CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

UNIVERSITY OF MICHIGAN

VOL. VIII, No. 7, pp. 193–204 (3 figs., 1 map) JULY 28, 1950

NEW EVIDENCE OF THE LOWER MIOCENE AGE OF THE BLACKTAIL DEER CREEK FORMATION IN MONTANA

BY

CLAUDE W. HIBBARD and KENDALL A. KEENMON

UNIVERSITY OF MICHIGAN PRESS
ANN ARBOR

CONTRIBUTIONS FROM THE MUSEUM OF PALEONTOLOGY

UNIVERSITY OF MICHIGAN

Director: LEWIS B. KELLUM

The series of contributions from the Museum of Paleontology is a medium for the publication of papers based entirely or principally upon the collections in the Museum. When the number of pages issued is sufficient to make a volume, a title page and a table of contents will be sent to libraries on the mailing list, and also to individuals upon request. Correspondence should be directed to the University of Michigan Press. A list of the separate papers in Volumes II–VII will be sent upon request.

VOL. I. The Stratigraphy and Fauna of the Hackberry Stage of the Upper Devonian, by C. L. Fenton and M. A. Fenton. Pages xi+260. Cloth. $2.75.

VOL. II. Fourteen papers. Pages ix+240. Cloth. $3.00. Parts sold separately in paper covers.

VOL. III. Thirteen papers. Pages viii+275. Cloth. $3.50. Parts sold separately in paper covers.

VOL. IV. Eighteen papers. Pages viii+295. Cloth. $3.50. Parts sold separately in paper covers.

VOL. V. Twelve papers. Pages viii+318. Cloth. $3.50. Parts sold separately in paper covers.

VOL. VI. Ten papers. Pages viii+336. Paper covers. $3.00. Parts sold separately.

VOL. VII. Ten numbers sold separately.

(Continued on inside back cover)

VOL. VIII, No. 7, pp. 193–204 (3 figs., 1 map) JULY 28, 1950

NEW EVIDENCE OF THE LOWER MIOCENE AGE OF THE BLACKTAIL DEER CREEK FORMATION IN MONTANA

By

CLAUDE W. HIBBARD and KENDALL A. KEENMON

CONTENTS

INTRODUCTION

DURING the summer of 1948 the Blacktail–Snowcrest region in Beaverhead County, southwestern Montana, was studied and mapped by the junior author in preparation of a thesis at the University of Michigan. Mapping of this area is part of a project of geologic mapping in southwestern Montana, sponsored by the staff of Camp Davis, the Rocky Mountain field station of the University of Michigan, situated in the Hoback River Valley about seventeen miles south of Jackson, Wyoming. On July 11 and 12, 1948, the type locality, of the Blacktail Deer Creek formation, described by Douglass (1902, pp. 239–79), was carefully examined by the authors. In the course of the investigation of these beds additional vertebrate remains were collected which further substantiate the Lower Miocene age of the formation.

The authors are indebted to Mr. Bryan Patterson of the Chicago Natural History Museum for permission to study and refigure the type specimen of *Gregorymys riggsi* Wood from the Lower Miocene, Arikaree Beds, Raw Hide Creek below OLO Ranch, Wyoming. This specimen was borrowed for comparison with the specimen of the new species of *Gregorymys* found by the authors.

Walter Wheeler and Thomas Piper, graduate students in the Department of Geology, and George R. L. Gaughran, graduate student in the Department of Zoology, University of Michigan, assisted the authors on their visit to the type locality of the Blacktail Deer Creek formation.

Financial support accorded the senior author by the Faculty Research Fund of the University of Michigan made possible the illustrations of this paper.

BLACKTAIL DEER CREEK FORMATION

Location of type section.—Douglass (1902, pp. 243, 247, 269) stated:

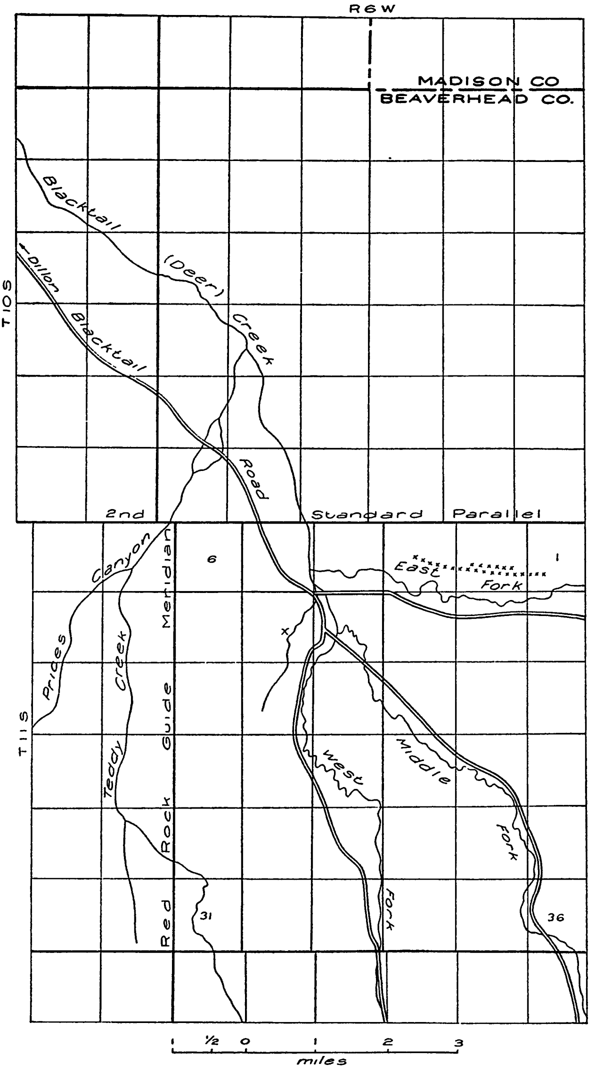
> The Blacktail Deer Creek Beds are on Blacktail Deer Creek, about thirty miles south and east of Dillon. The exposure is small and only a few fossils were found. The material . . . is mostly light-colored and fine-grained, yet there are thin strata of sandstone. None of the fossils positively determine the horizon. There was the new genus *Arretotherium,* part of the back of a skull of *Caenopus* . . . and part of a mandible of *Steneofiber hesperus* . . . The specimen was found in a light-colored sandy clay . . . It was near the top of an exposure in which, a considerable distance below, were the remains of *Arretotherium* . . . Part of the posterior portion of a skull of a rhinoceros . . . was found in a sandy layer near, and a considerable distance above, where the type of *Steneofiber hesperus* was obtained.

The location of the type section of the formation was determined by the authors to be near the center of sec. 8, T. 11 S., R. 6 W., Beaverhead County, Montana. The establishment of this location has been confirmed by J. LeRoy Kay, of the Carnegie Museum of Natural History, in a personal communication. Kay was a student under Douglass, when Douglass investigated the Cenozoic deposits of southwestern Montana, and visited the locality under discussion with him.

The area is readily accessible by a good dirt road, which extends up the valley of Blacktail Creek southeast of Dillon, Montana (see Map 1). The name of this creek has been subject to considerable change as may be seen from various maps of the area. At one time it was called "Blacktail Deer Creek" by inhabitants of the region and this is the name used by Douglass on his map on page 241 of his 1902 report. The United States Geological Survey topographic sheet of the Dillon quadrangle, edition of October, 1893, and reprinted in December, 1901, gave the name as "Blacktail Creek." The Forest Service of the United States Department of Agriculture issued a map of the Beaverhead National Forest, Montana, dated 1947, which shows a change in name to "Dry Blacktail Creek." As there seems to be no reason for the change to "Dry Blacktail Creek," the name "Blacktail Creek" will be used in this paper for the stream and the name "Blacktail Deer Creek" for the formation, as it was originally designated by Douglass.

Lithology and thickness of strata.—The beds in the type section are exposed in the west flank of a gentle anticline in Cenozoic sediments and crop out one-half mile west of the West Fork Road, at a point one-half mile southwest of the junction of the East Fork and West Fork roads (sec. 8, T. 11 S., R. 6 W.; see Map 1), which follow the upper tributaries of Blacktail Creek. These beds dip about five degrees to the west, although near-by underlying basalts dip to the west as much as thirty degrees. Strata which may be questionably assigned to the Blacktail Deer Creek formation are well exposed on the east flank of the anticline along the valley of the East Fork of Blacktail Creek in secs. 1, 2, and 3, T. 11 S., R. 6 W. (Map 1). No fossils were found in the beds of the east flank during a brief examination on July 12, 1948. The lower and upper limits of the formation have not been definitely established. The beds from which the vertebrate remains were removed are composed of a varying sequence of light-colored clays, volcanic ash, sandstones, and fine conglomerates. Approximately 400 feet of strata were measured, extending about 30 feet below and 370 feet above the fossiliferous zone. No fossils were found in the upper 370 feet of beds and, hence, the determination of their age is not definite. The similarity in lithological character of the upper beds to that of the strata containing the fossils suggests that the upper part is also of Lower Miocene age.

Measured section of the Blacktail Deer Creek Formation.—Type section of the Blacktail Deer Creek formation near the center of sec. 8, T. 11 S., R. 6 W., Beaverhead County, Montana. Measured by Keenmon and Piper, August 5, 1948, see Map 1, locality X.



MAP 1. Base map of the Blacktail Creek area of Beaverhead County, Montana. The type locality of the Lower Miocene Blacktail Deer Creek formation of Douglass, from which the vertebrate fossils were removed, is indicated by X; exposure of the questionable Blacktail Deer Creek beds by xxx.

Unit		*Thickness in feet*
43.	Limestone, very fine-grained, dense, light gray; weathers to a mottled white and dark reddish brown	1.0
42.	Clay, light tan	54.0
41.	Limestone, white, crumbly	10.0
40.	Clay, light tan; cherty zone 1 foot thick at base	20.0
39.	Siltstone, tuffaceous, light tan, and sandstone, tuffaceous, medium-grained, light gray to purplish; with interbedded layers of light-tan clay	33.0
38.	Clay, light tan	21.0
37.	Sandstone, tuffaceous, light gray	1.5
36.	Clay, light tan, with stains of iron hydroxide	12.5
35.	Sandstone, coarse-grained, light gray, becoming purplish on weathering	1.0
34.	Clay, light tan, with stains of iron hydroxide	2.0
33.	Sandstone, conglomeratic, greenish, ranges from coarse- to very fine-grained	3.0
32.	Clay, mottled light gray to yellowish	7.0
31.	Sandstone, coarse, light gray becoming purplish on weathering	2.0
30.	Clay, light gray	32.0
29.	Sandstone, conglomeratic, with stains of iron hydroxide along base	1.0
28.	Clay, light gray	4.0
27.	Sandstone, conglomeratic, light gray, surface encrusted by orange and black lichens	4.0
26.	Clay, light gray	7.0
25.	Sandstone, medium-grained, gray-green	1.0
24.	Clay, light gray; lower 6 inches yellowish orange	10.0
23.	Sandstone, medium- to fine-grained, light gray-green, weathering to reddish brown	1.0
22.	Clay, varies from yellow to orange	2.0
21.	Sandstone, conglomeratic, light gray	2.0
20.	Clay, light orange, with interbedded layers of fine-grained sandstone one-half inch in thickness	1.0
19.	Sandstone, light gray	4.0
18.	Clay, light gray, 1-foot cherty bed 4 feet below top of unit; lower part of unit interbedded with thin white cherty layers	21.0
17.	Clay, orange	3.0
16.	Sandstone, conglomeratic, indistinctly cross-bedded	2.0
15.	Clay, light gray	15.0
14.	Clay, orange	3.0
13.	Sandstone, light tan	2.0
12.	Covered interval (grassy slope)	40.0±
11.	Clay, light cream-colored	5.0
10.	Sandstone, conglomeratic, dark brownish yellow with stains of iron hydroxide, pebbles up to one-half inch in diameter; upper 6 inches blocky	3.0
9.	Clay, sandy, light tan	14.0
8.	Sandstone, conglomeratic, light tan, some large pebbles of black chert	6.0
7.	Clay, light tan, with stains of iron hydroxide and probably considerable volcanic ash. *Gregorymys montanensis and Promerycochoerus (P.) barbouri* present near center of unit	13.0

6.	Sandstone, conglomeratic, light tan; conglomerate layer 6 inches thick at base of unit	5.0
5.	Clay, light gray, with stains of iron hydroxide similar to unit 7	5.5
4.	Sandstone, fine-grained to clayey, light tan with iron hydroxide stains at top and bottom of unit with thin interbedded clay; unit similar to unit 5	1.5
3.	Clay, light gray, with iron hydroxide stains, considerable volcanic ash and thin layers of lignite	22.0
2.	Conglomerate, light gray, with pebbles up to three-fourths of an inch in diameter; weathers darker gray and encrusted with orange and black lichens	0.5
1.	Sandstone, light tan, medium- to coarse-grained, and massive, with some large pebbles of black chert up to one-half inch in diameter (base not exposed)	2.0
	Total thickness	400.5±

Age of formation.—The three fossils found by Douglass were *Arretotherium acridens* Douglass, *Monosaulax hesperus* (Douglass), and part of a large rhinoceros skull reported as *Caenopus?* They do not definitely establish the stratigraphic position of the beds, but Douglass considered them of probable White River (Oligocene) age. Subsequent work in the field of vertebrate paleontology suggests a Lower Miocene age on the basis of known stratigraphic occurrences of *Arretotherium.* The two additional mammals recovered in the summer of 1948 confirm the Lower Miocene age of the formation.

SYSTEMATIC DESCRIPTIONS

Class Mammalia

Order Rodentia

Family Geomyidae

Gregorymys montanensis, sp. nov.

(Fig. 1A)

Holotype.—No. 25760, University of Michigan Museum of Paleontology, anterior part of skull, bearing incisors, RP^4–M^2, and LP^4–M^3. Collected on July 11, 1948, by the University of Michigan field party.

Horizon and type locality.—Lower Miocene; Blacktail Deer Creek beds of Douglass (1902), northwest corner of SE. 1/4 sec. 8, T. 11 S., R. 6 W., Beaverhead County, Montana.

Diagnosis.—A geomyid rodent with a long diastema; cheek teeth high-crowned and rooted; P^4 molariform with protoloph and metaloph three-cusped and without accessory cusplets; a longitudinal groove on the outer surface of the margin of the inner edge of the upper incisors. *Gregorymys montanensis* is distinguished from *Gregorymys riggsi* Wood (Fig. 1B) by the longer diastema, the position of the groove on the upper incisors, and the smaller M^3.

Description of holotype.—The incomplete skull is that of a young animal. The longitudinal groove on the margin of the inner edge of the upper incisors is as well developed as the one in *Thomomys.*

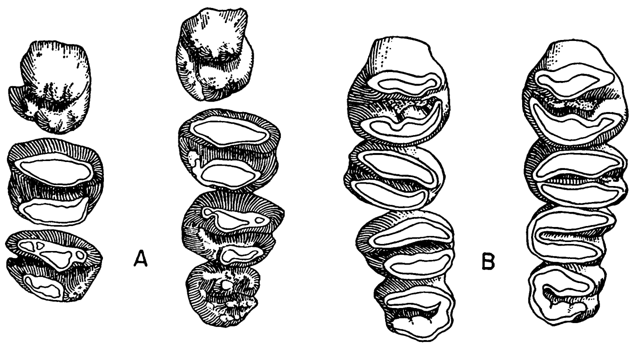


Figure 1

(A) *Gregorymys montanensis,* sp. nov., holotype, No. 25760 U.M.M.P., RP^4–M^2 and LP^4–M^3. Occlusal view. × 5. Drawing by Janet Roemhild.

(B) *Gregorymys riggsi* Wood, holotype, No. P12221, Chicago Natural History Museum, RP^4–M^3 and LP^4–M^3. × 5. Drawing by Janet Roemhild.

The incisor has a transverse width of 1.7 mm., and an anteroposterior depth of 2.2 mm. The rostral region is slightly fractured in the area of the anterior palatine foramina. The fracture may have slightly shortened the diastemal length. The length of the diastema in *G. montanensis* is 15.0 mm.; the diastemal length in *Gregorymys formosus* (Matthew) is 12.8 mm. and in *G. curtus* (Matthew) 13.1 mm. (both measurements after Matthew, 1907).

The upper premolars have just erupted and show no wear. The protoloph has a transverse width of 1.8 mm. The transverse width of the metaloph is 2.2 mm.

M^1 shows the greatest amount of wear. The anteroposterior width of the crown is 1.3 mm. The transverse width of the protoloph is 2.3 mm. The transverse width of the metaloph is 2.2 mm.

M^2 has three cusps on both the protoloph and metaloph. The anteroposterior width of the crown is 1.45 mm. The transverse width of the protoloph is 2.25 mm. The transverse width of the metaloph is 2.0 mm. With further wear the protoloph and metaloph of M^1 and M^2 would join on the lingual side of the tooth to produce a U-shaped pattern. The same pattern would appear on the crown of P^4 after greater wear.

The protoloph and metaloph of M^3 are connected on the lingual side of the tooth. The tooth is unworn. The protoloph of M^3 is three-cusped. Two accessory cusplets occur in the area where the protoloph and metaloph join. The metaloph of M^3 is three-cusped and possesses in addition a posterior cingulum. The anteroposterior width of the tooth is 1.25 mm. The greatest transverse width is 1.6 mm.

The M^1 and M^2 are approximately the size of the M^1 and M^2 in the holotype of *Gregorymys riggsi*; the M^3 is smaller than that of *G. riggsi.*

Gregorymys montanensis is distinguished from *G. formosus* by its longer diastema and the presence of three cusps on the protoloph of P^4; from *G. curtus* by the presence of a shallow groove along the inner edge of the upper incisors; from *G. douglassi* by larger size; and from *G. riggsi,* which possesses a shallow groove in the center of the upper incisor.

Gregorymys douglassi and *montanensis* appear to be more closely related to one another than either is to other species of *Gregorymys.*

The skull of *G. montanensis* was recovered while removing a skull and lower jaws of the oreodon *Promerycochoerus (Parapromerycochoerus) barbouri* Schultz and Falkenbach.

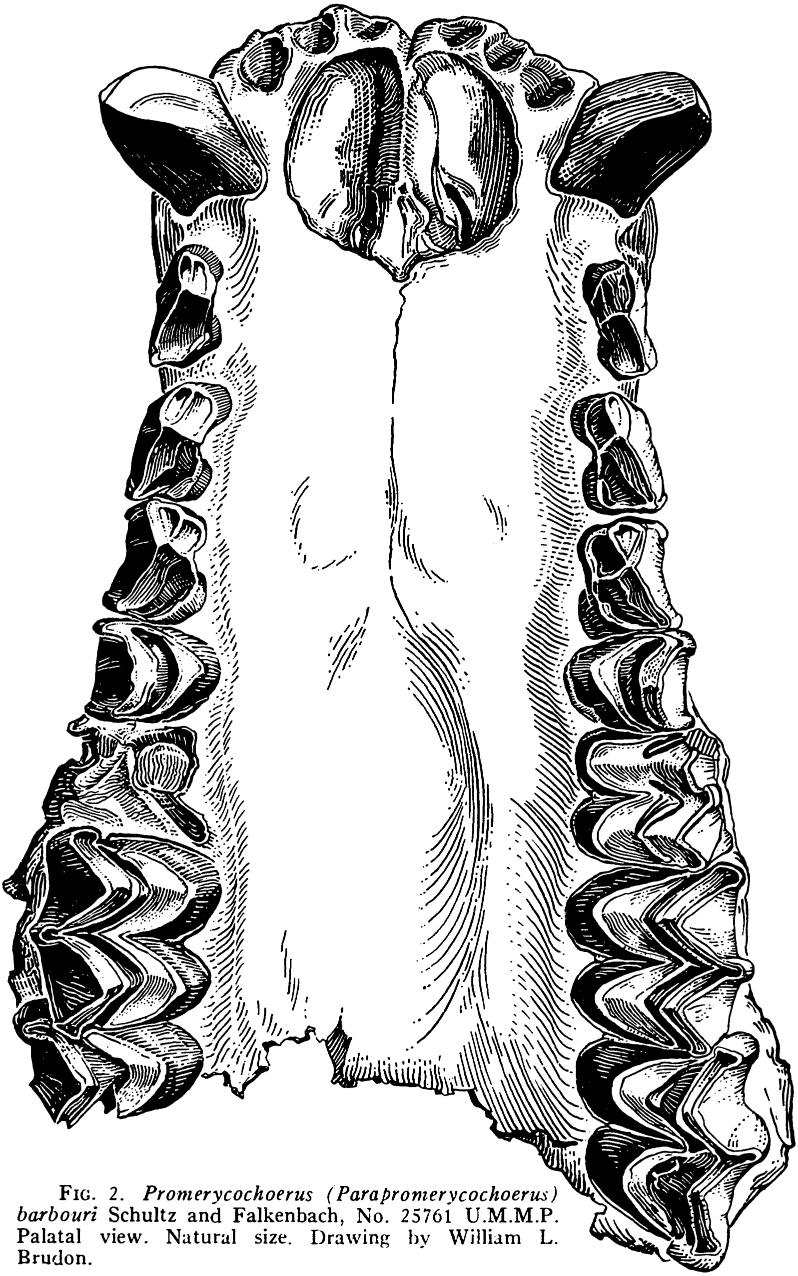


FIG. 2. *Promerycochoerus (Parapromerycochoerus) barbouri* Schultz and Falkenbach, No. 25761 U.M.M.P. Palatal view. Natural size. Drawing by William L. Brudon.

Order Artiodactyla

Family Merycoidodontidae

Promerycochoerus (Parapromerycochoerus) barbouri Schultz and Falkenbach

(Figs. 2–3)

Promerycochoerus (Parapromerycochoerus) barbouri Schultz and Falkenbach, 1949, *Amer. Mus. Nat. Hist. Bull.,* Vol. 93, Art. 3, pp. 117–18. Figs. 5–7, 11, 12.

Maxillaries and premaxillaries of this large oreodon, bearing left C, P^1–M^4, and M^2–M^3, with associated lower jaws, No. 25761, University of Michigan Museum of Paleontology, were recovered from unit No. 7.

The authors are grateful to Charles H. Falkenbach of the Frick Laboratory, the American Museum of Natural History, for identification of the specimen and for the following comparison with the holotype, F.A.M. (Frick Collection American Mammals) No. 33315, of *Promerycochoerus (P.) barbouri*:

> Your specimen No. 25761, is very close to *Promerycochoerus (Parapromerycochoerus) barbouri.* The measurement of C–M^3 in your specimen is about 10.0 mm. longer than in the holotype. The holotype shows prominent external cingula on P^1–P^4, M^2, and on the first lobe of M^3, while in specimen No. 25761 there is only a weak cingulum on the right P^4, which is lacking on the left P^4, this is considered by Schultz and myself as individual variation. The anterior palatine pits are larger in your specimen but this varies in individuals. The specimen possesses a slightly longer diastema between P^1 and P^2 than occurs in the holotype. The position of the anterior nasal-maxilla contact seems to be about the same in both specimens. It is almost certain that the deposit from which your specimen was taken is approximately equivalent to the Harrison of the Great Plains.

Measurements in millimeters of specimen No. 25761 U.M.M.P.

Greatest width across canines	82.0
Width of palate between fourth premolars	46.6
Width of palate between canines	44.3
Length of C–M^3 inclusive	165.5
Length of P^1–M^3 inclusive	138.5
Length of P^1–P^4 inclusive	65.3
Length of diastema between P^1 and P^2	4.0
Length of M^1–M^3 inclusive	76.0
Greatest length of M^3	35.5
Greatest width of M^3	26.4
Greatest anteroposterior length of palatine pits	28.5

Greatest width of right palatine pit	16.5
Depth of jaw below anterior edge of M_3	50.1
Length of $C–M_3$ inclusive	159.9
Length of $P_1–M_3$ inclusive	147.6
Length of $P_1–P_4$ inclusive	65.1
Length of $M_1–M_3$ inclusive	81.6

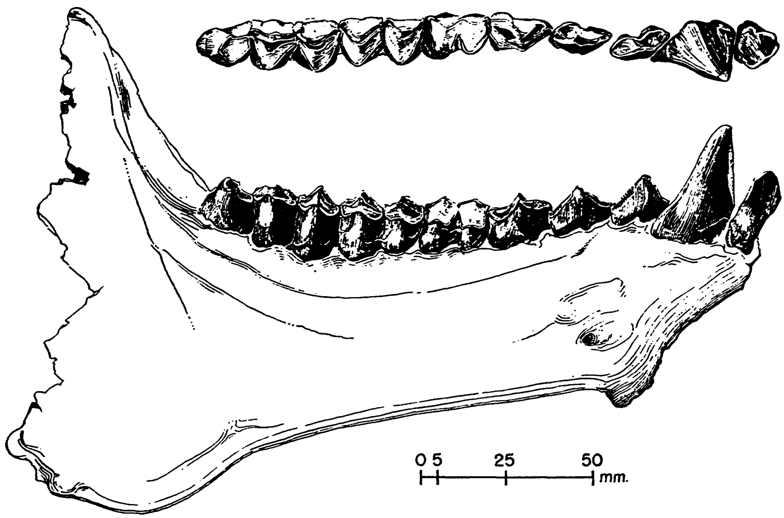


FIG. 3. *Promerycochoerus (Parapromerycochoerus) barbouri* Schultz and Falkenbach, No. 25761 U.M.M.P., right ramus. Lateral and occlusal views. Reduced. Drawing by William L. Brudon.

Specimen No. 25762, U.M.M.P., part of a left ramus of *P. barbouri,* bearing the canine and P_4 was also recovered from unit No. 7.

The development of the large palatine pits (incisive foramina) in the oreodons is of interest. This development may partly reflect, as suggested by Moojen (1948, pp. 326–27 and p. 393), the environmental conditions under which they lived. As a result of his study of the Brazilian spiny rats of the genus *Proechimys,* Moojen (p. 393) concluded that "in subspecies of any one full species, the incisive foramen is larger in animals which inhabit arid areas than in those which inhabit humid areas. Possibly increased area of moist mucosa associated with Jacobson's organ is required in arid areas for maintenance of the necessary keenness of smell."

LITERATURE CITED

DOUGLASS, EARL. 1902. Fossil Mammalia of the White River Beds of Montana. Trans. Amer. Philos. Soc., 20, n.s., Pt. 3; 237–79.

MATTHEW, W. D. 1907. A Lower Miocene Fauna from South Dakota. Amer. Mus. Nat. Hist. Bull., 23: 169–219, 26 figs.

MOOJEN, JOAO. 1948. Speciation in the Brazilian Spiny Rats (Genus Proechimys, Family Echimyidae), Univ. Kans. Publ. Mus. Nat. Hist., 1, No. 19: 301–406.

SCHULTZ, C. B., and FALKENBACH, C. H. 1949. Promerycochoerinae, a New Subfamily of Oreodonts. Amer. Mus. Nat. Hist. Bull., 93, Art. 3: 69–198, 26 figs.

U. S. Forest Service. 1947. Map of Beaverhead National Forest Montana, Washington, D.C.: U. S. Dept. Agric.

U. S. GEOL. SURVEY. 1901. Topographic Map of the Dillon Quadrangle, Montana, ed. Oct. 1893, reprinted Dec. 1901. Washington, D.C.

WOOD, ALBERT ELMER. 1936. Geomyid Rodents from the Middle Tertiary. Amer. Mus. Novitates, 866: 1–31, 33 figs.

——— 1937. Parallel Radiation Among the Geomyoid Rodents. Journ. Mammal., 18: 171–76.

VOLUME VIII

1. *Pachyphyllum vagabundum*, a New Coral from the Upper Devonian Strata of New York, by George M. Ehlers. Pages 1–6, with 3 plates. Price $.30.

2. Techniques of Collecting Microvertebrate Fossils, by Claude W. Hibbard. Pages 7–19, with 4 plates. Price $.50.

3. Corals of the Devonian Traverse Group of Michigan. Part II, *Cylindrophyllum, Depasophyllum, Disphyllum, Eridophyllum,* and *Synaptophyllum,* by George M. Ehlers and Erwin C. Stumm. Pages 21–41, with 8 plates. Price $.75.

4. A New Testudo from Madison County, Montana, by Thomas M. Oelrich. Pages 43–58, with 1 plate. Price $.50.

5. Megaspores from the Michigan Coal Basin, by Chester A. Arnold. Pages 59–111, with 18 plates. Price $1.50.

6. Mammals of the Rexroad Formation from Fox Canyon, Meade County, Kansas, by Claude W. Hibbard. Pages 113–192, with 5 plates. Price $1.50.

7. New Evidence of the Lower Miocene Age of the Blacktail Deer Creek Formation in Montana, by Claude W. Hibbard and Kendall A. Keenmon. Pages 193–204. Price $.50.

8. Corals of the Devonian Traverse Group of Michigan. Part III, *Antholites, Pleurodictyum,* and *Procteria,* by Erwin C. Stumm. Pages 205–220, with 5 plates. Price $.75.