS, 1940, Carnegie Inst. Washington Publ., no. 514, paper 9, p. 187, fig. 9, pl. 1, figs. 2–3a, pls. 2, 3.

SPECIFIC CHARACTERS

SKULL: Small size; low and flat; supraoccipital wings widely spread, possibly less fan-shaped occipital region than in average *Merychyus* examples; brain case well inflated laterally with slight reduction of the postorbital restriction; very short and low sagittal crest; wide frontals; orbits somewhat oblong with anteroposterior axis; lacrimal fossa large but shallow; prelacrimal vacuity small; zygomatic arch with a rounded inferior border, curving upward on both sides of the orbit (a large depression on the side of the face above the dental series causes the zygomatic arch to appear as if it rises from the face almost at the contact of the premaxilla and maxilla); infraorbital foramen above P^3; postglenoid process very thin anteroposteriorly, wide transversely, with sloping external and internal borders. (Characters based on immature and fragmentary material.)

MANDIBLE: Moderately heavy construction; gradual increase posteriorly in depth of ramus; posterior border of ascending ramus with inward curve. (Characters based on immature material.)

DENTITION: Light; subhypsodont for a small *Merychyus;* superior premolars crowded, P^1–P^2 set at a slight angle to the alveolar border; external styles of molars moderately prominent. (Characters based on mature specimen.)

LIMBS: Slender construction, approximating small *Merychyus* from the Great Plains.

ILLUSTRATION: Figure 13.

DISCUSSION

Unfortunately all the skull remains, excepting one palate, are of immature individuals. The partial skull, C.I.T. 1382, was considered by Jahns[1] to be mature, but the present writers have examined this specimen and consider it immature, with dP^4–M^2 in place of M^1–M^3. All of the superior portions of the available skulls demonstrate that the skull is low and flat with a well-inflated brain case, and a very low and short sagittal crest. In many respects the immature cranium approaches the examples of *Oreodontoides*, but that genus lacks a facial vacuity. From the available material, the writers consider this species to be equal in geologic age to the species of *Merychyus* found in the Harrison formation of the Great Plains. (See further discussion of this species under *M. crabilli*, p. 190.)

In the type description Jahns also noted that P^4 has a spur projecting from the anterior surface of the internal wall of the tooth. The presence or absence of an anterior spur on P^4 may be attributed to individual variation.

Jahns further pointed out that cingula are present on P^4 and M^3 in "*M. delicatus*" and *M. minimus*, but absent in *M. calaminthus*. This character varies in individuals within a species. In the chart of measurements, Jahns gives the maximum length of skull C.I.T. 1829 as 126 mm., but the measurement is composite as it is based on two individuals. Taking into consideration the individual variation apparent within a species of *Merychyus*, this measurement is of questionable value. Jahns also stated that *M. calaminthus* differs from "*M. delicatus*" in having a facial or prelacrimal vacuity. The present writers consider "*M. delicatus*" in synonymy with *M. minimus* (see p. 205), and the latter species does have a facial vacuity. It is true that the original illustration of "*M. delicatus*" by Loomis[2] and by Thorpe[3] does not show this vacuity but the shaded area anterior to the orbit in the drawing is the location of the facial vacuity (see fig. 6).

Jahns[4] shows a comparative faunal list and indicates that *M. minimus*, *M. arenarum*, and *Merycochoerus proprius magnus* come from the "Upper Harrison," which is equal to the

[1] Jahns, Richard H., 1940, *ibid.*

[2] Loomis, Frederic B., 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 33, fig. 22.

[3] Thorpe, Malcolm R., 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 225, fig. 164, pl. 32, figs. 9–10.

[4] Jahns, Richard H., 1940, Carnegie Inst. Washington Publ., no. 514, paper 9, p. 175.

Marsland. The first two species just mentioned are found in the lower Marsland, and the third form comes from a horizon somewhat higher, perhaps in the lower part of the upper Marsland. *Merycochoerus matthewi* is found associated with *M. minimus* and *M. arenarum*, in the lower Marsland.

Seven specimens are here recorded:

HOLOTYPE

Partial skull with P^1–M^3. (w)	C.I.T. 1383[1]	From Tick Canyon formation, Los Angeles County, California Figured by Jahns, 1940, pl. 2, figs. 1–1a This paper, fig. 13

REFERRED BY JAHNS[2] FROM TYPE LOCALITY

		C.I.T.
Partial skull with dP^4–M^2; figured by Jahns, 1940, pl. 2, figs. 2–2a	(I)	1382
Partial skull and mandible; figured by Jahns, 1940, pl. 1, figs. 3, 3a, pl. 3	(I)	1829
Partial skull and mandible; figured in part by Jahns, 1940, pl. 1, figs. 2, 2a	(I)	1384
Partial mandible		1342
Miscellaneous teeth		2684
Partial left pes and tibia; figured by Jahns, 1940, fig. 9		2681

3. **Merychyus crabilli**,[3] new species

From the Harrison formation, Box Butte County, Nebraska; referred specimens from Dawes and Morrill counties, Nebraska, and Niobrara County, Wyoming

Description

SKULL: Smaller than that of *M. minimus* and considerably smaller than examples of *M. siouxensis* from the same formation; nasals light; prelacrimal vacuity very small; lacrimal fossa shallow, slightly deeper than in *M. arenarum* and *M. minimus;* infraorbital foramen above anterior portion of P^4; postglenoid process light; occipital condyles smaller than in examples of *M. minimus* and *M. siouxensis;* bulla well inflated with a somewhat flattened internal surface, large for size of the skull.

MANDIBLE: Light construction; inferior border with a gradual downward trend posteriorly; smaller than *M. minimus* and decidedly smaller than *M. siouxensis.*

DENTITION: Superior and inferior series crowded, with less over-all length than in examples of *M. minimus* or *M. siouxensis;* molar series approximately equal in length to those of *M. minimus.*

LIMBS: Short and light; smaller than examples of *M. minimus* and considerably smaller than examples of *M. siouxensis* (see figs. 15–17).

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1, 6, 13–17.

Discussion

Although no limbs are definitely associated with the holotypic skull and ramus, referred limb elements from the same quarry are illustrated. Figures 1, 5–7, 15–17 show the marked difference in size of the skulls, rami, and limb elements of *M. crabilli* and *M. siouxensis*, both from the Harrison formation, and *M. minimus* from the lower Marsland formation. The morphologic characters, substantiated by geologic evidence, suggest that *M. crabilli* represents the ancestor of *M. minimus.*

The material referred to this new species is remarkable in that it includes at least 20 individuals found associated (within two field blocks from one small quarry) with the holotype. This assemblage provides the best example of individual variation in the Merychyinae available at this time. This variation is discussed on page 262 and illustrated in charts 3 and 4.

The various associated specimens representing the genus *Merychyus* demonstrate the

[1] Jahns gives the holotype number as C.I.T. 1383, but on pl. 2, figs. 1 and 1a, the number is given as 1382. The latter number, however, is used for a second skull in the text and also on pl. 2.

[2] The specimens listed here were considered cotypes and paratypes by Jahns.

[3] Named in honor of Frank Crabill, who worked with the South Field Party of the University of Nebraska State Museum from 1929 to 1935.

variation of individuals within a species. Large or small superior canines and inferior first premolars may be present, as well as large or small premolar series (noted under individual listings). This is discussed in more detail under *Merychyus* on page 172.

Upon close examination of the available material it is evident that *M. crabilli* and *M. calaminthus* represent closely related species. The size and characters of the two forms are very similar. As the California material is incomplete and chiefly immature, however, and as the two collecting localities are geographically widely separated, the two species may best be considered as distinct from each other. Future discovery of additional material of *M. calaminthus* may demonstrate that *M. crabilli* is a subspecies or a geographic variant of the California form.

Fifty-five specimens are here recorded:

HOLOTYPE

Skull with I^1–I^3 alv. and C/–M^3 and left ramus with I_3(alv.)–M_3 (C/ and P_1 moderately small, premolars large). (M+)	F:A.M. 45384A	From the Harrison formation on the West Morava Ranch, 1 mi. S. and 8 mi. W. of Marsland, Box Butte County, Nebraska; collected by Ted Galusha, 1940 Figs. 1, 6, 14

REFERRED FROM (A) BOX BUTTE, (B) MORRILL, AND (C) DAWES COUNTIES, NEBRASKA; AND (D) NIOBRARA COUNTY, WYOMING

A. FROM WEST MORAVA RANCH, TYPE LOCALITY, BOX BUTTE COUNTY, NEBRASKA

(Collected by Ted Galusha, 1940)

NOTE: All material from the type locality was collected in two field blocks from one small quarry and was associated with the holotype. The premolars are large, except where stated.

FOUR SKULLS AND MANDIBULAR RAMI

Skull with I^1–I^3 alv. and C/–M^3 and right ramus with P_1–M_1 (C/ and P_1 small)	(W+)	F:A.M. 45384C
Inferior anterior portion of skull with C/–M^3 and right ramus with I_3–M_3 (C/ and P_1 moderate size). Fig. 13	(M+)	45384G
This specimen is illustrated to demonstrate the change in the antero-posterior length of the molar crowns as a result of wear.		
Inferior anterior portion of skull with C/–dP^1–M^2 and mandible with /C–P_1 alv. and dP_2(br.)–M_2	(I)	45384L
Anterior portion of skull with C/(erupt.)–dP^2–M^2 and left ramus with dP_2(br.)–M_2	(I)	45384M

13 SKULLS

5 skulls with		
I^1–I^3 alv. and C/(br.)–M^3 (P^1 alv.) (C/ small)	(W‡+)	45384B
I^1–I^3 alv. and C/–M^3 (P^1 alv.) (C/ moderate size)	(W+)	45384D
I^1–I^2 alv. and I^3–M^3 (C/ moderate size)	(W)	45384E
I^1–I^3 alv. and C/–M^3 (C/ and premolars small)	(W)	45384F
I^1–I^3 alv. and C/(erupt.)–dP^1–M^2	(I)	45384N
8 partial skulls with		
I^1–C/ alv. and P^1–M^3	(W+)	45384H
M^3	(W‡)	45384J
C/–M^3 (C/ small)	(M)	45384S
I^1–I^3 alv. and C/–dP^2–M^2	(I)	45384O
dP^1–M^2	(I)	45384P
I^1(alv.)–dP^2–M^3(germ)	(I)	45384Q
C/–dP^1–M^2	(I)	45384R
P^1–dP^2–dP^4(br.)	(I)	45384T

		F:A.M.
2 MAXILLAE		
Right maxilla with C/–P^1 alv. and P^2–M^3	(W+)	45384I
Left maxilla with dP^3–M^1	(I)	45384U
5 MANDIBULAR RAMI		
3 partial right rami with		
/C–dP_2 br. and dP_3–M_2	(I)	45384V
dP_3–M_2	(I)	45384W
M_1–M_2	(–M)	45384X
2 partial left rami with		
I_1–P_1 alv. and P_2–M_3	(W‡)	45384K
I_1–P_1 alv. and dP_2–M_3	(I)	45384Y
9 SKELETAL ELEMENTS		
3 humeri (1 partial). Fig. 15 (45384 Z4–Z5 only)		45384 Z4–Z6
2 radii		45384 Z7–Z8
Ulna		45384 Z9
3 femora (1 partial). Fig. 16 (45384 Z1–Z2 only)		45384 Z1–Z3

B. FROM 8 MI. N. OF BRIDGEPORT, MORRILL COUNTY, NEBRASKA

(Collected by A. C. G. Kaemphfer of Bridgeport, 1933)

		U.N.S.M.
SKULL		
Skull with I^1–M^3 (lacking superior occipital region (C/ small)	(W)	1-1-7-33 S.P.

C. FROM W. OF MARSLAND, DAWES COUNTY, NEBRASKA

		U.N.S.M.
MANDIBULAR RAMUS		
Partial right ramus with I_3–M_3	(W+)	3-28-7-34 N.P.

D. FROM NIOBRARA COUNTY, WYOMING

(Collected by John Lynch, Everett DeGroot, and Charles H. Falkenbach, 1931–1932)

FROM N. OF KEELINE, 1931–1932:

		F:A.M.
SKULL, MANDIBLE, AND ASSOCIATED SKELETAL ELEMENTS		
Partial skull with P^4–M^3, partial mandible with M_1–M_3, fore foot, astragalus, and atlas. Fig. 16 (in part)	(M+)	43391
PARTIAL SKULL, ETC.		
Anterior portion of skull with I^1–I^3 rt. and I^3–M^2 and fragment of left ramus (premolars large, C/ medium size)	(W)	44452
SKULL AND MANDIBLE, IMMATURE		
Skull with I^3–dP^2–M^1 and mandible with I_3–dP_2–M_1	(I)	44629
2 MAXILLAE		
Partial right maxilla with M^2–M^3	(W‡+)	44404
Partial left maxilla with M^1–M^3	(W)	44454
3 PARTIAL MANDIBULAR RAMI		
3 partial left rami with		
I_1–M_1 (P_1 large)	(W+)	43392
/C–M_3 (P_1 br.) (P_1–P_2 small, P_4 large)	(W‡+)	44457
P_1–M_3 (P_1–P_2 large)	(W‡+)	44458
4 MANDIBULAR RAMI, IMMATURE		
Partial mandible with /C–dP_2–M_2(germ)	(I)	44634
2 partial right rami with		
I_1–dP_2–M_1 (P_1 erupt.)	(I)	44631

		F:A.M.
dP_4–M_2(br.)	(I)	44632
Partial left ramus with /C(rt.)–dP_2–M_2(br.)	(I)	44633
PARTIAL SKULL AND SKELETAL ELEMENTS		
Occipital region of skull, 2 humeri (1 partial), 2 radii, 2 ulnae, 2 manus, and vertebrae. Figs. 15, 17		43393
FROM N. OF LUSK, 1931 AND 1933:		
MANDIBLE		
Partial mandible with P_4–M_3(br.)	(w‡+)	44455
FROM 77 HILL, N. OF MANVILLE:		
3 MAXILLAE		
Partial right maxilla with M^1–M^3(br.)	(w+)	44602
2 partial left maxillae with		
P^1–M^3	(w+)	44456
P^4–M^3	(w)	44601
FROM N. OF JERIAH:		
MANDIBULAR RAMUS		
Partial right ramus with I_1–P_3 (I_2–I_3 alv., P_1 rt.) (premolars large)	(w)	44603
FROM NEAR VAN TASSELL; COLLECTED BY FIELD PARTY FROM AMHERST COLLEGE, 1931:		
SKULL, MANDIBLE, AMD SKELETON		A.C.
Partial skull with C/–M^3, mandible with I_1–M_3, and mounted skeleton	(w‡)	1931–26

4. **Merychyus elegans** Leidy

From the upper Marsland formation, Nebraska; referred specimens from Dawes, Box Butte, and Cherry counties, Nebraska; tentatively referred specimens from Sioux County, Nebraska; and (4a) a geographic variety from Logan and Weld counties, Colorado

Merychyus elegans LEIDY, 1858, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, p. 25; 1869, Jour. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 118, pl. 11, figs. 1–11. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 226, pl. 31, figs. 5–8.

Merychyus paniensis LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 34, figs. 23–24.

Merychyus elegans paniensis (Loomis), THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 227, fig. 165, pl. 34, fig. 4.

SPECIFIC CHARACTERS

SKULL: Larger than that of *M. minimus*, approaching that of *M. arenarum* in size; bulla semi-depressed, somewhat as in *Merychyus* (*Metoreodon*). (See generic characters.)

MANDIBLE: Same size comparisons as skull. (See generic characters.)

DENTITION: Series larger than those of *M. minimus* and with a tendency to be larger than in *M. arenarum*, but with a certain amount of overlapping.

LIMBS: Closer to those of *M. minimus*, smaller and lighter than those of *M. arenarum*.

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1, 4, 13, 15–17.

DISCUSSION

This species is the genotype, upon which the generic characters were based. The horizon of the type specimen is discussed on page 171. The limb elements are known only from a few examples, but the available specimens are similar to those of *M. minimus* in structure and length, and decidedly smaller than those of *M. arenarum*. Presumably *M. minimus* gave rise to *M. elegans*.

The material from Colorado was referred to *M. elegans* by Matthew.[1] The writers agree with Matthew's determination that the Colorado specimens do not warrant separation as proposed by Loomis[2] under "*M. paniensis*," or by Thorpe[3] under "*M. elegans*

[1] Matthew, W. D., 1901, Mem. Amer. Mus. Nat. Hist., vol. 1, pt. 7, p. 419.

[2] Loomis, F. B., 1924, *loc. cit.*

[3] Thorpe, M. R., 1937, *op. cit.*, p. 227, fig. 164, pl. 34. fig. 4.

paniensis." Thorpe believed "*M. paniensis*" should be considered a geographic subspecies. The differences mentioned by both Loomis and Thorpe are well within the range of individual variation of *M. elegans*.

W. D. Matthew, Barnum Brown, and H. T. Martin collected the A.M. specimens; Ted Galusha the F:A.M. and F:B:A.M. material; and other collectors are noted in the descriptions of localities.

One hundred and fifty-five specimens are here recorded:

HOLOTYPE

Right maxilla with C/–M^3. (w)	A.N.S.P. 11290	From the "sands of the Niobrara River," upper Marsland formation of the Hemingford group (see discussion, p. 171); collected by Lt. G. K. Warren, 1857
Right ramus with I_1–/C alv. and P_1 (rt.)–M_3 (P_2 rt.). (w)	U.S.N.M. 121	Figured by Leidy, 1869, pl. 11; Thorpe, 1937, pl. 31; Leidy, figs. 2, 7; Thorpe, figs. 6, 8 This paper, fig. 13
Left maxilla with I^1(rt.)–M^3. (w)	U.S.N.M. 121 or 438	Leidy, figs. 1, 4, 11; Thorpe, figs. 5, 7
Left ramus with I_1–P_2 alv. and P_3–M_3. (w)	A.N.S.P. 11289	Leidy, fig. 5; Thorpe, fig. 6

The above four specimens represent a single individual. Leidy apparently divided them for preservation between the two institutions, the United States National Museum and the Academy of Natural Sciences of Philadelphia. Since the original illustrations were made, left ramus (A.N.S.P. 11289) has lost P_1 and P_2, and maxilla (U.S.N.M. 121 or 438) has lost I^3.

Thorpe's figure 6 is labeled U.S.N.M. 121, but this illustration represents the left ramus, A.N.S.P. 11289.

REFERRED FROM (A) TYPE AREA, (A′) DAWES, (B) BOX BUTTE, AND (C) CHERRY COUNTIES, NEBRASKA; (4a) GEOGRAPHIC VARIETY FROM (D) LOGAN AND (E) WELD COUNTIES, COLORADO

A. FROM TYPE AREA

MAXILLA AND MANDIBLE

Right maxilla with C/–M^3 and anterior portion of right ramus with I_1–P_4. (w)	U.S.N.M. 120	Figured by Leidy, 1869, pl. 11, figs. 3, 8, 9
Left ramus with I_1–I_2 alv. and I_3–M_2. (w)	U.S.N.M. 119 or 120	This paper, figs. 6, 10

The above two specimens represent one individual.

A′. FROM DAWES COUNTY, NEBRASKA

FROM N. OF HEMINGFORD, 1936–1940:

GROUP I (SMALL PREMOLARS)

3 SKULLS, ETC.

Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 large), partial scapula, partial humerus, radius, 2 partial ulnae, partial tibia, manus and pes elements, and fragments. Figs. 4, 15, 16	(w+)	U.N.S.M. 2-10-8-36 N.P.
The zygomatic arches are robust below the orbits and flare outwardly.		
Partial skull with I^1–M^3, partial mandible with I_1–M_2 (C/ and P_1 small), partial humerus, partial ulna, etc. Fig. 4 (in part)	(M+)	3-5-8-36 N.P.
Partial skull with C/–M^3 (C/ large), partial ulna, and fragments	(M)	5-5-8-36 N.P.

		U.N.S.M.
MAXILLA		
Partial left maxilla with P^2–M^3	(w)	5-3-8-36 N.P.
MANDIBLE		
Partial mandible with I_1–M_3 (P_1 small)	(w+)	4-2-7-36 N.P.
GROUP II (LARGE PREMOLARS)		
2 MANDIBULAR RAMI		
Partial right ramus with P_3(rt.)–M_2	(w)	9-10-9-40
Left ramus with I_1–M_3 (P_1 large)	(w)	6-5-8-36 N.P.
GROUP QUESTIONABLE		
SKULL, MANDIBLE, AND SKELETAL ELEMENTS, IMMATURE		
Skull with I^1–dP^2–M^3(erupt.), mandible with I_1(alv.)–dP_2–M_3(erupt.), 2 partial humeri, 2 radii, 2 ulnae, partial femur, manus and pes elements, vertebrae, and ribs	(i)	2-5-8-36 N.P.
MANDIBULAR RAMUS, IMMATURE		
Partial left ramus with P_1(rt.)–dP_2–M_2	(i)	2-3-8-36 N.P.
FROM N.E. OF HEMINGFORD, 1939–1940:		
GROUP I (SMALL PREMOLARS)		
MAXILLA		
Partial left maxilla with C/–M^1(br.) (C/ large)	(w‡)	8-10-9-40
GROUP QUESTIONABLE		
MANDIBLE, IMMATURE		
Partial mandible with /C–dP_3–M_3(erupt.) (P_2 absent)	(i)	33-10-9-39
FROM N. OF MARSLAND, 1935:		
GROUP I (SMALL PREMOLARS)		
RIGHT AND LEFT MAXILLAE		
Partial right and left maxillae with P^1–M^3(br.)	(w)	1-7-5-35 N.W.P.
FROM N.E. OF MARSLAND, 1934 AND 1937:		
GROUP II (LARGE PREMOLARS)		
SKULL AND MANDIBLE		
Partial skull with I^1–M^3 and partial mandible with P_4–M_3 (C/ large) The zygomatic arches are robust below the orbits and flare outwardly.	(m)	1-31-5-37 N.P.
MANDIBULAR RAMUS		
Partial left ramus with /C(br.)–M_3 (M_3 with split heel) (P_1 large)	(w)	7-18-8-34 N.P.
FROM DUNLAP CAMEL QUARRY, N.E. OF HEMINGFORD, 1937:		
GROUP I (SMALL PREMOLARS)		
2 MANDIBULAR RAMI		F:A.M.
Mandible with I_1–/C alv. and P_1(rt.)–M_3	(w)	44786
Partial left ramus with P_2–M_3	(w‡)	44787
GROUP II (LARGE PREMOLARS)		
SKULL		
Partial skull with C/–M^3 (C/ large)	(w‡)	43338

MANDIBULAR RAMUS

		F:A.M.
Partial left ramus with P_2–M_3	(w‡‡)	43340

GROUP QUESTIONABLE

3 MAXILLAE

2 partial right maxillae with		
M^1–M^2	(w)	37219
M^1–M^2	(m)	43339
Partial left maxilla with P^3–M^1	(w)	43341

SKULL, IMMATURE

Partial skull with P^1–dP^2–M^2	(i)	37204

3 MANDIBULAR RAMI

Partial right ramus with P_1–P_2 alv. and P_3–M_2(br.) (P_4 alv.)	(w)	43343
Partial right ramus with dP_3–M_2(br.)	(i)	37220
Partial left ramus with P_2–P_4 alv. and M_1–M_3(br.)	(w)	43342

FROM "A QUARRY," 1937:

GROUP I (SMALL PREMOLARS)

2 MANDIBULAR RAMI

		F:B:A.M.
2 partial left rami with		
P_2(alv.)–M_1(rt.) (P_3 br.)	(w+)	44782
I_1–P_1 alv. and P_2–P_3	(w)	44783

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial left ramus with P_2(br.)–P_4	(w)	33658

GROUP QUESTIONABLE

MAXILLA, IMMATURE

Partial right maxilla with dP^4–M^1	(i)	33645

FROM "B QUARRY," 1937:

GROUP I (SMALL PREMOLARS)

2 MAXILLAE

2 partial left maxillae with		
P^4–M^3	(w+)	34334
P^3–M^3(br.)	(w+)	37205

2 MANDIBULAR RAMI

Partial right ramus with P_1–P_4 (P_1 small)	(w)	33644
Partial left ramus with /C–P_2 alv. and P_3–P_4	(w)	44823

GROUP II (LARGE PREMOLARS)

MAXILLA

Partial left maxilla with P^1(alv.)–M^1	(w‡)	33640

GROUP QUESTIONABLE

MAXILLA, IMMATURE

Partial left maxilla with dP^2–M^1	(i)	34323

2 MANDIBULAR RAMI

		F:B:A.M.
Partial left ramus with P_1–P_4 alv. and M_1–M_2	(W)	34330
Partial left ramus with dP_4(br.)–M_2(br.)	(I)	44824

FROM ANTELOPE VALLEY, 1937:

GROUP II (LARGE PREMOLARS)

2 SKULLS, ETC.

		F:A.M.
Partial skull with C/(rt.)–M^3, partial mandible with I_1–I_3 alv. and I_3(rt.)–M_3 (P_1 medium size), 2 partial humeri, radius, partial ulna, etc.	(W+)	44821
The M^3 heel is enlarged, approaching a third lobe in size.		
Partial skull with C/(br.)–M^3(br.)	(M+)	44822

FROM N.E. OF DUNLAP, 1936:

GROUP I (SMALL PREMOLARS)

PARTIAL SKULL, MAXILLA, AND MANDIBULAR RAMUS

		F:B:A.M.
Left side of skull with C/–M^3 and left ramus with I_1–M_3 (C/ and P_1 large)	(W)	34290A
Right maxilla with P^1–M^3	(W)	34290B
These two specimens were found associated and may represent one individual. There is, however, a slight difference in the wear of the teeth.		

ANTERIOR PORTION OF SKULL

Anterior portion of skull with I^1–I^3 alv. and C/(br.)–M^3(br.) (P^1 alv.)	(W‡)	34312
The zygomatic arches are robust and flare outwardly below the orbit.		

GROUP QUESTIONABLE

PARTIAL SKULL AND MANDIBLE, IMMATURE

Partial skull with P^1–dP^2–M^3 and mandible with I_1–/C alv. and P_1–dP_2–M_2	(I)	34314

FROM WOODS CANYON, 1935 AND 1937:

GROUP QUESTIONABLE

SKULL AND MANDIBLE, IMMATURE

Skull with I^1–dP^2–M^3(erupt.) and partial mandible with I_1–dP_2–M_3(germ)	(I)	33634

PARTIAL MAXILLA, IMMATURE

Partial right maxilla with C/(erupt.)–dP^1–dP^4(rt.)	(I)	37210

FROM SAND CANYON QUARRY, SAND CANYON LOCALITY,[1] 1937 AND 1939:

GROUP I (SMALL PREMOLARS)

PARTIAL SKULL AND MANDIBLE

Left anterior portion of skull with I^3(rt.)–M^3 (C/ br.) and mandible with I_1–M_3 (C/ and P_1 small)	(W)	33636

ANTERIOR PORTION OF SKULL

Anterior portion of skull with I^1–M^3 (C/ small)	(W)	44780

GROUP QUESTIONABLE

MANDIBULAR RAMUS

Partial left ramus with M_1–M_3	(W+)	37222

[1] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 217.

FROM PEBBLE CREEK, NEAR DUNLAP, 1937–1938:

GROUP QUESTIONABLE

		F:B:A.M.
PARTIAL MAXILLA		
Partial left maxilla with M^3	(W)	37212
ANTERIOR PORTION OF SKULL, IMMATURE		
Anterior portion of skull with C/–dP^1–M^1	(I)	44825
MANDIBULAR RAMUS, IMMATURE		
Partial left ramus with I_1(alv.)–P_1(erupt.)–dP_2–M_1	(I)	37217

FROM NEAR MARSLAND; COLLECTED BY FRANK FIGGINS AND NELSON J. VAUGHAN, 1927:

GROUP I (SMALL PREMOLARS)

		Col. M.
PARTIAL SKULL		
Anterior portion of skull with I^1–M^3 (C/ medium size)	(–M)	1–10
2 MANDIBULAR RAMI		
Partial right ramus with P_4–M_3	(M)	1–19
Left ramus with I_2–/C alv. and P_1–M_3 (P_1 large)	(W+)	2–1927

GROUP QUESTIONABLE

LIMB ELEMENTS		
Partial femur, 2 tibiae, etc. Figure 17 (tibia only)		2–31, 34

FROM POTTER QUARRY (SAND CANYON DRAINAGE SYSTEM), 1937:

GROUP I (SMALL PREMOLARS)

		F:A.M.
MANDIBULAR RAMUS		
Partial left ramus with I_2–/C alv. and P_1(br.)–M_2 (br.) (P_2 alv., P_4 br.)	(–M)	43386

GROUP II (LARGE PREMOLARS)

MAXILLA		
Partial left maxilla with P^1(rt.)–M^2	(W)	37207

GROUP QUESTIONABLE

4 MAXILLAE		
2 partial right maxillae with		
P^1–P^4 alv. and M^1–M^2(br.)	(W‡)	37208
C/(alv.)–dP^1–M^1	(I)	43385
2 partial left maxillae, immature, with		
C/–dP^2–M^2/(erupt.)	(I)	37206
C/(erupt.)–dP^1–dP^2	(I)	37213
MANDIBULAR RAMUS		
Partial left ramus with I_2–/C alv. and dP_1–dP_3	(I)	37216
HUMERUS		
Partial humerus		43387

B. FROM BOX BUTTE COUNTY, NEBRASKA

FROM HEMINGFORD QUARRY 2, N. OF HEMINGFORD, 1936–1938:

GROUP QUESTIONABLE

		U.N.S.M.
MAXILLA		
Partial left maxilla with M^2–M^3	(M+)	55-77-38

FROM HEMINGFORD QUARRY 3, N.E. OF NONPAREIL:

GROUP I (SMALL PREMOLARS)

2 MANDIBULAR RAMI		U.N.S.M.
Partial right ramus with P_3(br.)–M_3	(W)	2-17-9-36 S.P.
Partial left ramus with /C–P_2 rt. and P_3–M_3	(W)	3-3-8-37 S.P.

FROM S.W. OF HEMINGFORD QUARRY 4, N.W. OF HEMINGFORD, 1937–1940:

MANDIBULAR RAMUS, IMMATURE		
Partial right ramus with P_1–dP_2–M_2	(I)	10-10-9-38

FROM HEMINGFORD QUARRY 7B, N.W. OF HEMINGFORD:

GROUP I (SMALL PREMOLARS)

SKULL		
Skull with I^1(alv.)–M^3 (C/ medium size)	(W)	2-10-9-39

4 PARTIAL MAXILLAE		
4 partial right maxillae with		
P^2–M^2	(W+)	4-10-9-39
P^1–P^4	(W)	5-10-9-39
C/–P^3 (P^1 br.), (C/ large)	(W+)	6-10-9-39
P^1–P^3	(W+)	7-10-9-39

4 MANDIBULAR RAMI		
3 partial right rami with		
P_2–M_2	(W+)	295-7-8-37 S.P.
P_1(alv.)–M_3	(W‡)	10-10-9-39
P_1–M_3(br.) (P_2 alv.) (P_1 large)	(W)	11-10-9-39
Partial left ramus with P_2–P_4	(W+)	20-10-9-39

GROUP II (LARGE PREMOLARS)

SKULL		
Partial skull with P^1(rt.)–M^3 (P^2 br.)	(W)	1-10-9-40

4 MAXILLAE		
2 partial right maxillae with		
C/–P^1 rt. and P^2–M^3	(W+)	3-10-9-39
C/(alv.)–P^4	(W)	8-10-9-39
2 partial left maxillae with		
P^1–M^3	(W)	9-10-9-39
P^1–P^4(br.)	(W‡)	36-10-9-39

7 MANDIBULAR RAMI		
Partial right ramus with I_1–/C alv. and P_1–M_3(br.) (P_1 small)	(W‡)	12-10-9-39
6 partial left rami with		
I_1–P_2 alv. and P_3(br.)–M_3	(W‡+)	1-10-9-39
I_2–P_1 alv. and P_2–M_3	(W‡)	14-10-9-39
P_1–M_3 (P_2 alv.) (P_1 small)	(W‡)	15-10-9-39
I_1–P_2 alv. and P_3–M_3	(W‡)	16-10-9-39
I_1–I_3 alv. and /C–M_2 (P_1 large)	(W)	17-10-9-39
P_2–M_1	(W‡+)	18-10-9-39

GROUP QUESTIONABLE

7 MANDIBULAR RAMI		
3 partial right rami with		
M_2–M_3	(W‡)	82-7-8-37 S.P.

		U.S.N.M.
M_2–M_3	(w‡)	185a-7-8-37 S.P.
P_4–M_3(br.) (M_2 br.)	(w‡+)	13-10-9-39
Partial right ramus, immature, with dP_2(rt.)–M_2	(I)	185b-7-8-37 S.P.
3 partial left rami with		
M_1–M_3	(w‡)	34-7-8-37 S.P.
M_1–M_2	(w+)	2-10-9-38
M_1(br.)–M_3	(w‡)	19-10-9-39

FROM N.E. OF HEMINGFORD QUARRY 7B, 1938–1939:

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial left ramus with P_1–M_1(br.) (P_1 small). The premolars are very crowded.	(w‡)	39-10-9-39

FROM N.E. OF HEMINGFORD QUARRY 8, N. OF HEMINGFORD, 1938:

GROUP II (LARGE PREMOLARS)

MANDIBLE

Partial mandible with I_3–M_3 (P_1 large)	(w+)	8-10-9-38

FROM S.W. OF HEMINGFORD QUARRY 9A, N.E. OF HEMINGFORD, 1939:

GROUP II (LARGE PREMOLARS)

2 SKULLS, ETC.

Partial skull with P^3(br.)–M^3 (pronounced split heel)	(w)	32-10-9-39
Partial skull with I^1–M^3, partial mandible with I_1(rt.)–M_3(br.) (M_1 br.) (C/ and P_1 large), radius, partial ulna, and partial femur	(w+)	789-39

MANDIBULAR RAMUS

Partial left ramus with P_1(rt.)–M_3(br.)	(w‡+)	34-10-9-39

FROM HEMINGFORD QUARRY 11B, N.E. OF HEMINGFORD, 1939:

GROUP I (SMALL PREMOLARS)

MAXILLA

Right maxilla with P^1–M^3	(w+)	21-10-9-39

MANDIBULAR RAMUS

Partial right ramus with I_3(alv.)–M_1(rt.) (/C and P_1 br.)	(w)	23-10-9-39

GROUP QUESTIONABLE

MAXILLA

Partial right maxilla with M^1–M^3	(w+)	22-10-9-39

FROM HEMINGFORD QUARRY 12A, N.E. OF HEMINGFORD, 1939:

GROUP I (SMALL PREMOLARS)

MAXILLA

Partial right maxilla with C/(rt.)–M^1	(w)	24-10-9-39

GROUP QUESTIONABLE

MAXILLA

Partial right maxilla with M^1–M^2	(w‡)	25-10-9-39

FROM S.E. OF HEMINGFORD QUARRY 12A, 1939:

GROUP II (LARGE PREMOLARS)

MAXILLA

		U.N.S.M.
Left maxilla with C/(br.)–M^3	(w‡+)	6-10-9-39

MANDIBLE

Mandible with $I_{\overline{2}}$–M_3 (P_1 medium size) This specimen is rather robust.	(w‡+)	30-10-9-39

GROUP QUESTIONABLE

MANDIBULAR RAMUS

Partial left ramus with /C–P_3 alv. and dP_4–M_3(germ)	(I)	35-10-9-39

FROM HEMINGFORD QUARRY 12C, N.E. OF HEMINGFORD, 1938:

MANDIBULAR RAMUS, IMMATURE

Partial right ramus with $I_{\overline{2}}$–P_1 alv. and dP_2(br.)–M_1	(I)	9-10-9-38

FROM HEMINGFORD QUARRY 12D, N.E. OF HEMINGFORD, 1937–1941:

GROUP I (SMALL PREMOLARS)

MAXILLA

Partial left maxilla with P^1–P^2(br.) and P^3–M^1 alv.	(w‡)	27-10-9-39

3 MANDIBULAR RAMI

2 partial right rami with		
P_3(alv.)–M_3(br.)	(w+)	117-13-8-38 N.P.
I_1–P_1 alv. and P_2(br.)–M_3 (P_3 br.)	(w‡)	2-10-9-41
Partial left ramus with I_1–/C alv. and P_1–M_3 (P_1 large)	(w‡)	53-5-11-37

GROUP II (LARGE PREMOLARS)

2 PARTIAL SKULLS

Partial skull with I^1–M^3	(w)	1-11-9-39
Anterior portion of skull with I^1(alv.)–M^3 (C/ medium size)	(w)	26-10-9-39

MAXILLA

Partial right maxilla with P^2(br.)–M^3	(M+)	2-10-9-40

4 MANDIBULAR RAMI

3 partial right rami with		
/C–M_3 (P_1 small)	(w‡+)	11-8-38 N.P.
P_1–M_3 (P_1 large)	(w)	28-10-9-39
/C–M_3 (P_2 alv.) (P_1 large)	(w)	1-10-9-41
Partial left ramus with P_4–M_3	(w)	105-13-8-38

GROUP QUESTIONABLE

MAXILLA

Partial left maxilla with M^1–M^3	(w+)	86-27-10-37

FROM HEMINGFORD QUARRY 17, N.E. OF HEMINGFORD, 1938:

GROUP II (LARGE PREMOLARS)

2 MAXILLAE

Right maxilla with P^1(alv.)–M^3(br.)	(w+)	3-10-9-38
Left maxilla with P^1–M^3 M^3 has a small third accessory interior-posterior lobe, external-posterior style, exceptionally large.	(w)	4-10-9-38

GROUP QUESTIONABLE

PARTIAL SKULL AND MANDIBLE, IMMATURE

Anterior portion of skull with P^1–dP^2–M^2 and partial mandible with P_1–dP_2–M_3(germ) . . . . . (I) 5-10-9-38

FROM HEMINGFORD QUARRY 21, S.W. OF MARSLAND, 1940:

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial left ramus with P_1–M_3 (P_1 small) . . . . . (W‡) 4-10-9-40

FROM HEMINGFORD QUARRY 23, S.W. OF MARSLAND, 1935:

GROUP QUESTIONABLE

MAXILLA, IMMATURE

Right maxilla with P^1–dP^2–M^2 . . . . . (I) 7-19-7-35 N.W.P.

TIBIA

Partial tibia . . . . . 7-11-7-35 N.W.P.

FROM N.E. OF HEMINGFORD, 1939:

GROUP I (SMALL PREMOLARS)

MAXILLA

Partial left maxilla with P^4–M^3 . . . . . (M+) 37-10-9-39

FROM W. MARSLAND REGION, 1940:

GROUP I (SMALL PREMOLARS)

2 MAXILLAE, ETC.

		F:A.M.
Partial right maxilla with P^1(alv.)–M^1(alv.) (P^2 and P^4 br.) and partial right ramus with I_1–/C alv. and P_1–P_3(alv.) (P_2 alv.) (P_1 small)	(W‡)	44784
Partial right maxilla with C/–P^2 (C/ large)	(W+)	44785

C. FROM CHERRY COUNTY, NEBRASKA

FROM W. OF POLE CREEK; COLLECTED BY MORRIS SKINNER AND ASSOCIATES, 1938:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS F:A.M.

Partial left ramus with I_1–P_1 alv. and P_2–M_2 . . . . . (W+) 43306

GROUP QUESTIONABLE

MAXILLA, IMMATURE

Partial left maxilla with dP^3–M^1 (alv.) . . . . . (I) 43307

MANDIBULAR RAMUS, IMMATURE

Partial left ramus with dP_2–M_2(germ, br.) . . . . . (I) 43308

FROM E. OF POLE CREEK:

GROUP I (SMALL PREMOLARS)

MAXILLA, MANDIBULAR RAMUS, AND LIMB ELEMENTS

Partial left maxilla with P^4–M^3, partial right ramus with I_1–P_4 and M_3 (C/ and P_1 br.), partial scapula, partial humerus, 2 partial radii, and manus and pes elements. Fig. 17 (in part) . . . . . (W+) 43305

GROUP QUESTIONABLE

MANDIBULAR RAMUS F:A.M.

Partial right ramus with M_2–M_3(br.) . . . . . (w‡+) 43309

FROM E. OF GORDON, 1940:

GROUP I (SMALL PREMOLARS)

MANDIBLE U.N.S.M.

Partial mandible with P_1–M_3(br.) (P_1 large) . . . . . (w‡+) 10-10-9-40

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

D. FROM MARTIN CANYON, LOGAN COUNTY, COLORADO

UPPER TEETH AND MANDIBULAR RAMI A.M.

Broken superior teeth . . . . . (w) 9045A

Partial mandible with I_2–M_3 (P_1 small) . . . . . (w+) 9045B

Partial left ramus with P_3–P_4 . . . . . (w‡) 9045C

Partial radius, partial ulna, partial tibia, astragalus, calcaneum, and fragments, associated with above 3 specimens

3 MANDIBULAR RAMI, ETC.

Right ramus with I_1(alv.)–M_3 (P_2 rt.) (P_1 large), partial humerus, radius, partial ulna, partial tibia, and manus and pes elements. Figured by Loomis, 1924, fig. 23; Thorpe, 1937, fig. 165, pl. 34, fig. 4. This paper, fig. 13 (in part) . . . . . (w) 9047

This specimen was the holotype of "*Merychyus paniensis*" Loomis. The original description by Loomis mentions the narrowness of the teeth, which is well within individual variation, as is demonstrated in mandible A.M. 9045. The M_3 of ramus A.M. 9047 is not complete, which makes the posterior molar region appear narrow. Other points of difference noted by Loomis are quite minute and may be considered as individual variation. The upper dentition here listed compares readily with *M. elegans*.

Partial mandible with /C–M_3 (P_1 small) and fragments. Fig. 13 . . . . . (w+) 9048

Partial right ramus with I_1–/C alv. and P_1(erupt.)–dP_3 (dP_2 rt.) . . . . . (I) 9044

LIMB ELEMENTS

Radius, partial ulna, and pes; figured by Loomis, 1924, fig. 24 9046

E. FROM PAWNEE BUTTE AREA, WELD COUNTY, COLORADO

4 PARTIAL SKULLS, ETC. A.M.

Partial skull with P^4–M^3 . . . . . (w‡‡) 9442

Partial skull with I^1(alv.)–dP^2–M^2 . . . . . (I) 9444

Partial skull with P^3(br.)–M^3, mandible with P_4–M_3, partial humerus, partial radius, partial ulna, 2 partial tibiae, manus and pes elements, etc. . . . (M+) 9443A

Partial skull and mandible attached . . . . . (I) 9443B

It is of interest to note that the information in the American Museum catalogue concerning specimens A.M. 9442 and 9443 shows that they were found "five and ten feet above the base," respectively. The "base" evidently is the contact between the Oligocene and the later Tertiary.

In 1941 field work was carried on in the Pawnee Butte area by the Frick Laboratory under the direction of Charles H. Falkenbach. The lithology and stratigraphy of the area were studied and, in July of the same year, C. Bertrand Schultz spent some time with Falkenbach checking the geology. The writers noted the presence of 5 to 10 feet of massive brown sands at the base of the Ogallala (Pliocene) deposits in some instances. These basal deposits may be Miocene in age and may represent a remnant of Marsland (or "Martin Canyon," in part). No identifiable fossils were collected from this basal horizon but the lithology was very suggestive of the Marsland formation in Nebraska, even to the type of sand crystals which were present.

The type section of the "Martin Canyon" of Matthew[1] was also visited by Falkenbach and later by

[1] Matthew, W. D., 1901, Mem. Amer. Mus. Nat. Hist., vol. 1, pt. 7, p. 357, fig. 17.

Schultz. The exact location from which the skeletons[1] of *Merycochoerus proprius magnus* (Loomis) were collected was also determined. Although some of the sediments in the Martin Canyon area have a typical White River appearance, a part of the section appears to be equivalent to the Marsland of Nebraska because of the similarity in mammalian forms and in certain lithologic characteristics.

MANDIBULAR RAMUS

Partial right ramus with P_3(rt.)–M_3(br.). (w‡)	F:A.M. 44826	From deposits directly overlying the Oligocene; collected by C. Frick, 1931

TENTATIVELY REFERRED FROM APHELOPS DRAW, SNAKE CREEK-SHEEP CREEK AREA, SIOUX COUNTY, NEBRASKA

(Collected by Albert Thomson, 1923)

SKULL

		A.M.
Partial skull with I^1–M^3	(w‡+)	20523

The matrix on this specimen indicates that it came from massive pinkish sands and not from the usual channel deposits of the Snake Creek-Sheep Creek area. The American Museum catalogue gives "Sheep Creek" for the horizon. The Snake Creek-Sheep Creek area has been visited frequently by the writers, who venture the opinion that some of the massive pinkish sands below the quarries might well represent upper Marsland deposits.

The muzzle of the skull is wider than *Merychyus* (*Metoreodon*) *relictus taylori* from the "Sheep Creek" and the dentition, although worn, is readily referred to *M. elegans* from the upper Marsland.

4b. **Merychyus elegans bluei,**[2] new subspecies

From the upper Marsland formation, Box Butte County, Nebraska; referred specimens from Dawes County, Nebraska; and tentatively referred specimen from Weld County, Colorado

Subspecific Description

Skull: Characters similar to those in *M. elegans* but postglenoid process somewhat heavier and nasals with more tendency for retraction than in that species.

Mandible: Similar to that of *M. elegans*.

Dentition: Lighter and more brachyodont than that of *M. elegans*, but molar series of equal size.

Limbs: Similar to those of *M. elegans*.

Measurements: Tables 1 and 2.

Illustrations: Figures 1, 4, 15–17.

Discussion

This subspecies occurs in the same formation as *M. elegans*. The size and characters of the skull are like those of *M. elegans* except for the differences noted above.

Four specimens are here recorded:

HOLOTYPE

Partial skull with I^1–M^3, mandible with I_1–M_3, radius, ulna, 2 partial tibiae, astragalus, and calcaneum. (w)	U.N.S.M. 7-10-9-38	From ¼ mi. E. of Hemingford Quarry 9, N. and E. of Hemingford, Box Butte County, Nebraska; collected by U.N.S.M. field party, 1938 Figs. 1, 4, 15–17

REFERRED FROM DAWES COUNTY, NEBRASKA

From N. and W. of Hemingford; Collected by University of Nebraska State Museum Field Party, 1940:

MAXILLAE, MANDIBLE, AND LIMB ELEMENTS

Left premaxilla and maxilla, partial right maxilla with I^1–M^3, mandible with I_1–I_3 alv. and /C–M_3 (C/ and P_1 small), partial scapula, partial humerus, partial radius, partial ulna, and pes fragments	(w‡+)	U.N.S.M. 3-10-9-40

[1] Schultz, C. Bertrand, and Charles H. Falkenbach, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 288.

[2] Named in honor of Emery L. Blue, who was a member of University of Nebraska State Museum field parties from 1930 to 1941.

FROM PEBBLE CREEK; COLLECTED BY TED GALUSHA, 1938:

	SKULL AND LIMB FRAGMENTS	F:A.M.
Skull with I^1–M^3 (C/ large), partial humerus, astragalus, calcaneum, etc. .	(w‡+)	44788

TENTATIVELY REFERRED FROM PAWNEE CREEK AREA, WELD COUNTY, COLORADO

(Collected by John C. Blick, 1932)

	SKULL	F:A.M.
Skull with I^1–M^3 (C/ large)	(w+)	33500

The skull is somewhat lighter and narrower than those of the holotype or referred specimens. It may represent the female of the variety.

5. **Merychyus minimus** Peterson

From the lower Marsland, Sioux County, Nebraska; referred remains from Sioux, Dawes, and Sheridan counties, Nebraska, Niobrara, Goshen, and Platte counties, Wyoming, and Shannon County, South Dakota

Merychyus minimus subsp.[1] nov. PETERSON, 1906, Ann. Carnegie Mus., vol. 4, no. 1, p. 67, fig. 16.

Merychyus elegans subsp. *minimus* (Peterson), PETERSON, 1923, Ann. Carnegie Mus., vol. 15, no. 1, p. 96, figs. 1–8, pls. 7 and 8 (in part only).

Merychyus minimus (Peterson), LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 31 (fig. 7, *M. minimus*, number of specimen not indicated).

Merychyus arenarum minimus (Peterson), THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 217, fig. 161, pl. 33.

Merychyus delicatus LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 33, fig. 22. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 225, fig. 164, pl. 32, figs. 9–10.

SPECIFIC CHARACTERS

SKULL: Ranges in size from slightly larger than *M. crabilli* to a small *M. arenarum* example from the lower Marsland; basal length shorter than that of *M. arenarum* and *M. elegans*.

MANDIBLE: Same comparisons as for skull; more abrupt rise of the ascending ramus posterior to M_3, than in examples of *M. arenarum*.

DENTITION: Superior and inferior series larger than those of *M. crabilli* and smaller than average examples of *M. arenarum* and *M. elegans*.

LIMBS: Longer than those of *M. crabilli* and, on the average, shorter and lighter than those of *M. arenarum*.

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1, 5, 6, 15–17.

DISCUSSION

The skeleton that is mounted with the holotypic skull and mandible is composite. If a sufficient number of skeletal elements were associated with both *M. minimus* and "*M. delicatus*" differentiation between the two forms might become possible. Examples of *M. minimus* are found throughout the lower Marsland, but specimens representing *M. arenarum* and exhibiting larger skulls and more robust limbs occur mostly in the upper part of the same geologic section. The material referred to *M. minimus* has lighter limbs, with examples approaching those of *M. arenarum*. *M. minimus* evidently gave rise to both *M. arenarum* of the upper part of the lower Marsland and *M. elegans* of the upper Marsland. The limbs of the latter species are somewhat larger than average examples of those of *M. minimus*, but are smaller than those of *M. arenarum*. The writers believe that the material here referred to *M. minimus* has developmental tendencies in two directions, one toward the much larger *M. arenarum*, and the other toward the moderately larger *M. elegans*. Thus, if the limbs associated with the holotype of "*M. delicatus*" had been smaller, and if those associated with *M. minimus* had been somewhat larger, the former might have warranted recognition as a subspecies.

If the foregoing assumption were correct,

[1] The writers do not clearly understand which species was used originally by Peterson as a basis for this subspecies. The type description of the subspecies directly follows Peterson's discussion of "*M.*" *medius* Leidy, which is now recognized as a species of *Ustatochoerus* (Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 23). In 1923, however, Peterson did consider *minimus* as a subspecies of *M. elegans*.

specific identification of the skull or mandible could not be made without associated skeletal elements. This, however, would be a very impracticable method, and thus the combining of the two forms into one species seems to be necessary. If the range of individual variation of *M. minimus* had been known, Loomis probably would not have named "*M. delicatus*." Unfortunately the holotype of *M. minimus* is a skull much larger than the mean, while the type specimen of "*M. delicatus*" is smaller.

Loomis[1] and Thorpe[2] both maintained that a facial vacuity was apparently absent in "*M. delicatus*." A definite angular opening is present on the holotypic skull, but a part of the surfaceless area is definitely due to breakage. Since, however, the opening is in the same position as the facial vacuity, the present writers see no reason to doubt its presence (see fig. 6 and also discussion on p. 188). The skull and mandible representing the holotype of "*M. delicatus*" were not separated from the original matrix until the present writing; thus many of the characters had heretofore been obscured.

Ted Galusha collected the F:A.M. specimens from Dawes and Sheridan counties, Nebraska; John Lynch, Everett DeGroot, Gene Roll, Nelson J. Vaughan, and Charles H. Falkenbach collected the remainder of the listed F:A.M. material; and specimens from other institutions, as well as their collectors, are noted in the descriptions of localities.

Three hundred and ninety-eight specimens are here recorded:

HOLOTYPE

Skull with I^1–M^3 and mandible with I_2–M_3, partial ulna, partial tibia, manus elements, and vertebrae. (C/ and P_1 large.) (w)	C.M. 1466	From Sioux County, Nebraska; collected by Peterson, 1904 Figured by Peterson, 1906, fig. 16, 1923, figs. 1–2, pls. 7 and 8 (in part); Thorpe, 1937, fig. 161, pl. 33 This paper, fig. 5

The measurements which Thorpe[3] used for the skeleton mounted with the type skull and mandible in the Carnegie Museum are less than the actual measurements. Perhaps they were taken from Peterson's[4] figure which was reproduced smaller than the scale indicates.

The skeleton is a composite made from seven individuals. Peterson based his type description on a series of 15 individuals, but the writers have been unable to locate or definitely to identify all of the other 14 specimens. In 1923, Peterson,[5] in a discussion of this species, listed specimens C.M. 565, 1331, 1403, 1439, 1462, 1466, 1525, and 3397.

REFERRED FROM (A) SIOUX, (B) DAWES, AND (C) SHERIDAN COUNTIES, NEBRASKA; (D) NIOBRARA, (E) GOSHEN, AND (F) PLATTE COUNTIES, WYOMING; AND (G) SHANNON COUNTY, SOUTH DAKOTA

A. FROM SIOUX COUNTY, NEBRASKA

FROM RUNNING WATER (NIOBRARA RIVER):

		C.M.
SKULL		
Skull with I^1–M^3	(w‡)	1458
This specimen is close to type in measurements.		
SKULL, MANDIBLE, AND SKELETAL ELEMENTS		
Skull, mandible, and skeletal elements; figured by Peterson, 1923, figs. 4, 6, pls. 7 and 8 (in part)		3397

[1] Loomis, Frederic B., 1924, *op. cit.*, p. 33.
[2] Thorpe, Malcolm R., 1937, *op. cit.*, p. 225.
[3] Thorpe, Malcolm R., 1937, Mem. Peabody Mus., vol. 3, pt. 4, table 12, p. 290.
[4] Peterson, O. A., 1923, Ann. Carnegie Mus., vol. 15, no. 1, pls. 7–8.
[5] Peterson, O. A., 1923, *ibid.*, vol. 15, no. 1, p. 96.

FROM S. OF HARRISON, SIOUX COUNTY, NEBRASKA, 1937–1938:

GROUP I (SMALL PREMOLARS)

		F:A.M.
PARTIAL SKULL		
Anterior portion of skull with I^3–M^3 (I^2–P^2 rt.)	(W+)	44728

GROUP II (LARGE PREMOLARS)

4 SKULLS, ETC.		
Right side of skull with I^1–M^3 (C/ small)	(W‡‡)	43304
Skull with I^1–M^3 br., partial scapula, and partial humerus	(W)	44537
Partial skull with C/–M^3, partial mandible with /C–M_3 (C/ and P_1 large), partial humerus, partial radius, partial ulna, partial tibia, and partial pes	(W‡+)	44615
Anterior portion of skull with P^2–M^3	(M+)	34415

GROUP QUESTIONABLE

PARTIAL SKULL, ETC.		
Posterior portion of skull with M^2–M^3, partial femur, and partial tibia (limbs heavy)	(W)	44538
MAXILLA AND MANDIBULAR RAMI		
Partial left maxilla with M^1–M^3 and partial mandible with I_2–M_3 (P_1–P_3 rt.)	(W+)	44764
6 PARTIAL SKULLS AND MANDIBLES, IMMATURE		
6 partial skulls and partial mandibles with		
C/–dP^2–M^2(erupt.), dP_4–M_2(erupt.)	(I)	44722
C/(erupt.)–dP^1–M^2(germ), P_1–dP_2–M_2(germ)	(I)	44723
I^1–dP^1–M^2	(I)	44724
I^1–C/ alv. and dP^1–M^1, dP_3–M_1	(I)	44725
I^2–dC/–M^1, dP_2–M_1	(I)	44726
C/(germ)–P^1(germ)–dP^2–M^1(germ), dP_4	(I)	44727

FROM S.W. OF ANDREWS; COLLECTED BY UNIVERSITY OF NEBRASKA STATE MUSEUM FIELD PARTY, 1938:

GROUP I (SMALL PREMOLARS)

		U.N.S.M.
MAXILLA		
Partial left maxilla with C/–M^3 (P^1 alv.) (C/ medium size)	(W+)	11-10-9-39

FROM S. OF NIOBRARA RIVER; COLLECTED BY OLCOTT, 1907:

		A.M.
SKULL, MANDIBLE, AND LIMB ELEMENTS		
Partial skull with I^1–M^3, partial mandible with I_1–M_3, (C/ and P_1 medium size), 2 partial femora, tibia, astragalus, and calcaneum	(W)	13820

B. FROM DAWES COUNTY, NEBRASKA

FROM N.W. OF MARSLAND; COLLECTED BY DAYTON AND SULLENBERGER, 1917, AND UNIVERSITY OF NEBRASKA STATE MUSEUM FIELD PARTY, 1934:

GROUP I (SMALL PREMOLARS)

		U.N.S.M.
SKULL		
Skull with I^1–M^3 (C/ small)	(W‡+)	2-2-8-34 N.P.
5 MANDIBULAR RAMI		
4 partial right rami with		
I_2–/C alv. and P_1–M_2 (P_1 large)	(W+)	5-1-1-17
I_2–P_2 alv. and P_3–M_3(br.) (P_4 rt.)	(W‡)	6-1-1-17

		U.N.S.M.
P_4–M_3	(w‡+)	7-1-1-17
P_3–P_4 br. and M_1–M_3	(w‡)	34-14-17
Partial left ramus with I_2–I_3 alv. and /C–P_4 (P_1 br.)	(w)	14-1-1-17

GROUP QUESTIONABLE

2 MAXILLAE

2 partial right maxillae with		
P^4–M^2	(w)	8-1-1-17
P^4(alv.)–M^3	(w+)	3-1-1-17

FROM SAND CANYON REGION:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS

		F:A.M.
Partial right ramus with P_2–M_3	(w+)	37218

FROM GENERAL ARBA:

GROUP II (LARGE PREMOLARS)

SKULL

Partial skull with C/(rt.)–M^3	(w)	34313

C. FROM HAY SPRINGS CREEK AREA, WEST OF HAY SPRINGS, SHERIDAN COUNTY, NEBRASKA, 1939

GROUP I (SMALL PREMOLARS)

10 PARTIAL SKULLS, ETC.

		F:A.M.
Anterior portion of skull with C/–M^3 (C/ small)	(w+)	44789
Partial skull with P^1–M^3	(w‡+)	44795
Anterior portion of skull with P^3–P^4 br. and M^1–M^3, partial mandible with /C–M_3 (P_1 small), and partial humerus	(w‡)	44804
Partial skull with I^1–M^3 (P^4–M^2 br.), partial left ramus with P_3–M_1(br.) (C/ large), partial radius, and 2 partial tibiae (limbs heavy)	(w‡+)	44806
Partial skull with P^3–M^3	(w+)	44808
Partial skull with P^4–M^3 and partial mandible with P_3–M_3	(w‡+)	44819
Anterior portion of skull with C/–M^3 and partial mandible with P_1–M_3 (C/ and P_1 small)	(w+)	44791
Anterior portion of skull with I^1–M^3	(w)	44801
Anterior portion of skull with C/–M^3, mandible with /C–M_3, radius, partial ulna, partial tibia, and manus elements (C/ and P_1 small)	(w+)	45378
Right side of skull with P^4–M^3, partial mandible with /C–M_3, and skeletal fragments (P_1 small)	(w‡)	45379

MAXILLA

Partial left maxilla with P^1–P^3	(w)	45380

TWO MANDIBULAR RAMI

Partial mandible with P_4–M_3	(w‡‡)	44798
Left ramus with P_2–M_3	(M+)	44797

GROUP II (LARGE PREMOLARS)

11 SKULLS, ETC.

Skull with C/–M^3 (C/ large)	(w)	44792
Partial skull with P^2–M^3, mandible with P_1–P_2 rt. and P_3–M_3, partial humerus, 2 radii (1 partial), 2 partial ulnae, femur, and 2 tibiae (1 partial) (limbs light)	(w‡+)	44805

		F:A.M.
Partial skull with P^2–M^3	(w‡+)	44807
Anterior portion of skull with P^1(alv.)–M^3	(w‡+)	44809
Crushed skull with C/–M^3 (P^1 alv.), mandible with P_2–M_3 (C/ large), partial tibia, astragalus, calcaneum, partial pes, and partial pelvis (limbs light)	(w‡)	44816
Partial skull with P^1–M^3, partial mandible with /C–M_3 (P_1 small), partial humerus, 2 partial radii, partial ulna, and manus	(w+)	44817
Partial skull with C/–M^3 and mandible with I_2–M_3 (C/ and P_1 small)	(w‡)	44818
Partial skull with I^2–M^3, right ramus with P_1–M_3, pes elements, and fragments (C/and P_1 small)	(w+)	45381
The skull is large for this species, but pes elements are approximately equal to other examples of this species.		
Anterior portion of skull with I^1–I^3 rt. and C/–M^3 and partial mandible with /C–M_3 (C/ and P_1 medium size)	(w+)	45382

3 MAXILLAE

2 partial right maxillae with		
C/–M^2 (C/ small)	(w‡)	44790
P^4–M^3	(w+)	44799
Partial left maxilla with P^4(br.)–M^3	(M+)	44794

MANDIBULAR RAMUS

Partial right ramus with P_4–M_3	(w+)	44813

6 MANDIBULAR RAMI

4 partial mandibles with		
P_4 and M_2–M_3	(w‡)	44802
I_1–M_3 (P_1 rt. and P_2–P_3 alv.)	(w‡+)	44810
Superior fragmentary teeth were found associated with this specimen.		
I_1–M_3 (/C–P_1 alv.)	(w+)	44812
/C–M_3 (P_1 medium size)	(M+)	44815
2 partial left rami with		
/C–P_4 (P_1 large)	(w)	44796
M_1–M_3	(w+)	44814
Superior fragmentary teeth were found associated with this specimen.		

GROUP QUESTIONABLE

SKULL, MANDIBLE, AND SKELETAL ELEMENTS, IMMATURE

Partial skull with C/–dP^2–M^2(germ) (P^1 alv.), mandible with dP_2(br.)–M_2(germ), partial femur, partial tibia, manus and pes elements	(I)	45383

PARTIAL SKULL

Partial skull with P^4(br.)–M^3 (M^1 br.)	(w)	44793

2 MANDIBULAR RAMI, IMMATURE

Partial mandible with dP_2–M_2	(I)	44803
Partial left ramus with I_1–/C alv. and P_1–dP_4–M_3(erupt.) (P_2–P_4 germs)	(I)	44811

TIBIA

Tibia		44820

D. FROM NIOBRARA COUNTY, WYOMING

FROM ROYAL VALLEY, 9 MI. S. OF LUSK, 1932–1940:

GROUP I (SMALL PREMOLARS)

18 SKULLS, ETC.

		F:A.M.
10 skulls, mandibles, etc.:		
Partial skull with C/–M^3 and partial mandible with I_3–/C alv. and P_1–M_3 (C/ and P_1 small)	(w)	33381

		F:A.M.
Partial skull with I^1–M^3 and partial mandible with I_2–M_3 (C/ and P_1 small)	(w)	33388
Partial skull with I^1(alv.)–M^3 and partial mandible with P_1–M_3 (C/ and P_1 small)	(w‡+)	34405
Partial skull with P^1–M^3 (M^2 br.) and partial mandible with I_1–M_3 (C/ and P_1 small)	(w)	43297
Partial skull with P^3–M^3 and partial mandible with I_2–M_3(br.) (C/ and P_1 small)	(w‡)	43298
Partial skull with I^1–M^3(br.), partial right ramus with M_3(br.) (C/ large), and partial tibia (limb light)	(w+)	44406
Skull with I^1–M^3 and partial mandible with I_3–M_3 (C/ and P_1 small)	(w+)	44408
Partial anterior portion of skull with C/–M^3 (M^1–M^3 br.), partial mandible with I_2–M_3(br.) (M_1–M_2 missing) (C/ and P_1 small), femur, partial tibia, pes elements, and partial pelvis	(w‡‡)	44481
Anterior portion of skull with C/–M^3(br.) (C/ large)	(w‡)	44491
Partial skull with C/–M^3, partial mandible with P_1–M_3, and calcaneum (C/ and P_1 large)	(w‡‡)	44523
8 partial skulls with		
I^3–M^3 (C/ small)	(w)	33376
I^3–M^3 (C/ small)	(w+)	33383
P^3–M^3(br.)	(M)	34423
C/–M^3(br.) (C/ large)	(w)	43296
P^1–M^3	(w)	44409
C/–M^3 (P^1 alv.) (C/ large)	(w)	44485
I^1–M^3(br.) (C/ small)	(w+)	44492
C/(br.)–M^3 (P^1 absent) (C/ small)	(w)	45376
11 MANDIBULAR RAMI		
7 partial mandibles with		
P_1–M_3 (P_1 small)	(w+)	34414
P_1(rt.)–M_3	(w‡)	44496
/C–M_3	(w‡+)	44497
P_1–M_3 (P_1 small)	(w‡)	44500
P_1–M_3(br.) (P_1 large)	(w‡+)	44511
I_1(rt.)–M_3 (/C rt.) (P_1 small)	(w+)	44498
P_3–M_3	(w‡‡)	44499
4 partial right rami with		
/C–M_3 (P_1 small), and partial tibia	(w‡+)	44502
/C–M_3 (P_1 small)	(w‡)	44503
I_1–M_3 (P_1 large)	(w‡)	44504
P_1(rt.)–M_3(br.)	(w‡)	44514
GROUP II (LARGE PREMOLARS)		
18 SKULLS, ETC.		
12 skulls, mandibular rami, etc.:		
Partial skull with C/–M^3 (P^1 missing) and partial mandible with P_3–M_3	(w+)	44407
Partial skull with P^2–M^3 and partial mandible with P_4(br.)–M_3	(w+)	44478
Partial skull with P^2–M^3 and partial mandible with P_3–M_3	(M+)	44479
Left maxilla with C/–M^3 all br. and partial mandible with I_1–M_3 (P_1 small)	(w+)	44480
Anterior portion of skull with I^2–M^3(br.) and partial mandible with /C–M_3(br.) (C/ and P_1 small)	(w+)	44482
Fragmentary skull with I^2–C/, left ramus with I_3–M_3 (P_1 alv.; P_2 and M_2 br.) (C/ small), astragalus, calcaneum, and fragments	(w‡+)	44483
Partial right maxilla with C/–P^3 and partial right ramus with /C(br.)–M_2 (br.) (C/ and P_1 large)	(w‡)	44484
Partial skull with C/(br.)–M^3 and mandible with I_1–M_3 (C/ and P_1 large), partial radius, and partial ulna	(–M)	44487

		F:A.M.
Anterior portion of skull with I^1–M^2 (M^1 br.) and partial mandible with I_3–M_3 (C/ and P_1 small); exceptionally large heel on M_3	(W)	44488
Right side of skull with I^1(alv.)–M^3 (M^2 br.) and partial left ramus with P_1(br.)–M_1(br.) (C/ large)	(W‡)	44489
Right anterior portion of skull with I^1–M^3 (P^1 alv.) and partial mandible with /C–M_3(br.) (P_1 br.) (C/ and P_1 large)	(W+)	44490
Partial skull with C/–M^3 and partial mandible with /C–M_3 (C/ and P_1 small)	(W)	45377
6 partial skulls with		
P^1–M^3	(W‡)	43174
C/–M^3 (C/ small)	(W+)	43185
P^4–M^3	(W)	43295
P^1–M^3	(W‡‡)	44486
C/–M^3 (C/ large)	(M)	44493
P^4–M^3	(W‡+)	44767
6 MANDIBULAR RAMI		
3 partial mandibles with		
/C–M_3 (P_1 large) and partial femur (light)	(M)	44495
P_3–M_1	(W‡)	44509
/C–M_3 (P_1 small)	(W‡)	44510
Partial right ramus with P_3–M_3	(W‡+)	44512
2 partial left rami with		
/C(erupt.)–M_3 (P_1 br.) (P_1 large)	(–M)	44505
P_1(br.)–M_3	(M)	44506
GROUP QUESTIONABLE		
2 PARTIAL SKULLS		
Anterior portion of skull with M^1(br.)–M^3	(W‡)	44494
Partial left maxilla with M^1–M^2(br.)	(W+)	44508
4 MANDIBULAR RAMI		
Partial mandible with P_1–M_3 (P_2–P_3 alv., P_4 erupt.) and partial humerus	(–M)	44501
2 partial right rami with		
P_4–M_3	(W+)	44410
M_1–M_3	(W‡‡)	44513
Partial left ramus with M_1(br.)–M_3(br.)	(W‡+)	44515
17 PARTIAL SKULLS, ETC., IMMATURE		
3 partial skulls and partial mandibles with		
C/–dP^1–M^2(germ) and /C–P_1(erupt.)–dP_2–M_2(germ)	(I)	44663
Superior dentition not recognizable and dP_2–M_3(germ)	(I)	44666
dP^2–M^1 and d/C(rt.)–P_1(erupt.)–M_1	(I)	44667
Skull with I^1–I^3 alv. and C/–dP^1–M^2(erupt.), mandible with dP_1–M_2, partial tibia, and partial manus	(I)	44706
Partial skull with C/–P^1 rt. and dP^2–M^2, partial radius, and partial ulna	(I)	44755
11 partial skulls, immature, with		
I^1–dP^2–M^2 (I^2 alv.)	(I)	44654
I^3–dP^2–M^2	(I)	44655
C/–dP^2–M^2(germ) (dP^1 br.)	(I)	44656
I^1–C/(erupt.)–dP^1–M^1	(I)	44657
I^2–C/(erupt.)–dP^1–M^1(br.) (dP^4 rt.)	(I)	44658
dP^3–M^2(germ)	(I)	44659
I^3–dP^2–M^2	(I)	44660
C/(erupt.)–dP^1–M^2(germ)	(I)	44661
C/(br.)–dP^1–M^2	(I)	44662
dP^1(br.)–M^2(br.)	(I)	44664

		F:A.M.
C/–dP^2–M^2	(I)	44754
Partial right maxilla with dP^4–M^1	(I)	44665
3 MANDIBULAR SPECIMENS		
2 partial mandibles with		
/C–dP$_1$–M$_1$	(I)	44668
/C–dP$_2$–M$_2$(br.)	(I)	44669
Partial right ramus with P$_1$(rt.)–dP$_3$–M$_3$(germ)	(I)	44756
LIMB ELEMENTS		
Femur, partial tibia, and partial pes		44411
Partial femur		44507

FROM SILVER SPRINGS AREA, N.W. OF RAWHIDE BUTTE, 1935–1938:

GROUP I (SMALL PREMOLARS)

3 PARTIAL SKULLS, ETC.		
Partial skull with P^4–M^3 and partial mandible with P$_3$–M$_3$	(W+)	44546
Skull with I^3–M^3 and partial mandible with /C–M$_3$ (C/ and P$_1$ small)	(W+)	44547
Fragment of skull with P^2–M^3 (P^4 br.)	(M+)	44709
MANDIBLE		
Partial mandible with P$_3$–M$_3$	(W$\pm^+$)	44550

GROUP II (LARGE PREMOLARS)

2 PARTIAL SKULLS		
2 anterior portions of skulls with		
C/–M^3 (C/ small)	(W)	44548
C/–M^3(br.) (C/ small)	(M)	44549

GROUP QUESTIONABLE

2 PARTIAL SKULLS, ETC., IMMATURE		
Partial skull with dP^2–M^1(germ) and partial mandible with dP$_2$–M$_1$(germ)	(I)	44707
Partial skull with C/–dP^2–M^2	(I)	44708
2 MANDIBULAR RAMI		
Partial mandible with dP$_3$–M$_2$(germ)	(I)	44710
Partial left ramus with P$_1$–dP$_2$–M$_2$	(I)	44711

E. FROM GOSHEN COUNTY, WYOMING

FROM 12–15 MI. DISTRICT, 12–15 MI. S.E. OF LUSK, 1932–1933:

GROUP I (SMALL PREMOLARS)

4 SKULLS, ETC.		F:A.M.
Partial skull with I^3–M^3 and mandible with P$_1$–M$_3$ (C/ and P$_1$ large)	(W)	33382
Partial skull with I^1–M^3 (P^4–M^2 br.) and partial mandible with /C–M$_3$(br.) (M$_1$–M$_2$ absent) (C/ and P$_1$ small)	(W+)	33391
Partial skull with P^4–M^3 and partial left ramus with M$_2$–M$_3$	(W+)	34424
Partial skull with I^1–M^3 (C/ small) and partial humerus	(M+)	44419
3 MANDIBULAR RAMI		
Partial mandible with /C–M$_3$ (P$_1$ small)	(W$\pm$)	44640
Partial right ramus with I$_3$–P$_3$ (P$_1$ small)	(W$\pm$)	44643
Partial left ramus with /C–M$_3$ (P$_1$ small)	(W$\pm^+$)	44772

GROUP II (LARGE PREMOLARS)

SKULL AND MANDIBLE

		F:A.M.
Skull with I^1–M^3 and mandible with I_1–M_3 (C/ and P_1 large)	(M)	34429

3 PARTIAL SKULLS, ETC.

Partial skull with P^2–M^3	(W‡+)	34409
Anterior portion of skull with I^2–M^3 (C/ medium size)	(W‡)	44543
Partial skull with P^1–M^3 and partial mandible with P_1(br.)–M_3	(M)	44763

GROUP QUESTIONABLE

PARTIAL SKULL AND MANDIBLE

Posterior portion of skull with M^1–M^3 and partial mandible with M_1–M_3	(W)	44544

2 MANDIBULAR RAMI

Partial right ramus with M_1–M_3	(–M)	44642
Partial left ramus with M_1–M_3	(W‡+)	44641

5 PARTIAL SKULLS, ETC., IMMATURE

Partial skull with C/(br.)–dP^1–M^2(germ)	(I)	44694
Partial skull with I^2–dP^1–M^2(germ) and partial right ramus with dP_3–dP_4–M_2(germ)	(I)	44695
Partial skull with C/–dP^2–M^2(erupt.)	(I)	44696
Anterior portion of skull with dP^1–M^1 and partial right ramus with dP_4–M_2 (germ)	(I)	44704
Anterior portion of skull with dP^1–M^1 and partial mandible with P_1–dP_2–M_2	(I)	44705

MANDIBULAR RAMUS, IMMATURE

Partial left ramus with P_1–dP_2–M_2(br.)	(I)	44773

FROM THE 16 MI. DISTRICT, 16 MI. S.E. OF LUSK, E. SIDE OF U.S. HIGHWAY NO. 85, 1930–1940:

From the lowest part of the exposures:

GROUP I (SMALL PREMOLARS)

MAXILLA AND MANDIBLE

Partial left maxilla with P^4–M^3 and partial mandible with /C–P_1 rt. and P_2–M_3	(W‡)	43181

2 MANDIBLES, ETC.

Partial mandible with P_3–M_3 (M_1–M_2 br.) and partial manus	(W‡)	43188
Partial mandible with I_2–M_3 (P_1 small)	(W‡+)	44475

From the middle portion of the exposures:

GROUP I (SMALL PREMOLARS)

2 SKULLS, ETC.

Anterior portion of skull with C/–M^3 and partial left ramus with M_1–M_3 (C/ small)	(W+)	43183
Skull with I^1–M^3	(W)	43349

GROUP II (LARGE PREMOLARS)

6 SKULLS, ETC.

Complete skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 medium size), partial humerus, radius, ulna, manus, 2 femora, 2 tibiae, partial pes, pelvis, vertebrae, and ribs. Figs. 1, 5, 15, 16, 17	(M)	33364
Partial skull with P^1–M^3 and mandible with P_1–P_2 rt. and P_3–M_3	(W)	43195

		F:A.M.
Skull with I^2–M^3, mandible with I_1(br.)–M_3 (C/ and P_1 large), tibia, and vertebrae	(W+)	43299
The tibia is very light but approaches *M. arenarum* in length.		
Partial skull with C/–M^3, partial mandible with P_1–M_3 (C/ and P_1 small), partial radius, and partial ulna	(W)	44423
Partial skull with I^3–M^3 (P^1 alv.), mandible with P_2–M_3 (C/ small), 2 partial tibiae, astragalus, calcaneum, and metatarsals	(W)	44469
Partial skull with C/–M^3 (C/ large), partial humerus, 2 radii (1 partial), ulna, partial femur, 2 partial tibiae, etc.	(W+)	44471

From the high portion of the exposures:

Group I (Small Premolars)

3 skulls, etc.

Anterior portion of skull with I^1–M^3, partial mandible with P_2–M_3 (C/ small), and partial humerus	(W+)	43353
Anterior portion of skull with I^2(rt.)–M^3 (P^1, M^1–M^2 br.), partial mandible with I_1–M_3 (I_2–I_3 and M_2 alv.) (C/ and P_1 small), and 2 partial humeri	(W‡‡)	44613
Skull with I^1–M^3, mandible with I_1–M_3 (P_1–P_2 alv.) (C/ small), partial humerus, partial radius, and partial ulna	(W‡‡)	44470

partial mandible

Partial mandible with /C–M_3 (M_1–M_2 br.) (P_1 small)	(W‡+)	44474

Group II (Large Premolars)

11 skulls, etc.

Skull with I^1–M^3 (C/ small), atlas, and partial pelvis	(W+)	43175
Partial skull with I^3–M^3, mandible with /C(rt.)–M_3 (C/ and P_1 large), and 2 partial manus	(W‡+)	43190
Left inferior side of skull with P^1(br.)–M^3 and mandible with I_1–I_3 alv. and /C(br.)–M_3 (P_1 br.)	(W+)	43300
Skull with I^2(rt.)–M^3 and partial left ramus with P_1–M_1(br.) (P_2 alv.) (C/ and P_1 small)	(–M)	43301
Partial skull with C/–M^3 (C/ small) and metatarsal	(W+)	43303
Inferior portion of skull with I^1–M^3, mandible with I_2–M_3 (C/ and P_1 large), and partial pes	(W+)	43337
Partial skull with P^1–M^3 and partial mandible with P_3–M_3	(M)	43350
Partial skull with P^4–M^3	(M+)	44612
Right maxilla with P^2–M^1	(W‡)	44473
Partial skull with C/–M^3 and mandible with /C–M_3 (C/ and P_1 large)	(W)	45371
Partial skull with I^3–M^3(erupt.) (P^1 alv. and P^2–P^4 erupt.) (C/ large)	(–M)	45372

2 mandibular rami

Mandible with I_1–M_3 (P_1 small)	(W)	44476
Partial left ramus with P_2(rt.)–M_3(br.) (P_3 br.)	(W+)	44566

Group Questionable

10 partial skulls, etc., immature

Partial right and left maxillae with dP^2–M^1 and partial mandible with dP_2–M_1	(I)	44686
Anterior portion of skull with C/–dP^2–M^3(germ)	(I)	44687
Anterior portion of skull with I^3–dP^3–M^1 and partial mandible with P_1–dP_4–M_2	(I)	44697
Partial skull with dP^3–M^2(germ, br.) and partial mandible with /C–dP_2–M_2(germ)	(I)	44698

		F:A.M.
Skull with I^1–C/(erupt.)–dP^1–M^1, mandible with I_1–/C alv. and dP_1–M_2 (germ), and pes elements	(I)	44699
Fragmentary skull with P^1–dP^2–M^2(germ), left ramus with /C–dP_2–dP_4, calcaneum, etc.	(I)	44700
Partial skull with C/–dP^1–M^1, partial mandible with P_1(rt.)–dP_2–M_1, and partial manus	(I)	44702
Posterior portion of skull and partial mandible with dP_1–M_1	(I)	44703
Anterior portion of skull with I^3(br.)–dP^1–M^1 (dP^3–dP^4 br.) and partial right ramus with dP_2–dP_4	(I)	44760
Skull with I^1–dP^2–M^2(erupt.) and mandible with I_1–dP_2–M_2 (P_1 alv.)	(I)	45373

From questionable level of the exposures:

GROUP I (SMALL PREMOLARS)

2 PARTIAL SKULLS, MANDIBLES, ETC.

Partial skull with I^1–M^3 and partial mandible with I_1–M_3 (C/ and P_1 small).	(w‡)	45374
Left premaxilla and maxilla with I^1–M^3, partial mandible with I_1–I_3 br. and /C–M_3, calcaneum, and partial pelvis (C/ and P_1 medium size)	(w)	45375

SKULL

Partial skull with C/–M^3(br.) (P^4–M^2 absent) (C/ small)	(w‡+)	34406

GROUP QUESTIONABLE

MANDIBULAR RAMUS

Partial left ramus with P_4(br.)–M_3(br.)	(w‡)	44770

FROM THE 18 MI. DISTRICT, 18 MI. S.E. OF LUSK, E. SIDE OF U. S. HIGHWAY NO. 85, 1931–1940:

From the lowest portion of the exposures:

GROUP I (SMALL PREMOLARS)

SKULL AND MANDIBULAR RAMI

Partial skull with C/(rt.)–M^3 (P^1 alv.) and partial left ramus with I_1(alv.)–M_3 (C/ and P_1 small)	(w+)	43191

From the middle portion of the exposures:

GROUP I (SMALL PREMOLARS)

SKULL AND MANDIBLE

Partial skull with I^1–M^3 (P^2–P^3 br. and M^2 alv.) and partial mandible with I_2–M_3 (C/ and P_1 small)	(w‡)	44517

From the upper portion of the exposures:

GROUP I (SMALL PREMOLARS)

2 PARTIAL SKULLS, ETC.

Partial skull with P^2–M^3	(M)	44519
Partial right maxilla with C/–M^3(br.), left ramus with I_2–M_3 (C/ and P_1 large), radius, ulna, and atlas	(M+)	44522

GROUP II (LARGE PREMOLARS)

2 PARTIAL SKULLS, ETC.

Partial skull with I^1(alv.)–M^3 (P^1 alv.) (C/ large)	(w‡‡)	44520
Left maxilla with P^1–M^3, radius, partial ulna, and partial manus	(w‡+)	44521

GROUP QUESTIONABLE

PARTIAL SKULL, ETC., IMMATURE

		F:A.M.
Anterior portion of skull with C/–dP^2–M^2(erupt.), partial mandible with P$_1$–dP$_2$–M$_2$(erupt.) (P$_1$ large), radius, partial ulna, and partial manus . .	(I)	44690

MANDIBULAR RAMUS

Partial right ramus with /C–dP$_3$–M$_2$(erupt.)	(I)	44692

From questionable level of the exposures:

GROUP I (SMALL PREMOLARS)

2 PARTIAL SKULLS, ETC.

Posterior portion of skull with M^1–M^3, partial mandible with /C–M$_3$ (P$_1$ large), 2 partial humeri, radius, ulna, 2 partial femora, 2 tibiae, manus and pes elements, vertebrae, and partial pelvis. Figs. 15, 16, 17	(w‡⁺)	44610
Partial skull with I^1–P^4, partial mandible with I$_1$(alv.)–M$_3$, (C/ and P$_1$ small), 2 partial tibiae, partial pes, and partial pelvis	(w‡‡)	44611

2 MANDIBLES

2 partial mandibles with		
I$_1$–M$_3$ (P$_1$ large)	(w+)	44464
/C–M$_3$ (P$_1$ small)	(w+)	44468

GROUP II (LARGE PREMOLARS)

4 PARTIAL SKULLS, ETC.

Partial skull with P^2–M^3, partial mandible with P$_3$–M$_3$, and limb fragments .	(M)	34410
Partial skull with I^3–M^3 and mandible with I$_1$–I$_2$ rt. and I$_3$–M$_3$ (C/ and P$_1$ large)	(M)	44426
Partial skull with P^2–M^3 and partial mandible with I$_1$–M$_2$ (P$_1$ large) . . .	(M)	43302
Skull with I^1(alv.)–M^3, mandible with I$_2$–M$_3$ (C/ and P$_1$ small), 2 partial humeri, 2 radii, ulna, 2 femora, 2 tibiae (1 partial), manus and pes elements, vertebrae, and ribs	(w)	44459

GROUP QUESTIONABLE

PARTIAL SKULL, IMMATURE

Anterior portion of skull with I^3–dP^2–M^2	(I)	44689

MANDIBLE, IMMATURE

Partial mandible with I$_1$–dP$_2$–M$_2$	(I)	44691

FROM JAY EM DISTRICT, AREA 2 MI. S. TO 5 MI. N. OF JAY EM, E. SIDE OF U. S. HIGHWAY NO. 85, 1931–1940:

From middle portions of the exposures:

GROUP I (SMALL PREMOLARS)

PARTIAL SKULL, ETC.

Anterior portion of skull with I^1–M^3 (C/ small), tibia, and pes elements . .	(w‡‡)	44461

GROUP II (LARGE PREMOLARS)

3 PARTIAL SKULLS, ETC.

Anterior portion of skull with C/–M^3 and mandible with /C–M$_3$ (C/ and P$_1$ medium size)	(w‡⁺)	43184
Anterior portion of skull with I^3–M^3 and partial right ramus with P$_1$–M$_3$ (C/ and P$_1$ large)	(w‡)	43194

		F:A.M.
Partial right and left maxillae with P^3–M^2	(W)	44614A
Partial mandible with /C(rt.)–dP_2–M_2	(I)	44614B

The above two specimens were found associated.

GROUP QUESTIONABLE

SKULL AND MANDIBLES, IMMATURE

Partial skull with dI^1–C/(erupt.)–dP^2–M^1 and mandible with dI_2–P_1(erupt.)–dP_2–M_1	(I)	44761B
Partial mandible with dI_1–P_1(erupt.)–dP_2–M_1	(I)	44761A

The above two specimens were found associated.

From the higher portion of the exposures:

GROUP I (SMALL PREMOLARS)

5 PARTIAL SKULLS, ETC.

Partial skull with I^1–I^3 rt. and C/–M^3 (C/ large)	(W+)	37529
Partial skull with C/(br.)–M^3 (P^1–P^4 rt.) and partial mandible with P_2–M_3	(W)	43178
Anterior portion of skull with I^1–M^3 (C/ medium size)	(W)	43182
Anterior portion of skull with P^3–M^3	(W‡+)	44462
Right premaxilla and maxilla with I^2(br.)–M^3, partial mandible with I_3–/C br. and P_1–M_3 (C/ and P_1 large), partial humerus, 2 partial radii, 2 partial ulnae, 2 partial manus, and fragments (limbs heavy)	(W+)	44530

MANDIBLE

Partial mandible with I_3–M_3 (P_1 small)	(W+)	44467

GROUP II (LARGE PREMOLARS)

6 SKULLS, ETC.

Inferior portion of skull with I^1–M^3 and mandible with I_1–M_3 (C/ and P_1 small)	(W‡)	43177
Partial skull with P^1–M^3	(W+)	43180
Skull with I^1–M^3, mandible with /C–M_3 (C/ and P_1 small), partial humerus, partial radius, partial ulna, partial tibia, and pes elements (limbs light)	(M)	43189
Partial skull with C/(loose)–M^3 (C/ large)	(W+)	43192
Partial skull with P^2–M^3	(W+)	43286
Anterior portion of skull with C/–M^3(br.) and partial left ramus with P_1(br.)–M_3(br.) (C/ and P_1 large)	(W)	43354

MANDIBULAR RAMUS

Partial right ramus with P_1–M_3 (P_1 large)	(W)	44466

GROUP QUESTIONABLE

5 PARTIAL SKULLS, ETC., IMMATURE

3 partial skulls with		
C/–dP^1–M^2	(I)	44670
I^3–dP^1–M^2(erupt.)	(I)	44671
dP^3–M^2(br.)	(I)	44674
Partial skull with C/–dP^1–M^2, mandible with /C–dP_3–M_2 (P_1–P_2 alv.), and limb fragments	(I)	44675
Partial skull with dP^1–M^1 and partial mandible with P_1–P_2 alv. and dP_3–M_1	(I)	44677

2 MANDIBULAR RAMI

Partial mandible with I_2–dP_2–M_2	(I)	44676

		F:A.M.
Partial left ramus with I_3–dP_4–M_3(br.) (P_2–P_3 alv.)	(I)	44680

From questionable level of the exposures:

Group I (Small Premolars)

4 skulls and mandibular rami

Skull with I^1–M^3 and mandible with I_1–M_3 (C/ and P_1 small)	(W‡)	33393
Partial skull with P^1(br.)–M^3(br.) and left ramus with P_1–M_3 (P_1 small)	(W+)	34430
Anterior portion of skull with P^2–M^3 and partial mandible with P_1(br.)–M_2	(W+)	44460
Partial left side of skull with P^3–M^3 and left ramus with I_2–I_3 br. and /C–M_3 (P_1 large)	(W)	44673

6 partial skulls

6 partial skulls with		
I^1–M^3 (P^4–M^2 absent) (C/ small)	(W‡+)	33384
I^3–M^3 (C/ small)	(W‡)	34411
I^1–M^3 (C/ small)	(M)	43186
P^3–M^3 (M^1 br.)	(M+)	44463
P^1–M^3(br.) (P^1, P^2, P^3 br. and M^1–M^2 alv.)	(W+)	44472
I^1–C/ rt. and P^1–M^3 (C/ large)	(W‡+)	44516

11 mandibular rami

4 partial mandibles with		
I_2–M_3 (P_1 small), partial radius, and partial manus	(W‡+)	34412
I_2–M_3 (P_1 large)	(W+)	44555
/C–M_3 (P_1 large)	(W‡‡)	44556
I_1–M_2 (P_1 small)	(W+)	44775
7 partial right rami with		
/C(rt.)–M_3 (P_1 large)	(W)	44477
I_3(rt.)–M_3 (P_1 large)	(W+)	44557
I_2(alv.)–M_3 (I_2–/C rt.) (P_1 small)	(W‡)	44558
/C–P_3 alv. and P_4–M_3(br.)	(W‡+)	44559
I_3–M_3 (/C missing) (P_1 small)	(W‡)	44560
P_3–M_3	(W)	44757
P_4–M_3	(W+)	44774

Group II (Large Premolars)

2 skulls and mandibular rami

Skull with I^2–M^3 (C/–P^1 br.) and mandible with I_1–M_3 (C/ and P_1 small)	(W‡+)	43176
Partial skull with I^3–M^3 (P^1–P^2 absent) and partial right ramus with M_2–M_3 (C/ large)	(W+)	43187

Anterior portion of skull and associated immature mandible

Anterior portion of skull with I^1–P^3 (C/ small)	(W)	44681A
Partial mandible with /C–dP_2–M_2	(I)	44681B

6 partial skulls

6 partial skulls with		
I^2–M^3 (C/ small) (very small skull)	(W‡+)	33394
I^1–M^3 (C/ small)	(W‡)	33395
P^1–M^3	(W)	34355
I^3–M^3 (C/ small)	(M)	34407
C/(br.)–M^3(erupt.) (P^1 rt.) (C/ small)	(–M)	34426
C/(rt.)–M^3 (C/ small)	(W)	44518

5 MANDIBULAR RAMI

		F:A.M.
2 partial mandibles with		
P_1–M_3 (P_2 alv.) (P_1 large) and limb fragments	(W$^{++}_{+}$)	44465
/C–M_3 (P_1 large)	(W+)	44618
2 partial right rami with		
P_4–M_3	(M+)	44561
I_2–P_4 (P_1 large)	(W)	44776
Partial left ramus with /C–M_1 (P_1 small)	(W)	44562

GROUP QUESTIONABLE

PARTIAL SKULL

Partial skull with M^2–M^3	(W$^{++}_{++}$)	44554

4 PARTIAL SKULLS, ETC., IMMATURE

Partial skull with dP^2–M^2(erupt.) (M^1 br.)	(I)	44672
Anterior portion of skull with C/–dP^2–M^2 and partial mandible with I_1–P_1 alv. and dP_2–M_3(germ)	(I)	44678
Partial left maxilla with P^1(br.)–dP^2–M^1 and partial mandible with P_1–dP_3–M_1 (P_2 alv.)	(I)	44683
Anterior portion of skull with dP^1–dP^4	(I)	44684

2 MANDIBULAR RAMI

Partial right ramus with I_2–dP_2–M_1(br.)	(I)	44685
Partial left ramus with I_1–dP_2–M_2	(I)	44679

FROM 25 MI. DISTRICT, 16 MI. S. AND 9 MI. E. OF LUSK, 1936:

GROUP I (SMALL PREMOLARS)

3 SKULLS, MANDIBULAR RAMI, AND SKELETAL ELEMENTS

Skull with I^1–M^3, mandible with I_3–M_3, partial scapula, 2 partial humeri, radius, ulna, 2 partial femora, 2 tibiae (1 partial), manus and pes elements, vertebrae, ribs, and pelvis	(W+)	43290
Partial skull with C/–M^3, partial mandible with I_1–M_3 (P_4 rt.) (C/ and P_1 large), partial radius, partial ulna, manus elements, etc.	(M+)	43291
Anterior portion of skull with I^1–M^3 (C/ small)	(W)	43292

GROUP II (LARGE PREMOLARS)

2 SKULLS, ETC.

Anterior portion of skull with I^3–M^3 (C/ small)	(W$^{+}_{+}$)	43293
Partial skull with P^2–M^3 and partial mandible with P_1–M_3 (P_1 small)	(W$^{+}_{+}$)	43294

3 MANDIBULAR RAMI

Partial mandible with P_2–M_3	(W$^{+}_{+}$)	44563
Partial right ramus with P_3–M_3	(W)	44616
Partial left ramus with I_2–M_3 (P_1 small)	(W+)	44564

GROUP QUESTIONABLE

MANDIBULAR RAMUS, IMMATURE

Partial left ramus with P_1(erupt.)–dP_2–M_1	(I)	44688

FROM SAND GULCH (MIDDLE OF EXPOSURES), 18 MI. S.E. OF LUSK, W. SIDE OF U. S. HIGHWAY NO. 85, 1937:

GROUP I (SMALL PREMOLARS)

SKULL, ETC.		F:A.M.
Partial skull with C/–M^3 (C/ medium size) and radius	(W+)	43179

FROM RAWHIDE CREEK AREA; COLLECTED BY J. B. ABBOTT, 1906:

2 SKULLS AND MANDIBLES		C.N.H.M.
Partial skull with I^1–M^3 and mandible with I_1–M_3	(W)	P 12242
Partial skull with C/–M^3 and mandible with I_3–M_3	(W)	P 12244

F. FROM PLATTE COUNTY, WYOMING

FROM GUERNSEY AREA, 1940–1941:

GROUP I (SMALL PREMOLARS)

9 SKULLS, ETC.		F:A.M.
Partial skull with I^1–M^3 and mandible with I_1–M_3 (C/ and P_1 large)	(W‡+)	44434
Anterior portion of skull with C/–M^3(br.) (C/–P^2 br.) and partial mandible with P_4–M_3(br.)	(W+)	44436
Anterior portion of skull with I^1–M^3 (C/ large)	(W+)	44437
Partial skull with I^3–M^3, mandible with /C–M_3 (C/ and P_1 small), radius, and 2 partial ulnae (limbs light)	(W‡)	44524
Anterior portion of skull with C/–M^3 and partial mandible with I_2–M_3 (C/ and P_1 small)	(W‡)	44527

PARTIAL SKULL AND MANDIBLE		
Partial skull with I^1(alv.)–M^3 (I^3 rt.) and mandible with I_1–M_3 (C/ and P_1 small)	(W‡)	44529
Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 small), 2 partial humeri, 2 radii (1 partial), 2 ulnae (1 partial), manus elements, partial tibia, pes elements, pelvis, and vertebrae	(W)	44531
Anterior portion of skull with C/–M^3, partial mandible with /C–M_3 (C/ and P_1 medium size), and tibia	(W)	44532
Partial skull with I^1–P^2 and right ramus with /C–M_3 (C/ and P_1 large)	(W)	44552

3 MANDIBULAR SPECIMENS		
Partial mandible with P_1–M_3	(W)	44525
Partial mandible with I_3(rt.)–M_3(rt.) (P_1 large)	(W+)	44526
Partial left ramus with P_4–M_3(br.)	(M+)	44528

GROUP II (LARGE PREMOLARS)

6 PARTIAL SKULLS		
Partial skull with I^1–M^3 (C/ medium size)	(W+)	44438
Anterior portion of skull with I^2–M^1 (C/ large)	(W+)	44439
Skull with I^1–M^3, mandible with I_1–M_3 (C/ and P_1 small), radius, partial ulna, partial manus, partial femur, tibia, and partial pes	(W‡)	44431
Anterior portion of skull with C/–M^3, partial mandible with P_1–M_3 (C/ and P_1 small), and atlas	(M)	44712
Anterior portion of skull with I^3–M^2(br.) (C/ medium size)	(W)	44713A
Anterior portion of skull with I^3–dP^1–M^2	(I)	44713B

The above two specimens were found associated.

GROUP QUESTIONABLE

9 PARTIAL SKULLS, ETC., IMMATURE		
Partial skull with I^1–dP^2–M^2, partial mandible with /C–dP_2–M_2, partial tibia, and astragalus	(I)	44714

		F:A.M.
Anterior portion of skull with C/–dP^1–M^2	(I)	44715
Partial skull with I^3–dP^2–M^2(br.) and partial left ramus with /C–dP_2(br.)–M_1	(I)	44716
Partial skull with C/–dP^4–M^3(erupt.) (dP^2–dP^3 present on left side)	(I)	44717
Skull with C/–dP^2–M^2, 2 femora (1 partial), 2 partial tibiae, and pes	(I)	44718
Fragments of skull with dP^2–M^1(germ br.) and partial mandible with I_2–dP_2–M_1(erupt.) (P_1 germ)	(I)	44719
Fragments of skull with dP^1–M^1 and left ramus with I_2–P_1(erupt.)–dP_2–M_1	(I)	44720
Anterior portion of skull with dP^1–M^1(br.) and partial mandible with dP_3–M_1	(I)	44721
Anterior portion of skull with C/–dP^1–M^2(br.) and partial right ramus with /C–dP_2–M_3(germ)	(I)	44759
MAXILLA		
Partial left maxilla with P^3(rt.)–M^3	(w‡‡)	44442
LIMB ELEMENTS		
Partial humerus, partial radius, partial ulna, 2 femora (1 partial), 2 tibiae (1 partial), and partial manus		44441
FROM WHEATLAND AREA, 1933 AND 1938:		
GROUP I (SMALL PREMOLARS)		
2 PARTIAL SKULLS AND MANDIBLES		
Partial skull with M^2–M^3 and partial mandible with P_4–M_3	(w‡)	34428
Partial skull with I^1–M^3 and partial mandible with I_1–M_3 (C/ and P_1 large)	(w‡)	44551
MANDIBLE, ETC.		
Partial mandible with I_1–M_3 (P_1 small) and metacarpal	(w‡+)	44540
GROUP II (LARGE PREMOLARS)		
PARTIAL SKULL, MANDIBLE, AND SKELETAL ELEMENTS		
Occipital of skull, partial mandible with I_2–M_2, 2 humeri, radius, ulna, partial femur, partial tibia, manus and pes elements, vertebrae, and ribs	(w‡+)	45370
PARTIAL SKULL		
Anterior portion of skull with C/–M^3 (C/ large)	(w‡+)	44413
GROUP QUESTIONABLE		
SKULL		
Posterior portion of skull with P^4(br.)–M^3	(M)	43193
3 PARTIAL SKULLS, ETC., IMMATURE		
Partial skull with I^1–dP^2(germ), partial radius, partial femur, fragments of pes, and partial pelvis	(I)	44651
Anterior portion of skull with dP^1(br.)–M^2	(I)	44652
Partial right maxilla with dP^2–M^1(br.) and partial mandible with I_1–P_1(erupt.)–dP_2–M_1	(I)	44653
FROM 5–8 MI. S.E. OF CHUGWATER:		
GROUP I (SMALL PREMOLARS)		
PARTIAL SKULL AND MANDIBLE		
Anterior inferior portion of skull with C/–M^3 and partial mandible with P_3–M_3(br.) (C/ small)	(w+)	44860
6 MANDIBULAR RAMI		
2 partial mandibles with I_1–I_2 alv. and I_3(rt.)–M_3 (P_1 br.)	(w‡+)	44868

		F:A.M.
P_1(alv.)–P_4(rt.)	(M)	44869C
2 partial right rami with		
P_3–M_1	(W+)	44872A
P_2(alv.)–M_1	(W+)	44872C
2 partial left rami with		
/C–P_2 rt. and P_3–P_4	(W+)	44875A
/C(alv.)–M_1 (P_2–P_4 br.)	(W+)	44875C

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL

Partial skull with I^1(alv.)–M^3 (I^2–I^3 rt.) (C/ medium size)	(M+)	44859

6 MANDIBULAR RAMI

4 partial mandibles with		
I_1–M_3 (P_1 large)	(W‡)	44866
I_3–M_3 (P_1 br.)	(W+)	44867
I_1–P_4(br.) (P_1 large)	(W+)	44869A
I_1–P_4 (P_1 small)	(W+)	44869B
Partial right ramus with /C(rt.)–M_2 (P_1 rt.)	(W‡)	44872D
Partial left ramus with P_3–M_3	(W‡+)	44874

GROUP QUESTIONABLE

3 PARTIAL SKULLS, ETC., IMMATURE

Anterior portion of skull with I^3–dP^1–M^2 and partial mandible with I_1–dP_2–M_2	(I)	44861
Skull with I^2–dP^1–M^2	(I)	44862
Fragment of skull with dP^3–M^1 and partial manus	(I)	44863

4 PARTIAL MAXILLAE

Partial right maxilla with M^2–M^3	(W‡+)	44865
3 partial left maxillae with		
M^2–M^3	(W‡)	44864A
M^1–M^3	(W+)	44864B
M^1–M^3(br.)	(W‡)	44864C

10 MANDIBULAR RAMI

2 mandibles, immature, with		
dP_2–M_2(germ, br.)	(I)	44870
P_1–dP_2–M_2	(I)	44871
Partial right ramus with M_2–M_3	(W)	44872B
3 partial right rami, immature, with		
dP_2–M_1	(I)	44873A
I_1–dP_2–dP_3	(I)	44873B
dP_3–M_1	(I)	44873C
Partial left ramus with P_4–M_2(br.)	(W‡)	44875B
3 partial left rami, immature, with		
dP_2–dP_4	(I)	44876A
dP_2(rt.)–M_1	(I)	44876B
I_3–dP_2–M_1 (P_1 alv.)	(I)	44876C

G. FROM PORCUPINE AREA, SHANNON COUNTY, SOUTH DAKOTA

(Collected by Albert Thomson, 1906)

FROM PORCUPINE BUTTE:

GROUP I (SMALL PREMOLARS)

3 INDIVIDUALS UNDER 1 NUMBER

		A.M.
Muzzle of skull with I^1(erupt.)–P^3 (I^2 and C/ br., I^3 and P^1–P^2 erupt.)	(I)	27854

		A.M.
Partial mandible with /C–M_3 (P_1 medium size)	(w)	
Partial right ramus with P_4–M_3(br.)	(w‡+)	
Partial ulna, partial tibia, astragalus, calcaneum, pes elements, and partial pelvis		27854

2 MANDIBULAR RAMI

Mandible with I_1–M_3 (P_1 small)	(w+)	27858
Partial left ramus with P_1(alv.)–M_2	(w)	27857

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL AND MANDIBULAR RAMI

Anterior portion of skull with I^1–M^3 and partial left ramus with P_2–M_3 (C/ small)	(w)	12975

FROM PORCUPINE CREEK:

GROUP I (SMALL PREMOLARS)

SKULL, MANDIBLE, AND SKELETAL ELEMENTS

Skull with C/–M^3, mandible with I_1–/C alv. and P_1(rt.)–M_3, radius, ulna, and skeletal fragments; figured by Loomis, 1924, fig. 22; Thorpe, 1937, fig. 164, pl. 32, figs. 9–10; this paper figs. 6, 15, 17	(w+)	12980
This specimen is the holotype of "*Merychyus delicatus*" Loomis. See discussion, page 204.		

MAXILLA AND MANDIBULAR RAMUS

Right maxilla with P^1–M^3 (M^1 br.) and right ramus with /C–M_3 (P_1 large)	(w‡)	27862

GROUP QUESTIONABLE

2 SKULLS, ETC., IMMATURE

Anterior portion of skull with I^1–C/(erupt.)–dP^1–M^1, and partial mandible with I_1–P_1(erupt.)–dP_2–M_1	(I)	27856
Anterior portion of skull with I^1–dP^2–M^1(br.)	(I)	27860

FROM W. OF PORCUPINE CREEK:

GROUP II (LARGE PREMOLARS)

SKULL AND MANDIBLE

Partial skull with I^1–M^3 (C/–P^1 alv.) and partial mandible with I_1–M_3	(w‡+)	27859

FROM E. OF PORCUPINE CREEK:

GROUP I (SMALL PREMOLARS)

2 INDIVIDUALS UNDER 1 NUMBER

Partial right maxilla with P^3–M^3(br.)	(w)	
Partial mandible with P_1–M_3 (P_1 small)	(w)	
Partial left ramus with I_3–M_2(br.), (P_1, P_3–P_4 br.)	(w+)	
Fragments		27855

3 INDIVIDUALS UNDER 1 NUMBER

Partial skull with I^1–M^3	(w‡+)	
Partial right maxilla with P^2–P^4	(w‡+)	
Partial right ramus with M_1–M_2	(w+)	
And skeletal elements not prepared		27863

6. **Merychyus siouxensis** Loomis

From the Harrison formation, Sioux County, Nebraska; referred specimens from Niobrara and Goshen counties, Wyoming; and (6a) geographic variety from Silver Bow County, Montana

Merychyus siouxensis LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 33, fig. 21. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 232, fig. 169, pl. 34, figs. 5–6.

Phenacocoelus munroensis PETERSON, 1928, Mem. Carnegie Mus., vol. 11, no. 3, p. 161, pl. 18, figs. 1–9. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 181, pl. 37, fig. 9.

SPECIFIC CHARACTERS

SKULL: Larger than that of *M. crabilli;* approximate size of large examples of *M. arenarum;* nasals heavier than those of *M. crabilli*; lacrimal fossa deep and large; prelacrimal vacuity moderately large; postglenoid process decidedly heavier than that of *M. crabilli;* occipital condyles moderately large, larger than in *M. crabilli;* bulla large and well inflated.

MANDIBLE: Larger than that of *M. crabilli.*

DENTITION: Superior and inferior series decidedly longer and heavier than those of *M. crabilli;* closer to those of *M. arenarum.*

LIMBS: Decidedly longer and heavier than those of *M. crabilli.*

MEASUREMENTS: Tables 1 and 2.

ILLUSTRATIONS: Figures 1, 7, 13, 15–17.

DISCUSSION

Loomis[1] stated in his original reference that the anterior portions of P^2 and P^3 are especially long for this genus, and that the anterior basin is divided into two parts. The present writers believe this to be individual variation due to wear of the teeth of the holotype.

Thorpe[2] stated that the premolars are not spaced properly, and that a noticeable diastema is present between I^3 and C/. When several skulls of the same species are examined, it is apparent that spacing and size of diastema can be attributed to individual variation within a species of oreodonts.

The holotype of "*Phenacocoelus munroensis*" is typical of *Merychyus.* The dentition is lighter, more hypsodont, and completely lacks the squarish appearance of that of *Phenacocoelus.* The ramus differs from examples of *Phenacocoelus* as follows: lighter construction; less prominent chin; ascending ramus of less width (anteroposteriorly); and less posterior projection beyond the condyle. The limb elements, as pointed out by Peterson[3] and Thorpe,[4] are long and light compared with those of *Phenacocoelus typus.*

It is unfortunate that the skeletal elements of *Merychyus siouxensis* are not well represented in the collections. The complete femur C.M. 1288 (holotype of "*P. munroensis*") compares favorably with the immature femur F:A.M. 44628 of *M. siouxensis.* The partial tibia of the former specimen compares readily with the partial tibia F:A.M. 37530. The manus and pes elements of the Carnegie Museum specimen are slightly smaller than the not quite mature example of *M. siouxensis,* A.M. 17222.

The geologic horizon for "*Phenacocoelus munroensis*" was given by Peterson as "upper Monroe Creek," but the fossiliferous zone from which the holotype was collected is in the lower part of the Harrison.[5] The upper Monroe Creek exposures along this part of Pine Ridge form perpendicular bluffs, and it is a rarity to find any fossils in these deposits. All of the referred specimens of *M. siouxensis* have been collected from the Harrison. There also is a question as to whether the holotype of *Phenacocoelus typus* actually came from the Monroe Creek, but this will be discussed at a later time when that genus is considered.

The referred specimens here listed under *M. siouxensis* include the first published ramal and limb evidence of the species. All of the superior canines and the inferior first premolars are large. A few might be called medium size, but none are equal to the small size found in other *Merychyus* listings in this paper. The F:A.M. material from Wyoming was collected by Nelson J. Vaughan, John Lynch, Everett DeGroot, Gene Roll, and Charles H. Falkenbach, 1931–1939.

Fifty-seven specimens are here recorded:

[1] Loomis, Frederic B., 1924, *ibid.*, p. 33.

[2] Thorpe, Malcolm R., 1937, *ibid.*, p. 234.

[3] Peterson, O. A., 1928, *loc. cit.*

[4] Thorpe, Malcolm R., 1937, *loc. cit.*

[5] Schultz, C. Bertrand, 1938, Amer. Jour. Sci., vol. 35, pp. 441–444; 1941, Bull. Univ. Nebraska State Mus., vol. 2, no. 8, pp. 69–82, figs. 28, 29, 32.

HOLOTYPE

Skull with I^2–M^3. (w) Type has large premolars	A.M. 13774	From 10 mi. W. of Agate, Sioux County, Nebraska; collected by T. F. Olcott, 1907 Figured by Loomis, 1924, fig. 21; Thorpe, 1937, fig. 169, pl. 34, figs. 5–6 This paper, figs. 1, 7

REFERRED FROM (A) SIOUX COUNTY, NEBRASKA; (B) NIOBRARA AND (C) GOSHEN COUNTIES, WYOMING

A. FROM SIOUX COUNTY, NEBRASKA

FROM 5½ MI. S. OF SNAKE CREEK-SHEEP CREEK AREA; COLLECTED BY MORRIS SKINNER AND ASSOCIATES, 1941:

GROUP I (SMALL PREMOLARS)

4 ASSOCIATED SKULLS AND MANDIBULAR RAMI

2 anterior portions of skulls, etc.:		
Anterior portion of skull with I^1(alv.)–M^3 and right ramus with I_3(alv.)–M_3 (/C–P_1 rt., P_2–P_3 absent) (C/ medium size)	(w)	F:A.M. 44606B
Anterior portion of skull with I^1–M^3 (C/ large)	(w)	44606C

GROUP II (LARGE PREMOLARS)

Anterior portion of skull with P^1–M^3 and left ramus with /C–M_3 (P_1 medium size)	(w‡‡)	44606A

GROUP QUESTIONABLE

Anterior portion of skull with I^1–dP^2–M^2	(i)	44606D

The above four associated skulls and rami are of interest as they demonstrate the association of large and small premolar series.

FROM N. OF HARRISON; COLLECTED BY E. H. BARBOUR, 1892:

GROUP II (LARGE PREMOLARS)

SKULL

Partial skull with P^1–M^3	(w)	U.N.S.M. 7-7-92

FROM ½ MI. N. OF AGATE POST OFFICE; COLLECTED BY ALBERT THOMSON, 1919:

GROUP QUESTIONABLE

SKULL, MANDIBLE, AND LIMB ELEMENTS, IMMATURE

Partial skull with I^1–dP^2–M^3(erupt.), mandible with I_1(alv.)–dP_3–M_3(erupt.), and limbs	(i)	A.M. 17722

FROM AGATE SPRING QUARRY; COLLECTED BY HAROLD J. COOK, 1904:

GROUP II (LARGE PREMOLARS)

SKULL, MANDIBULAR RAMUS, AND SKELETAL ELEMENTS

Partial skull with I^1–M^3, left ramus with I_3(br.)–M_3 (P_1 br.), partial radius, and partial ulna	(w)	C.M. 1593

The postglenoid process is heavier than the type, but within individual variation.

FROM THE HEAD OF WARBONNETT CREEK:

MANDIBLE AND SKELETAL ELEMENTS

Mandible with I_1–M_3, 2 partial radii, femur, partial tibia, manus and pes

		C.M.
elements, partial pelvis, and vertebrae. Figured by Peterson, 1928, pl. 18, figs. 1–9; this paper, figures 7, 16	(W+)	1288

This specimen is the holotype of *Phenacocoelus munroensis* Peterson. See discussion, page 223.

B. FROM NIOBRARA COUNTY, WYOMING, 1931–1934

FROM N. OF KEELINE:

GROUP I (SMALL PREMOLARS)

3 PARTIAL SKULLS

		F:A.M.
3 partial skulls with		
I^1–I^3 alv. and C/–M^3	(W^{++}_{+})	33368
I^2–M^3	(W+)	44444
I^1–M^3(br.) (I^2 alv.)	(W)	45365

2 MANDIBLES

Mandible with /C–M_3	(M+)	34418
Partial mandible with I_1–M_3(br.) (I_3 alv.)	(W+)	44448

GROUP II (LARGE PREMOLARS)

SKULL, MANDIBLE, AND ASSOCIATED LIMB ELEMENTS

Crushed skull with I^1–I^2 rt. and I^3–M^3, mandible with I_1–M_3, partial femur, 2 partial tibiae, and pes; figured by Schultz and Falkenbach, 1941, fig. 17F; this paper, figs. 13, 17 (in part)	(M+)	37530

2 PARTIAL SKULLS

2 partial skulls with		
I^1–M^3	(M+)	33380
I^1–I^2 alv. and I^3–M^3 (C/ medium size)	(W)	43396

2 MANDIBULAR RAMI

Partial right ramus with I_1(alv.)–P_4 (I_2–/C rt.)	(W+)	43401
Partial left ramus with I_1–M_3	(W)	44446

GROUP QUESTIONABLE

PARTIAL SKULL

Partial skull with P^4(br.)–M^3	(M+)	43397

MAXILLA, IMMATURE

Partial right maxilla with dP^2(br.)–dP^4	(I)	44635

3 MANDIBULAR RAMI

3 partial left rami with		
M_1(br.)–M_2	(W+)	44403
P_4–M_3 (P_4 large)	(M+)	44447
I_1–I_2 alv. and I_3(br.)–M_3 (P_2–P_4 rt.)	(W^{+}_{+})	44449

2 MANDIBULAR RAMI, IMMATURE

Partial mandible with P_1 and dP_4(br.)–M_3(germ)	(I)	44637
Partial right ramus with dP_4–M_1(alv.)	(I)	44636

FROM N. OF LUSK (NEAR U. S. HIGHWAY NO. 85), 1931, 1932, AND 1938:

GROUP I (SMALL PREMOLARS)

SKULL AND MANDIBLE

Skull with C/–M^3 and mandible with I_1–M_3	(W^{+}_{+})	43394

4 PARTIAL SKULLS

		F:A.M.
4 partial skulls with		
I^1–M^3	(W)	33378
I^2–M^3 (I^3 alv.)	(W+)	34339
C/–M^3	(W+)	43395
I^1–M^3	(W)	44599

2 MANDIBLES

2 mandibles with		
I_1–M_3	(W‡)	43400
I_1–M_3	(W‡)	45360

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with I_1–/C alv. and P_1–M_3 (P_2 br., P_3 alv.)	(W)	44451

GROUP QUESTIONABLE

PARTIAL SKULL

Partial skull with P^4–M^3	(W‡+)	43399

MAXILLA, MANDIBLE, AND LIMB ELEMENTS, IMMATURE

Left maxilla with dP^2–dP^3 br. and dP^4–M^1, mandible with I_3–dP_4–M_2(germ) (P_3 alv.), partial scapula, partial humerus, femur, and pelvis	(I)	44628A
Partial left ramus with I_1–M_1 rt. and M_2–M_3	(W)	44628B
The above two specimens were found associated.		

SKELETAL ELEMENTS

Radius, ulna, partial femur, partial tibia, and vertebrae. Figs. 15, 16, 17 (in part)		44405

FROM S.E. OF VAN TASSELL, 1933 AND 1938:

PARTIAL SKULL, ETC., IMMATURE

Partial skull with C/(erupt.)–dP^1–M^1, partial right ramus with P_1(alv.)–P_3(rt.)–dP_4–M_1 (P_2 rt.), 2 partial humeri, 2 partial radii, 2 partial ulnae, partial femur, 2 partial tibiae, etc.	(I)	44753

FROM 1 MI. S.W. OF VAN TASSELL:

GROUP II (LARGE PREMOLARS)

SKULL, MANDIBLE, AND SKELETAL ELEMENTS

Skull with I^1–M^3, mandible with I_3(br.)–M_3, radius, partial ulna, and atlas	(W+)	45364

2 MANDIBULAR RAMI

Partial right ramus with I_1–/C alv. and P_1–dP_2–M_2	(I)	44729
Partial left ramus with I_1–I_2 alv. and I_3–M_1(br.)	(W‡)	44765

FROM N. OF MANVILLE, 1931 AND 1933:

GROUP I (SMALL PREMOLARS)

SKULL AND MANDIBLE

Anterior portion of skull with C/–M^3 and mandible with P_1–M_3	(M+)	33365
Associated with *Promerycochoerus carrikeri.*		

2 MANDIBLES

2 mandibles with		
I_1–M_3	(W+)	44445
I_1–M_3	(W‡)	44450

GROUP QUESTIONABLE

PARTIAL SKULL

		F:A.M.
Partial skull with C/–M^3 (P^2–P^3 absent)	(w)	43398

MAXILLA

Partial left maxilla with P^4–M^3 (P^4–M^2 br.)	(w‡+)	44453

2 MANDIBULAR RAMI, IMMATURE

Mandible with I_1–I_2 rt. and I_2–dP_2–M_3(br.)	(I)	44638
Partial right ramus with I_1–/C alv. and P_1(rt.)–dP_2–dP_4	(I)	44639

FROM N. OF VAN TASSELL, 1931:

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL AND MANDIBLE

Partial skull with P^1(br.)–M^3 and partial mandible with P_2(br.)–M_3	(w+)	34421

FROM N. OF JERIAH, 1932–1933:

GROUP II (LARGE PREMOLARS)

MANDIBLE

Partial mandible with P_1(alv.)–M_3	(w+)	44600

FROM 8 MI. S.W. OF KEELINE:

GROUP I (SMALL PREMOLARS)

MANDIBLE

Partial mandible with I_1–M_3	(w‡)	44605

GROUP QUESTIONABLE

MANDIBULAR RAMUS

Partial right ramus with I_1–M_3(rt.) (/C br., P_1 absent, P_2 br.)	(w+)	44604

C. FROM GOSHEN COUNTY, WYOMING

FROM 13 MI. S. OF JAY EM, 1931:

PARTIAL SKULL

		F:A.M.
Anterior portion of skull with C/–M^3 (C/ large)	(w‡)	43269

FROM 6 MI. N.W. OF LINGLE, 1931:

MAXILLA, MANDIBLE, ETC.

Right maxilla with C/–M^3, partial mandible with I_1–I_2 alv. and I_3–M_3 (P_3–M_1 absent), 2 astragali, and 2 calcanea	(w)	44621

6a. QUESTIONABLE GEOGRAPHIC VARIETY FROM ½ MILE EAST OF WOODIN, SILVER BOW COUNTY, MONTANA

(Collected by Charles H. Falkenbach, 1936 and 1942)

PARTIAL MAXILLA AND PARTIAL MANDIBLE

		F:A.M.
Partial right maxilla with C/–P^3 br. and partial mandible with P_1–M_3 br.	(w‡)	44858

MANDIBLE

Partial mandible with I_3–M_3 (/C rt.)	(M+)	44857

The dentition in specimen F:A.M. 44858 is not separable from the average examples of *Merychyus siouxensis* from the central Great Plains. The dentition of mandible F:A.M. 44857 differs in having a rather small P_4 but large P_1–P_3, and the teeth are more hypsodont than examples of *Merychyus siouxensis*.

This material is of importance in that it is the first *Merychyus* remains to be reported from Montana. The location is a very short distance from the collecting locality of "*Ticholeptus breviceps*" of Douglass, 1 mile southeast of Woodin, Montana. "*Ticholeptus breviceps*" is closely related to "*Ticholeptus petersoni*" of Loomis which comes from the Harrison formation of the central Great Plains. Both *Merychyus siouxensis* and "*Ticholeptus petersoni*" are found in the same formation, which fact indicates that this questionable geographic variety probably comes from deposits approximating the Harrison in age.

7. **Merychyus**, species undetermined

From Miocene deposits of questionable age, Jackson Hole, Lincoln County, Wyoming

Merychyus arenarum Cope, COLBERT, 1943, Jour. Paleont., vol. 17, no. 3, p. 298, fig. 1.

DESCRIPTION

SKULL: Narrow (although laterally crushed, the skull is not so wide as other examples of *Merychyus*); muzzle indicating a skull in width comparable with examples of *Merychyus* (*Metoreodon*) *relicitus taylori;* lacrimal fossa small, size of either *Merychyus* or *M.* (*Metoreodon*); anterior border of prelacrimal vacuity above anterior edge of P^4; infraorbital foramen above anterior border of P^4; muzzle joined for longer distance than in *Merychyus*, similar to that of *M.* (*Metoreodon*); anterior palatine foramen small, anterior border in line with posterior portion of P^1 [similar to *M. crabilli* and smaller than most examples of *M.* (*Metoreodon*)]. (Skull known from anterior portion only.)

MANDIBLE: Light construction, comparable to that of *M. crabilli;* inferior border like *Merychyus*, lacking concave curve of *M.* (*Metoreodon*); postsymphysis below anterior portion of P_3; muzzle slightly concave, similar to *M. arenarum.*

DENTITION: Similar to *Merychyus;* lacking the suggested cusps on P^2 and P^3 and the deep external grooving on P_2–P_4 as in *M.* (*Metoreodon*); superior and inferior dentition measurements within the variation found in either *M. arenarum*, *M. minimus*, or *M.* (*Metoreodon*) *relictus;* premolars more or less in line with the alveolar border, in *M.* (*Metoreodon*); P_1–P_3 set at an angle to the ramus; C/ small; /C larger than P_1 (a rarity in *Merychus*).

LIMBS: Unknown.

MEASUREMENTS: Table 1.

ILLUSTRATIONS: Figure 7.

DISCUSSION

The skull from the Jackson Hole area is of interest as it comes from a new locality in Wyoming where heretofore fossils had not been reported. Although Colbert identified the specimen as *Merychyus arenarum* Cope, there appears to be little evidence to substantiate this determination. As the specimen had not been fully removed from the original matrix when first described, some of the characters were obscured. The writers are indebted to Dr. F. M. Fryxell of Augustana College for permission to have the skull and mandible separated and the specimen further prepared for study (see fig. 7).

The specimen in question has many characters similar to those of *Merychyus* and some like those of the subgenus *M.* (*Metoreodon*). The small superior canine is not diagnostic, since both large and small canines are found within the same species of *Merychyus.* In *M.* (*Metoreodon*), however, all of the superior canines are small. The inferior canine in the mandible of the Wyoming specimen is unique because of its large size, but perhaps this may be attributed to individual variation. The well-worn teeth leave in doubt the distinguishing characters of the superior premolars. The discovery of a skull having the posterior portion present, as well as of associated skeletal elements, undoubtedly would aid in a definite identification of the form. The writers do believe that the skull in question can be referred to the genus *Merychyus* but definitely not to the species *M. arenarum.* Additional material may prove that the narrow width of the skull and the large size of the inferior canine may be of specific value but on the other hand may represent individual variation of a known species. It seems best, therefore, to list the specimen as undetermined.

The geologic age of the Jackson Hole sediments seems to be very questionable at this time. It appears, however, that the deposits are of Miocene origin but whether

TABLE 1

Merychyus LEIDY. COMPARATIVE MEASUREMENTS[1] OF SKULLS AND RAMI

	M. crabilli, new species	*M. siouxensis* Loomis	*M. arenarum* Cope			*M. arenarum idahoensis*, new subspecies
	Holotype U.N.S.M. 1-1-7-33 S.P.	Holotype A.M. 13774	Holotype A.M. 8146	Referred A.M. 8149[2]	Referred F:A.M. 33369	Holotype F:A.M. 44827
SKULL						
Stage of wear of teeth	(w)	(w)	(w+)	(w+)	(w+)	(w+)
Length (including supraoccipital crest and incisors)	((153))	177.5	—	168	168	((173))
Basal length (from anterior notch of foramen magnum to posterior base of I^1)	((130))	153.5	—	153	152.5	161
Width (max.)	(88)	104	((100))	(85)	102	((111))
Width of brain case (max.)	(48)	55	(52)	41	53	(54)
Width, interorbital (min.)	40	55	55	41	50	46.5
Distance from anterior rim of orbit to anterior base of canine	55	68	—	63.5	66	70
Distance from anterior rim of orbit to supraoccipital crest	—	113	124	116	109	—
Length of nasal	46.5	60.5	—	—	58	62
Width of muzzle at infraorbital foramina	40	49	54	39	52	47.5
Width across canines	23.5	29	—	16.5	29	30
Length, C/–M^3 incl.	72	88	—	81	82.5	86.5
Length, P^1–M^3 incl	67	80	—	73.5	74.5	80.5
Length, P^1–P^4 incl.	28.5	35.5	—	33	32.5	36
Length, M^1–M^3 incl.	40.5	46	45	43.5	44.5	46.5
Width of M^3 (max.)	14	17.5	15.5	16	16	16.5
Depth of malar below orbit	15	18.5	18.5	17.5	18	17.5
	Referred F:A.M. 44458	Referred F:A.M. 44446				Referred U.M.
RAMUS						
Stage of wear of teeth	(w^{+}_{+})	(w)				(w)
Length (max., including incisors)	—	—	—	138	(136)	—
Length, /C–condyle incl.	—	—	—	127	127.5	—
Depth of jaw under coronoid	—	—	—	69.5	72	—
Depth of jaw below anterior edge of M_3	26.5	29.5	33	28	29	28.5
Length, /C–M_3 incl.	—	90.5	95	85.5	84	90
Length, P_1–M_3 incl.	71	85	88	79	78.5	83
Length, P_1–P_4 incl.	31	35	40	32	32	36
Length, M_1–M_3 incl.	40	50	48.5	48	47	47

[1] ( ) Approximate; (( )) estimated. All measurements in millimeters.
[2] Holotype of *M. arenarum leptorhynchus* Cope.

TABLE 1—*Continued*

	M. minimus Peterson		*M. elegans* Leidy			*M. elegans bluei*, new subspecies	*Merychyus*, species undetermined
	Holotype C.M. 1466	Referred A.M. 12980[1]	Holotype[2]	Referred U.N.S.M. 2-10-8-36 S.P.	Referred A.M. 9047[3]	Holotype U.N.S.M. 7-10-9-38	Example Aug.C. V.120
SKULL							
Stage of wear of teeth	(w)	(w+)	(w)	(w+)	(w)	(w)	(w+)
Length (including supraoccipital crest and incisors)	156	—	—	((175))	—	—	—
Basal length (from anterior notch of foramen magnum to posterior base of I^1)	135	(137)	—	(154)	—	—	—
Width (max.)	90	((85))	—	108	—	112	—
Width of brain case (max.)	(43)	((41))	—	56	—	60	—
Width, interorbital (min.)	38	(42)	—	49.5	—	49	31.5
Distance from anterior rim of orbit to anterior base of canine	61	54.5	—	71	—	72	61.5
Distance from anterior rim of orbit to supraoccipital crest	92	—	—	—	—	—	—
Length of nasal	(58)	—	—	53	—	—	—
Width of muzzle at infraorbital foramina	41	39	—	50	—	49	32
Width across canines	29	—	—	30.5	—	34	21
Length, C/–M^3 incl.	79	71.5	88.5	86	—	83	79
Length, P^1–M^3 incl.	70	65	77	75	—	71	73.5
Length, P^1–P^4 incl.	32	30	31.5	33.5	—	33.5	31.5
Length, M^1–M^3 incl.	40	37	46	42.5	—	41	42.5
Width of M^3 (max.)	14	14	16	15	—	14.5	15.5
Depth of malar below orbit	16	13	—	22	—	16.5	15
RAMUS							
Stage of wear of teeth							
Length (max., including incisors)	132	(119)	—	145.5	142.5	150	—
Length, /C–condyle incl.	117.5	(112)	—	(134)	131	139.5	—
Depth of jaw under coronoid	66	63	—	—	—	68	—
Depth of jaw below anterior edge of M_3	26	26	27.5	27	27.5	29	27
Length, /C–M_3 incl.	81.5	—	—	88	87	86.5	82.5
Length, P_1–M_3 incl.	76.5	(70)	((84))	80	80	78.5	78
Length, P_1–P_4 incl.	32.5	(28)	35[4]	34.5	34	35	31
Length, M_1–M_3 incl.	44	42	49.5	46	47	43.5	47

[1] Holotype of *M. delicatus* Loomis.
[2] U.S.N.M. 438 or 121 and A.N.S.P. 11289 and 11290.
[3] Holotype of *M. paniensis* Loomis.
[4] U.S.N.M. 119 or 120.

TABLE 2

Merychyus LEIDY. COMPARATIVE MEASUREMENTS[1] OF SKELETAL ELEMENTS

	M. crabilli, new species			*M. siouxensis* Loomis		*M. arenarum* Cope	*M. arenarum idahoensis*, new subspecies
	Referred F:A.M.		A.C. 1931–26	Referred F:A.M.		Referred F:A.M. 43277	Holotype F:A.M. 44827
Length of humerus (articular)	112.5	45384Z4	117.5	—		125	124.5
Length of radius (articular)	96.5	43393	(108)	122.5	44405	118	112
Length of ulna (max.)	125	43393	142	(155)	44405	(155)	(148)
Length of metacarpal III (max.)	53.5	43393	(62)	—	C.M.	59	56.5
Length of femur (articular)	122.5	45384Z1	(116)	162.5	1288	142	((145))
Length of tibia (articular)	—		(117)	—	F:A.M.	142	131.5
Length of metatarsal III (max.)	—		(68)	74	37530	70	65.5
Length of calcaneum (max.)	—		—	—		49	—

TABLE 2—*Continued*

	M. minimus Peterson		*M. elegans* Leidy		*M. elegans bluei*, new subspecies
	Referred F:A.M. 33364	44610	Referred U.N.S.M.		Holotype U.N.S.M. 7-10-9-38
Length of humerus (articular)	—	—	((127))	2-10-8-36	—
Length of radius (articular)	107.5	103.5	120	2-10-8-36	101.5
Length of ulna (max.)	(140)	—	—		—
Length of matacarpal III (max.)	57.5	—	57	F:A.M. 43305	—
Length of femur (articular)	128	—	—		—
Length of tibia (articular)	130.5	116.5	126.5	Col.M. 2-31	—
Length of metatarsal III (max.)	63	—	69	F:A.M. 43305	—
Length of calcaneum (max.)	45	46	45	U.N.S.M. 2-10-8-36	47

[1] ( ) Approximate; (( )) estimated. All measurements in millimeters.

they are Arikareean or Hemingfordian is not certain. To the northwest of Jackson Hole in eastern Idaho there are deposits equivalent to the Marsland (see p. 186) and to the southeast in central Wyoming there are various exposures that have yielded *Brachycrus* remains[2] which have close affinities to those found in the "Sheep Creek" and "Lower Snake Creek" sediments of Nebraska. The Marsland formation is well exposed in many sections of eastern Wyoming. Harrison deposits which are fossiliferous are chiefly concentrated in the Lusk area and the Pine Ridge region adjacent to Nebraska. The Miocene exposures in eastern Wyoming have been explored extensively by field parties from the Frick Laboratory and have yielded a large paleontological collection.

One specimen is here recorded:

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, pp. 247–254.

SKULL AND MANDIBLE

Partial skull with I^1–M^3 and partial mandible with I_1–I_3. (w‡)	Aug.C. V120	From Pilgrim Creek, Jackson Hole, Lincoln County, Wyoming; collected by Roy A. Saunders Figured by Colbert, 1943, fig. 1 This paper, fig. 7

IA. MERYCHYUS (METOREODON)
MATTHEW AND COOK

Merychyus, sub. gen. *Metoreodon* sub. gen. nov. MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., vol. 26, art. 27, p. 391.

Metoreodon (Matthew and Cook), COOK, 1912, Nebraska Geol. Surv., vol. 7, pt. 5, p. 45. MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., vol. 38, art. 7, p. 215; 1924, *ibid.*, vol. 50, art. 2, p. 181. HAY, 1930, Carnegie Inst. Washington Publ., no. 390, p. 788. THORPE, 1937, Mem. Peabody Mus. Nat. Hist., vol. 3, pt. 4, p. 202.

SUBGENOTYPE: *Merychyus* (*Metoreodon*) *relictus*[1] Matthew and Cook.

SUBGENERIC CHARACTERS

SKULL: Small size; ranging in basal length from 147 mm. to 152 mm.; occipital region completely fan-shaped, the base of the paroccipital process being incorporated in the flare; exoccipital pits small, but more like those typical of *Ustatochoerus* (see fig. 14), fan-shaped flare as in *Ustatochoerus* and greater than in *Merychyus;* lacrimal fossa very shallow to absent; prelacrimal vacuity present; infraorbital foramen above region of P^3–P^4; paroccipital process expanded laterally, forming part of the fan-shaped occipital region; postglenoid process compressed anteroposteriorly (in average *Merychyus* the process is comparatively heavy); bulla large, semidepressed (depressed in basioccipital region and inflated anterior of paroccipital process); auditory meatus expanded between postglenoid and paroccipital processes (somewhat similar to that of *Ustatochoerus*).

MANDIBLE: Similar to that of *Merychyus* but differing in having a more developed apophysis or process posterior to the condyle; inferior ramal border more concave than in *Merychyus*.

DENTITION: Subhypsodont; premolars more complicated than those of *Merychyus;* P^2–P^3 with a suggestion of cusps on the posterior crescent (in *Ustatochoerus* these cusps are well developed); P_1–P_3 set obliquely in ramus; C/ and P_1 small (in *Merychyus* there are large and small superior canines and inferior first premolars within a species; see fig. 13 and discussion on p. 172); P_2–P_4 well grooved externally.

LIMBS: Light and moderately long; approximately equal to those of *M. elegans*, an intermediate-sized *Merychyus*.

MEASUREMENTS: Tables 3 and 4.

ILLUSTRATIONS: Figures 1, 8, 10, 11 (skulls, mandibles, and dentitions); 14 (occipital region of skull); 15–17 (limbs).

DISCUSSION

Merychyus (*Metoreodon*) and *Merychyus* are similar in size. Matthew and Cook[2] established the subgenus to provide for the forms with more complicated premolars, namely, *M.* (*Metoreodon*) *relictus* and "*M.* (*Metoreodon*) *profectus*" (= *Ustatochoerus profectus*). In 1941 Schultz and Falkenbach[3] proposed the separation of the two species, designating *profectus* as the genotypic species of the new genus *Ustatochoerus*, and recognizing *relictus* as the subgenotypic species of *Merychyus* (*Metoreodon*) Matthew and Cook.

Under the discussion of *Ustatochoerus* it was stated that the premolars of both species were complicated, but that the premolars of *U. profectus* were decidedly more advanced than *M.* (*Metoreodon*) *relictus*. Furthermore, *Ustatochoerus* represents a much larger form (which is confined to the Valentine and Ash Hollow of the Ogallala or to formations of approximately the same age) than *Merychyus* (*Metoreodon*) (which is known from the "Sheep

[1] For discussion of the subgenotypic species *relictus*, see Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 10.

[2] Matthew, W. D., and Cook, H. J., 1909, *loc. cit.*

[3] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, *loc. cit.*

Creek" and "Lower Snake Creek" deposits or from beds of equivalent age).

Merychyus and *Merychyus* (*Metoreodon*) could not be readily separated were it not for the complicated superior and inferior premolars of the latter and the simpler premolars of the former. Other noticeable differences which distinguish the subgenus from *Merychyus* are the more pronounced fan-shaped occipital region, the lighter postglenoid process, the more prominent postcondyle process of the ramus, and the slightly more concave inferior ramal border.

The dentition of *Merychyus* (*Metoreodon*) approaches that of *Ticholeptus*, but is of smaller size. In the former, P_1–P_3 are set at an angle to the ramal border, while in *Ticholeptus* there is less crowding of the premolars. *Ticholeptus* is known from a horizon correlated with the "Sheep Creek" and "Lower Snake Creek" or with other late Miocene deposits of similar age.

The "Lower Snake Creek" is considered by the writers to be a part of the Sheep Creek formation,[1] but the terms "Sheep Creek" and "Lower Snake Creek" of Matthew will be retained for convenience in this paper. The writers find that the fauna may be divided into two horizons according to Matthew, 1924. Perhaps the terms Lower Sheep Creek fauna and Upper Sheep Creek fauna would simplify the matter, the former equaling Matthew's "Sheep Creek" and the latter equaling "Lower Snake Creek."

Merychyus (*Metoreodon*) represents the last known group of the oreodonts to be considered by the writers from the Snake Creek-Sheep Creek areas of Sioux County, Nebraska. The table below indicates the known distribution of the four genera and one subgenus recognized from this area.

[1] Lugn, A. L., 1938, Amer. Jour. Sci., ser. 5, vol. 36, p. 226; Matthew, W. D., 1924, Bull. Amer. Mus. Nat. Hist., vol. 50, art. 2, p. 61; Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 220; 1941, *ibid.*, vol. 79, art. 1, p. 76.

Distribution

One species, two subspecies, and one undetermined species are here recorded from the upper Miocene of California, Nebraska, and New Mexico. This is the first report of the occurrences of *Merychyus* (*Metoreodon*) in California and New Mexico. (See distribution chart, p. 169, and figs. 1, 8, 10, 11, 14–17; also comparisons and distribution of Merycochoerinae[2] and Ticholeptinae.[3])

Summary of Species and Types

One species and two varieties of *Merychyus* (*Metoreodon*) from three Miocene localities are here recorded:

1. *Merychyus* (*Metoreodon*) *relictus* Matthew and Cook, 1909, from Sioux County, Nebraska; referred remains from Dawes County, Nebraska. ("Lower Snake Creek" or equivalent.)

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, *ibid.*, vol. 77, art. 5, p. 216.

[3] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, *ibid.*, vol. 79, art. 1, p. 6.

Distribution of Oreodonts[4] within the Snake Creek-Sheep Creek Areas

	"Sheep Creek"	"Lower Snake Creek"	"Upper Snake Creek"
Brachycrus siouense (small species)		x	
Brachycrus wilsoni (large species)	x		
Ticholeptus hypsodus		x	
Merychyus (*Metoreodon*) *relictus taylori* (small species)	x		
Merychyus (*Metoreodon*) *relictus* (slightly larger species)		x	
Mediocherus blicki		x	
Ustatochoerus profectus (small species)			x
Ustatochoerus major (larger species)			x

[4] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 218; 1941, *ibid.*, vol. 79, art. 1, pp. 10, 72, 92.

HOLOTYPE: Partial right ramus, A.M. 14056. Figure 10.

1a. *Merychyus* (*Metoreodon*) *relictus taylori*, new subspecies, from Sioux County, Nebraska. ("Sheep Creek.")

HOLOTYPE: Skull, F:A.M. 34319. Figures 1, 8.

1b. *Merychyus* (*Metoreodon*) *relictus fletcheri*, new subspecies, from the Barstow area, San Bernardino County, California. (?Approximate "Sheep Creek" or "Lower Snake Creek" equivalent.)

HOLOTYPE: Partial left maxilla, F:A.M. 34491. Figure 11.

2. *Merychyus* (*Metoreodon*), species undetermined, from west of Chimayo, Santa Fe County, New Mexico. (?Approximate "Sheep Creek" or "Lower Snake Creek" equivalent.)

EXAMPLE: Partial maxilla and fragmentary limbs, F:A.M. 43129.

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

MERYCHYUS (METOREODON)

TOTAL AVAILABLE SPECIMENS: 199

1. Merychyus (Metoreodon) relictus Matthew and Cook

From the Miocene deposits ("Lower Snake Creek"), Sioux County, Nebraska; and referred specimens from Dawes County, Nebraska

Merychyus (*Metoreodon*) *relictus* MATTHEW AND COOK, 1909, Bull. Amer. Mus. Nat. Hist., vol. 26, art. 27, p. 392, fig. 14.

Metoreodon relictus (Matthew and Cook), COOK, 1912, Nebraska Geol. Surv., vol. 7, pt. 5, p. 45. MATTHEW, 1918, Bull. Amer. Mus. Nat. Hist., vol. 38, art. 7, p. 215; 1924, *ibid.*, vol. 50, art. 2, p. 182. LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, fig. 6. HAY, 1930, Carnegie Inst. Washington Publ., no. 390, p. 788. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 212, figs. 5, 154.

SPECIFIC CHARACTERS

SKULL: Approximate size of *M. elegans;* nasals broad; malar deep below orbits; bulla large and semi-depressed; postglenoid process moderate size, but light and crowded by bulla.

MANDIBLE: Approximate size of *M. elegans.*

DENTITION: Superior and inferior series equal in length to those of *M. elegans;* premolars complicated (see subgeneric characters, p. 232).

LIMBS: Light and long, approximating those of *M. elegans.*

MEASUREMENTS: Tables 3 and 4.

ILLUSTRATIONS: Figures 1, 8, 10, 14–17.

DISCUSSION

The skull and limb elements of *M.* (*Metoreodon*) *relictus* are figured here for the first time. The subspecific differences between *M.* (*Metoreodon*) *relictus* from the "Lower Snake Creek" and *M.* (*Metoreodon*) *relictus taylori*, new subspecies, from the "Sheep Creek," although well marked, do not demonstrate the specific size difference noted in *Brachycrus siouense* from the "Lower Snake Creek" and *B. wilsoni* from the "Sheep Creek."

The F:A.M. specimens from Sioux County, Nebraska, were collected in 1934–1940 by Jack Wilson and Carl Long, in 1941 by Morris Skinner, Gordon Fletcher, and associates, and in 1935–1938 from Dawes County, Nebraska, by Ted Galusha and associates. The A.M. specimens were collected in 1908 by Dr. W. D. Matthew and Albert Thomson and in 1921 and 1925 by Albert Thomson.

One hundred and thirty-six specimens are here recorded:

HOLOTYPE

Partial right ramus with I_1–/C alv. and P_1–M_3 (M_2 alv.). (w‡)	A.M. 14056	From "Lower Snake Creek" horizon, Sioux County, Nebraska, 1908 Figured by Matthew and Cook, 1909, fig. 14; Loomis, 1924, fig. 6; Thorpe, 1937, figs. 5, 154; Schultz and Falkenbach, 1941, fig. 17E This paper, fig. 10

REFERRED FROM (A) SIOUX AND (B) DAWES COUNTIES, NEBRASKA

A. FROM TYPE AREA, SIOUX COUNTY, NEBRASKA

FROM HUMBUG QUARRY, RANCHHOUSE DRAW, 1939–1941:

GROUP I (SMALL PREMOLARS)

2 SKULLS

		F:A.M.
Skull (lacking nasals and premaxillae) with P^1–M^3; figured by Schultz and Falkenbach, 1941, fig. 17E; this paper, figs. 1, 8, 14 (in part)	(M)	43078
Skull (lacking nasals and premaxillae) with C/–M^3	(M)	43079

3 MAXILLAE

3 partial left maxillae with		
P^1–M^3(br.)	(W)	43093
P^2–M^3(br.)	(W‡)	43094
P^4–M^3	(W)	43095

18 MANDIBULAR RAMI

3 mandibles with		
I_1–I_3 alv. and /C–P_4(br.)	(W‡)	37541
I_1–P_1 alv. and P_2–M_3	(W)	43091
I_1–I_2 alv. and I_3–M_3. Figure 8	(W‡)	43098
5 right rami with		
P_2(rt.)–M_3	(W‡)	43101
P_2–M_3	(W‡)	43102
P_1(alv.)–M_3(br.)	(W‡)	43103
I_2–/C alv. and P_1–M_2	(W+)	43104
P_1–M_3	(W‡)	43227
10 left rami with		
P_3(br.)–M_3(br.)	(W‡)	43110
P_4–M_3	(W)	43111
I_2–/C alv. and P_1–M_2	(W+)	43112
I_1–/C alv. and P_1–M_1	(W+)	43113
/C–P_1 alv. and P_2–M_3(br.) (P_4 alv.)	(W+)	43116
I_1–P_1 alv. and P_2–M_3	(W‡+)	43117
I_1–/C alv. and P_1–M_3	(W)	43360
I_2–/C alv. and P_1–M_3	(W‡)	43361
P_3(br.)–P_4	(W+)	43362
P_2(alv.)–M_1 (P_4 br.)	(W+)	43363

GROUP II (LARGE PREMOLARS)

2 SKULLS

Skull (lacking nasals and posterior of skull) with I^1–M^3 (long basal length)	(W‡)	43238
Skull (lacking left zygomatic arch) with I^1–I^2 alv. and I^3–M^3 (long basal length)	(W‡+)	43370

2 MAXILLAE

Partial right maxilla with P^1–M^3	(W+)	43219
Partial left maxilla with P^2–M^1	(W‡+)	43357

14 MANDIBULAR RAMI

2 mandibles with		
I_1–I_3 alv. and /C–M_3(br.)	(W‡+)	43099
I_1–I_3 alv. and /C–M_1(br.)	(W‡)	43223
8 right rami with		
P_4–M_3(br.)	(W‡)	43106

		F:A.M.
P_1–M_3 (P_4 rt.)	(w‡)	43196
P_1–M_3	(w‡)	43197
I_1–I_2 alv. and I_3–M_3	(w‡)	43224
P_3–M_3(br.) (P_4–M_1 br.)	(w+)	43225
/C–P_1 (alv.) and P_2–M_1	(w)	43230
P_2–M_2(br.)	(w‡+)	43231
P_1(rt.)–M_1(rt.)	(w)	43232
4 left rami with		
I_1–/C alv. and P_1–M_3	(w‡)	43107
/C–P_4 (P_1–P_2 alv.)	(w)	43115
/C–M_3	(w+)	43235
P_4–M_3(br.)	(w‡)	43237

GROUP QUESTIONABLE

3 PARTIAL SKULLS, IMMATURE

3 partial skulls, immature, with		
C/–dP^2–M^2 (lacking nasals and premaxillae)	(1)	43080
C/(germ)–dP^2–M^1 (P^1 alv.)	(1)	43088
dP^1–M^2	(1)	43218

9 MAXILLAE

3 partial right maxillae with		
M^2–M^3	(w‡)	43089
M^2–M^3	(w‡+)	43266
M^1–M^3(br.)	(w)	43358
3 partial right maxillae, immature, with		
dP^4–M^2	(1)	43090
P^1(alv.)–dP^2–dP^4	(1)	43092
C/–dP^2–M^2	(1)	43220
Partial left maxilla with M^1–M^3(br.)	(w‡)	43222
2 partial left maxillae with		
C/–dP^2–M^1	(1)	43096
dP^4–M^1(br.)	(1)	43097

14 MANDIBULAR RAMI

Mandible with I_1–P_1 alv. and dP_2–M_2	(1)	43100
5 partial right rami with		
M_1–M_3	(w‡)	43105
M_1(br.)–M_3	(w‡)	43226
M_1–M_3	(w‡)	43228
M_2–M_3	(w‡)	43229
M_1(br.)–M_3	(w‡+)	43359
4 partial right rami, immature, with		
dP_4(br.)–M_1(br.)	(1)	43108
dP_4(br.)–M_2	(1)	43109
P_3(erupt.)–dP_4–M_2(br.) (P_4 germ)	(1)	43233
P_1–dP_2–M_1	(1)	43234
2 partial left rami with		
M_1(br.)–M_3	(w)	43236
P_4(rt.)–M_2	(w‡+)	43239
2 partial left rami, immature, with		
P_1–P_2 alv. and dP_3–M_1	(1)	43118
I_3–P_1 alv. and dP_2–M_2 (dP_4 br.)	(1)	43241

3 SKELETAL ELEMENTS

2 radii (43119B immature)		43119A-B
Ulna, immature		43120

FROM ECHO QUARRY, ANTELOPE DRAW, 1934–1941:

GROUP I (SMALL PREMOLARS)

		F:A.M.
2 MAXILLAE		
Right maxilla with P^1–M^3 (M^1 br.)	(W)	37542
Partial left maxilla with P^4–M^3 (M^1 br.)	(W+)	43245
8 MANDIBULAR RAMI		
2 mandibles with		
P_1(alv.)–M_3	(W‡+)	33581
I_1–/C alv. and P_1–M_2	(W‡+)	43246
Right ramus with I_1–/C alv. and P_1–M_3	(W)	37160
5 partial left rami with		
/C(alv.)–M_3	(–M)	33544
P_2–P_3 alv. and P_4–M_1	(W+)	37561
I_2–I_3 alv. and /C–M_3 (P_1 alv. and P_2–M_1 br.)	(W‡)	43248
I_2–P_2 alv. and P_3–M_2 (M_1–M_2 alv.)	(W)	43373
I_1–P_1 alv. and P_2–M_3	(W‡)	43389

GROUP II (LARGE PREMOLARS)

2 MANDIBULAR RAMI		
Partial right ramus with /C–P_1 alv. and P_2–M_3	(W)	37161
Partial left ramus with P_2(alv.)–M_2 (M_1 br.)	(W)	43372

GROUP QUESTIONABLE

3 PARTIAL SKULLS, IMMATURE		
Posterior portion of skull with M^1–M^2(germ)	(I)	43242
Inferior anterior portion of skull with P^1–dP^2–M^2	(I)	43243
Inferior anterior portion of skull with P^1(alv.)–dP^2–M^1(br.)	(I)	43371
2 MAXILLAE, IMMATURE		
Partial right maxilla with dP^1–M^1	(I)	43244
Partial left maxilla with C/–dP^2–M^2	(I)	37185
5 MANDIBULAR RAMI		
3 partial right rami with		
M_3	(W‡)	43265
M_2–M_3	(W‡+)	43390
I_3–/C alv. and dP_1–dP_3	(I)	37194
2 partial left rami with		
M_2–M_3	(W‡)	37562
dP_4(br.)–M_2(br.)	(I)	43247

FROM EAST RAVINE QUARRY, NEAR ANTELOPE DRAW, 1939:

MANDIBLE		
Partial mandible with I_1–I_2 alv. and I_3–M_2 (P_2 and P_4 alv.)	(–M)	43251

FROM QUARRY 2, SINCLAIR DRAW, 1939–1941:

GROUP II (LARGE PREMOLARS)

MAXILLA		
Partial right maxilla with C/–M^1	(W‡+)	43082
5 MANDIBULAR RAMI		
3 partial right rami with		
P_4–M_3(br.)	(W‡+)	43121

		F:A.M.
P_1–M_2 (P_3 rt.)	(w‡)	43249
P_2–M_3(br.)	(w+)	43264
2 partial left rami with		
I_1–I_3 alv. and /C–M_3	(w‡)	43125
This specimen completely lacks the postcondyle process.		
P_1(rt.)–M_3	(w‡)	43126

GROUP QUESTIONABLE

PARTIAL SKULL

Posterior portion of skull (no dentition)		43254

4 MANDIBULAR RAMI, IMMATURE

2 partial right rami with		
P_1–P_2 alv. and dP_3–M_1 (P_4 alv.)	(I)	43123
I_2–P_3 alv. and dP_4–M_2(br.)	(I)	43124
2 partial left rami with		
I_1–/C alv. and P_1–dP_4–M_1	(I)	43250
dP_3(br.)–M_1(br.)	(I)	43127

With the exception of ramus F:A.M. 43249, the material from Quarry 2 seems to be larger than average specimens referred to this species. The partial skull, F:A.M. 43284, differs in having a more massive postglenoid process than average examples, and the inferior edge of the foramen magnum lacks the usual notch. The heavier postglenoid process is more like that found in true *Merychyus*. The inferior dental series, in most cases, are longer than average referred specimens, but the complicated premolars are approximately equal. Ramus F:A.M. 43125 completely lacks the postcondyle process which is present in all other examples, i.e., when the ascending ramus is complete. In this respect the ramus resembles examples of *Merychyus* in that the postcondyle process is less prominent.

The differences just considered may indicate that Quarry 2 represents a slightly different horizon within the "Lower Snake Creek" than is apparent in the other quarries mentioned. There is not sufficient material available, however, for a more definite classification at this time.

FROM QUARRY 3, SINCLAIR DRAW, 1932:

GROUP II (LARGE PREMOLARS)

RIGHT MANDIBULAR RAMUS

		F:A.M.
Partial right ramus with /C(alv.)–M_3 (P_1 rt.)	(w)	37546

FROM QUARRY 4, SINCLAIR DRAW, 1938:

GROUP I (SMALL PREMOLARS)

RIGHT MANDIBULAR RAMUS

Partial right ramus with P_3(br.)–M_3 (M_1 br.)	(w‡)	33545

GROUP QUESTIONABLE

LEFT MAXILLA, IMMATURE

Partial left maxilla with P^1–dP^2–M^1	(I)	43375

FROM QUARRY 8, SINCLAIR DRAW, 1941:

GROUP I (SMALL PREMOLARS)

MANDIBLE

Mandible with I_1(alv.)–M_3 (I_3 alv.)	(w‡‡)	43367

GROUP II (LARGE PREMOLARS)

MAXILLA

Partial right maxilla with C/–P^4 (P^1 alv.)	(w‡‡)	43122

		F:A.M.
2 MANDIBULAR RAMI		
Partial right ramus with P_2–M_3 (P_4–M_3 br.)	(w‡)	37166
Partial left ramus with P_3(rt.)–M_3(br.)	(w‡)	43368

FROM QUARRY 9, SINCLAIR DRAW, 1941:

GROUP QUESTIONABLE

3 MANDIBULAR RAMI

3 partial right rami with		
M_1–M_2	(w+)	43364
M_1–M_2	(w+)	43365
M_1–M_2(alv.)	(w+)	43366

FROM SAND QUARRY, SINCLAIR DRAW, 1941:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS

Partial left ramus with I_1–P_2 alv. and P_3–P_4(br.)	(w‡+)	43369

FROM VERSION QUARRY, 1936:

GROUP II (LARGE PREMOLARS)

MAXILLA

Partial right maxilla with C/–P^3(br.)	(w‡+)	34325

FROM WEST SURFACE QUARRY, SINCLAIR DRAW, 1938:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with I_1–I_3 alv. and /C–M_1	(w+)	43374

FROM NEW SURFACE QUARRY, 1939:

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with I_1–P_1 alv. and P_2–M_2	(w+)	43128

FROM EAST SINCLAIR DRAW, 1937:

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with /C–P_2 alv. and P_3–M_3	(w‡+)	33513

GROUP QUESTIONABLE

MAXILLA

Partial left maxilla with M^2–M^3	(w‡)	33586

FROM WEST SINCLAIR DRAW, 1933:

GROUP QUESTIONABLE

MANDIBULAR RAMUS, IMMATURE

Partial left ramus with I_1–/C alv. and P_1–dP_2–M_2	(I)	33631

A'. FROM TYPE AREA

(American Museum specimens, 1908, 1921, and 1925)

FROM "SHEEP CREEK QUARRY" OF 1921 ("LOWER SNAKE CREEK" HORIZON):

GROUP I (SMALL PREMOLARS)

2 MANDIBLES

		A.M.
2 partial mandibles with		
I_1–/C alv. and P_1–M_3	(w‡)	18339
I_1–I_3 alv. and /C–M_3 (P_2 br.)	(w‡+)	18340

GROUP QUESTIONABLE

MANDIBULAR RAMUS

Partial left ramus with P_1–dP_2–M_2 (dP_4 br.)	(I)	18342

FROM GRASS ROOT QUARRY, KILPATRICK PASTURE, 1925:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with I_1–I_3 alv. and /C–M_3 (P_4 br.)	(w‡)	21424

FROM GENERAL AREA, 1908:

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with /C(alv.)–P_4 (P_1 rt.)	(w+)	14064[1]

Matthew and Cook[2] associated this specimen with material (A.M. 14058, 14060, 14065, and 14067) which they considered to represent a large variety or a distinct species. With the additional material now available in the Frick Collections, Schultz and Falkenbach[3] were able to refer these specimens to *Ticholeptus hypsodus* Loomis.

Thorpe[4] considered A.M. 14057, 14058, and 14065 as paratypes of *Metoreodon relictus*. Ramus A.M. 14057 is the holotype of *Ticholeptus hypsodus* Loomis.[5]

B. FROM HAY SPRINGS AREA, DAWES COUNTY, NEBRASKA

FROM PEPPER CREEK AREA, 1935 AND 1938:

GROUP I (SMALL PREMOLARS)

SKULL AND ASSOCIATED SKELETAL ELEMENTS

		F:A.M.
Skull (lacking partial right zygomatic arch) with I^1(alv.)–M^3, partial scapula, partial humerus, 2 ulnae (1 partial), 2 radii (1 partial), partial tibia, calcaneum, and various manus and pes elements. Figures 15, 16, 17 (in part)	(w‡+)	33635

MANDIBLE

Partial mandible with I_1–/C alv. and P_1–M_3	(–M)	33659

GROUP QUESTIONABLE

2 MANDIBULAR RAMI

2 partial left rami with		
I_1–/C alv. and P_1(rt.)–dP_2–dP_4	(I)	43383
I_2–/C alv. and P_1–dP_3–M_1 (P_2 alv.)	(I)	43384

[1] *Merychyus*, species undetermined, Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 81.

[2] Matthew, W. D., and H. J. Cook, 1909, Bull. Amer. Mus. Nat. Hist., vol. 26, art. 27, p. 393.

[3] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 81.

[4] Thorpe, Malcolm R., 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 212.

[5] Loomis, Frederic B., 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 35, fig. 25. Thorpe, Malcolm R.,1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 191. Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 76.

FROM OBSERVATION QUARRY, 1936:

GROUP QUESTIONABLE

		F:A.M.
MAXILLA		
Partial left maxilla with M^1(rt.)–M^3(br.)	(w+)	34328

FROM GINN QUARRY, 1935–1938:

GROUP I (SMALL PREMOLARS)

MAXILLA		
Right maxilla with I^1(alv.)–M^3	(w‡‡)	33637

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL		
Inferior anterior portion of skull with I_1–M^3	(w‡+)	43382
MANDIBULAR RAMUS		
Right ramus with /C(erupt.)–M_3	(–M)	33638

FROM NEAR GINN QUARRY, 1938:

GROUP I (SMALL PREMOLARS)

MAXILLA		
Partial left maxilla with P^2–M^3 (P^4–M^2 alv.)	(w‡+)	43381

1a. **Merychyus (Metoreodon) relictus taylori,**[1] new subspecies

From the Miocene deposits ("Sheep Creek"), Sioux County, Nebraska

SUBSPECIFIC DESCRIPTION

SKULL: Narrower throughout than that of *M.* (*Metoreodon*) *relictus*, but of approximately the same length; supraoccipital wings narrow; nasals lighter than those of *M.* (*Metoreodon*) *relictus;* postglenoid process slightly lighter and not so wide transversely as in the previously named species.

MANDIBLE: Symphyseal portion not so wide as that of *M.* (*Metoreodon*) *relictus.*

DENTITION: Characters and size range approximately the same as examples of *M.* (*Metoreodon*) *relictus.*

LIMBS: Approximately equal to those of *M.* (*Metoreodon*) *relictus.*

MEASUREMENTS: Table 3.

ILLUSTRATIONS: Figures 1, 8.

DISCUSSION

Although the dentition of this subspecies is similar to that of *Merychyus* (*Metoreodon*) *relictus*, the skull in all available examples is narrower throughout and the occipital condyles are noticeably smaller and lighter. More complete limb material may help to identify additional subspecific or specific differences.

Merychyus (*Metoreodon*) *relictus* comes from the "Lower Snake Creek" horizon and *M.* (*Metoreodon*) *relictus taylori* from the "Sheep Creek" horizon. In *Brachycrus* there is considerable size difference. *B. siouense*, the smaller-sized form, comes from the "Lower Snake Creek" and *B. wilsoni*, the larger, from the "Sheep Creek."[2]

The F:A.M. specimens were collected by Jack Wilson, Carl Long, and associates, 1933–1940; the A.M. material by Albert Thomson, 1921–1927.

Sixty specimens are here recorded:

HOLOTYPE

Skull with I^1(alv.)–M^3 (lacking frontals and most of nasals). (w‡+) The type has small premolars	F:A.M. 34319	From Long Quarry, Antelope Draw, "Sheep Creek" deposits, Sioux County, Nebraska; collected by Jack Wilson and Carl Long, 1936 Figs. 1, 8

[1] Named in honor of Beryl Taylor, member of the staff of the Frick Laboratory, who has helped the authors in compiling field data from the various locations.

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, pp. 232, 242.

REFERRED FROM TYPE AREA, SIOUX COUNTY, NEBRASKA

FROM TYPE LOCALITY (LONG QUARRY), 1934–1937:

GROUP I (SMALL PREMOLARS)

MAXILLA

		F:A.M.
Partial left maxilla with P^1–M^1	(w‡⁺)	33527

4 MANDIBULAR RAMI

Partial mandible with I_1–/C alv. and P_1–M_3	(w)	33584
Partial right ramus with I_1–I_3 alv. and /C–M_3(br.)	(w‡⁺)	37162
2 partial left rami with		
P_4–M_2	(w‡)	34326
P_3–M_3	(w‡)	37178

GROUP II (LARGE PREMOLARS)

SKULL

Partial skull with I^1–I^3 alv. and C/–M^3 (P^4 alv.). Figure 8	(–M)	33524
This specimen is figured in order to illustrate the characters of unworn P^1–P^3.		

MAXILLA

Partial left maxilla with P^2–M^3	(w+)	33590

4 MANDIBULAR RAMI

2 partial right rami with		
P_4–M_3	(w)	33541
I_1–I_3 alv. and /C–M_3 (P_2–P_3 alv.)	(w‡)	33583
2 partial left rami with		
/C–M_1	(w‡)	33520
P_1–M_3(br.)	(w+)	34318

GROUP QUESTIONABLE

3 MAXILLAE

Partial right maxilla with M^2–M^3	(w‡)	33529
2 partial left maxillae with		
P^4–M^3	(w+)	33528
M^2–M^3	(w+)	33587

3 MANDIBULAR RAMI

3 partial left rami with		
P_1–M_1 rt. and M_2–M_3(br.)	(w+)	37177
P_1–dP_2–M_2	(I)	33543
P_2(alv.)–dP_3–M_2(br.)	(I)	37179

FROM GREENSIDE QUARRY, RANCHHOUSE DRAW, 1935–1937:

GROUP I (SMALL PREMOLARS)

3 MAXILLAE

2 partial right maxillae with		
P^1–P^2 alv. and P^3–M^1(alv.)	(w‡)	34327
P^4–M^3 (M^1 br.)	(w‡)	34332
Partial left maxilla with P^1–P^2 alv. and P^3–M^3	(w‡)	34322

2 MANDIBULAR RAMI

Partial right ramus with P_2–M_3	(w‡)	33517
Partial left ramus with I_3(alv.)–M_3. Figure 8	(w+)	34320

GROUP QUESTIONABLE

2 MAXILLAE

		F:A.M.
Partial right maxilla with dP^3–M^1	(I)	33549
Partial left maxilla with M^1(br.)–M^3	(W+)	33585

5 MANDIBULAR RAMI

Partial right ramus with P_1–dP_3–M_2	(I)	37170
4 partial left rami with		
M_2–M_3	(W‡+)	33546
P_1(alv.)–M_3 (P_4 large with other premolars small)	(W‡)	33676
I_1(alv.)–M_3 (I_2 rt., I_3 alv.) (P_4 large with other premolars small)	(W‡+)	34321
dP_2(rt.)–M_2	(I)	43376

METAPODIAL

Metapodial		43087

FROM THOMSON QUARRY, STONEHOUSE DRAW, 1933–1938:

GROUP I (SMALL PREMOLARS)

MAXILLA

Partial left maxilla with C/(rt.)–P^4(rt.)	(M+)	33588

MANDIBLE

Partial mandible with I_1(alv.)–M_3	(W‡‡)	33677

GROUP II (LARGE PREMOLARS)

5 MANDIBULAR RAMI

Partial right ramus with I_1–I_2 alv. and I_3–M_3(br.)	(W‡)	33699
4 partial left rami with		
P_2–M_2 (P_3–P_4 erupt.)	(–M)	33516
I_1–/C alv. and P_1–M_3(br)	(W+)	33525
P_3–M_3	(W‡+)	33580
P_2–P_4 germs and M_1–M_2	(I)	34329

GROUP QUESTIONABLE

MAXILLA

Partial right maxilla with dP^3(br.)–M^2	(I)	37549

3 MANDIBULAR RAMI

Partial mandible with I_1(alv.)–dP_2–dP_4(br.)	(I)	33531
2 partial left rami with		
M_1–M_3(br.)	(W‡)	34324
P_1–dP_4–M_1 (P_2–P_3 alv.)	(I)	43379

FROM ¼ MI. N.W. OF STONEHOUSE DRAW, 1933:

GROUP II (LARGE PREMOLARS)

PARTIAL SKULL, MANDIBLE, AND ASSOCIATED SKELETAL FRAGMENTS

Partial skull with P^4–M^3, mandible with I_1(rt.)–M_3 (I_2 alv. and I_3 rt.), and skeletal fragments	(W+)	33675

FROM HILLTOP QUARRY, ANTELOPE DRAW, 1937–1938:

GROUP QUESTIONABLE

MAXILLA, IMMATURE

Partial left maxilla with dP^3–M^2	(I)	43221

6 MANDIBULAR RAMI

		F:A.M.
3 partial right rami with		
M_2–M_3(br.)	(w)	43380
dP_3–M_1	(i)	37173
dP_4(br.)–M_2	(i)	37174
3 partial left rami with		
M_2–M_3(br.)	(w‡)	37183
dP_3(br.)–M_1	(i)	37184
P_1(rt.)–dP_2–M_1	(i)	37189

FROM THISTLE QUARRY, ANTELOPE DRAW:

GROUP I (SMALL PREMOLARS)

MANDIBULAR RAMUS

Partial left ramus with P_1–M_3	(w)	33542

GROUP II (LARGE PREMOLARS)

MANDIBULAR RAMUS

Partial right ramus with I_1–I_2 alv. and I_3–M_3	(w+)	33523

GROUP QUESTIONABLE

3 MANDIBULAR RAMI

2 partial right rami with		
I_1–P_1 alv. and dP_2–M_1	(i)	33518
P_1–dP_2–M_1	(i)	33540
Partial left ramus with P_3–P_4 alv. and M_1–M_3	(w‡)	33547

FROM GENERAL AREA, 1932:

GROUP QUESTIONABLE

PARTIAL SKULL, IMMATURE

Partial skull with I^1–P^1–dP^2–M^2	(i)	33548

FROM TYPE AREA, VARIOUS LOCATIONS (A.M. SPECIMENS):

GROUP I (SMALL PREMOLARS)

MAXILLA

Partial right maxilla with P^2–M^3.	(w‡)	A.M. 18954	From Stonehouse Draw, 1922

MANDIBULAR RAMUS

Partial right ramus with P_3–M_3(br.)	(w‡)	22380	From Ashbrook Pasture, 1927

GROUP QUESTIONABLE

2 MANDIBULAR RAMI

Partial right ramus with dP_2–M_2(br.)	(i)	18346	From Channel Quarry, 1922
Partial left ramus with P_3(rt.)–M_3(alv.).	(w‡+)	18844	1921

1b. Merychyus (Metoreodon) relictus fletcheri,[1] new subspecies

From the Miocene deposits, north of Barstow, San Bernardino County, California

SUBSPECIFIC DESCRIPTION

SKULL: Appears to be wider than that of either *M.* (*Metoreodon*) *relictus* or *M.* (*Metoreodon*) *relictus taylori.*

MANDIBLE: Unknown.

DENTITION: Superior premolar series longer than average of *M.* (*Metoreodon*) *relictus* series, but molar series approximately equal.

LIMBS: Unknown.

MEASUREMENTS: Table 3.

ILLUSTRATION: Figure 11.

[1] Named in honor of Gordon Fletcher, who assisted in making the Frick Collections from the Mohave Desert of California.

Discussion

The holotype is the only specimen known at this time, but the teeth, although well worn, indicate the size difference mentioned above. The proportions of the superior dental series indicate that the anterior portion of the skull was slightly elongated.

The occurrence of *Merychyus* (*Metoreodon*) in the deposits underlying the later beds which include the Hemicyon Stratum[1] is of interest in determining faunal association. *Brachycrus*[2] and *Merychyus* (*Metoreodon*) have been found associated in the "Lower Snake Creek" and "Sheep Creek" of Sioux County, Nebraska, in the Barstow area of California, and in the Miocene of Santa Fe County of New Mexico. *Merychyus* (*Metoreodon*), however, has not been reported from Montana or the Sweetwater River area of central Wyoming, where *Brachycrus* material is quite common. *Ticholeptus*[3] has been found associated with *Brachycrus* and *Merychyus* (*Metoreodon*) only in the "Lower Snake Creek" of Nebraska.

One specimen is here recorded:

HOLOTYPE

Partial left maxilla with P^2(br.)–M^3. (w‡‡) — F:A.M. 34491 — From "Red or Third Division," north of Barstow, San Bernardino County, California; collected by Jack Wilson and Carl Long, 1932
Figure 11

2. **Merychyus (Metoreodon)**, species undetermined

Two specimens are here recorded:

A. FROM THE LOWER PART (MIOCENE) OF THE "SANTA FE BEDS," EAST OF ESPANOLA, SANTA FE COUNTY, NEW MEXICO

(Collected by John C. Blick, William Klaus, and associates, 1940)

MAXILLA AND LIMB ELEMENTS

Partial left maxilla with C/–M^2, partial humerus, partial femur, partial tibia, astragalus, and metapodials . . . . . (w‡‡) — F:A.M. 43129

The well-worn teeth obscure the characters. The size of the dental series and fragments of limb elements compare well with *Merychyus* (*Metoreodon*) *relictus*.

LIMB ELEMENTS

Partial humerus, partial radius, partial ulna, partial tibia, 2 astragali, etc. 43330

The occurrence of *Merychyus* (*Metoreodon*) material in this part of the "Santa Fe Beds," where it is associated with examples of *Brachycrus*,[4] is of importance. The two forms also have been found associated in the "Sheep Creek" and "Lower Snake Creek" deposits in Sioux County, Nebraska, and in the Barstow deposits of San Bernardino County, California.

[1] Frick, Childs, 1926, Bull. Amer. Mus. Nat. Hist., vol. 56, art. 1, p. 34; Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, Bull. Amer. Mus. Nat. Hist., vol. 77, art. 5, p. 224; 1941, *ibid.*, vol. 79, art. 1, p. 32.
[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, *ibid.*, vol. 77, art. 5, pp. 218–276.
[3] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, *ibid.*, vol. 79, art. 1, pp. 72–91.
[4] Schultz, C. Bertrand, and Charles H. Falkenbach, 1940, *ibid.*, vol. 77, art. 5, p. 254.

TABLE 3

Merychyus (*Metoreodon*) MATTHEW AND COOK. COMPARATIVE MEASUREMENTS[1] OF SKULLS AND RAMI

	M. (*Metoreodon*) *relictus* Matthew and Cook		*M.* (*Metoreodon*) *relictus taylori*, new subspecies	*M.* (*Metoreodon*) *relictus fletcheri*, new subspecies
SKULL	Holotype A.M. 14056	Referred F:B:A.M. 33635	Holotype F:A.M. 34319	Holotype F:A.M. 34491
Stage of wear of teeth	(w‡)	(w‡+)	(w‡+)	(w‡+)
Length (including supraoccipital crest and incisors)	—	165.5	170	—
Basal length (from anterior notch of foramen magnum to posterior base of I^1)	—	146.5	153	—
Width (max.)	—	((107))	91.5	—
Width of brain case (max.)	—	52	50.5	—
Width, interorbital (min.)	—	53.5	—	—
Distance from anterior rim of orbit to anterior base of canine	—	69	64	—
Distance from anterior rim of orbit to supraoccipital crest	—	103.5	—	—
Length of nasal	—	—	—	—
Width of muzzle at infraorbital foramina	—	48	48.5	—
Width across canines	—	27.5	19	—
Length, C/–M^3 incl.	—	82	78.5	—
Length, P^1–M^3 incl.	—	74	71.5	69.5
Length, P^1–P^4 incl.	—	33.5	32	30
Length, M^1–M^3 incl.	—	42.5	41	41
Width of M^3 (max.)	—	15.5	14	17
Depth of malar below orbit	—	21	13.5	—
RAMUS		F:A.M. 43098	Referred F:A.M. 34420	
Stage of wear of teeth		(w‡)	(w+)	
Length (max., including incisors)	—	(138)	—	—
Length, /C–condyle incl.	—	180	—	—
Depth of jaw under coronoid	—	66.5	—	—
Depth of jaw below anterior edge of M_3	27	27.5	24.5	—
Length, /C–M_3 incl.	—	82.5	—	—
Length, P_1–M_3 incl.	(78.5)	77	79.5	—
Length, P_1–P_4 incl.	33	30.5	30	—
Length, M_1–M_3 incl.	(47)	46.5	49.5	—

[1] ( ) Approximate; (( )) estimated. All measurements in millimeters.

TABLE 4

Merychyus (Metoreodon) MATTHEW AND COOK. COMPARATIVE MEASUREMENTS[1] OF SKELETAL ELEMENTS

	M. (Metoreodon) relictus Matthew and Cook
	Referred F:B:A.M. 33635
Length of humerus (articular) . .	111.5
Length of radius (articular) . . .	(141)
Length of ulna (max.)	—
Length of metacarpal III (max.) .	—
Length of femur (articular) . . .	—
Length of tibia (articular) . . .	—
Length of metatarsal III (max.) .	68.5

[1] ( ) Approximate. All measurements in millimeters.

II. PARAMERYCHYUS, NEW GENUS

GENOTYPE: *Paramerychyus harrisonensis* (Peterson).

GENERIC CHARACTERS

SKULL: Small, ranging in basal length from 164 mm. to 170 mm.; mesocephalic; low and flat; occipital region somewhat fan-shaped; supraoccipital wings with slight posterior projection, but with tendency to form a fan-shaped region, but still retaining the curved notch below and to the side of the supraoccipital wings; exoccipital pits elongated instead of round as in *Merychyus* and *Merychyus (Metoreodon)*; occipital area similar to that found in *Oreodontoides*, considerably less fan-shaped than in *Merychyus* and *M. (Metoreodon)* (see fig. 14); sagittal crest low; brain case well inflated and broad; frontals moderately wide; lacrimal fossa deep; prelacrimal vacuity present; infraorbital foramen above region of P^3; nasals pointed anteriorly, widest portion at anterior nasal-maxilla contact; occipital condyles moderately small; paroccipital process very wide at base (actually a part of the somewhat fan-shaped postoccipital region) and perpendicular to longitudinal axis of skull, tapering to a triangular cross section; bulla well inflated with highest point at external side, sloping off internally as found in examples of *Merychyus;* postglenoid process moderately heavy and deep, cone-shaped or peg-shaped in outline (in *Merychyus* the postglenoid process is anteroposteriorly compressed with sloping external border).

MANDIBLE: Unknown.

DENTITION: Brachyodont in comparison with examples of *Merychyus;* premolars not crowded; premolars with reduced anterior portion (in unworn specimens); a small incipient cusp on the interior-posterior portion of P^2 and P^3.

LIMBS: Unknown.

MEASUREMENTS: Tables 5 and 6.

ILLUSTRATIONS: Figures 1, 9, 10 (skulls and dentitions); 14 (occipital region of skull).

DISCUSSION

The proposed new genus, although having many characters in common with *Merychyus*, differs sufficiently to warrant generic rather than subgeneric rank. *Paramerychyus* differs primarily from *Merychyus* in that it has more brachyodont teeth, a lower, flatter skull with a peg-shaped postglenoid process, and a less fan-shaped postoccipital region.

Paramerychyus also has some characters similar to those of *Eporeodon* but differs in having a fan-shaped occipital region, a low skull, and wide, sloping, tympanic bulla. In *Eporeodon* the bullae are greatly inflated and are very long vertically.

The small, incipient cusp on the slightly worn P^2 and P^3 is similar to cusps found on the premolars of *Ustatochoerus*. In the latter genus, however, the cusps are well developed on P^1–P^3, while in *Ticholeptus* the P^3 is the only tooth to show a development of a cusp. From the standpoint of the development of cusps on the premolars, *P. harrisonensis* seems to be more advanced than any species of either *Ticholeptus* or *Merychyus*, the latter giving no evidence of complicated premolar cusps. The partially fan-shaped occipital region of this genus seems more primitive than the fan-shaped occipital of *Ticholeptus* or of *Merychyus* (see fig. 14).

DISTRIBUTION

Remains of *Paramerychyus*, although not common, are known from Harrison deposits in South Dakota and Wyoming. (See distribution chart, p. 169.)

SUMMARY OF SPECIES AND TYPES

Two species of *Paramerychyus*, new genus, from two Miocene localities are here recorded:

1. *Paramerychyus harrisonensis* (Peterson), from Niobrara County, Wyoming. (Harrison.)

HOLOTYPE: Skull, C.M. 1341.

2. *Paramerychyus relictus* (Loomis), from Washington County, South Dakota. (Harrison equivalent.)

HOLOTYPE: Partial skull, A.M. 13813. Figures 1, 10, 14.

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

PARAMERYCHYUS

TOTAL AVAILABLE SPECIMENS: 5

1. **Paramerychyus harrisonensis** (Peterson)

From the Harrison formation, Niobrara County, Wyoming

Merychyus harrisonensis PETERSON, 1906, Ann. Carnegie Mus., vol. 4, p. 37, figs. 7–8. SCHLAIKJER, 1935, Bull. Mus. Comp. Zool., vol. 76, no. 4, p. 169, pl. 41, fig. 3. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 229, figs. 166–168.

"*Merychyus*" *harrisonensis* (Peterson) O'HARA, 1920, South Dakota School Mines, Dept. Geol., bull. no. 13, p. 157.

Ticholeptus harrisonensis (Peterson) LOOMIS, 1923, Amer. Jour. Sci., vol. 6, p. 227, fig. 5 (not this species, see following discussion).

Ticholeptus (*Merychyus*) *harrisonensis* (Peterson) LOOMIS, 1923, *ibid.*, vol. 6, p. 228.

SPECIFIC CHARACTERS

SKULL: Larger than any known examples of *Merychyus;* smaller than known specimens of *Ticholeptus;* approximate size of *P. relictus;* lacrimal fossa moderately large and deep; prelacrimal vacuity present (in the holotype the very large prelacrimal vacuity may be due to damage of the area; in the referred skull the vacuity is much smaller); malar moderately robust, with a slight but gradual upward trend posteriorly; zygomatic arch of medium construction with shallow rise posteriorly; orbits round, looking forward and upward; postorbital pillar quite heavy; bulla covering large area (Peterson described the bulla as "flask-like in form with a conical swelling on the posterior-external surface"); palatal surface vaulted.

MANDIBLE: Unknown.

DENTITION: C/ heavy but not long; premolars not crowded; external styles of molars prominent.

LIMBS: Unknown.

MEASUREMENTS: Table 5.

ILLUSTRATIONS: Figures 1, 9.

DISCUSSION

Remains of *P. harrisonensis* are not well represented in the various collections. Loomis[1] reported two skulls of this species in the Amherst Collection. Basing his decision on these two skulls, he placed this species under the genus *Ticholeptus*. Loomis also illustrated one of the skulls, an immature individual, and identified it in the caption as *Ticholeptus* (*Merychyus*) *harrisonensis*. He considered this species too large and too heavy for *Merychyus*, but evidently used the two referred specimens for his basis of comparison. These two skulls, however, are not referable to *P. harrisonensis* but to a genus and species to be discussed in a later paper. Presumably Loomis used the type of "*Ticholeptus petersoni*" for his basis of generic comparison and was correct in noting the likeness of the two skulls in question and the larger "*T. petersoni*" but neither form belongs to the genus *Ticholeptus*.[2]

The two skulls referred to "*T. harrisonensis*" by Loomis appear more like a dwarf of "*T. petersoni.*" In fact, in the Amherst College exhibit, one of these dwarf type skulls is mounted and labeled "*T. petersoni,*" and in the same display case is the illustrated immature skull mentioned above, identified by the accompanying label in the case as "*T. harrisonensis.*"

In 1935 Schlaikjer[3] referred a maxilla, M.C.Z. 2869, to "*M. harrisonensis.*" Among the reasons given by Schlaikjer for retaining the species under the genus *Merychyus* was that it is smaller than "typical" *Ticholeptus* and the dental series is shorter than in such

[1] Loomis, Frederic B., 1923, Amer. Jour. Sci., vol. 6, fig. 5.

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 72.

[3] Schlaikjer, Erich M., 1935, Bull. Mus. Comp. Zool., vol. 76, no. 4, p. 169.

species as *M. arenarum* and *M. siouxensis*. The chart of measurements accompanying his discussion gives the length of the premolars of the M.C.Z. specimen as 37 mm. and of the molars as 44.5 mm. The premolars and molars of the holotype of *M. siouxensis* measure 35.5 mm. and 46 mm., respectively, and of the holotype of *Paramerychyus harrisonensis*, 35 mm. and 46 mm.

The M.C.Z. maxilla was reported to have come from the "Lower Harrison formation" from deposits located about 6 miles south of Old Fort Laramie. This does not give the precise stratigraphic occurrence, however, since Schlaikjer[1] considered the Gering, Monroe Creek, and Harrison as all "Lower Harrison." Both *M. siouxensis* and *P. harrisonensis* do come from the Harrison formation. Unfortunately the teeth in the maxilla in question are at a very advanced stage of wear and it is difficult definitely to demonstrate that the teeth are as brachyodont as those of *P. harrisonensis*. The maxilla may belong to either of the two Harrison species of *Merychyus*.

Figure 9 demonstrates the likeness of skull characters in mature and immature individuals. It is apparent that the bulla of the immature individual is almost the same size as that of the mature skull.

Three specimens are here recorded:

HOLOTYPE

Skull with I^1–M^3. (w)	C.M. 1341	From Van Tassel Creek, Niobrara[2] County, Wyoming Figured by Peterson, 1906, figs. 7–8; Thorpe, 1937, figs. 166–168

REFERRED FROM "Z QUARRY," NORTH OF KEELINE, NIOBRARA COUNTY, WYOMING

(Collected by John Lynch, Everett DeGroot, and Charles H. Falkenbach, 1932)

2 SKULLS		F:A.M.
Skull with C/–M^3. Fig. 9	(w)	33314
The teeth are somewhat lighter than those of the holotype.		
Skull with I^3–dP^2–M^2. Fig. 9	(i)	33387

2. **Paramerychyus relictus** (Loomis)

From the Lower Miocene deposits (equal to the Harrison formation), Washington County, South Dakota

Eporeodon relictus LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 36, fig. 26.

Eporeodon major relictus (Loomis) THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, pp. 78–79, fig. 39, pl. 6, figs. 4–5.

SPECIFIC CHARACTERS

SKULL: Slightly larger than known examples of *P. harrisonensis* and *Eporeodon occidentalis;* small but deep lacrimal fossa; prelacrimal vacuity questionably present; posterior border of nasals extended beyond the anterior line of the orbits; infraorbital foramen above the posterior border of P^3; postglenoid process slightly more robust than in examples of *P. harrisonensis;* orbits slightly oval in outline, axis anteroposterior to skull, looking forward and outward; malar robust, inferior border slightly arched; external auditory meatus opening more outwardly than posteriorly.

MANDIBLE: Unknown.

DENTITION: Series slightly longer and premolars larger than examples of *P. harrisonensis;* premolars set at a slight angle to alveolar border.

LIMBS: Unknown.

MEASUREMENTS: Table 5.

ILLUSTRATIONS: Figures 1, 10, 14.

DISCUSSION

Loomis,[3] in the original description of

[1] Schlaikjer, Erich M., 1935, *ibid.*, vol. 76, no. 4, pp. 111–120.

[2] This specimen was recorded as having been collected in Converse County, Wyoming. Since the time the specimen was actually collected, however, the county has been divided into two parts. The Van Tassel area is no longer included in Converse County but is now a part of Niobrara County, Wyoming.

[3] Loomis, Frederic B., 1924, *loc. cit.*

"*Eporeodon relictus*," referred two specimens to this species, A.M. 13814 and A.M. 8949. The latter example, however, is the holotype of *Eporeodon cedrensis* Matthew, a fact which was pointed out by Thorpe.[1] This specimen is immature and makes comparisons very difficult. Fortunately a mature skull, F:A.M. 45272, with the characters of Matthew's type, was found in the same area in northeastern Colorado. The second skull thus has afforded the present writers an opportunity to observe the differences between *E. cedrensis* and *P. relictus* and these are compared as follows: In the former species the skull is smaller but with a higher sagittal crest than in the latter, the brain case is more rounded, the lacrimal fossa larger, the bulla decidedly smaller, and the postglenoid process laterally compressed with a sloping external border, a character not observed in *P. relictus*. The dental series in both species are quite similar, but the dentition of *E. cedrensis* does not suggest the presence of incipient cusps on any of the premolars.

In his original description of *P. relictus*, Loomis[2] also included the limb elements of the holotype of *E. cedrensis* as examples of the former species. The limbs of *P. relictus*, however, are still unknown. Thorpe[3] observed that the supraoccipital crest of *P. relictus* is produced beyond the condyle and that the lateral wings of the occiput are not greatly spread. The present writers consider the spread of the lateral wings as moderate, decidedly more so than that of *E. occidentalis* (the genotypic species of *Eporeodon*) and less so than examples of *Merychyus*.

The difference in geologic age of the deposits producing remains of *P. relictus* and *E. cedrensis* also should be taken into account. The field records at the American Museum of Natural History show that the holotype of the former species was from the same locality in South Dakota as the holotype of the large oreodont *Promerycochoerus thompsoni* Loomis, which was found in deposits equivalent to the Harrison of Nebraska and Wyoming. *E. cedrensis* comes from sediments in Colorado which are correlated with the Brule clay of Nebraska.

Two specimens are here recorded:

HOLOTYPE

Partial skull with C/(rt.)–M^3.	(M+)	A.M. 13813	From "Lower Rosebud," 6 mi. W. of American Horse Creek, Washington County, South Dakota; collected by Paul Miller, 1907 Figured by Loomis, 1924, fig. 26; Thorpe, 1937, fig. 39, pl. 6, figs. 4–5 This paper, figs. 1, 10, 14

REFERRED FROM TYPE AREA

(Collected by Paul Miller, 1907)

SKULL		A.M.
Partial skull with P^1–M^3. Fig. 10 (in part)	(W^{++}_{+})	13814

The dental series is figured for comparison of the premolars with those of the holotype. The age difference has caused the referred older individual to show a reduction of the crown surface in the anterior portion of P^1–P^3.

[1] Thorpe, Malcolm R., 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 79.

[2] Loomis, Frederic B., 1924, *loc. cit.*

[3] Thorpe, Malcolm R., 1937, *loc. cit.*

III. OREODONTOIDES THORPE

Eporeodon (*Oreodontoides*)[4] THORPE, 1921, Amer. Jour. Sci., ser. 5, vol. 2, p. 107, figs. 11–13.

Oreodontoides THORPE, 1923, Amer. Jour. Sci., ser. 5, vol. 6, p. 240; 1924, *ibid.*, ser. 5, vol. 7, p. 316; 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 213.

[4] Thorpe, Malcolm R., 1921, Amer. Jour. Sci., ser. 5, vol. 2, p. 107, described *Oreodontoides oregonensis*, "subgen. et sp. nov." Although it was stated that *Oreodontoides* was a new subgenus, it appeared in the rank of a full genus. From the fact that the type description followed a consideration of *Eporeodon*, it is here taken for granted that Thorpe considered *Oreodontoides* a subgenus of *Eporeodon*.

Merychyus (*Oreodontoides*) (Thorpe) Loomis, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 31.

Genotype: *Oreodontoides oregonensis* Thorpe.

Generic Characters

Skull: Small, ranging in basal length from 158 mm. to 160 mm.; flat, superior contour slightly arched [not to the degree found in *O.* (*Paroreodon*)]; postoccipital region somewhat fan-shaped, similar to *Paramerychyus;* frontals moderately wide; lacrimal fossa rather small but deep; postglenoid process high and more or less peg-shaped. (Paroccipital process, bulla, and condyle not preserved on available material.)

Mandible: Shallow; inferior border straight to a point posterior of M_3 (posterior portion of ascending ramus incomplete in type), with abrupt downward curve posterior of M_3; postsymphysis below M_3.

Dentition: Brachyodont and light in comparison with *Merychyus.*

Limbs: Moderately short and light.

Measurements: Tables 5 and 6.

Illustrations: Figures 1, 10, 11 (skulls, mandibles, and dentitions); 15–17 (limbs).

Discussion

The genus *Oreodontoides*, which is poorly represented in the collections, is more closely related to the genera and subgenera of Merychyinae than to *Eporeodon.* In its more brachyodont dentition *Oreodontoides* differs from *Merychyus*, but resembles *Paramerychyus.* The writers consider the closely related *Paroreodon* as a subgenus of *Oreodontoides.*

Distribution

Remains of *Oreodontoides* are known from the John Day area of Oregon and questionably from South Dakota (see distribution chart, p. 169).

Summary of Species and Types

One species and one questionably referred species of *Oreodontoides* from two Miocene localities are here recorded:

1. *Oreodontoides oregonensis* Thorpe, 1921, from the John Day Valley, Oregon. (Approximate Harrison equivalent.)

Holotype: Partial skull, Y.P.M. 12329. Figure 11.

2. *?Oreodontoides curtus* (Loomis), 1924, from Washabaugh County, South Dakota. (Harrison equivalent.)

Holotype: Skull and mandible, A.M. 13817. Figures 1, 10.

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

OREODONTOIDES

Total available specimens: 16

1. **Oreodontoides oregonensis** Thorpe

From Miocene deposits (approximately equal to the Harrison formation), John Day Valley, Oregon

Eporeodon (*Oreodontoides*) *oregonensis*[1] Thorpe, 1921, Amer. Jour. Sci., ser. 5, vol. 2, p. 107, figs. 11–14.

Oreodontoides oregonensis Thorpe, 1923, Amer. Jour. Sci., ser. 5, vol. 6, p. 240; 1924, *ibid.*, ser. 5, vol. 7, p. 316, figs. 1–3; 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 213, figs. 155–159.

Merychyus (*Oreodontoides*) *oregonensis* (Thorpe) Loomis, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 31.

[1] See footnote 4, page 250.

Specific Characters

Skull: Approximately the size of a small *Merychyus;* low and flat; frontals moderately wide, with ridge or protrusion at mid-line, not so pronounced as in *Eporeodon occidentalis* or as in most examples of *Desmatochoerus;* nasals not reaching the region of the orbits posteriorly, uniform in width; no prelacrimal vacuity [*Oreodontoides* (*Paroreodon*) *marshi* with a facial vacuity]; infraorbital foramen above posterior border of P^3; malar moderately light; zygomatic arch incomplete, suggesting gradual rise posteriorly; palate slightly produced posterior of M^3.

Mandible: See generic characters.

Dentition: Lighter than in *Paramerychyus* or *O.* (*Paroreodon*); C/ and P_1 of moderate

size but short, similar to small superior canine and inferior first premolar in various species of *Merychyus;* P^1–P^4 damaged on holotype; premolar pattern simple; anterior portions of P^1–P^3 slightly less reduced than in the holotype of *?O. curtus* (a variable character due to wear of the individual teeth); premolars appearing to be at a slight angle to the ramus as in *?O. curtus;* inferior premolars (of referred rami, Y.P.M. 12635 and 12638) showing a definite crowding and overlapping, including P_4.

LIMBS: Slightly longer than examples of *?O. curtus.*

MEASUREMENTS: Tables 5 and 6.

ILLUSTRATIONS: Figures 11, 15–17.

DISCUSSION

The characters of this species, except for the low flat skull and the light teeth, are very similar to those of *O.* (*Paroreodon*) *marshi.* Additional material is necessary for more complete description.

Fourteen specimens are here recorded:

HOLOTYPE

Partial skull with I^1(br.)–M^3 (I^3, P^4, and M^1 br.). (w+)	Y.P.M. 12329	From ?middle John Day, Turtle Cove, John Day Valley, Oregon; collected by William Day, 1875 Figured by Thorpe, 1921, figs. 11–13; 1924, fig. 1; 1937, figs. 155–157 This paper, fig. 11

REFERRED FROM THE JOHN DAY VALLEY AREA, OREGON

3 SKULLS WITH ASSOCIATED MANDIBULAR RAMI

Anterior portion of skull with I^1(alv.)–M^3 and partial right ramus with P_3–M_3(br.). (w)	C.I.T.	From the John Day Valley
Crushed skull with C/–dP^2–M^2 and partial mandible with P_1–dP_3–M_2. (I)	504	From C.I.T. coll. loc. no. 27, E. of Cants Ranch, N. of Sheep Mountain
Partial skull with dP^2(br.)–dP^4, partial mandible with dP_3–dP_4, and fragments. (I)	A.M. 7538	From the John Day River

SKULL AND ASSOCIATED LIMB ELEMENTS

Partial skull with C/–M^3 (P^3 alv.), humerus, 2 partial femora, partial tibia, and partial pes. (w)	A.M. 7513	From the John Day Valley Figures 15, 16, 17 (in part)

5 SKULLS

Crushed partial skull with I^1–I^3 rt. and C/–M^3 br. (w‡)	C.I.T. 510	From the John Day Valley
Partial skull with C/(br.)–M^3(br.) (P^1–P^2 rt., P^4 br., and M^1 alv.). (w‡‡)	539	From C.I.T. coll. loc. no. 31, 1½ to 2 mi. S. of Johnson Ranch, at mouth of Rudio Creek, E. side of creek, S. of North Fork of the John Day River
Anterior portion of skull with dP^3(br.)–M^3(germ). (I)	A.M. 7617	From the John Day Valley

Associated with this specimen are fragments of large limbs which appear to be those of *Promerycochoerus* and which show association of the two genera.

Partial skull with dP^2–M^1 and fragments. (I)	A.M. 7768	From the Cove, John Day Valley; collected by Wortman, 1879
Center section of skull with dP^2–M^1. (I)	Y.P.M. 10149	From the Clarno Bottom; collected by S. Snook, 1874

MANDIBLE AND SKELETAL ELEMENTS

Partial mandible with /C–P_4 (P_1 br.), partial humerus, partial radius, 2 partial femora, 2 partial tibiae, and fragments. (w)	A.M. 7677	From the Cove; collected by Wortman

3 MANDIBULAR RAMI

Partial mandible with P_1–M_3. (M+)	A.M. 7519	From Haystack Valley Figure 11
Partial mandible with I_1–M_1(br.). (w)	Y.P.M. 12635	From Turtle Cove; collected by William Day, 1875
Partial mandible with I_1–/C rt. and P_1(br.)–M_2. (w)	12638	From Turtle Cove; collected by William Day, 1875 Figured by Thorpe, 1924, figs. 2–3; 1937, figs. 158–159 This paper, fig. 11

2. ? Oreodontoides curtus (Loomis)

From Miocene deposits (equal to the Harrison formation), Washabaugh County, South Dakota

Merychyus curtus LOOMIS, 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 31, figs. 19–20; 1933, Bull. Geol. Soc. Amer., vol. 44, p. 723, figs. 1–3. THORPE, 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 222, figs. 162–163, pl. 34, figs. 1–3, pl. 48, fig. 1.

SPECIFIC CHARACTERS

SKULL: Small size, approximately that of *O. oregonensis;* occipital region somewhat fan-shaped; no sagittal crest; temporal ridges robust and not joined until they reach the latter quarter of the skull, at which point they lose their robust surface (the robust temporal ridges may represent individual variation within a species); superior surface slightly arched; brain case long and well inflated; frontals narrow, sharply angular in outline; nasals light, widest portion at anterior maxilla contact; orbits slightly oblong in outline, axis vertical with skull, looking forward and upward; malar moderately deep with a gradual posterior rise; zygomatic arch moderately light; lacrimal fossa large and deep; infraorbital foramen above posterior border of P^3; prelacrimal vacuity[1]; muzzle joined for short distance; anterior nasal-maxilla contact above P^2; occipital condyle moderately small and widely expanded; paroccipital process wide at base, tapering somewhat to a triangular outline, adhering to the bulla; bulla comparatively large (lacking the internal surface slope as in *Merychyus*) and crowding the postglenoid process; postglenoid process more peg-shaped than in examples of *Merychyus*, which are laterally compressed, wide transversely, and with an external sloping border; glenoid surface arched; posterior palate extending beyond M^3.

MANDIBLE: Rather light in construction; moderately deep with gradual increase in depth to below M_3; inferior border straight until a point posterior of M_3 and then an abrupt downward curve, giving considerable depth to the ascending ramus (the abrupt descent of the inferior border of the ramus in this form is completely lacking in *Merychyus*); ascending ramus somewhat wide anteroposteriorly; condyle of moderate size, placed at angle to ramus; postsymphysis below P_2.

DENTITION: Brachyodont in comparison with *Merychyus;* similar to *O. oregonensis* and *Paroreodon marshi;* C/ small; superior premolars slightly crowded with P^2 and P^3 set at slight angle to the skull; M^1–M^3 graduated in size; external styles of molars moder-

[1] Loomis, Frederic B., 1924, *loc. cit.*, and Thorpe, Malcolm R., 1937, *loc. cit.*, stated that the holotype skull has a small facial vacuity. Both sides of the skull in question, however, are damaged within the area of the prelacrimal vacuity. The left side, which was figured by both authors, is damaged and has a small piece of bone that is out of place, thus forming what was called a vacuity. The present writers doubt if a prelacrimal vacuity was present; at least it cannot be definitely observed on material now available. The skull with the mounted skeleton at Amherst, A.C. 31-31, is mostly plaster. See discussion, page 254.

ately prominent; P_1 small; P_2 and P_3 crowded and set at an angle to the ramus (anterior portions of P_1^1–P_3^3 reduced in holotype).

LIMBS: Known from referred specimen only (see discussion of A. C. 31–31, below); light construction, similar to *Merychyus;* slightly smaller than examples of *M. crabilli.*

MEASUREMENTS: Tables 5 and 6.

ILLUSTRATIONS: Figures 1, 10.

DISCUSSION

As far as it is possible to compare the characters of this species and those of *O. oregonensis*, they appear to be very similar. The difficulty of making comparisons is due to lack of important characters of the holotype of *O. oregonensis*. *?O. curtus* differs from species of *Merychyus* in having a more rounded bulla, more peg-shaped postglenoid process, and more brachyodont teeth.

Loomis[1] referred a skeleton, A.C. 31–31, to "*Merychyus curtus.*" The individual bones of this specimen are difficult to measure since they are mounted in a plaster plaque, and the skull and mandible are not easily studied because they show a great deal of restoration. Loomis, in describing the holotype, stated that the skull measured 158 mm. in length, but in 1933 he[2] reported the length for his referred skull (A.C. 31–31) as 120 mm. Perhaps the latter skull was restored incorrectly, thus shortening its actual length. The dental series of this second specimen compares with the dentition of the holotype and seems to be more brachyodont when compared with *Merychyus*. Even if this skeleton is accepted as referable to this species, the limb elements are incomplete and do not significantly add to the information. In the skeleton and Loomis' 1933 illustration, the only complete limb elements are the radius and metacarpal III. The measurements of these skeletal parts suggest an animal slightly shorter than *Merychyus crabilli*, the smallest species known of that genus.

In 1933, Loomis[3] also compared the skeleton of *?O. curtus* with the skeleton of *M. minimus*, presumably using A.C. 31–31 for the former and skeleton A.C. 1931–26 as a basis for the latter. Loomis' measurements of the latter skeleton do not check with the measurements of the same skeleton taken by the writers. A photograph on display with the label and skeleton shows the bluffs south of Van Tassell, Wyoming, which are of Harrison age. *M. minimus* comes from the lower Marsland beds and *M. crabilli*, the species to which A.C. 1931–26 has been referred in this report, from the Harrison.

Two specimens are here recorded:

HOLOTYPE

Skull with I^1–M^3 and mandible with I_1–M_3. (w)	A.M. 13817	From 10 mi. E. of Kyle Post Office, Washabaugh County, South Dakota; collected by Albert Thomson, 1925 Figured by Loomis, 1924, figs. 19–20; Thorpe, 1937, figs. 162–168; pl. 34, figs. 1–3 This paper, figs. 1, 10

REFERRED FROM PORCUPINE CREEK, SOUTH DAKOTA

(Collected by Frederic B. Loomis and John Harlow, 1931)

Mounted skeleton consisting of partial skull, partial mandible, and skeletal elements (considerable restoration). (w+)	A.C. 31-31	Figured by Loomis, 1933, figs. 1–3; Thorpe, 1937, pl. 48, fig. 1

This skeleton was considered by Thorpe[4] as a plesiotype of "*Merychyus curtus.*"

[1] Loomis, Frederic B., 1933, *loc. cit.*
[2] *Idem.*
[3] *Idem.*
[4] Thorpe, Malcolm R., 1937, *op. cit.*

IIIA. OREODONTOIDES (PAROREODON) (THORPE)

Paroreodon THORPE, 1921, Amer. Jour. Sci., ser. 5, vol. 2, p. 109; 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 177.

GENOTYPE: *Oreodontoides* (*Paroreodon*) *marshi* (Thorpe).

GENERIC CHARACTERS

SKULL: Small size, equal to that of a large species of *Merychyus;* mesocephalic; superior surface well arched, more so than in *Oreodontoides;* occipital region somewhat fan-shaped (less than in typical *Merychyus*) but oblong (vertically); supraoccipital wings widely spread; incipient exoccipital pits; sagittal crest low and short; brain case inflated, with moderate postorbital restriction; lacrimal fossa large but shallow, slightly deeper than in average examples of *Merychyus minimus;* infraorbital foramen above region of posterior portion of P^3 and anterior portion of P^4; small triangular prelacrimal vacuity, placed more posteriorly than in *Merychyus;* zygomatic arch moderately heavy, with an abrupt rise posterior of malar; bulla well inflated, tapering to an anteroposterior ridge; paraoccipital process wide at base, tapering rapidly for lower one-half and adhering to the bulla; postglenoid process moderately heavy, anteroposteriorly compressed.

MANDIBLE: Inferior border increasing in depth anteroposteriorly, with moderate abrupt downward curve posterior of M_3; ascending ramus wide anteroposteriorly and high; condyle set at slight angle to ramus.

DENTITION: Light but heavier than in *Oreodontoides;* comparatively brachyodont in comparison with examples of *Merychyus;* superior premolars set in straight line with alveolar border; C/ heavy; anterior portion of P^3 shortened; external styles of M^2 and M^3 prominent; P_1–P_3 set straight with exterior alveolar border; inferior premolars not crowded and superior P^1–P^3 not at angular position as in *Oreodontoides;* M_3 with exceptionally prominent heel.

LIMBS: Light construction, similar to those of *Merychyus.* (Known only from a referred specimen.)

MEASUREMENTS: Tables 5 and 6.

ILLUSTRATIONS: Figures 1, 11, 12 (skulls, mandibles, and dentitions); 14 (occipital region of skull); 15, 16 (limbs).

DISCUSSION

The generic characters are based on the type and on the referred specimen C.I.T. 400, a nearly complete skeleton which is somewhat larger than the type but agrees in all the characters that are comparable. The genus is not well represented in the collections, nor is the geologic horizon for either the type or the referred specimen known. In other John Day oreodonts there is an apparent change of characters in the various lines, depending upon their position in the vertical section; the fact that the referred specimen is somewhat larger than the type may indicate that it came from a slightly different geologic level. Additional material from known horizons within the John Day is needed in order to determine stratigrahpic (vertical) and individual variation ranges.

Thorpe[1] gave his opinion that *O.* (*Paroreodon*) is a branch of the *Ticholeptus* line nearest to *Merycoides* but not referable to that genus. The writers believe that *Ticholeptus* and *O.* (*Paroreodon*) did come from the same ancestral stock, the former a direct descendant of *Merychyus* (*Metoreodon*) and the latter branching from *Merychyus* previous to the present known history of that genus. The relationship of *Merycoides*, however, is not apparent at this time; it includes forms of larger size with low, flat skulls and a comparably low bulla. It comes from beds equal in age to the Gering formation of the Great Plains.

Loomis[2] suggested a close relationship between *O.* (*Paroreodon*) and *Merychyus*, the former differing from the latter in the height of the skull and the unique pointed bulla. The writers agree with Loomis in the close relationship, but the comparatively brachyodont teeth and the unique bulla of *O.* (*Paroreodon*) separate it from *Merychyus*, even though many characters are common in both forms. The names *Oreodontoides* and *O.* (*Paroreodon*) were both established on material from the John Day beds of Oregon.

[1] Thorpe, Malcolm R., 1937, *loc. cit.*

[2] Loomis, Frederic B., 1924, Bull. Amer. Mus. Nat. Hist., vol. 51, art. 1, p. 14.

Although the two forms are considered to be closely related, the writers propose to continue the use of *Paroreodon* but as a subgenus of *Oreodontoides*.

The geologic level for the holotype of *O. (Paroreodon) marshi* is "Upper Oligocene, Middle John Day" according to the catalogue at the Yale Peabody Museum and to Thorpe.[1] The locality for this specimen is given as "Hay Stack Valley, Turtle Cove area, John Day Valley, Oregon." Throughout Thorpe's entire monograph on the oreodonts, the color of the matrix adhering to the John Day specimens was used as an indication of the age or level of the deposits from which the remains were collected. From personal conversations with Dr. J. P. Buwalda, Mr. Eustace L. Furlong, and Dr. Chester Stock, all of whom are very familiar with the John Day area, the present writers have learned that color of matrix is of little value in determining faunal levels. Mr. Carl Sorenson, who at the present time is preparing the John Day oreodonts in the Cope Collection at the American Museum of Natural History, confirms this with his observations that some specimens were embedded in both gray and green matrix.

Distribution

Oreodontoides (Paroreodon) remains are not well represented in the collections. The only recorded specimens of this genus are from the John Day beds of Oregon.

Summary of Species and Types

Two species of *Oreodontoides (Paroreodon)* from one Miocene locality are here recorded:

1. *Oreodontoides (Paroreodon) marshi* (Thorpe), 1921, from John Day Valley, Oregon. (?Middle John Day, Harrison equivalent.)

Holotype: Partial skull, Y.P.M. 12415. Figure 11.

2. *Oreodontoides (Paroreodon) stocki*, new species, from John Day Valley, Oregon. (?Upper John Day, Harrison equivalent.)

Holotype: Skull, C.I.T. 537. Figures 1, 12.

DETAILED LISTS OF TYPES, REFERRED SPECIMENS, AND SYNONYMY

OREODONTOIDES (PAROREODON)

Total available specimens: 20

1. Oreodontoides (Paroreodon) marshi (Thorpe)

From Miocene deposits (approximately equal to the Harrison), John Day Valley, Oregon

Paroreodon marshi Thorpe, 1921, Amer. Jour. Sci., ser. 5, vol. 2, p. 109, figs. 14–16; 1937, Mem. Peabody Mus., vol. 3, pt. 4, p. 178, figs. 129–131.

Specific Characters

Skull: Orbits appearing oblong, looking outward and slightly upward; malar robust; bulla with a noticeable external groove for the hyoid bone for the complete depth of the bulla; external auditory meatus opening mostly outward and slightly posteriorly; posterior palate extending beyond M^3.

Mandible: See generic description.

Dentition: Brachyodont in comparison with *Merychyus;* more like *Paramerychyus* and *Oreodontoides.*

Limbs: Light construction, approximating in length those of a large example of *Merychyus arenarum.*

Measurements: Tables 5 and 6.

Illustrations: Figures 1, 11, 12, 14–16.

Discussion

The holotypic skull is not complete, but additional characters of the genus and species have been added from an almost complete skeleton (C.I.T. 400) referred to this species. (See discussion, p. 255.)

Ten specimens are here recorded:

[1] Thorpe, Malcolm R., 1937, *loc. cit.*

HOLOTYPE

Partial skull with I^2–P^2 rt. and P^3–M^3 (M^1–M^3 br.) (Skull lacking postoccipital wings, zygomata, glenoid surface, and postglenoid process). (w+)	Y.P.M. 12415	From middle John Day, Hay Stack Valley-Turtle Cove area, the John Day Valley, Oregon; collected by L. S. Davis, 1875 Figured by Thorpe, 1921, figs. 14–16; 1937, figs. 129–131 This paper, fig. 11

REFERRED FROM JOHN DAY VALLEY, OREGON

3 SKULLS, MANDIBLES, AND SKELETAL ELEMENTS

Skull with C/–M^3, mandible with P_2–M_3, and most of skeleton. (w+)	C.I.T. 400	From C.I.T. coll. loc. no. 29a, entrance to Haystack Valley Figures 1, 12, 14, 15, 16
Skull with I^1–M^3, mandible with I_1–/C rt. and P_1–M_3, partial humerus, vertebrae, and ribs. (w‡+)	3493	From the John Day Valley
Partial skull with P^1–dP^2–M^1(erupt.), mandible (attached) with I_1–P_1 br. and dP_2–dP_4, partial humerus, and fragments. (I)	3448	From the John Day Valley

2 PARTIAL SKULLS AND ASSOCIATED MANDIBLES

Crushed skull with I^1–I^3 rt. and C/(br.)–M^3 and mandible (attached) with P_4–M_3. (w+)	C.I.T. 1495	From C.I.T. coll. loc. no. 372, N. of John Day Highway, at junction of Heppner Road
Partial skull with C/–M^3 and mandible (attached) with I_1–I_3 alv. and /C–M_3. (w)	3496	From C.I.T. coll. loc. no. 29, Haystack Valley

3 PARTIAL SKULLS

Partial skull with P^3–M^3 (M^1–M^3 br.). (w+)	3494	From Haystack Valley
Anterior portion of skull with C/–M^3. (w‡)	3497	From the John Day Valley
Partial skull with C/(rt.)–M^3. (w+)	3501	From Haystack Valley

SKULL AND ASSOCIATED SKELETAL ELEMENTS

Skull with C/–P^2 alv. and dP^3(rt.)–M^2 (germ), tibia, and 2 partial femora. (I)	A.M. 7550	From Haystack Valley; collected by Wortman and Day

2. **Oreodontoides (Paroreodon) stocki,**[1] new species

Questionably from the upper John Day beds (approximately equal to the Harrison of the Great Plains), John Day area, Oregon

Specific Description

Skull: Tendency to be larger than examples of *P. marshi;* characters equal to those of *P. marshi*, except for the bullae which are somewhat flattened on the inferior surface instead of coming to a sharp ridge as in the genotypic species; infraorbital foramen above the posterior portion of P^3.

Mandible: Somewhat heavier and larger than examples of *P. marshi.*

Dentition: Somewhat heavier and slightly longer series than examples of *P. marshi.*

Limbs: Unknown.

Measurements: Table 5.

Illustrations: Figures 1, 12.

Discussion

The writers have discussed the John Day stratigraphy with a number of the collectors

[1] Named in honor of Dr. Chester Stock who kindly allowed the writers the privilege of studying the John Day oreodont material in the California Institute of Technology.

TABLE 5

Paramerychyus, NEW GENUS, *Oreodontoides* THORPE, AND *Oreodontoides* (*Paroreodon*) (THORPE). COMPARATIVE MEASUREMENTS[1] OF SKULLS AND RAMI

	Paramerychyus harrisonensis (Peterson)		*Paramerychyus relictus* (Loomis)	*Oreodontoides oregonensis* Thorpe		*?Oreodontoides curtus* (Loomis)
SKULL	Holotype C.M. 1341	Referred F:A.M. 33314	Holotype A.M. 13813	Holotype Y.P.M. 12329		Holotype A.M. 13817
Stage of wear of teeth	(W)	(W)	(M+)	(W+)		(W)
Length (including supraoccipital crest and incisors)	195	(192)	((200))	((160))		158
Basal length (from anterior notch of foramen magnum to posterior base of I^1)	169	(164)	(170)	—		139
Width (max.)	(109)	113	((105))	((87))		99
Width of brain case (max.)	56	59	62	((52))		47
Width, interorbital (min.)	60	58	(64)	42		43.5
Distance from anterior rim of orbit to anterior base of canine	76	77	81	59		55.5
Distance from anterior rim of orbit to supraoccipital crest	123.5	(120)	127	((103))		106
Length of nasals	—	—	—	—		58.5
Width of muzzle at infraorbital foramina	51	42	—	38		44
Width across canines	34.5	35	—	—		(28.5)
Length, C/–M^3 incl.	91	88	96	70		73.5
Length, P^1–M^3 incl.	80	76	84	62		65.5
Length, P^1–P^4 incl.	35	36.5	40.5	30		30
Length, M^1–M^3 incl.	46	41.5	44	31.5		36
Depth of malar below orbit	—	16.5	16.5	—		15.5
RAMUS				Referred Y.P.M. 12638	A.M. 7519	
Stage of wear of teeth				(W)	(M+)	
Length (max., including incisors)	—	—	—	—	—	127.5
Length, /C–condyle incl.	—	—	—	—	—	117.5
Depth of jaw under coronoid	—	—	—	—	70	68
Depth of jaw below anterior edge of M_3	—	—	—	23.5	26	27
Length, /C–M_3 incl.	—	—	—	—	—	76.5
Length, P_1–M_3 incl.	—	—	—	—	71.5	71
Length, P_1–P_4 incl.	—	—	—	33	30	31
Length, M_1–M_3 incl.	—	—	—	—	41.5	41

[1] ( ) Approximate; (( )) estimated. All measurements in millimeters.

TABLE 5—*Continued*

	Oreodontoides (*Paroreodon*) *marshi* (Thorpe)		*Oreodontoides* (*Paroreodon*) *stocki*, new species
SKULL	Holotype Y.P.M. 12415	Referred C.I.T. 400	Holotype C.I.T. 537
Stage of wear of teeth	(w+)	(w+)	(w)
Length (including supraoccipital crest and incisors)	((164))	(179)	((179))
Basal length (from anterior notch of foramen magnum to posterior base of I^1)	140	(159)	((161))
Width (max.)	((95))	((95))	((103))
Width of brain case (max.)	57	50	65
Width, interorbital (min.)	49	((38))	52.5
Distance from anterior rim of orbit to anterior base of canine	62	65.5	69
Distance from anterior rim of orbit to supraoccipital crest	((104))	112.5	—
Length of nasals	—	53	—
Width of muzzle at infraorbital foramina	45	37	44
Width across canines	—	(35)	39
Length, C/–M^3 incl.	79	83	84.5
Length, P^1–M^3 incl.	70	71	76
Length, P^1–P^4 incl.	32	31.5	34.5
Length, M^1–M^3 incl.	40	39.5	45.5
Depth of malar below orbit	20	18	16
RAMUS			Referred A.M. 7578
Stage of wear of teeth			(w‡+)
Length (max., including incisors)	—	—	—
Length, /C–condyle incl.	—	—	—
Depth of jaw under coronoid	—	73.5	—
Depth of jaw below anterior edge of M_3	—	28.5	32.5
Length, /C–M_3 incl.	—	—	—
Length, P_1–M_3 incl.	—	—	92.5
Length, P_1–P_4 incl.	—	—	43.5
Length, M_1–M_3 incl.	—	42	48

TABLE 6

Oreodontoides THORPE AND *Oreodontoides* (*Paroreodon*) (THORPE). COMPARATIVE MEASUREMENTS[1] OF SKELETAL ELEMENTS

	Oreodontoides oregonensis Thorpe	*?Oreodontoides curtus* (Loomis)	*Oreodontoides* (*Paroreodon*) *marshi* (Thorpe)
	Referred A.M. 7513	Referred A.C. 31-31	Referred C.I.T. 400
Length of humerus (articular)	128.5	—	127.5
Length of radius (articular)	—	94.5	112.5
Length of ulna (max.)	—	((120))	147
Length of metacarpal III (max.)	—	51.5	—
Length of femur (articular)	—	(127)	147.5
Length of tibia (articular)	—	(116)	—
Length of metatarsal III (max.)	62.5	(58)	48.5
Length of calcaneum (max.)	—	—	49

[1] ( ) Approximate; (( )) estimated. All measurements in millimeters.

and geologists who have worked in the John Day beds, and who generally agree that at least two horizons are present—a conclusion which is substantiated by differences in the various oreodont forms from this area. No definite stratigraphic break, however, seems to be apparent; thus the term middle or upper John Day appears to be of little value. In the records accompanying the various collections of John Day oreodonts, which the writers have had the privilege of seeing, no clean-cut separation of the horizons is evident. Another point of interest in the collections from the John Day is that small forms like *O.* (*Paroreodon*) and others are found in the same horizons as the large *Promerycochoerus*. This is true also in the Great Plains, where *Promerycochoerus carrikeri* and *Merychyus siouxensis* are found associated.

The change in the type of bulla from *O.* (*P.*) *marshi* to that of *O.* (*P.*) *stocki* seems to indicate a difference in geological levels, as is evident in the changes of the bullae of forms from the great Plains, for example in the development from *Merychyus* to *M.* (*Metoreodon*). The prelacrimal vacuity was not observed in the available material, but this may be owing to the crushing and poor preservation of the facial region of the skulls.

Ten specimens are here recorded:

HOLOTYPE

Skull (somewhat crushed) with I^1(alv.)–M^3. (w) — C.I.T. 537 — From C.I.T. coll. loc. no. 32, 1 mi. E.–N.E. of Cressen Ranch, near Haystack Valley, John Day area, Oregon. This paper, figs. 1, 12

REFERRED FROM THE JOHN DAY VALLEY, OREGON

PARTIAL SKULL AND PARTIAL MANDIBLE

Partial skull with I^1–I^3 rt. and C/–M^3 (P^3, P^4, and M^3 erupt.) and partial left ramus with /C(rt.)–M_3(erupt.) (P_2–P_3 erupt. and P_4 alv.). (–M) — A.M. 7785 — From the John Day Valley

Although this specimen is not quite mature, it is larger than the holotype.

PARTIAL SKULL, MANDIBLE, AND ATLAS, IMMATURE

Partial skull with C/(rt.)–M^3(germ) (P^3–P^4 erupt.), partial mandible (at- — A.M. 8228 — From the Cove

tached) with P_1(br.)–dP_2–M_3(erupt.), and atlas. (I)

The skull is rather small, but the bullae are very large and flattened as in this species.

5 PARTIAL SKULLS

Badly crushed skull with I^1–C/ rt. and P^1–M^3. (W+)	A.M. 7814	From the John Day Valley
Anterior portion of skull with I^1–I^3 rt. and C/–M^3 (M^2 br.). (–M) Small C/.	C.I.T. 3499	From C.I.T. coll. loc. no. 29, Haystack Valley
Skull with I^1–M^3 (C/ br.). (M)	3502	From the John Day Valley
Anterior portion of skull with P^3–M^3. ($W\ddagger^+$)	A.M. 7690	From the Cove, collected by L. S. Davis, 1879
Skull with I^2–dP^2–M^2(erupt.) (C/ rt.). (I)	7649	From Camp Creek, Crooked River; collected by Wortman

2 PARTIAL RAMI

Partial right ramus with I_1–/C alv. and P_1–M_3. (–M)	A.M. 7543	From the Cove; collected by Day and Warfield, 1877?
Partial left ramus with /C–P_2 rt. and P_3–M_3. ($W\ddagger^+$)	7578	From the John Day Valley This paper, fig. 12

This ramus is somewhat larger than examples of *Oreodontoides* (*Paroreodon*) *marshi*, but its characters are typical of that species.

VARIATION[1]

THE FOLLOWING FIVE TYPES of variation have been considered in this study of the subfamily Merychyinae:

1. Age variation of the individual (see charts 3 and 4).
2. Sex variation (see chart 3).
3. Individual variation, without regard to age or sex variation (see charts 1 and 2).
4. Geographic variation (see chart 2).
5. Geologic variation (see chart 2).

1. AGE VARIATION OF THE INDIVIDUAL

Age variation of the individual is demonstrated in chart 3. Twenty-four individuals of *Merychyus crabilli*, found associated in two field blocks, are the basis for chart 3 and represent the best available assemblage for this type of study. Eleven of these specimens are fully mature and are represented by skulls, partial skulls, or rami. The balance of the associated material is immature and would not add materially to this study. The age of the individual has been determined by the external, vertical height of the enamel on M^3. On chart 3 the individuals are listed in order from youngest to oldest.

From a study of chart 3 it is evident that the individual age of a mature specimen does not govern any one measurement or even a combination of measurements. For example, the oldest individual may not have the longest basal length nor the youngest the shortest; and the youngest example may not have the shortest dental series nor the oldest the longest. Other possible measurements also do not relate to the age of the individual.

Figure 13 illustrates the dentition of one of the 10 associated specimens of *Merychyus crabilli*. From the illustration it may be seen that the actual length of the crowns of the premolar series does not alter appreciably with age. Changes due to age are apparent in the outline of the premolars, but not in the over-all measurements of this series. Likewise, the total length of the crowns of the molar series vary but slightly. M1, either superior or inferior, may be seen to change noticeably, becoming less with wear in its anteroposterior length; M2 likewise decreases but to a lesser degree; but M3 increases with wear in its anteroposterior length, almost compensating for the decrease in the other two molars.

Chart 4, which represents a rearrangement of the data on chart 3, retaining the same age succession from youngest to oldest, illustrates individual variation of a different type. It demonstrates that according to six different measurements of the skull and dentition, there is no mutual relationship between these measurements. In chart 4 a specimen symbol is used to designate the relative position of the individual when each measurement is considered independently of the others, for example, the fourth specimen (W^4) in the age succession of chart 3 ranks first in basal length, third in width, and fifth in length of M^1–M^3 in chart 4. Therefore, a skull which has the longest basal length may not have the longest C/–M^3 measurements, or the skull with the longest C/–M^3 series may not have the longest P^1–M^3 series.

2. SEX VARIATION

Sex variation is not evident at this time in examples of the subfamily Merychyinae. The wider skulls in chart 3 may represent males and the narrower, females. In Ticholeptinae, however, differences are apparent, and specimens referred to the genus *Ustatochoerus*,[2] which have the light and narrow skulls, are considered to represent females.

3. INDIVIDUAL VARIATION (Without Regard to Sex or Age Variation)

In the opinion of the writers, individual variation must be recognized as a factor of utmost importance when the revision of any group of fossil mammals is undertaken. Examples of individual variation are demon-

[1] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, Bull. Amer. Mus. Nat. Hist., vol. 79, art. 1, p. 97, tables 6–9. Individual variation was briefly discussed and demonstrated by four tables, and the data presented from a slightly different approach.

[2] Schultz, C. Bertrand, and Charles H. Falkenbach, 1941, *ibid.*, p. 48.

strated in charts 1 and 4, particularly in the latter. These charts also illustrate possible geographic and geologic variations, but the geologic differences are exhibited best in chart 2.

In chart 1 the basal lengths of the skulls and the inferior and superior dental series of the specimens listed under *Merychyus* and *Merychyus* (*Metoreodon*) are recorded in millimeters according to individual age. The weighted mean and the range also are cited. It is apparent that the age factor has no exclusive control over size.

4. GEOGRAPHIC VARIATION

Geographic (or horizontal) variation in this study may be best demonstrated in chart 2. As an example, two species (*Merychyus arenarum* and *M. minimus*) which are found in the same collecting localities and geologic levels form the basis for chart 2.

The weighted mean, the minimum, and the maximum of three measurements of examples of each species are cited, as well as the age of the particular individual used and the number of individuals considered in each case. These data show that *M. minimus* is known from the 13 localities mentioned, and *M. arenarum* from nine of these. It may be noted that the mean basal lengths in *M. arenarum* are longer in specimens from Goshen County, Wyoming, than they are in those from Platte County, Wyoming, and from South Dakota. Other measurements cited for the same localities, however, are within the expected individual variation.

In *M. minimus* the basal lengths, with the exception of the material from Sheridan County, Nebraska, seem to be well within individual variation. The skull from Sheridan County shows a basal length larger than small examples of *M. arenarum*, but the mean of the measurements of the dental series representing all of the specimens from this area is close to other examples of *M. minimus*. Such evidence of variation may represent either geologic or geographic differences.

5. GEOLOGIC VARIATION

Geologic (or vertical) variation in the oreodonts is usually evidenced by specific or subspecific changes in the forms from successive geologic levels. Within a species of *Merychyus*, geologic variation (or size changes due to difference in geologic time) is important, but without exact geologic data it is impossible to distinguish this time element from the geographic and individual factors. If one considers only two specimens of a species from the same locality, the larger specimen being from a slightly higher geologic level, the total amount of the observed size difference is not necessarily due to the time factor alone but also may be accounted for by individual variation. If a series of specimens from each geologic level were available, it would be possible to distinguish between those differences due to time and those due only to individual variation. The actual size differences due to the time element alone are important because they represent steps in the phylogeny of the species and the genus as a whole. These same factors must be considered when studying specimens from deposits of two separate geographic areas of approximately the same geologic age. (See chart 2.)

CHART 1

ASPECTS OF VARIATION AND RANGE IN *Merychyus* AND *Merychyus* (*Metoreodon*)
Comparisons of species, emphasizing apparent individual and age variation in basal lengths, superior and inferior dentitions

		Skull			Dentition					
		Basal length[1]			P^1–M^3			P_1–M_3		
	Wear	No. of Examples	Range	Mean[2]	No. of Examples	Range	Mean	No. of Examples	Range	Mean
M. (M.) relictus "Lower Snake Creek" 136 specimens	M	2	149	148	2	74–75	75	3	81–85	83
	M+	—	—		—	—		—	—	
	W	—	—		2	73–79		2	80–84	
	W+	—	—		1	75		1	81	
	W‡	—	—		1	76		9	78–91	
	W‡+	1	147		3	74–75		—	—	
	W‡‡	—	—		1	70		1	87	
M. (M.) r. taylori "Sheep Creek" 60 specimens	M	—	—	152	1	78	75	—	—	78
	M+	—	—		—	—		—	—	
	W	—	—		—	—		2	74–79	
	W+	—	—		—	—		3	76–80	
	W‡	—	—		—	—		1	80	
	W‡+	1	152		1	72		1	83	
	W‡‡	—	—		—	—		1	73	
M. elegans Upper Marsland 155 specimens	M	1	151	158	2	75–81	77	—	—	81
	M+	1	149		1	81		—	—	
	W	2	162–171		8	70–79		10	79–84	
	W+	—	—		6	76–81		6	81–86	
	W‡	—	—		2	72–80		7	72–84	
	W‡+	—	—		2	76–77		1	79	
	W‡‡	—	—		—	—		—	—	
M. e. bluei Upper Marsland 4 specimens	M	—	—	153	—	—	70	—	—	77
	M+	—	—		—	—		—	—	
	W	—	—		1	71		1	79	
	W+	1	153		1	68		—	—	
	W‡	—	—		—	—		—	—	
	W‡+	1	153		2	69–71		1	74	
	W‡‡	—	—		—	—		—	—	
M. minimus Lower Marsland 398 specimens	M	5	123–141	135	14	65–75	67	13	65–78	73
	M+	1	141		6	63–73		2	70–77	
	W	5	131–142		29	63–77		23	65–80	
	W+	11	123–152		37	62–82		27	64–80	
	W‡	5	130–142		21	59–73		28	66–79	
	W‡+	4	125–135		8	62–72		8	66–74	
	W‡‡	1	133		6	63–70		4	69–75	

[1] All measurements in millimeters.
[2] Weighted mean.

CHART 1—*Continued*

		Skull			Dentition					
		Basal length			P^1–M^3			P_1–M_3		
	Wear	No. of Examples	Range	Mean	No. of Examples	Range	Mean	No. of Examples	Range	Mean
M. arenarum	M	3	156–177		9	73–85		7	70–90	
Lower Marsland	M+	2	145–164		4	75–85		4	79–91	
204 specimens	W	12	145–167	156	20	71–87	78	15	76–91	82
	W+	10	151–178		15	70–88		15	72–93	
	$W\frac{+}{+}$	7	150–171		15	70–84		10	75–87	
	$W\frac{++}{+}$	4	145–157		11	73–87		14	76–90	
	$W\frac{++}{++}$	1	159		1	78		3	77–79	
M. a. idahoensis	M	—	—		—	—		—	—	
Approximate	M+	1	165		2	77–81		1	85	
Lower Marsland equivalent	W	—	—	171	—	—	81	—	—	85
	W+	—	—		—	—		—	—	
	$W\frac{+}{+}$	—	—		—	—		—	—	
6 specimens	$W\frac{++}{+}$	1	177		1	85		—	—	
	$W\frac{++}{++}$	—	—		—	—		—	—	
M. siouxensis	M	—	—		—	—		—	—	
Harrison	M+	1	147		3	77–80		3	84–87	
57 specimens	W	1	154	157	10	77–82	78	2	85–86	84
	W+	1	163		3	74–82		1	79	
	$W\frac{+}{+}$	1	164		3	75–82		6	77–91	
	$W\frac{++}{+}$	—	—		1	77		—	—	
	$W\frac{++}{++}$	—	—		1	78		1	82	
M. crabilli	M	—	—		2	64–66		—	—	
Harrison	M+	1	125		1	64		2	65–70	
55 specimens	W	3	123–130	128	3	59–67	64	—	—	69
	W+	1	133		3	63–70		—	—	
	$W\frac{+}{+}$	1	129		1	62		—	—	
	$W\frac{++}{+}$	1	132		1	62		2	71	
	$W\frac{++}{++}$	—	—		—	—		—	—	

CHART 2

ASPECTS OF VARIATION IN *Merychyus*

Comparison of two species from the same general geologic level, intended to show possible geographic variation, or slight difference in geologic level[1]

States			Wyoming									Nebraska			So. Dak.
Counties			Niobrara	Goshen					Platte			Sioux	Dawes	Sheridan	Various
Areas			Royal Valley	12 mi. Distr.	16 mi. Distr.	18 mi. Distr.	Jay Em Distr.	25 mi. Distr.	Guernsey	Wheatland	Chugwater	Harrison	Marsland	Hay Springs	Various
Merychyus arenarum Cope From the lower part of the Marsland formation or equivalent	Basal Length	Mean	—	[1] 171	[12] 158.1	[11] 161.5	[3] 160	[2] 164	[2] 148.5	[5] 154.2	—	—	—	—	[1] 151
		Min.	—	171 w‡	145 w‡+	145 w	151 w	151.5 w+	147 w	148 w	—	—	—	—	151 w+
		Max.	—		169.5 w‡	178 w+	173 w+	177 M	150 w‡	158.5 w‡‡	—	—	—	—	
	P^1–M^3	Mean	—	[4] 78	[7] 77	[17] 79	[12] 80.6	[3] 81.5	[4] 75.8	[10] 78	—	[4] 74.7	—	—	[3] 78.8
		Min.	—	74 w‡+	70 w+	70 w	72.5 M	75 w+	71 w	74.5 w; w‡+	—	73 w‡	—	—	74.5 w+
		Max.	—	82.5 w	84 w	87.5 w+	86.5 w‡+	85 M	78 w‡‡	83.5 –M	—	75.5 w‡	—	—	85 M+
	P_1–M_3	Mean	—	[4] 85.1	[18] 81.6	[13] 84.7	[11] 82.9	—	[2] 77	[12] 82.5	—	—	—	—	[5] 83.1
		Min.	—	82.5 w‡	72 w+	76 w	76 w	—	76.5 w‡‡	77 w‡+	—	—	—	—	77 w
		Max.	—	91 w	90 w+	93 w+	89.5 w‡+	—	77.5 w+	91 w	—	—	—	—	90.5 M+

CHART 2—*Continued*

States			Wyoming									Nebraska			So. Dak.
Counties			Niobrara	Goshen					Platte			Sioux	Dawes	Sheridan	Various
Areas			Royal Valley	12 mi. Distr.	16 mi. Distr.	18 mi. Distr.	Jay Em Distr.	25 mi. Distr.	Guernsey	Wheatland	Chugwater	Harrison	Marsland	Hay Springs	Various
Merychyus minimus Peterson From the lower part of the Marsland formation or equivalent	Basal Length	Mean	[2] 140.2	[3] 133	[9] 135	—	[8] 128.4	—	[2] 136.5	—	—	—	[1] 142	[1] 152	[2] 137
		Min.	139 w+	129 w+	130 w‡	—	122.5 M	—	131 W	—	—	—	142 w‡+	152 w+	136.5 w‡+
		Max.	141.5 W	141 M	141 w+	—	134 w‡+	—	141.5 w+	—	—	—			138 w+
	P^1–M^3	Mean	[26] 71.7	[6] 68.6	[19] 67.8	[9] 65.9	[23] 65.3	[3] 70.7	[11] 67.2	[1] 72	[2] 69	[3] 66.5	[1] 72	[12] 70.8	[4] 66.5
		Min.	65 w‡; w‡+	65.5 M	63 M+	58.5 w‡	58.5 w‡	69 M+	63 w+	72 w‡+	65 W	64.5 w‡+	72 w‡+	62 w‡+	64.5 w+
		Max.	73 w+	70.5 M	74.5 M	72 W	69.5 w‡	71.5 w; w‡	72 w+		73 M+	70 W		82 w+	70 w+
	P_1–M_3	Mean	[20] 70.2	[6] 74.5	[13] 71.3	[10] 69.6	[17] 70.5	[3] 71.3	[9] 71.5	[2] 73.7	[2] 74.8	[2] 71	—	[7] 71.9	[5] 69.7
		Min.	66 w‡+	70.5 w‡	63 M+	63.5 w+	66 w‡	71 w+; w‡	66.5 W	73 w‡	71 w+	69 w‡+	—	66.5 w‡	67.5 w; w‡
		Max.	75 W	79.5 w+	74.5 M	74 W	73 w‡	72 w+	74.5 w‡‡	74.5 w‡	78.5 w‡	73 w+	—	75 w+	75 M

[1] The figures in the square brackets are the number of individuals. The mean is a weighted mean. The stage of wear follows the measurements cited. All measurements in millimeters.

CHART 3

ASPECTS OF VARIATION IN *Merychyus crabilli*

Comparison of measurements of associated mature individuals of a single species as a measurement of the effects of age variation

F:A.M.	Identifying Symbols of Specimens[1]	M^3	Skull				Superior Dentition																	
		External Height[2]	Basal Length	Width	Bulla Length	Malar Depth below Orbit	C/–M^3	P^1–M^3	P^1 P^4	M^1–M^3	P^1		P^2		P^3		P^4		M^1		M^2		M^3	
											L.	W.	L.	W.	L.	W.	L.	W.	L.	W.	L.	W.	L.	W.
45384G	W^1	13.0+	—	—	—	—	72.3	66.0	30.0	38.0	6.0	4.8	7.3	7.0	8.4	8.0	7.6	9.4	11.0	10.8	13.2	13.0	15.2	12.7
45384S	W^2	13.0	—	—	—	15.0	69.6	64.0	29.0	37.8	5.1	4.5	6.5	6.3	7.8	8.8	7.3	9.8	11.2	12.3	13.7	13.1	16.3	13.2
45384A	W^3	12.6	125.0	85.5	21.6	13.5	71.0	65.5	29.0	38.5	5.0	4.5	7.0	6.0	8.7	7.6	6.7	9.6	11.0	11.0	14.1	13.0	15.0	13.2
45384C	W^4	11.6	132.5	85.5	24.0	11.9	70.0	63.1	28.2	36.4	4.5	4.5	6.7	6.5	7.5	7.5	6.5	9.3	9.0	10.8	11.3	11.7	17.5	13.6
45384E	W^5	(11.5)	126.5	92.7	21.5	11.5	71.0	65.0	30.0	37.0	5.0	4.2	9.2	8.0	8.5	8.2	7.6	10.0	11.0	11.5	13.7	12.6	18.0	12.3
45384F	W^6	10.5	(123.0)	79.5	(22.5)	11.0	65.2	59.2	27.1	33.6	4.3	3.4	6.0	5.5	7.7	6.8	7.0	9.0	9.4	10.8	13.0	12.5	14.4	11.7
45384I	W^7	9.6	—	—	—	—	—	—	—	35.5	—	—	7.6	6.5	7.6	—	6.2	9.7	10.0	10.2	—	—	16.5	12.6
45384D	W^8	8.3+	129.5	84.5	(24.0)	13.0	69.8	63.0	(25.8)	35.5	—	—	7.3	7.0	7.7	7.8	7.6	9.5	9.0	11.5	11.5	12.5	15.5	13.4
45384H	W^9	8.3	—	—	—	—	—	65.0	29.0	36.2	5.0	4.5	7.4	6.0	7.0	7.3	7.4	10.0	10.5	11.7	14.2	12.6	16.0	12.4
45384B	W^{10}	7.5	131.7	88.6	24.0	14.3	68.7	(62.5)	(27.5)	35.0	—	—	7.0	6.3	7.5	7.4	7.5	8.3	7.2	11.0	9.5	12.2	16.8	13.7

[1] The identifying symbols W^1–W^{10} refer to the F:A.M. specimens which are listed in sequence from youngest to oldest based on the wear (height) of M^3; for example, W^4 is *fourth* from youngest.

[2] All measurements in millimeters; ( )=approximate.

CHART 4

Aspects of Variation in *Merychyus crabilli*

Rearrangement of the data on chart 3 using the same wear symbols (W^1 to W^{10}) which designate the age sequence based on the external height (longest to shortest) of M^3. (Example: specimen W^4 ranked *fourth* from the longest in height of M^3 and *first* (longest) in the basal length of the skull.) This chart emphasizes that individual variation is more significant than age variation

Rank Based on Cited Measurements (Longest to Shortest)	Skull		Dentition			
	Basal Length	Width	Length C/–M^3	Length P^1–M^3	Length P^1–P^4	Length M^1–M^3
First	W^4	W^5	W^1	W^1	W^1, W^5	W^3
Second	W^{10}	W^{10}	W^3, W^5	W^3	W^2, W^3, W^9	W^1
Third	W^8	W^3, W^4	W^4	W^5, W^9	W^4	W^2
Fourth	W^5	W^8	W^8	W^2	W^{10}	W^5
Fifth	W^3	W^6	W^2	W^4	W^6	W^4
Sixth	W^6		W^{10}	W^8	W^8	W^9
Seventh			W^6	W^{10}		W^7, W^5
Eighth				W^6		W^{10}
Ninth						W^6

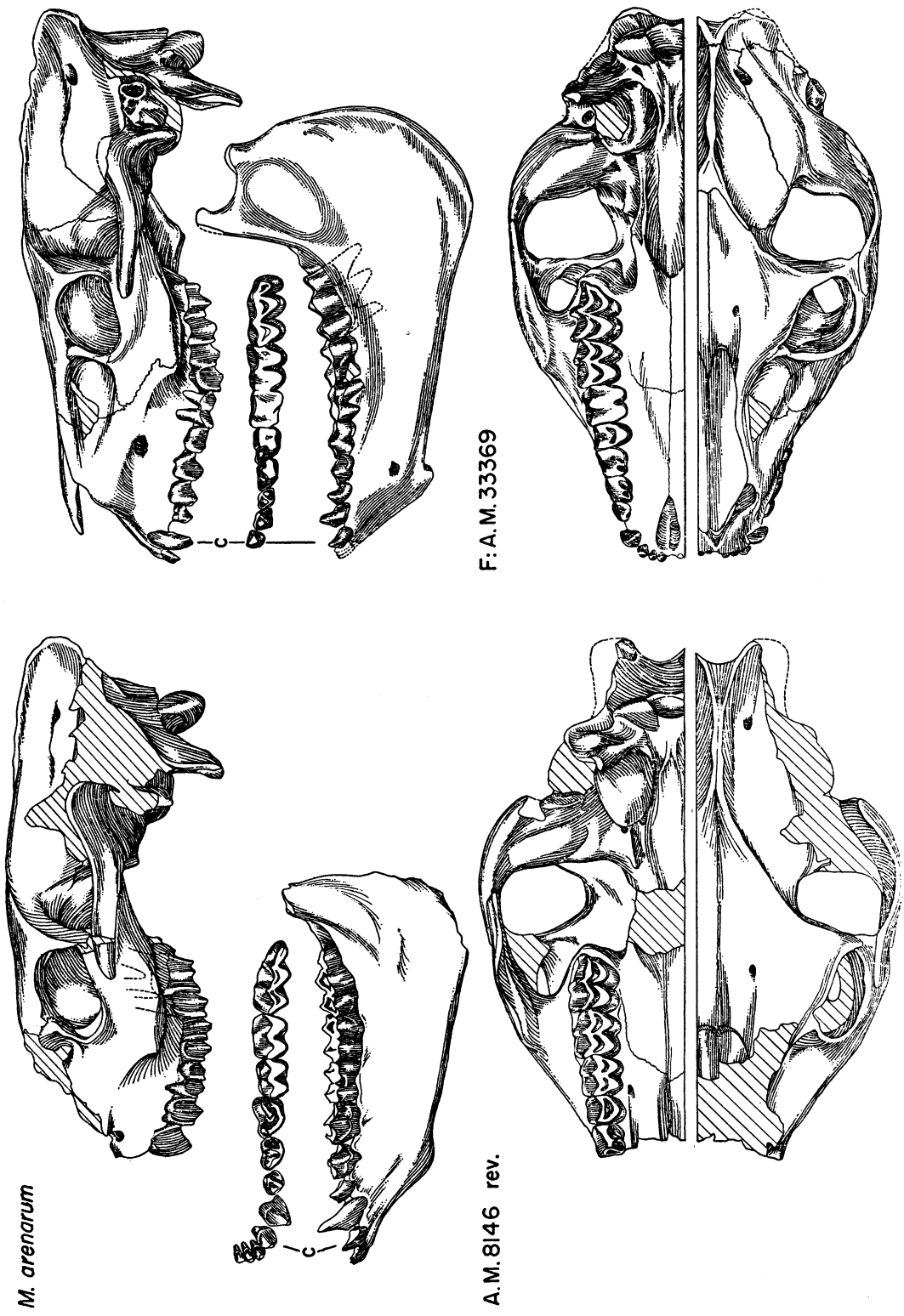

FIG. 2. *Merycbyus arenarum* Cope, holotype, A.M. 8146, skull and ramus (bulla restored; inferior dentition, /C and P_1 from opposite side), Wyoming, and referred, F:A.M. 33369, skull and ramus (inferior dentition from opposite side), lower Marsland, Platte County, Wyoming. ×⅓.

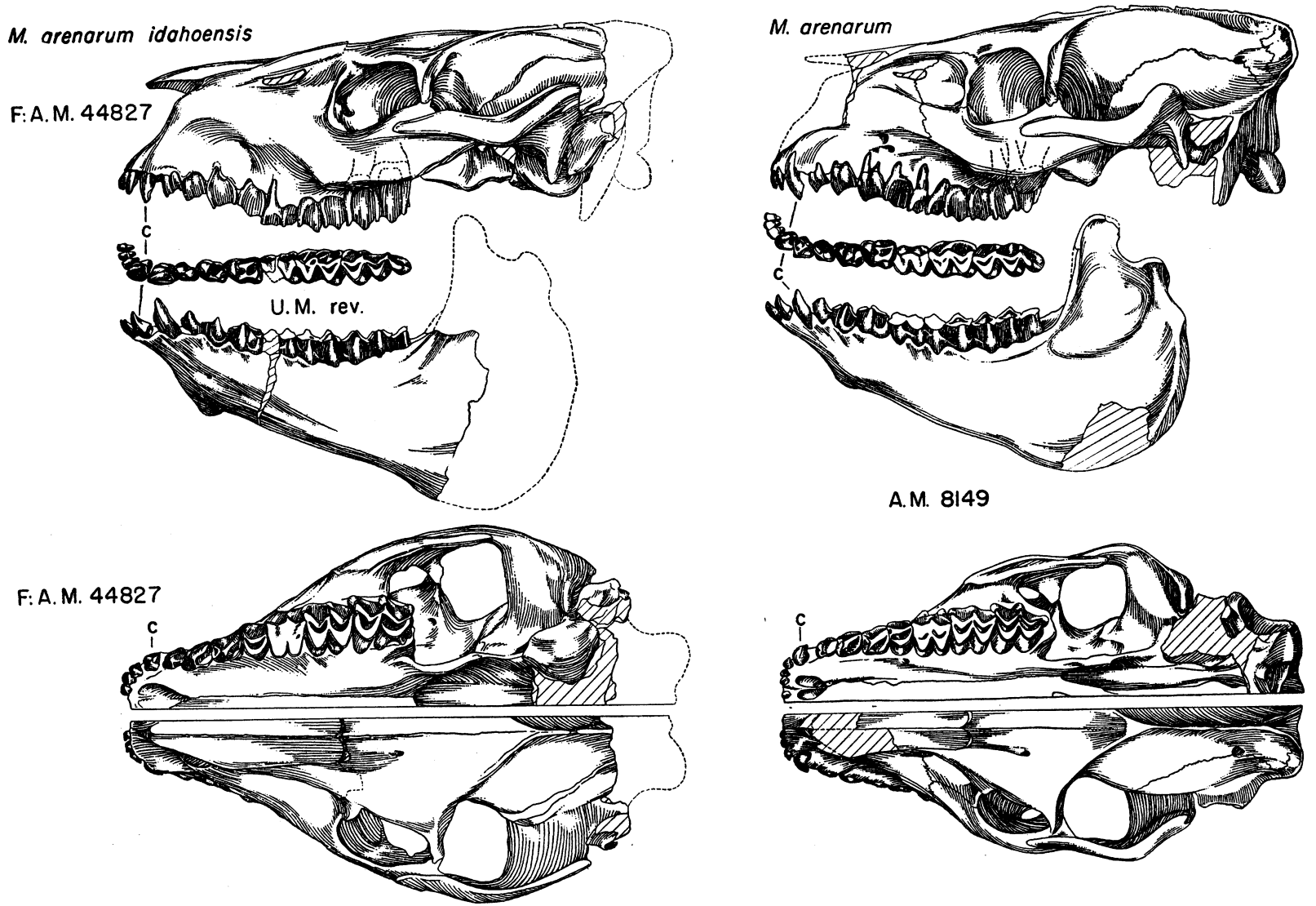

FIG. 3. *Merychyus arenarum* Cope, referred, A.M. 8149, skull and ramus (skull, combination of both sides; P_4 and last lobe of M_3 from opposite side), lower Marsland, Wyoming; *M. arenarum idahoensis*, new subspecies, holotype, F:A.M. 44827, skull, and referred, U.M. specimen, ramus, equal to lower Marsland, Lemhi County, Idaho. $\times\frac{1}{2}$.

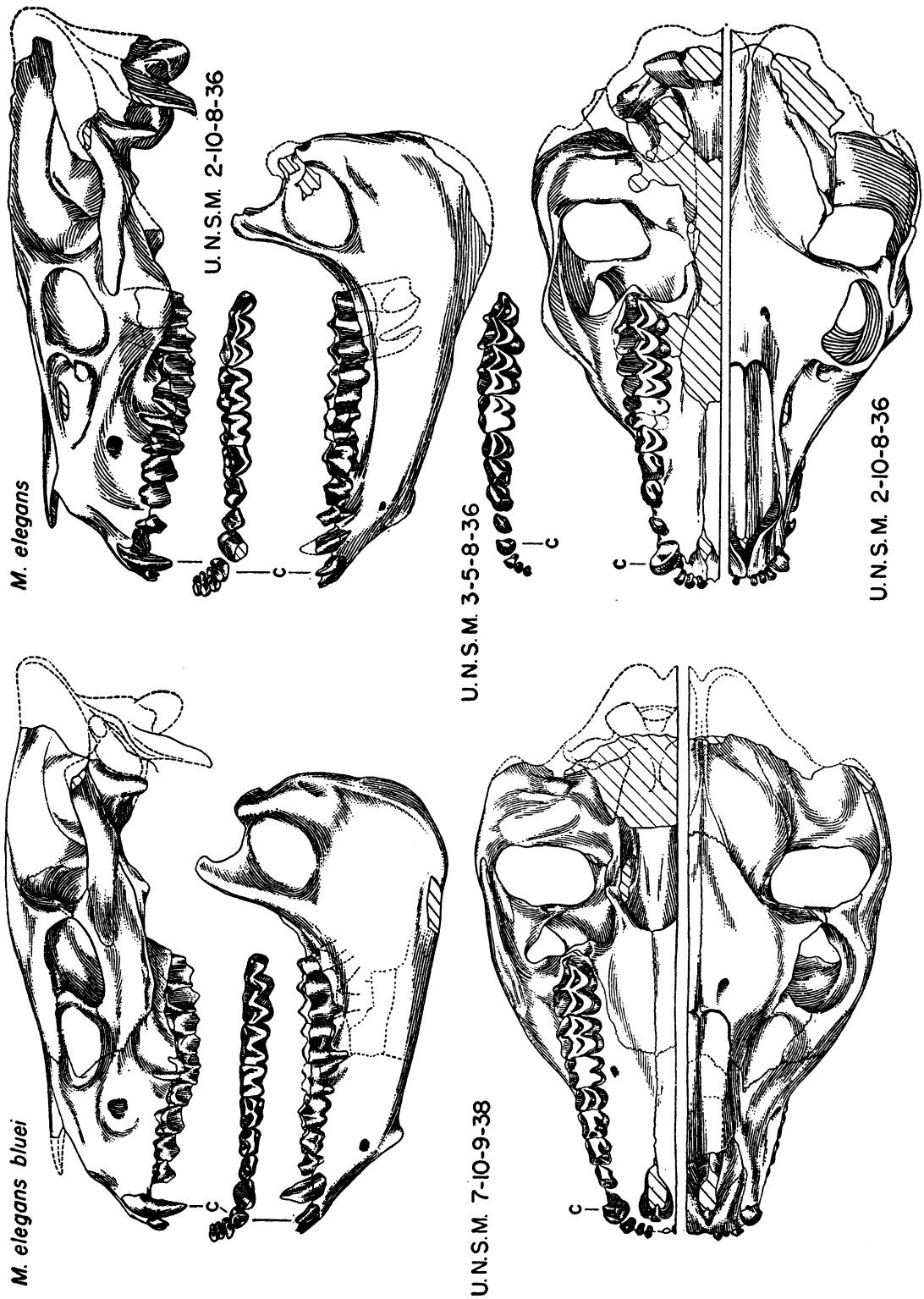

FIG. 4. *Merychyus elegans* Leidy, referred, U.N.S.M. 2-10-8-36, skull and ramus (skull, combination of both sides) and U.N.S.M. 3-5-8-36, superior dentition, upper Marsland, Dawes County, Nebraska; *M. elegans bluei*, new subspecies, holotype, U.N.S.M. 7-10-9-38, skull and ramus, upper Marsland, Box Butte County, Nebraska. $\times\frac{1}{2}$.

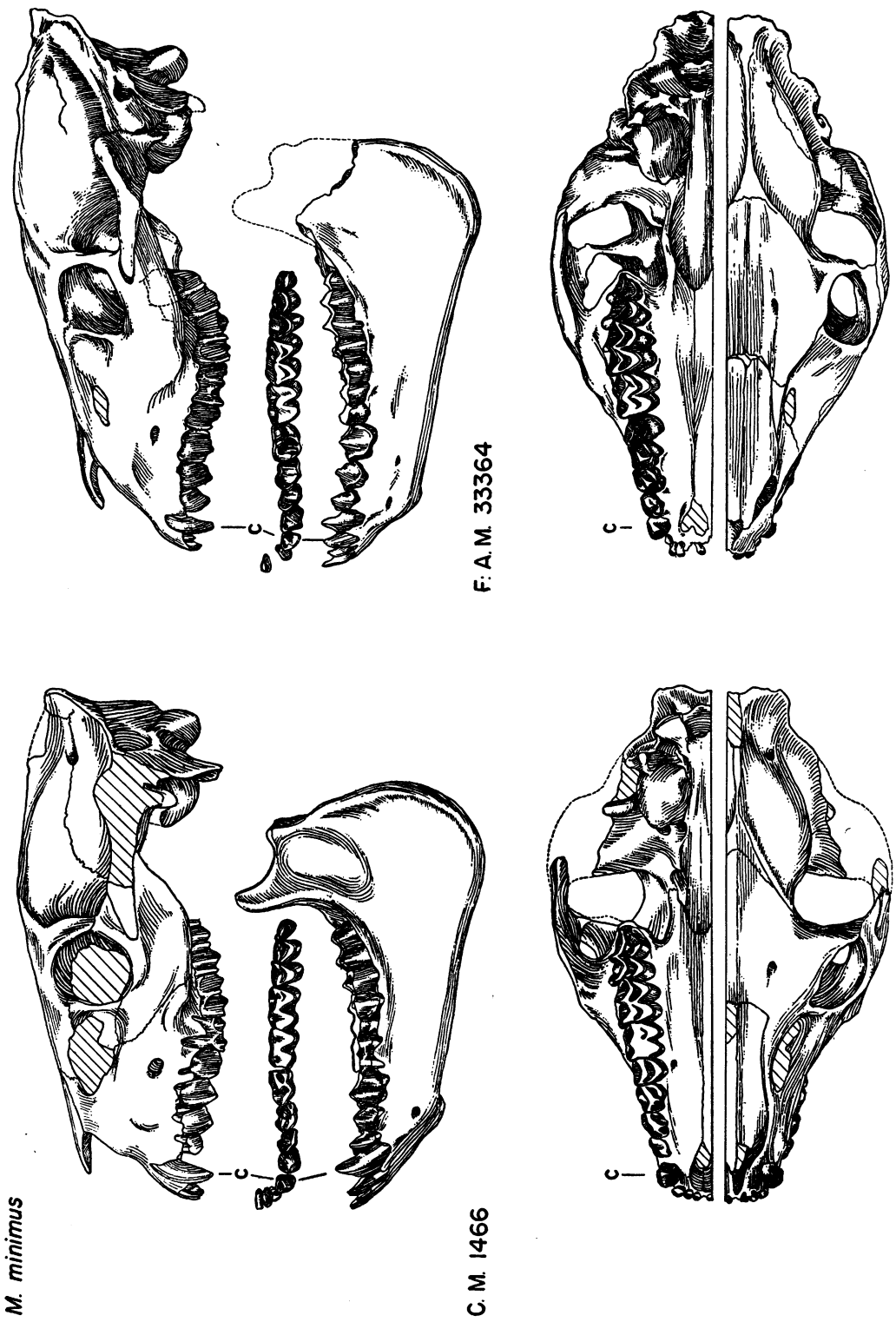

FIG. 5. *Merychyus minimus* Peterson, holotype, C.M. 1466, skull and ramus (skull, combination of both sides; inferior incisors from opposite side), lower Marsland, Sioux County, Nebraska; referred, F:A.M. 33364, skull and ramus, lower Marsland, Goshen County, Wyoming. X⅓.

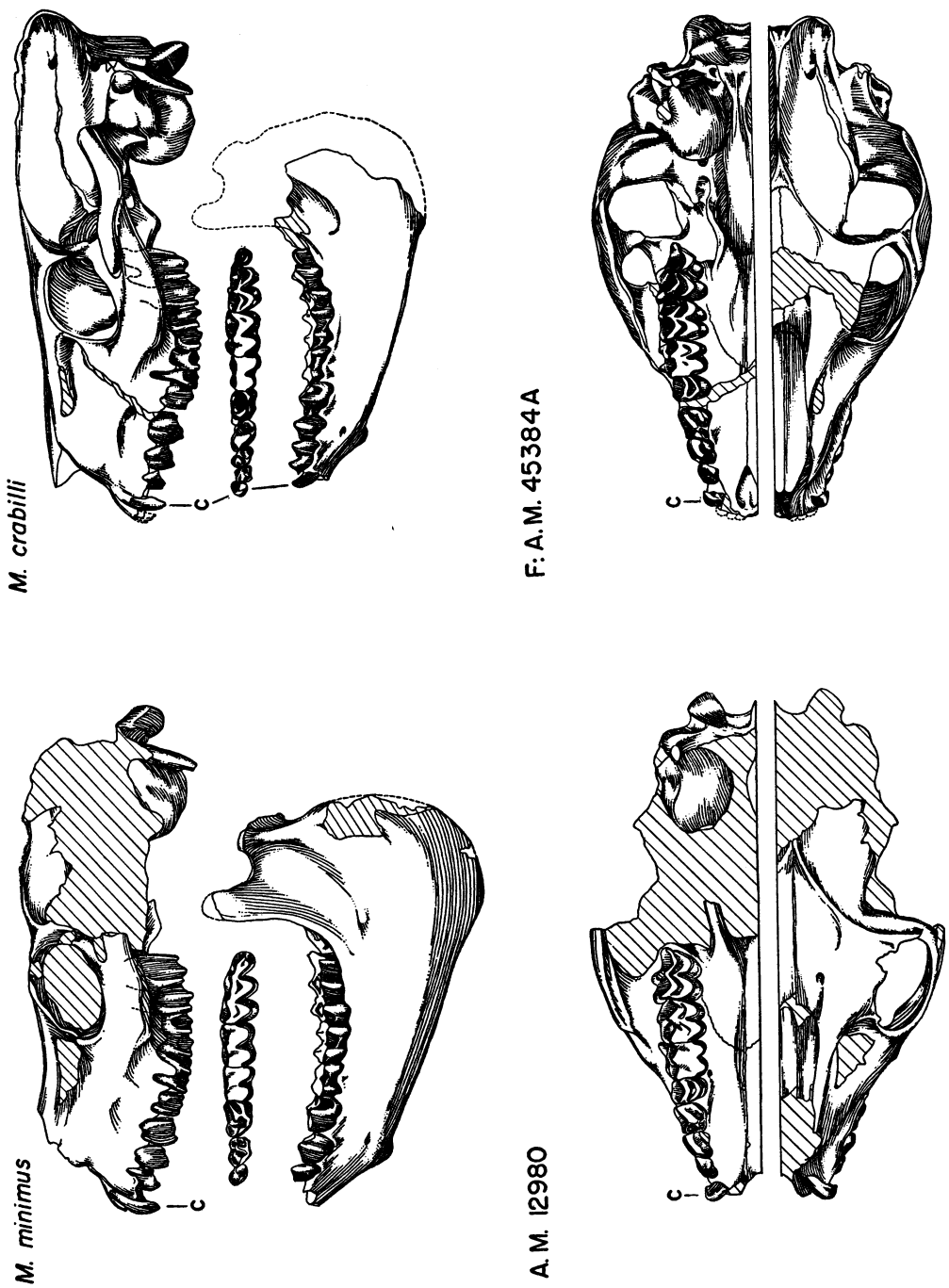

FIG. 6. *Merychyus minimus* Peterson, referred, A.M. 12980, skull and ramus (P_2 from opposite side), lower Marsland, Shannon County, South Dakota; *M. crabilli*, new species, holotype, F:A.M. 45384A, skull and ramus, Harrison, Box Butte County, Nebraska. ×½.

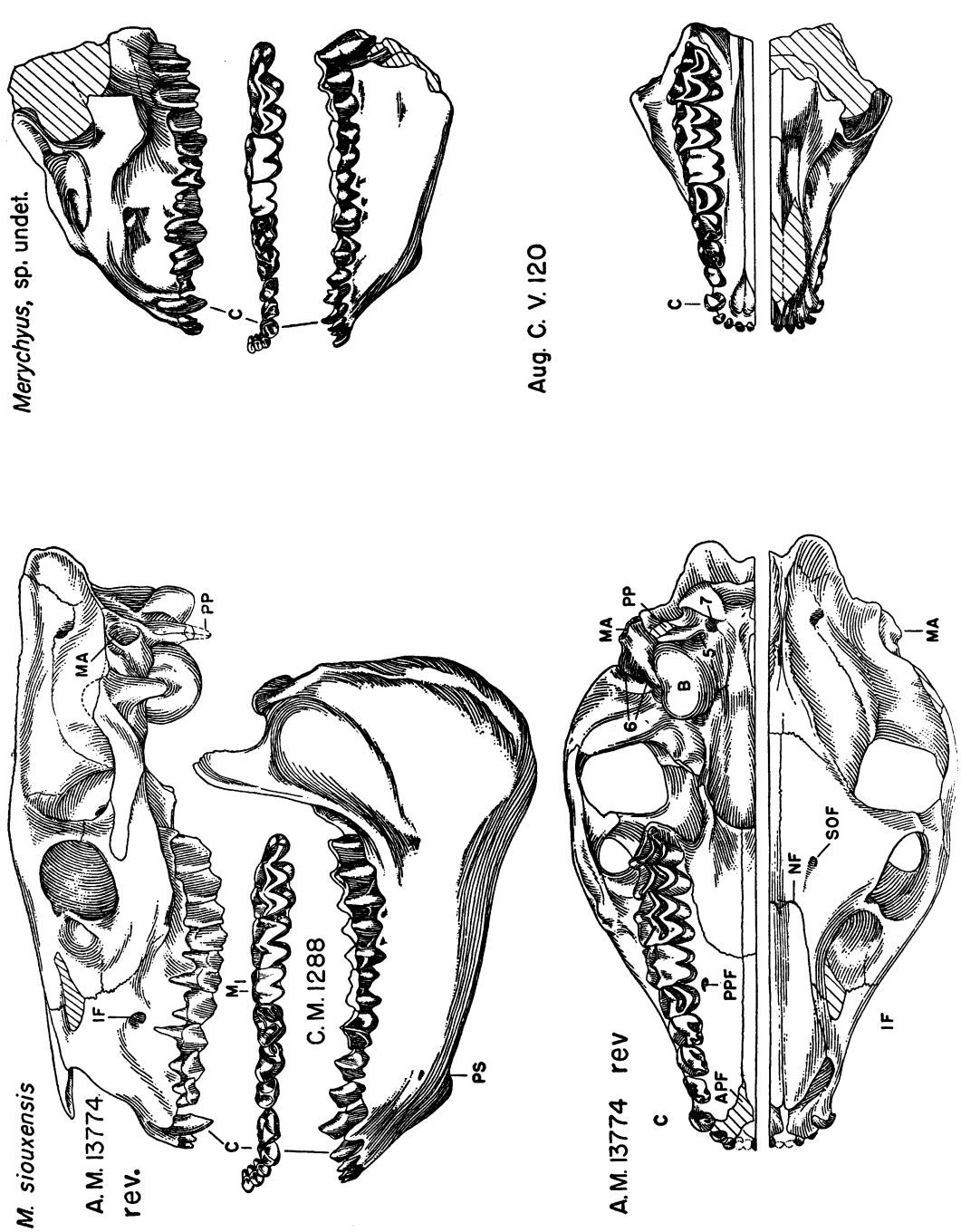

FIG. 7. *Merychyus siouxensis* Loomis, holotype, A.M. 13774, skull, and referred, C.M. 1288, ramus, Harrison, Sioux County, Nebraska; *Merychyus*, species undetermined, Aug.C. V120, partial skull and ramus (C/ from opposite side, M^3 and last lobe of M_3 restored), Lincoln County, Wyoming. ×½. APF, Anterior palatine foramen; B, auditory bulla; 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; 5, lacerated foramina; 6, glenoid foramina; 7, condylar foramen.

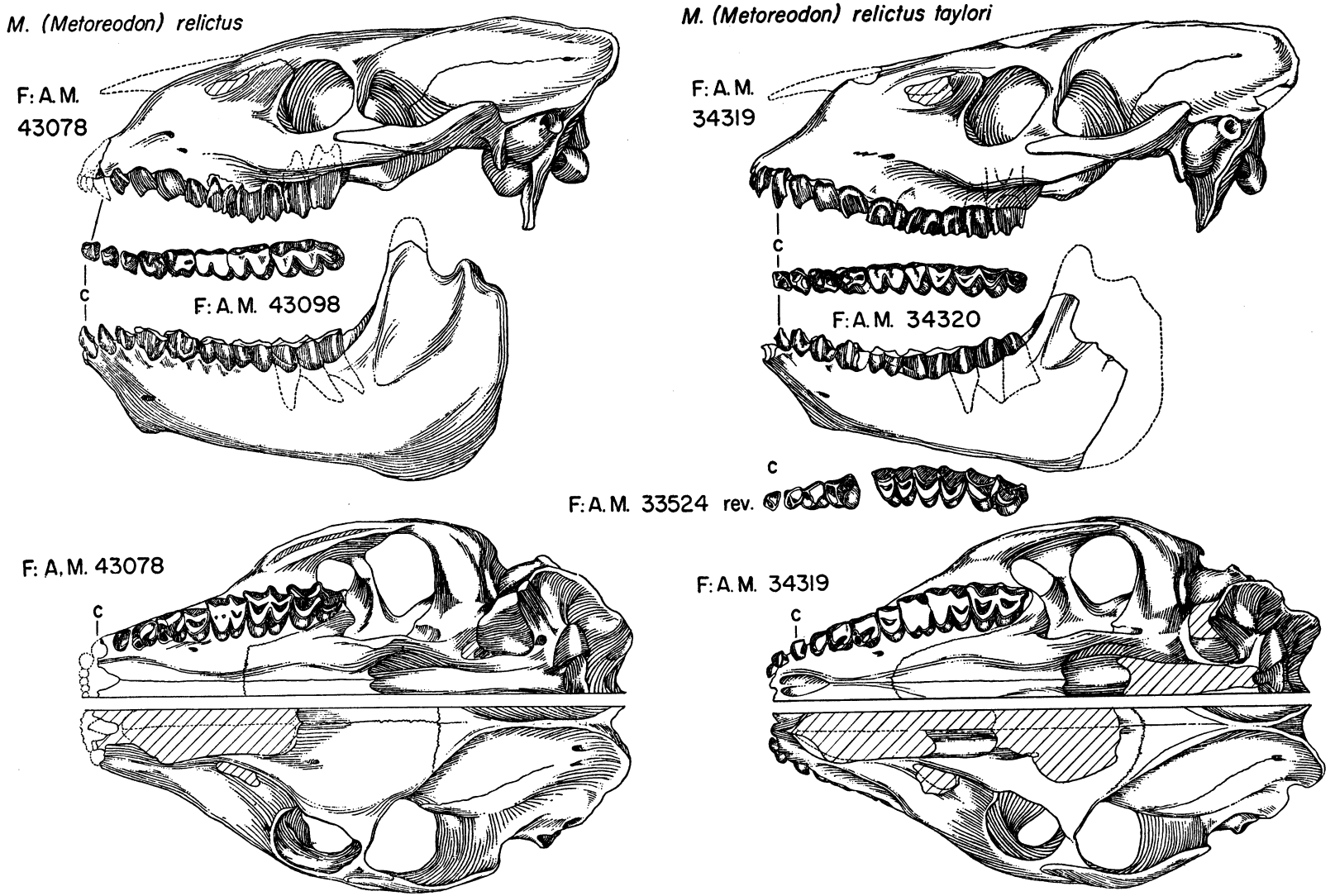

FIG. 8. *Merychyus* (*Metoreodon*) *relictus* Matthew and Cook, referred, F:A.M. 43078, skull (vacuity and posterior ridge of palate from opposite side), and F:A.M. 43098, ramus, "Lower Snake Creek," Sioux County, Nebraska; *M.* (*Metoreodon*) *relictus taylori*, new subspecies, holotype, F:A.M. 34319, skull (combination of both sides), and referred, F:A.M. 33524, superior dentition, and F:A.M. 34320, ramus, "Sheep Creek," Sioux County, Nebraska. ×½.

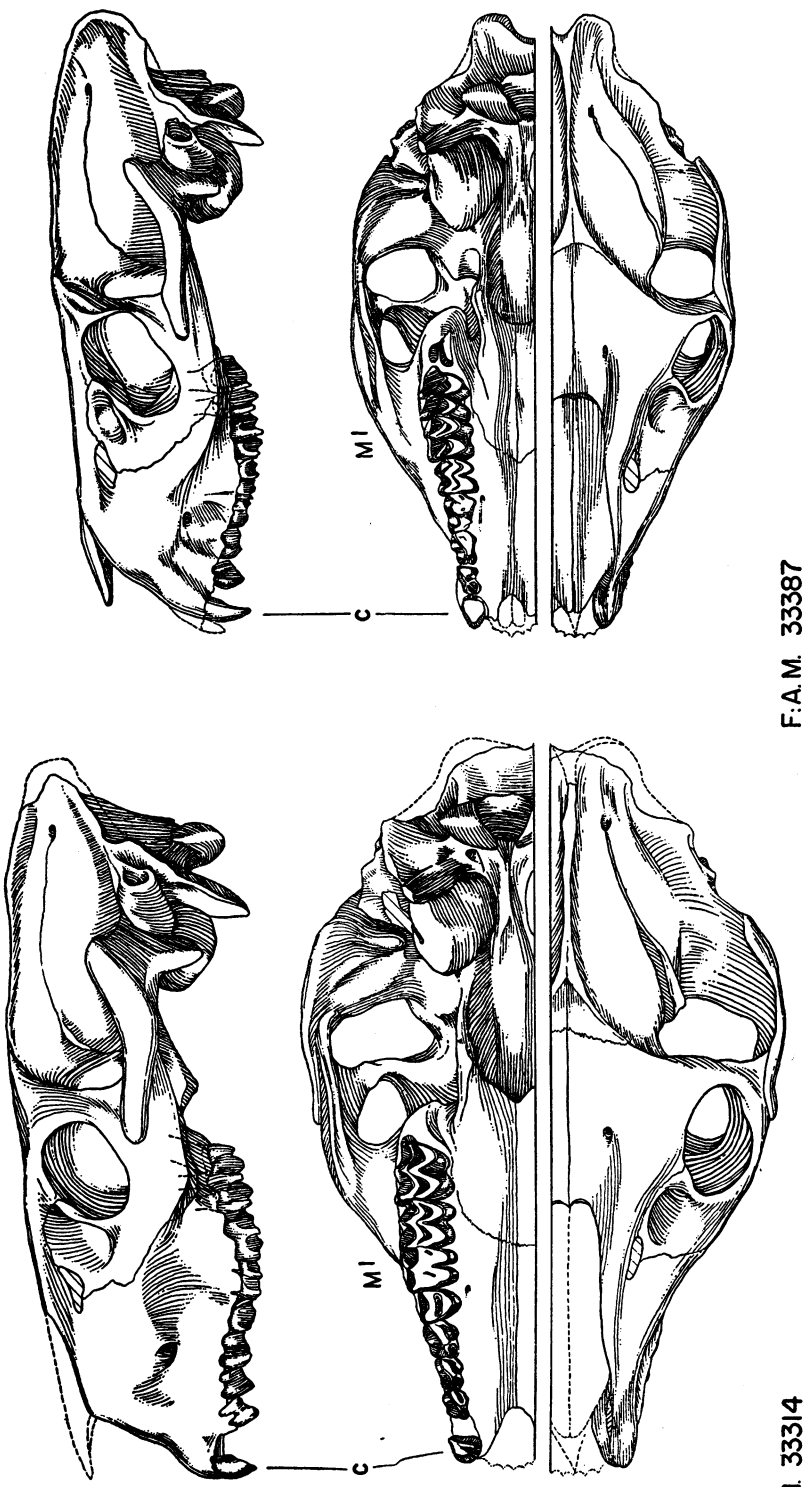

FIG. 9. *Paramerychyus harrisonensis* (Peterson), referred, F:A.M. 33314, skull, and F:A.M. 33387, immature skull (combination of both sides), Harrison, Niobrara County, Wyoming. X½.

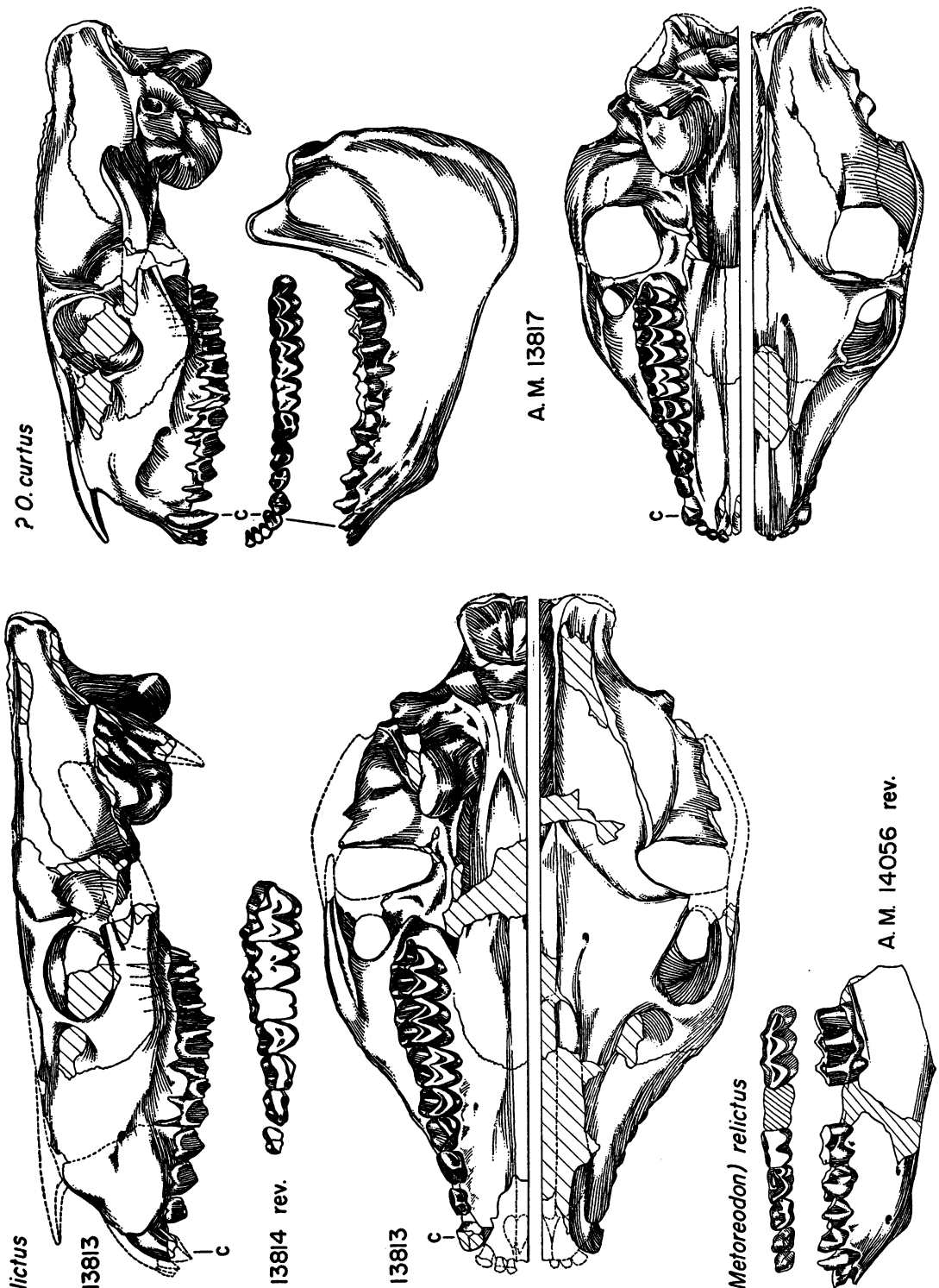

FIG. 10. *Paramerychyus relictus* (Loomis), holotype, A.M. 13813, skull (P^2 from opposite side), and referred, A.M. 13814, upper dentition, Harrison, Washington County, South Dakota; *Merychyus* (*Metoreodon*) *relictus* Matthew and Cook, holotype, A.M. 14056, ramus, "Lower Snake Creek," Sioux County, Nebraska; *?Oreodontoides curtus* (Loomis), holotype, A.M. 13817, skull and ramus, ?Washabaugh County, South Dakota. ×⅓.

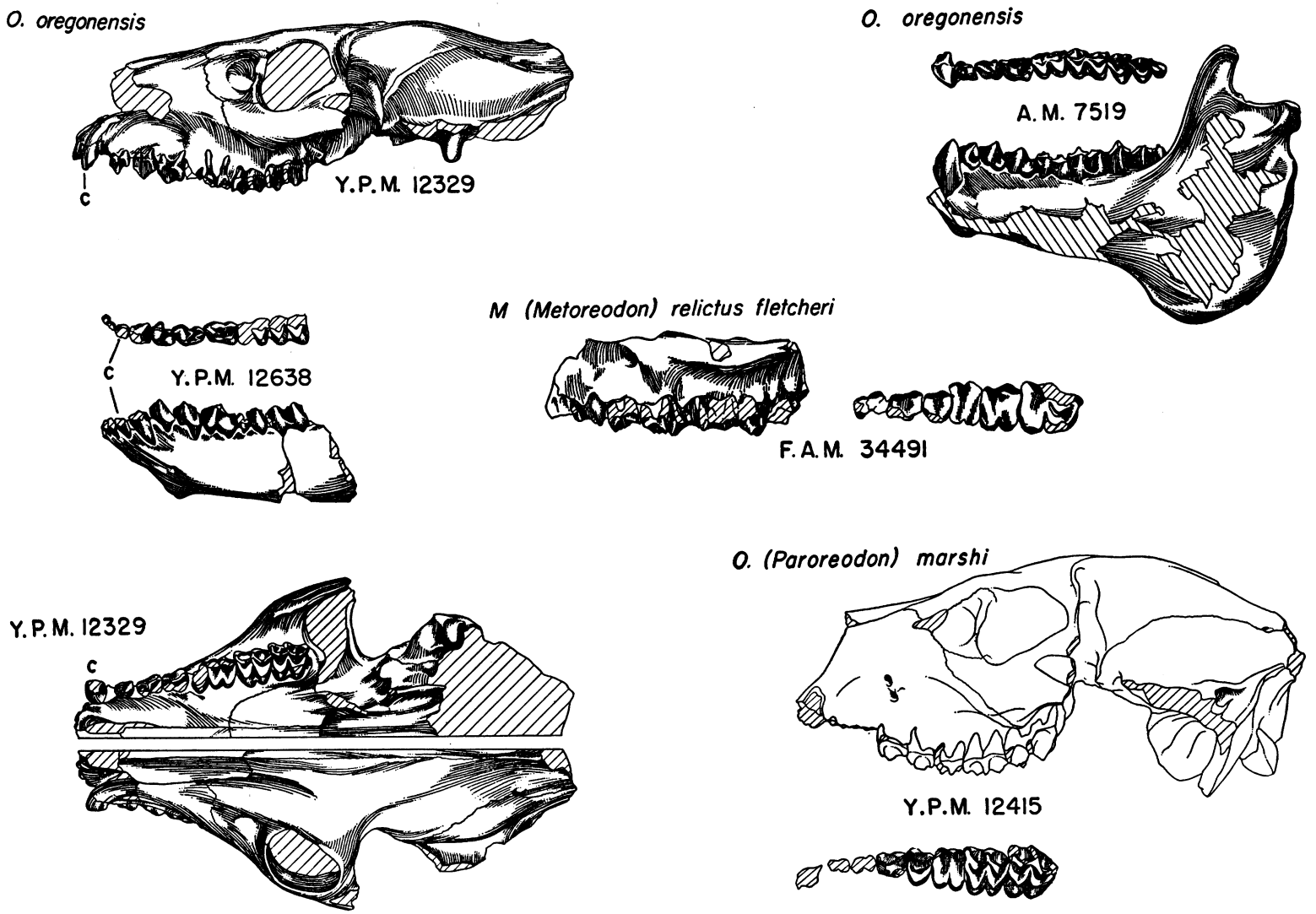

FIG. 11. *Oreodontoides oregonensis* Thorpe, holotype, Y.P.M. 12329, skull, and referred, Y.P.M. 12638 and A.M. 7519, rami, ?middle John Day, Oregon; *Merychyus* (*Metoreodon*) *relictus fletcheri*, new subspecies, holotype, F:A.M. 34491, partial skull, San Bernardino County, California; *Oreodontoides* (*Paroreodon*) *marshi* (Thorpe), holotype, Y.P.M. 12415, skull (combination of both sides, in outline), middle John Day, Oregon. ×½.

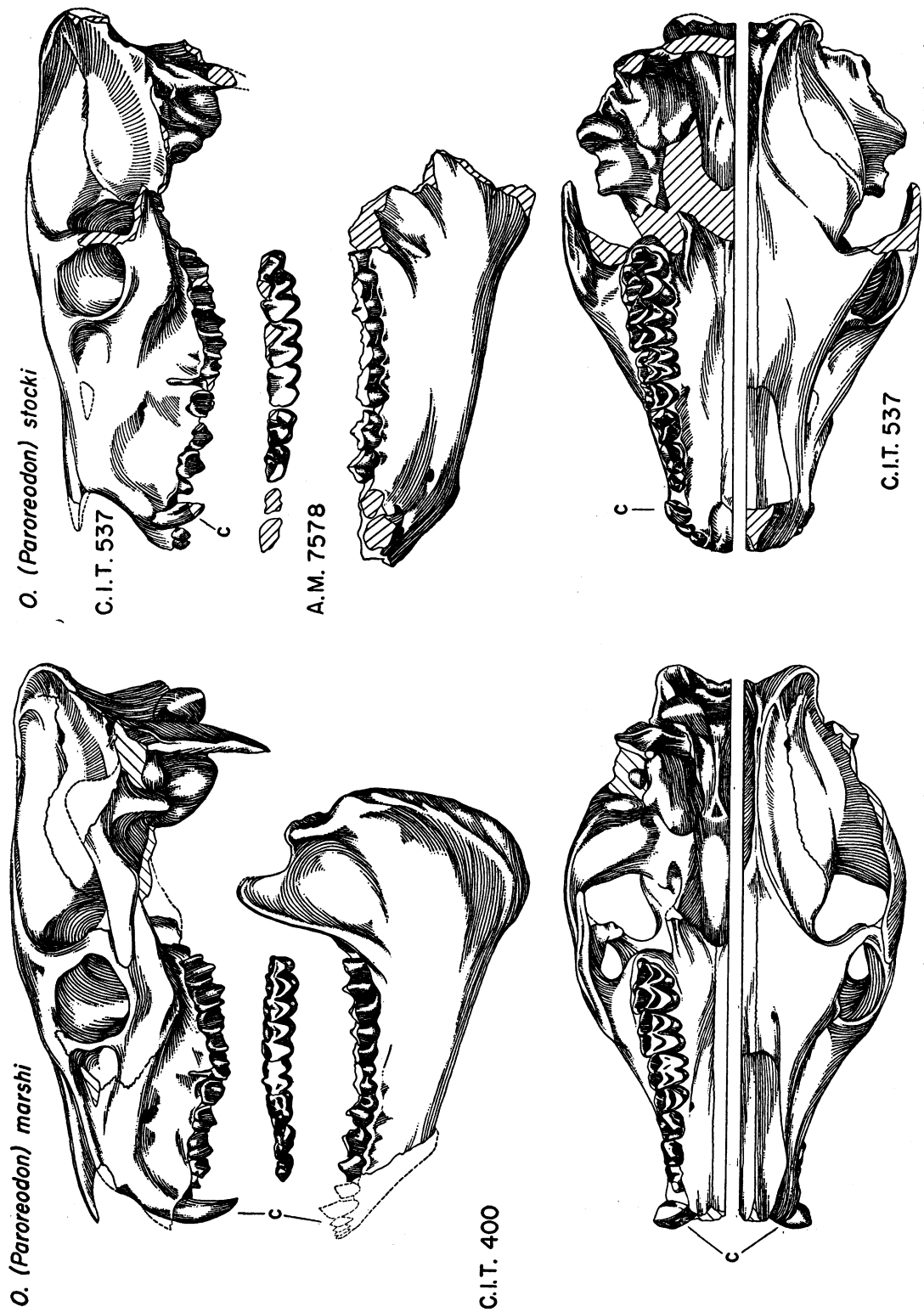

FIG. 12. *Oreodontoides* (*Paroreodon*) *marshi* (Thorpe), referred, C.I.T. 400, skull and ramus (skull, combination of both sides), middle John Day, Oregon; *Oreodontoides* (*Paroreodon*) *stocki*, new species, holotype, C.I.T. 537, skull (reconstructed from both sides), and referred, A.M. 7578, ramus, John Day, Oregon. $\times\frac{1}{2}$.

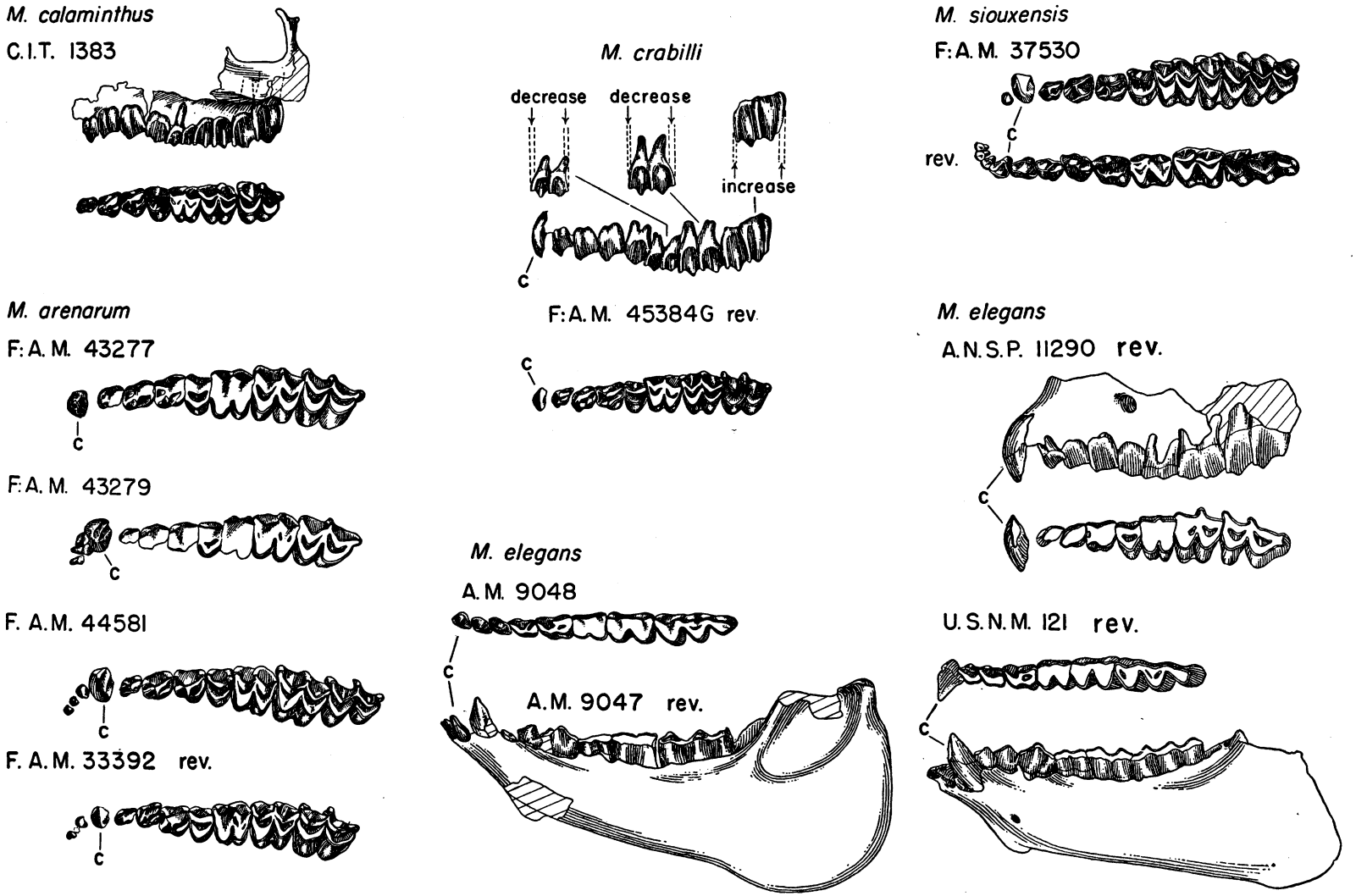

FIG. 13. *Merychyus calaminthus* Jahns, holotype, C.I.T. 1383, partial skull (combination of both sides), Los Angeles County, California; *M. siouxensis* Loomis, referred, F:A.M. 37530, superior and inferior dentitions (superior from opposite side), Harrison, Sioux County, Nebraska; *M. arenarum* Cope, referred, F:A.M. 43277, 33392, and 43279, three upper dentitions, lower Marsland, Goshen County, and F:A.M. 44581, upper dentition, Lower Marsland, Platte County, Wyoming (showing combinations of large and small canines and premolars); *M. crabilli*, new species, referred, F:A.M. 45384G, upper dentition, also M^1, M^2, and M^3 (showing approximate decrease in length of crown with wear on M^1 and M^2, and increase with wear on M^3), Harrison, Box Butte County, Nebraska; *M. elegans* Leidy, holotype, A.N.S.P. 11290, partial skull, and U.S.N.M. 121, ramus, upper Marsland, Nebraska, and referred, A.M. 9047, ramus, and A.M. 9048, lower dentition, Logan County, Colorado.

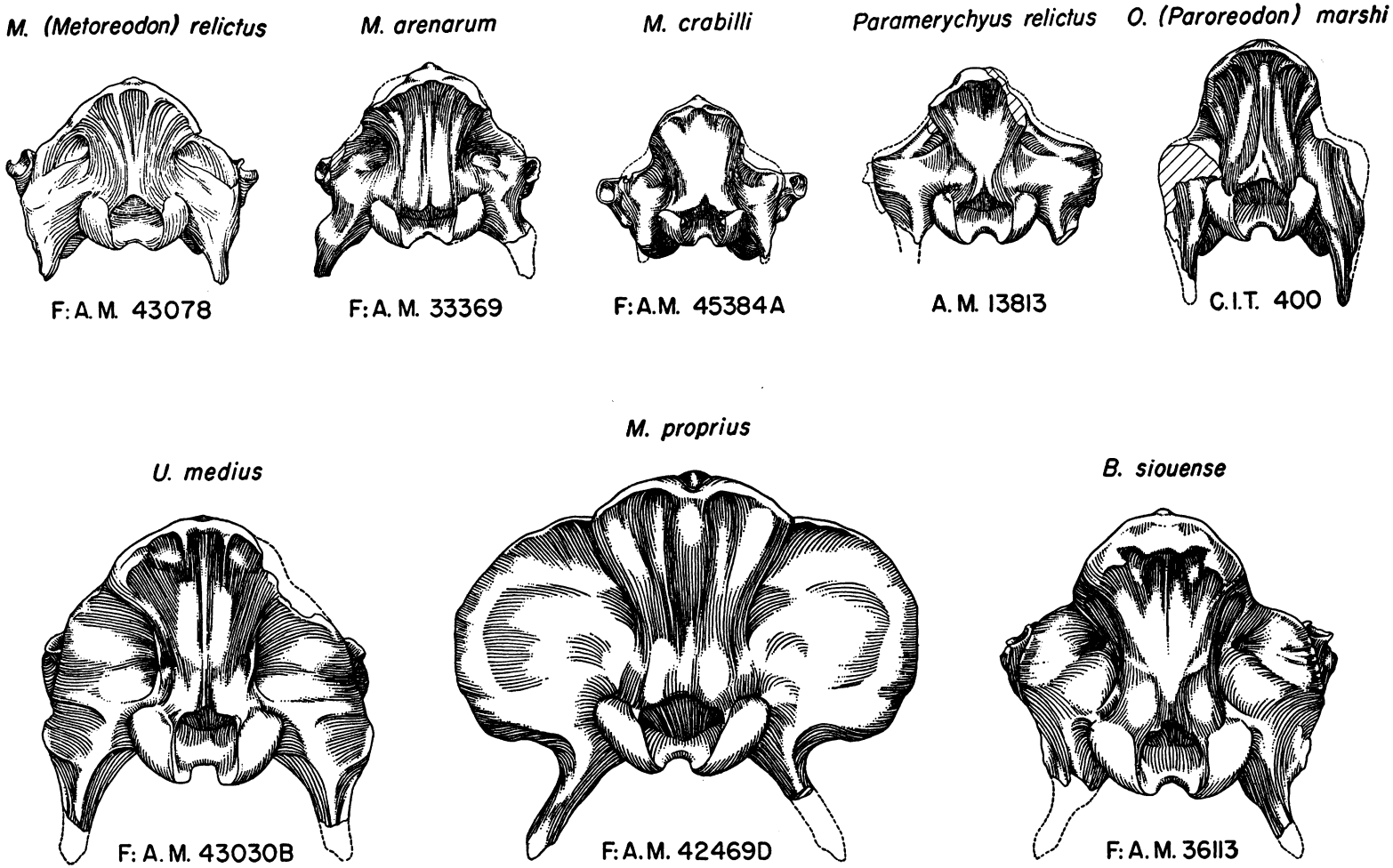

FIG. 14. Examples of occipital regions of skulls representing species of *Merychyus*, *Merychyus* (*Metoreodon*), *Paramerychyus*, *Oreodontoides* (*Paroreodon*), *Ustatochoerus*, *Merycochoerus*, and *Brachycrus*. $\times\frac{1}{2}$.

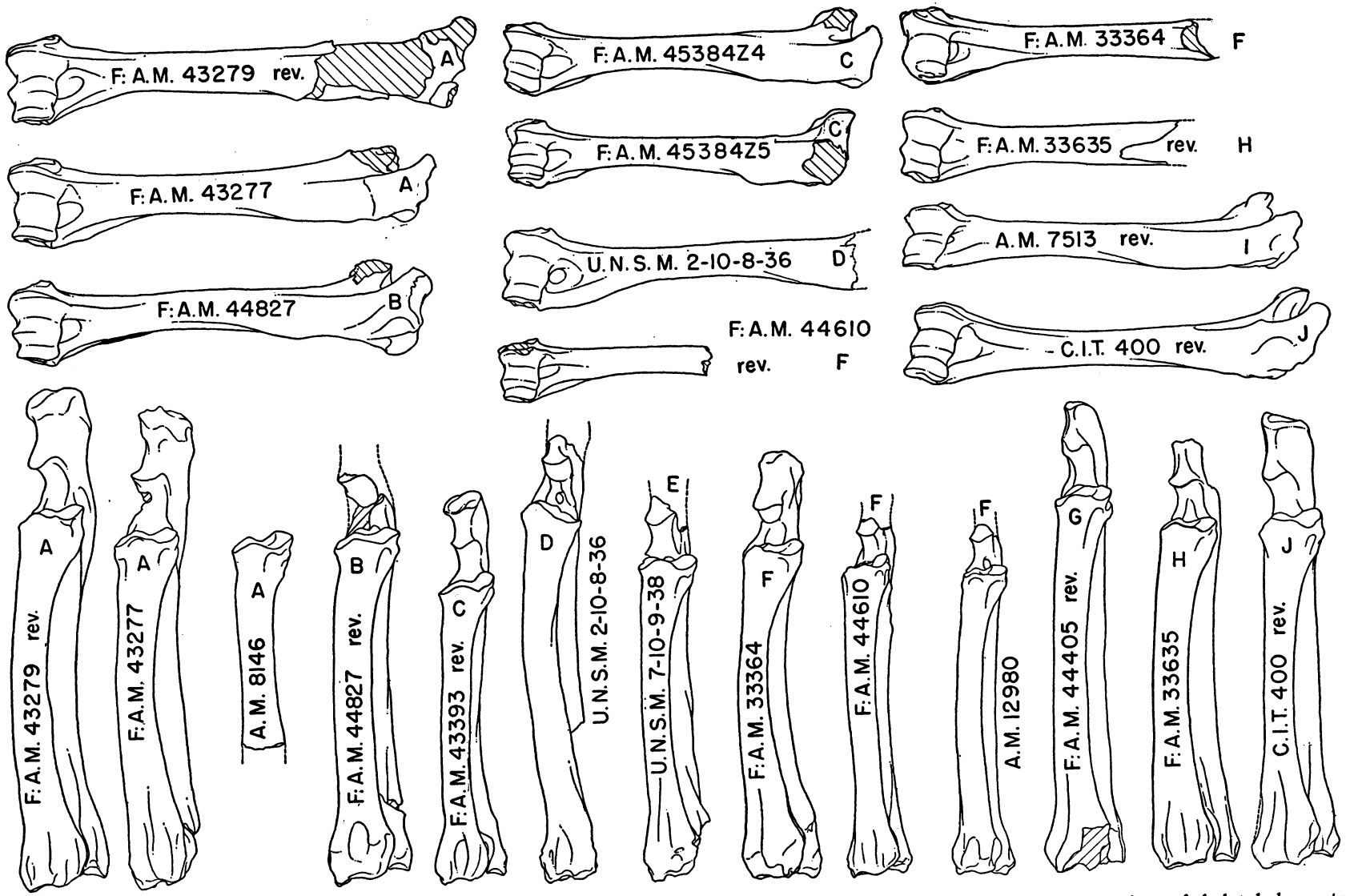

FIG. 15. *Merychyus* Leidy, *Merychyus* (*Metoreodon*) Matthew and Cook, and *Oreodontoides* (*Paroreodon*) (Thorpe), comparison of skeletal elements. A, *M. arenarum* Cope; B, *M. arenarum idahoensis*, new subspecies; C, *M. crabilli*, new species; D, *M. elegans* Leidy; E, *M. elegans bluei*, new subspecies; F, *M. minimus* Peterson; G, *M. siouxensis* Loomis; H, *Merychyus* (*Metoreodon*) *relictus* Matthew and Cook; I, *Oreodontoides oregonensis* Thorpe; J, *Oreodontoides* (*Paroreodon*) *marshi* (Thorpe). ×½.

FIG. 16. *Merychyus* Leidy, *Merychyus* (*Metoreodon*) Matthew and Cook, and *Oreodontoides* (*Paroreodon*) (Thorpe), comparison of skeletal elements. (See caption to fig. 15.) ×½.

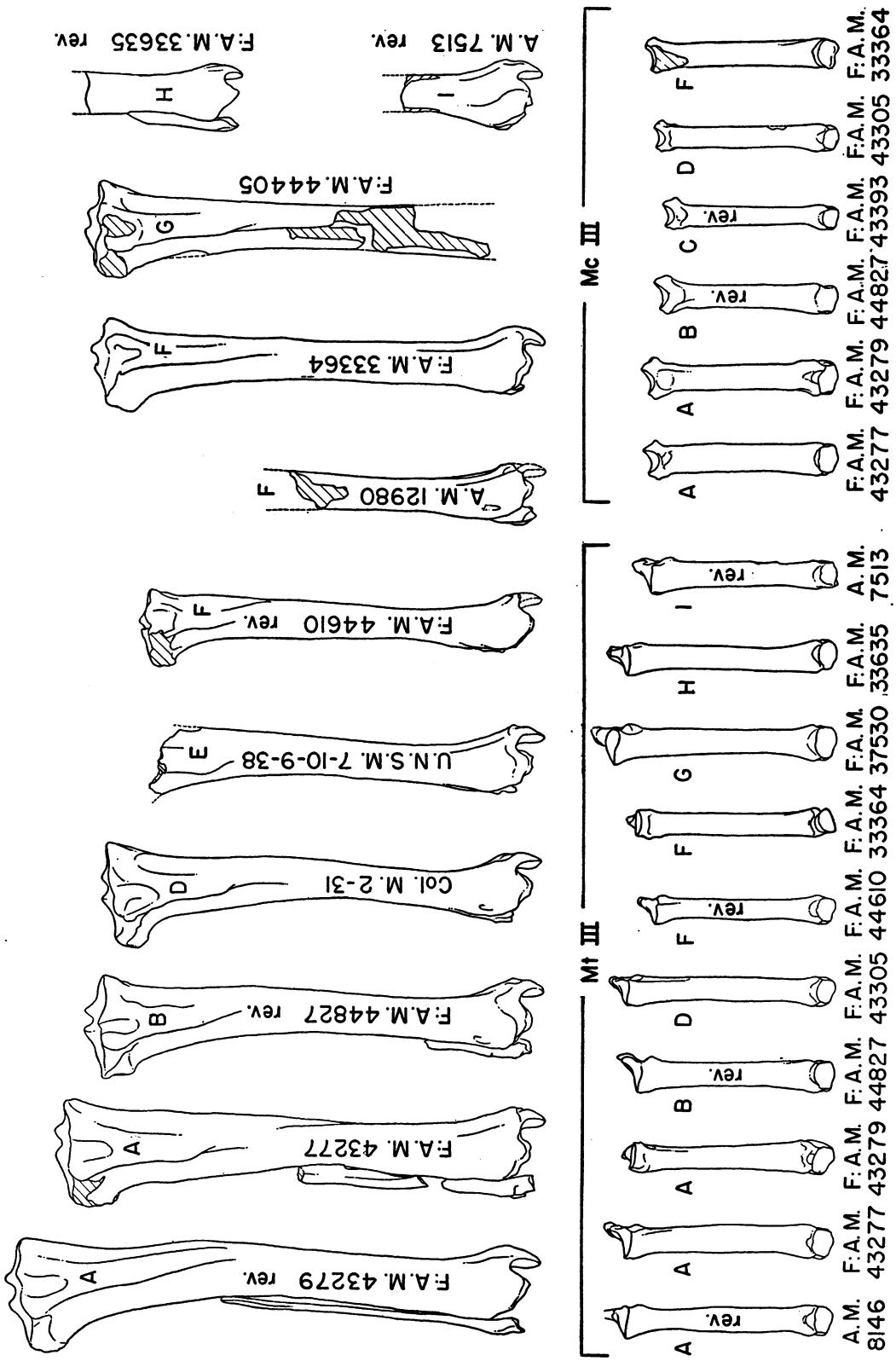

FIG. 17. *Merychyus* Leidy and *Merychyus* (*Metoreodon*) Matthew and Cook, comparison of skeletal elements. (See caption to fig. 15.) ×⅓.