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Notes on Eocene Mammalia and Mollusca from Tabernacle Butte, Wyoming

By Malcolm C. McKenna,[1] Peter Robinson,[2] and Dwight W. Taylor[3]

INTRODUCTION

The late Bridgerian Tabernacle Butte fauna has been discussed by McGrew and others (1959), Simpson (1959a, 1959b), and by McKenna and Simpson (1959). The present paper is the fourth to supplement the original monograph by McGrew and his co-authors. The section on non-marine gastropods is by Taylor; that on deltatheridioid and leptictoid insectivores, by McKenna; and that on erinaceoid insectivores and the bat, by Robinson.

We wish to thank the following individuals and the institutions that they represent: Dr. Craig Black, Carnegie Museum, for Eocene insectivores from Utah and Wyoming; Dr. C. Lewis Gazin, United States National Museum, and Dr. G. L. Jepsen, Princeton University, for comparative material of Paleocene and Eocene age; Drs. Bryan Patterson and G. G. Simpson, Harvard University, for preliminary information about the Harvard collection made in the vicinity of Tabernacle Butte in 1961 and for relinquishing C.M. No. 13627; Dr. J. T. Gregory, recently of the Peabody Museum of Natural History, Yale University, but now of the Department of Paleontology of the University of California, and

[1] Department of Vertebrate Paleontology, the American Museum of Natural History.
[2] Natural History Museum, University of Colorado.
[3] Paleontology and Stratigraphy Branch, United States Geological Survey.

Dr. E. L. Simons, Peabody Museum of Natural History, Yale University, for their many courtesies; Dr. Mary R. Dawson, recently of Smith College and the Peabody Museum of Natural History but now of the National Science Foundation, for her counsel; and Dr. L. S. Russell, Director of the National Museum of Canada, who generously turned over his unpublished notes and lists of identifications of the gastropods.

Robinson's section of the paper has been supported by National Science Foundation Grant No. 14255. The National Science Foundation supplied funds which permitted the curation of the large collection of middle Eocene vertebrates made almost a century ago for O. C. Marsh of Yale University. Marsh's types are now numbered and readily available and in many cases are now supplemented by additional curated material not previously available in usable form. We are greatly indebted to the National Science Foundation for its interest and financial aid, which places middle Eocene mammalian systematics on a much firmer basis than before.

Taylor's section of the paper has been improved by Drs. W. H. Bradley, United States Geological Survey; J. B. Burch, Museum of Zoology, University of Michigan; and E. G. Berry, National Institutes of Health, Bethesda, Maryland. Permission to publish Taylor's section was granted by the Director, United States Geological Survey.

Figures 1–5 were prepared by the United States Geological Survey. Figure 6 was drawn by Mr. Chester Tarka. Figures 7–9 were prepared by Robinson.

Abbreviations

A.M.N.H., the American Museum of Natural History, Department of Vertebrate Paleontology
A.M.N.H.:I.P., the American Museum of Natural History, Department of Invertebrate Paleontology
C.M., Carnegie Museum
U.C.M.P., Museum of Paleontology, University of California
U.S.G.S., United States Geological Survey
U.S.N.M., United States National Museum
Y.P.M., Peabody Museum of Natural History, Yale University

CLASS GASTROPODA

Late Bridgerian (late middle Eocene) vertebrates from the vicinity of Tabernacle Butte, Sublette County, Wyoming, were recorded by McGrew and others (1959). In association with these fossils the field parties from the American Museum of Natural History and University of Wyoming collected some fossil mollusks. A small additional collection, made by

M. C. McKenna and the author in 1950, supplements this older material. The value of these Eocene mollusks lies chiefly in the fact that they are associated with fossil mammals which date them reliably. Numerous non-marine mollusks have been described from Eocene rocks in southwestern Wyoming (for an introduction to pertinent literature, see Henderson, 1935), but their precise stratigraphic ranges are virtually unknown. The occurrence of the five or six species of snails according to locality is shown in table 1. The number of fossils is too small to warrant any detailed interpretation of environment. Both fresh-water species (*Anisus*, *Planorbina*) and land snails are present. The precise locality data for all the fossil localities mentioned are given below. The numbers of the localities in the vicinity of Tabernacle Butte (all in Sublette County, Wyoming) correspond to those in the paper by McGrew and his co-authors (1959), except for U.C.M.P. V-5629. The stratigraphic nomenclature has been modified from Bradley (1959).

TABLE 1

OCCURRENCE OF MOLLUSKS AT THE TABERNACLE BUTTE LOCALITIES[a]

Species	Localities					
	1	5	10	13	15	V-5629
Anisus new species?	—	—	—	x	—	—
Planorbina pseudoammonius (Schlotheim)	—	x	—	x	x	x
Oreoconus planispira Taylor	x	—	—	—	—	—
Oreoconus sp.	—	x	x	—	—	—
Holospira? sp.	—	x	—	x	—	—
Indeterminate land snail	—	x	—	—	—	—

[a] The locality numbers correspond to those given by McGrew and his co-authors (1959) with the exception of U.C.M.P. V-5629.

1: SW. 1/4, SE. 1/4, SW. 1/4, sect. 33, T. 29 N., R. 105 W.; Bridger Formation (= U.S.G.S. Cenozoic 22327)

5: NE. 1/4, SE. 1/4, SE. 1/4, sect. 5, T. 28 N., R. 105 W.; Bridger Formation ("*Hyopsodus* Hill")

10: NE. 1/4, SE. 1/4, sect. 33, T. 27 N., R. 104 W.; Laney Shale Member of Green River Formation

13: East border, NW. 1/4, NE. 1/4, SW. 1/4, sect. 33, T. 29 N., R. 105 W.; Bridger Formation

15: Northwest corner, NE. 1/4, NE. 1/4, sect. 31, T. 28 N., R. 103 W.; Bridger Formation

U.C.M.P. V-5629: One hundred yards east of locality 5 and stratigraphically a few feet higher; Bridger Formation

The following localities, which are outside the Tabernacle Butte area, are cited in the discussion of some of the fossils. All are numbered in the Cenozoic series of the United States Geological Survey localities.

20079: Fremont County, Wyoming; sect. 34, T. 27 N., R. 97 W.
20082: Lincoln County, Wyoming; Sage quadrangle (1954) 1:62,500; 300 feet east, 1900–2400 feet north of southwest corner of sect. 20, T. 21 N., R. 119 W., 6575 feet in elevation; Fowkes Formation; D. W. Taylor, W. W. Rubey, 1956
20083: Lincoln County, Wyoming; Sage quadrangle (1954) 1:62,500; 250 feet west, 600 feet north of southeast corner, sect. 19, T. 21 N., R. 119 W.; Fowkes Formation; D. W. Taylor, 1956
20084: Lincoln County, Wyoming; NW. 1/4, sect. 16, T. 20 N., R. 119 W.; Fowkes Formation; D. W. Taylor, 1956
20085: Fremont County, Wyoming; near southwest corner, sect. 26, T. 27 N., R. 97 W.; A. J. Collier

SUBCLASS EUTHYNEURA

ORDER BASOMMATOPHORA

SUPERFAMILY LYMNAEACEA

FAMILY PLANORBIDAE

SUBFAMILY PLANORBINAE

ANISUS STUDER, 1820

Wenz (1923) referred the American Eocene species *Planorbis cirrus* White to this genus (under the synonymous name *Paraspira*) with doubt. Probably he was influenced by the facts that no other living or fossil American species were known, and that the only occurrences elsewhere were in late Tertiary deposits of Europe.

Study of the type series of *Planorbis cirrus* White (U.S.N.M. No. 9005) and of the Tabernacle Butte material shows that they agree with the genus *Anisus* as now understood in all observable shell features such as size, shape of whorls, and the possession of numerous closely coiled whorls. Furthermore, a much younger American species has been described since Wenz's time—*Anisus pattersoni* (Baker), occurring in Pliocene and Pleistocene deposits over a large part of the United States (Taylor, 1958). Probably *Anisus* was represented by several species in much of North America from the early Tertiary until the late Pleistocene, when it became extinct on this continent. The time of differentiation of the genus may well be as early as the Cretaceous, for two species of the genus are known in the Eocene of Wyoming.

SUBGENUS *ANISUS, SENSU STRICTO*

Anisus (*sensu stricto*), new species?

Figure 1

DISCUSSION: A single specimen (A.M.N.H.:I.P. No. 28285) represents a species of *Anisus* new to America and perhaps new to science. Compared with the type series of *A. cirrus* (White) (U.S.N.M. No. 9005), it differs by having both sides more broadly and regularly concave, and by having subangular whorls slightly flattened on the sides, with the periphery

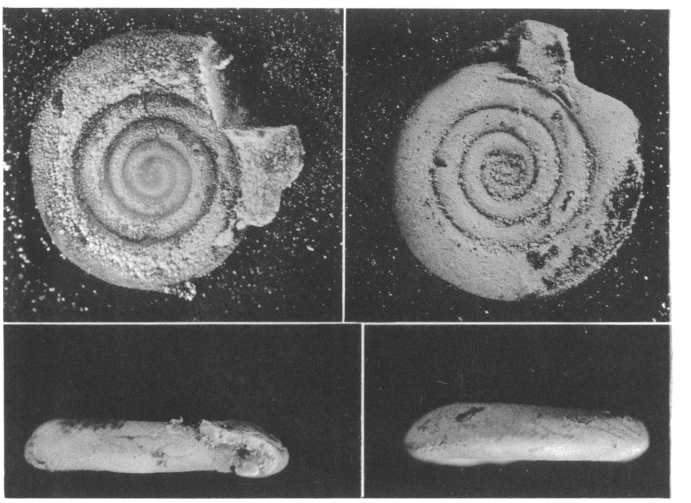

FIG. 1. *Anisus*, new species? A.M.N.H.:I.P. No. 28285; diameter, 6.0 mm.; Tabernacle Butte locality 13. *Upper left:* Right side. *Upper right:* Left side. *Lower left:* Apertural view. *Lower right:* Abapertural view. Note obtuse rounding of periphery to left of plane of coiling. All × 6.

toward the left of the plane of coiling. The whorls of *A. cirrus* are more evenly convex, with deeper sutures separating them, and with no marked subangularity.

The description of this specimen as a new species is inadvisable at this time. Additional material showing the range of variation, and a direct comparison with the various European species, are necessary for a well-founded appraisal of its status.

OCCURRENCE AND MATERIAL: Bridger Formation, late middle Eocene, Tabernacle Butte area, Sublette County, Wyoming: Locality 13, A.M.N.H.:I.P. No. 28285, one specimen.

PLANORBINA HALDEMAN, 1843

The scope of this group is accepted in the sense of Connolly (1939, pp. 483–484), Ranson (1955), and Paraense (1958, p. 71). The genus thus includes most of the tribe Biomphalarieae of Zilch (1959–1960) and includes as synonyms *Afroplanorbis* Thiele, 1931; *Armigerus* Clessin, 1884; *Australorbis* Pilsbry, 1934; *Biomphalaria* Preston, 1910; *?Syrioplanorbis* Baker, 1945; and *Tropicorbis* Brown and Pilsbry, 1914.

The name *Planorbina* is used following Wenz (1923), H. B. Baker (1960), and Burch (1960). H. B. Baker (1960) has discussed the reasons for accepting *Planorbina;* in brief, the question is whether the type designated by Dall (1905) falls within the diagnosis by Haldeman. No one name for this genus has gained general acceptance. A decision by the International Commission on Zoological Nomenclature, before whom the matter is pending, will help stabilize nomenclature of the group. *Planorbina* has been used by paleontologists for several decades, does not connote a particular geographic region as do some of the other names, and is at least as likely to survive as any other name.

Planorbina pseudoammonius (Schlotheim), 1820

Helicites pseudoammonius SCHLOTHEIM, 1820, Die Petrefaktenkunde, p. 101; "Bastberge bey Buschweiler," usually written "Bastberg bei Buchsweiler." Locality, the Lutetian of lower Alsace, France.

Planorbina (Planorbina) pseudoammonius pseudoammonius (Schlotheim), WENZ, 1923, *in* Pompecki and Quenstedt, Fossilium catalogus, I: Animalia, pt. 22, p. 1490. Extensive bibliography.

Biomphalaria pseudoammonia, GAZIN, 1959, Guidebook Intermountain Assoc. Petrol. Geol., no. 10, p. 137; Fowkes Formation, Uinta County, Wyoming.

Australorbis pseudoammonius (Schlotheim), Ross, "1959" [1960], Prof. Paper U. S. Geol. Surv., no. 296, pp. 70–71; Kishenehn Formation, southeastern British Columbia and northwestern Montana.

Planorbis convolutus MEEK AND HAYDEN, 1856, Proc. Acad. Nat. Sci. Philadelphia, vol. 8, p. 120; "Little Horn River."

Planorbis convolutus, M. & H., MEEK, 1876, *in* Hayden, Report of the United States geological and geographical survey of the Territories, vol. 9, p. 536, pl. 42, figs. 12a–b; Little Horn and Powder rivers, Montana.

Planorbis convolutus Meek and Hayden, HENDERSON, 1935, Special Paper Geol. Soc. Amer., no. 3, pp. 42, 245. Bibliography.

Planorbis spectabilis, Meek, MEEK, 1860, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 314; Ham's Fork, Wyoming.

Planorbis spectabilis, Meek, MEEK, 1877, *in* King, Report of the geological exploration of the fortieth parallel, vol. 4, p. 189, pl. 17, figs. 13, 13a–f.

Planorbis spectabilis spectabilis Meek, HENDERSON, 1935, Special Paper Geol. Soc. Amer., no. 3, pp. 39, 41, 250. Bibliography.

Australorbis spectabilis (Meek), YEN, 1946, Jour. Paleont., vol. 20, pp. 495–497,

figs. 5a–b; Tepee Trail Formation, Lysite Mountain, Hot Springs County, Wyoming.

Australorbis spectabilis (Meek), YEN, 1948, Jour. Paleont., vol. 22, pp. 634–637; Bridger formation, Sweetwater County, Wyoming; Tepee Trail Formation, Fremont and Natrona counties, Wyoming.

Australorbis spectabilis, VAN HOUTEN, 1954, U. S. Geol. Surv. Oil and Gas Map no. OM 140, 2 sheets; middle and upper Eocene rocks, Fremont County, Wyoming; White River Formation, Fremont County, Wyoming; Beaver Divide Conglomerate Member, White River Formation, Fremont County, Wyoming.

Planorbis utahensis, Meek, MEEK, 1860, Proc. Acad. Nat. Sci. Philadelphia, vol. 12, p. 314; Ham's Fork, Wyoming.

Planorbis spectabilis var. *Utahensis*, Meek, MEEK, 1877, *in* King, Report of the geological exploration of the fortieth parallel, vol. 4, p. 190, pl. 17, figs. 14, 14a–c; Bridger Formation, Ham's Fork, near Fort Bridger, Wyoming.

Planorbis spectabilis utahensis Meek, HENDERSON, 1935, Special Paper Geol. Soc. Amer., no. 3, pp. 39, 41, 250. Bibliography.

Australorbis utahensis (Meek), YEN, 1946, Jour. Paleont., vol. 20, pp. 495, 498, figs. 6a–b; Tepee Trail Formation, Lysite Mountain, Hot Springs County, Wyoming.

Planorbis kishenehnensis RUSSELL, 1952, Bull. Natl. Mus. Canada, no. 126, p. 130, fig. 9a, pl. 19, fig. 1; Kishenehn Formation, southeastern British Columbia.

Planorbis kishenehnensis Russell, RUSSELL, 1955, Bull. Natl. Mus. Canada, no. 136, pp. 104–107; Kishenehn Formation, southeastern British Columbia and northwestern Montana.

Planorbis near *planoconvexus* M. and H., GALE, 1910, Bull. U. S. Geol. Surv., no. 415, p. 85; Bridger Formation, southwestern Wyoming.

Australorbis cf. *A. convolutus* (M. & H.), LOVE, 1956, Guidebook Wyoming Geol. Assoc., no. 11, p. 86; middle sequence of Wind River and Indian Meadows formations, undivided, Jackson Hole, Teton County, Wyoming.

Drepanotrema sp., LOVE, 1956, Guidebook Wyoming Geol. Assoc., no. 11, p. 86; middle sequence of Wind River and Indian Meadows formations, undivided; and upper and middle Eocene rocks, undivided; Jackson Hole, Teton County, Wyoming.

DISCUSSION: The fossils from Tabernacle Butte and vicinity are not well enough preserved to show the details of surface sculpture, but they are readily recognizable as a large, many-whorled planorbid of the kind found commonly in the Bridger and Green River formations of the northern Rocky Mountains. Study of this group has led to the conclusions that (1) there is only one valid fossil species in America, instead of the several described, (2) this species is conspecific with the Old World species found in the same stratigraphic interval, and (3) this early Tertiary form is closely related to, and may be conspecific with, the living West Indian and South American species *Planorbina glabrata* (Say).

The only adequate study of variation in fossil *Planorbina* is that by Gutzwiller (1906). He demonstrated convincingly the previously unappreciated amount of variation within single populations and showed that

other named European forms were synonyms of *P. pseudoammonius*. Several names have been applied to American fossil *Planorbina*. These names have been proposed without adequate consideration of variability in freshwater snails, and without comparison with European species. In the light of Gutzwiller's study the following American names are added to the synonymy of *P. pseudoammonius* (Schlotheim):

Planorbis convolutus Meek and Hayden, 1856
Planorbis utahensis Meek, 1860
Planorbis spectabilis Meek, 1860
Planorbis kishenehnensis Russell, 1952

The close similarity between *Planorbina pseudoammonius* and the living *P. glabrata* (Say) of tropical America is evident not only from comparison of specimens, but from illustrations alone. The significant features common to both are large size (unusually large size for the family), numerous closely coiled whorls, nearly plane right side, concave left side, with a subangulation or abrupt curve next to the suture, and smooth nuclear whorls lacking carination.

The range of variation ascribed to the fossil *Planorbina pseudoammonius* includes at least many shells of the living *P. glabrata*. The two may be synonymous. For the time being, however, it is more prudent to maintain them as separate forms. The classification of the living species of *Planorbina* is in an unsettled state, and there have been no detailed studies of the variation in shell features of living species. In recent years students of the Planorbidae have tended to discount all but the grossest shell characters, because they have found many named species to be based on local variations in shells.

In investigating the literature on *Planorbina*, one soon concludes that there has been an almost total lack of communication between the paleontologists and zoologists. Sandberger (1870–1875, p. 227) noted a "great similarity" between *P. pseudoammonius* and a large Brazilian living species. Wenz (1923) grouped *P. pseudoammonius* as a *Planorbina* along with the living *P. glabrata*. Wenz's use of *Planorbina* was more restricted than that here and was equivalent to the synonym *Australorbis*. These two works by Sandberger and Wenz are the basic introductions to fossil non-marine mollusks, and both are based on many years of experience with the subject.

Recent zoologists have tended to rely on F. C. Baker's (1945) comprehensive treatment of the Planorbidae. Dealing so with *Planorbina*, they have been misled. F. C. Baker (1945, p. 37) commented on Wenz's work: ". . . Many of the species have obviously been placed in the wrong genera, especially some of the large forms which are listed under the genus

Planorbina, for it does not occur in Europe. It is quite probable that these large species are members of the genus *Planorbarius* and are related to the large *Planorbarius corneus* so common in the recent fauna." Wenz maintained a separate genus for the species Baker called *Planorbarius*, and as a European he had more than ample opportunity to study both *Planorbarius* and *Planorbina*.

Whether or not Baker's opinion was wholly original is speculative. It is plausible, at least, to think he was influenced by an earlier statement by Pilsbry (1934, p. 56): "Except for its occurrence in Haiti, Porto Rico and the Caribbean Islands, *Australorbis* is a South American group. That the series of Eocene and Oligocene European species referred to '*Planorbina*' by Wenz (Fossilium Catal., Animalia, Pars 22, p. 1482) belongs to this South American group seems in a high degree improbable. They seem more likely to belong to *Planorbarius*."

These two works cited, by Baker and Pilsbry, are both important milestones in the history of study of living Planorbidae. Naturally, later workers have relied upon them to a certain extent. With *Planorbina*, unfortunately, taxonomy has been largely influenced by prejudices concerning geographic distribution, rather than by morphologic study.

Zoologists who find improbable the former widespread occurrence in the Northern Hemisphere of a presently tropical American genus are recommended to investigate summaries of the early Tertiary faunas and floras of North America and Europe. The northern occurrence of presently tropical and remote types of animals and plants is so frequent as to be commonplace. To a paleontologist who is familiar with the tropical or subtropical elements in fossil faunas of the north temperate zone, the early wide distribution of *Planorbina* comes as no surprise. This different background, the possession or lack of a historical perspective, is basically responsible for the divergent classification of fossil *Planorbina* by Sandberger, Wenz, and Taylor on one hand, and that of Pilsbry and Baker on the other.

DISTRIBUTION: Lutetian and Bartonian stages, Europe (Wenz, 1923, p. 1521); Eocene (no more precise age) in northern China, Manchuria, and Korea (Suzuki, 1949, p. 120); early Eocene to earliest Oligocene deposits of the northern Great Basin and northern Rocky Mountains in the United States and southern British Columbia. More precise localities are given in the synonymy above and in references listed by Henderson (1935). The known stratigraphic extremes of the species are early (but not earliest) Eocene in Jackson Hole, Wyoming (Love, 1956), and in the western part of the Bridger Basin, Wyoming (Oriel, MS); and earliest Oligocene (Beaver Divide Conglomerate Member of White River For-

mation), at Beaver Divide, Fremont County, Wyoming (Van Houten, 1954). The last-mentioned occurrence would be regarded as latest Eocene rather than Oligocene by Gazin (1959). The Kishenehn Formation, considered late Eocene by Russell (1955), would represent a second Oligocene occurrence according to Gazin (1956b, p. 31).

OCCURRENCE AND MATERIAL: Bridger Formation, late middle Eocene, Tabernacle Butte area, Sublette County, Wyoming: Locality 5, A.M.N.H.:I.P. No. 28286, one specimen; A.M.N.H.:I.P. No. 27914, in part, one specimen; A.M.N.H.:I.P. No. 27919, in part, 21 specimens. Locality 13, A.M.N.H.:I.P. No. 27912, in part, two specimens; A.M.N.H.:I.P. No. 27913, in part, three specimens. Locality 15, A.M.N.H.:I.P. No. 27915, two specimens. U.C.M.P. V-5629, A.M.N.H.:I.P. No. 28287, one specimen.

ORDER STYLOMMATOPHORA

SUBORDER SIGMURETHRA

INFRAORDER HOLOPODA

SUPERFAMILY BULIMULACEA

FAMILY BULIMULIDAE

The classification and ranking used here are from Zilch (1959–1960). The family Bulimulidae is thus equivalent to the subfamily Bulimulinae of older classifications (Thiele, 1929–1935; Pilsbry, 1902).

This group of medium- to large-sized land snails is a large one, including 94 genera and subgenera, according to Zilch. All these are American, except for 15 that are found in Australasia. The American groups are almost all South American. There is a progressive lack of diversity as one moves northward to the present northern limit of the family in the southern United States.

Authors who have previously considered the distribution of the Bulimulidae have based their conclusions primarily on the great diversity of the group in South America, the poverty of the fossil record elsewhere, and the assumption that these snails are now expanding their range. Thus Pilsbry (1911, p. 613) thought that the Bulimulidae are ". . . now invading North America," and Solem (1959, p. 124) inferred, "Apparently the bulimulids are entering North America in the wake of the warming climate." The fossil evidence now available, however, suggests that the Bulimulidae have been in North America for some time. Three fossil occurrences in the Rocky Mountains are:

1. *Bulimulus?* sp. in the upper part of the Flagstaff Formation (Eocene) of Utah (La Rocque, 1960).

2. *Oreoconus planispira* Taylor, new genus and species, in the Eocene of western Wyoming. Three or four other undescribed species of *Oreoconus* are represented in United States Geological Survey collections from early Tertiary deposits of the same region.

3. An undescribed genus and two species from middle Pliocene deposits of southeastern Idaho, represented in United States Geological Survey collections (U.S.G.S. Cenozoic 21671).

Probably the Bulimulidae were differentiated as a family by the Cretaceous. They seem never to have been diversified as greatly in North America as in South America, but did range into the middle Rocky Mountains of Utah and Wyoming during the Eocene. One can only speculate about the causes of their extinction there, but the severe climates of the Pleistocene seems a more plausible reason than competition by other snails.

OREOCONUS[1] TAYLOR, NEW GENUS

DIAGNOSIS: Shell about 25–35 mm. in length, conical, with nearly flat-sided spire and rounded base. Aperture ovate-pyriform, with internally thickened, reflected lip. Whorls five to six, body whorl descending slightly to the aperture. Base narrowly perforate.

TYPE SPECIES: *Oreoconus planispira* Taylor, new species.

DISTRIBUTION: Eocene, western Wyoming.

Oreoconus planispira[2] Taylor, new species

Figures 2–4

TYPE: U.S.N.M. No. 647848; Fremont County, Wyoming; sect. 34, T. 27 N., R. 97 W.; U.S.G.S. Cenozoic 20079.

DIAGNOSIS: Shell 30–40 mm. in maximum length, broadly conical, with nearly flat-sided spire. Aperture about 50 per cent of shell length and body whorl about 75 per cent of shell length. Body whorl descending slightly to the aperture; outer lip thickened internally and reflected.

DESCRIPTION: The shell is about 30–40 mm. long in adults, conical, with a rounded base. The lateral profiles of the spire are nearly straight, slightly convex, with sutures weakly or not at all incised. The whorls are five to six in number, regularly expanding. The body whorl is about three-fourths of the total shell length. The base of the shell is narrowly perforate; rarely, the reflection of the parietal and columellar lips seals the hollow columella.

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[1] Greek *oreos*, mountain, and *conus*, cone.

[2] Latin *planus*, plane; and *spira*, spire.

The aperture is ovate-pyriform, in plane retractive relative to the axis, and about 40–50 per cent of the shell length. The outer edge of the aperture is broadly rounded and meets the parietal wall with an acute angle. The parietal edge is broadly concave, joining the columellar edge with an obtuse angle. The columellar edge is straight and passes into the outer edge through a narrowly rounded interval.

Mature shells are marked by a slight descent of the body whorl to the aperture (fig. 2, right; fig. 3, upper right), and by a callus within the

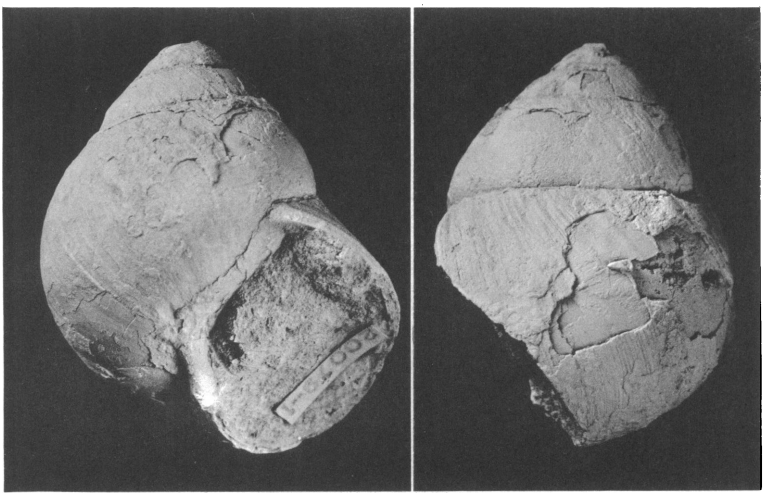

FIG. 2. *Oreoconus planispira* Taylor, new species, type, U.S.N.M. No. 647848; length, 37.8 mm.; U.S.G.S. Cenozoic 20079. *Left:* Apertural view of a mature shell, with apex and anterior part of outer lip broken away. Note callus on parietal wall. *Right:* Profile view of same specimen. A slight descent of the body whorl to the aperture is discernible. Both × 1.5.

aperture and a reflected lip. Immature shells have a sharp peripheral keel (fig. 3, lower right) which fades out entirely or almost entirely on mature shells (fig. 2, left; fig. 3, upper left and upper right).

The axial sculpture consists of irregular, coarse, retractive growth lines. These may become coarser toward the reflected lip in mature shells. Only one specimen (fig. 3, upper right) shows a trace of spiral sculpture. Just below the suture, a quarter-whorl behind the aperture, are discernible a few incised lines which cut the growth lines. Most of the shell is broken away from the body whorl of this specimen, so that the extent of this spiral sculpture is uncertain.

The type measures as follows: length, 37.8 mm.; width, 30.7; length

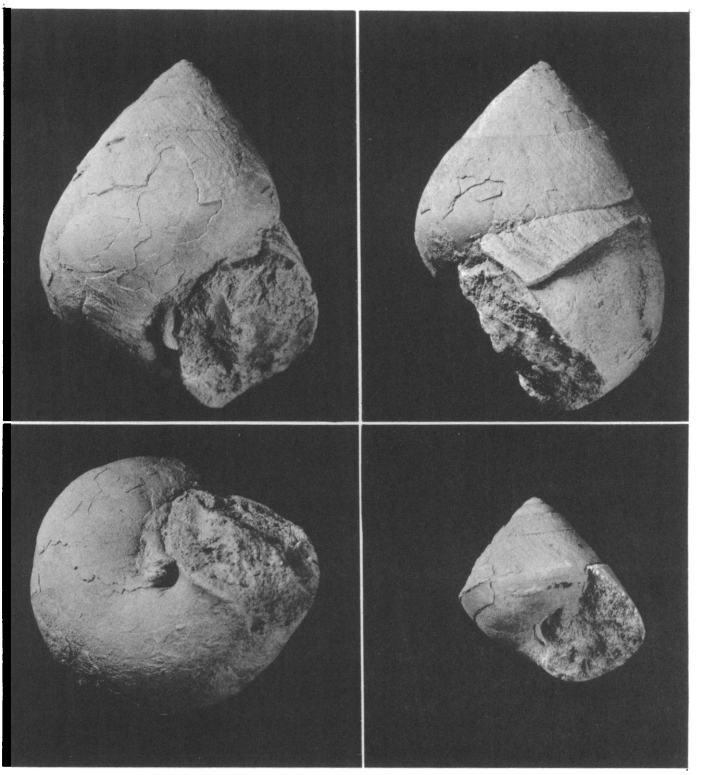

FIG. 3. *Oreoconus planispira* Taylor, new species, U.S.N.M. No. 647849; length, 31.0 mm.; U.S.G.S. Cenozoic 20079. *Upper left*: Small but mature shell, apertural view. Note nearly flat sides of spire. *Upper right:* Same specimen in profile view. The peripheral keel is visible just above the body whorl at the right, but fades out toward the left. Traces of spiral sculpture are evident on the body whorl just below the suture at the right. Note slight descent of the body whorl to the aperture and the coarser growth lines just behind the aperture. *Lower left:* Same specimen in basal view. *Lower right:* An immature shell in apertural view, U.S.N.M. No. 647850; length, 16.9 mm.; U.S.G.S. Cenozoic 20079. Note the sharp peripheral keel and sinuous inner lip. All × 1.5.

of aperture, 19.3; width of aperture, 16.2; length of body whorl, 30.5. The specimen is broken and probably would have measured 40–41 mm. long when complete. Measurements of the figured specimens are given in the figure legends.

DISCUSSION: The molds from the vicinity of Tabernacle Butte usually do not retain shell material over much of their surfaces. The most nearly complete specimen (fig. 4, lower left) has slightly more incised sutures

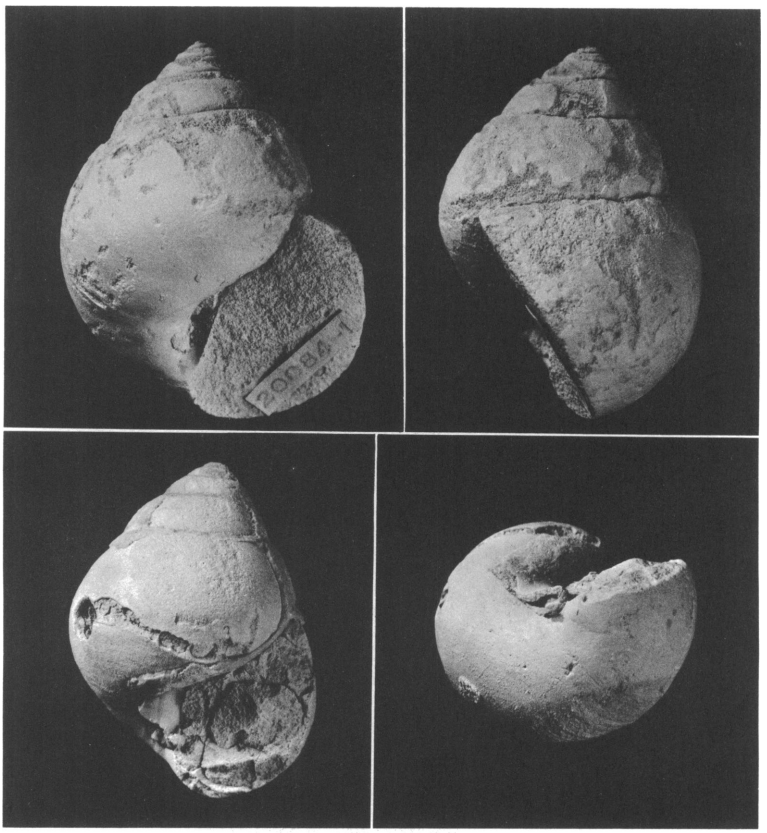

FIG. 4. *Oreoconus planispira* Taylor, new species. *Upper left:* A mature specimen in apertural view, U.S.N.M. No. 647851; length, 33.8 mm.; U.S.G.S. Cenozoic 20084. This internal mold by its nature shows less flat sides of the spire. *Upper right:* Same specimen in profile view. Note slight descent of body whorl to aperture. *Lower left:* An incomplete specimen, consisting of an internal mold with parts of the shell adhering, U.S.N.M. No. 647852; length, 30.0 mm.; U.S.G.S. Cenozoic 22327; Tabernacle Butte locality 1. *Lower right:* Same specimen, showing perforate columella. All × 1.5.

and less nearly plane spire outlines than the other specimens from the type locality. The difference is not enough to warrant specific separation on the basis of the material available.

The broadly conical shape of *Oreoconus planispira* is rare within the Bulimulacea, although both narrower and more depressed species are known in both the Bulimulidae and the Orthalicidae. The perforate shell axis of the fossils is a bulimulid character. Within the family Bulimulidae

some South American species of *Bulimulus*, subgenus *Rhinus* Albers, 1860, have a similar shape and size. The other subgenera of *Bulimulus* are more narrowly conical, usually smaller, and often more openly perforate. The larger, more broadly conical species of *Rhinus* (as described by Pilsbry, 1897–1898, pp. 74–81, and as represented in United States National Museum collections) differ in being more broadly perforate than *Oreoconus planispira*, and are less flat-sided on the spire and less angular at the periphery in immature shells. Unfortunately, the valuable character of embryonic sculpture is not preserved in the fossils, but the size and shape of embryonic whorls in *Oreoconus* can be duplicated in *Rhinus*. The coarse, irregular lines of growth in *Oreoconus* are like those of the larger species of *Rhinus*, but the fossils are not well enough preserved to show whether spiral sculpture was also present as it is in *Rhinus*.

Oreoconus planispira has a close superficial resemblance to the freshwater snail *Viviparus wyomingensis* Meek. Indeed, the resemblance of *V. wyomingensis* to a land snail is so close that Meek founded his species on a mixture: the type of the species belongs to *Viviparus*, but all other specimens represent *Oreoconus*.

The type of *Viviparus wyomingensis* Meek (U.S.N.M. No. 8295, illustrated by White, 1883, pl. 30, figs. 13–14) is an internal mold much like the specimens of *Oreoconus* from the vicinity of Tabernacle Butte in size and shape. It differs in having a more oval aperture, with a smoother contour of the parietal and columellar areas, weaker growth lines, and no umbilicus.

Except for the observation that it belongs to a group of land snails, no inferences about the habitat of *Oreoconus* are warranted.

Occurrence and Material: The following localities in Eocene deposits of western Wyoming: Fowkes Formation, late middle to late Eocene, Lincoln County, Wyoming: U.S.G.S. 20082, 16 mostly fragmentary internal molds; U.S.G.S. 20083, six mostly fragmentary internal molds; U.S.G.S. 20084, 12 mostly fragmentary internal molds. The stratigraphic relations of the Fowkes Formation have been discussed by Tracey and Oriel (1959). Horsetrack anticline, Eocene, Fremont County, Wyoming, U.S.G.S. 20079, 22 specimens, most retaining part of the shell; U.S.G.S. 20085, 27 specimens, many retaining part of the shell. Bridger Formation, late middle Eocene, Tabernacle Butte area, Sublette County, Wyoming: Locality 1, 28 internal molds, many fragmentary and some retaining part of the shell; A.M.N.H.:I.P. No. 27918, U.S.G.S. 22327, the same as locality 1 of McGrew and others (1959).

Oreoconus sp.

DISCUSSION: Poorly preserved material from the Tabernacle Butte area probably represents species of *Oreoconus*. The fossils may be *O. planispira* Taylor, new species, or other undescribed species known to occur in the region.

OCCURRENCE AND MATERIAL: Bridger Formation, late middle Eocene, Tabernacle Butte area, Sublette County, Wyoming: Locality 5,

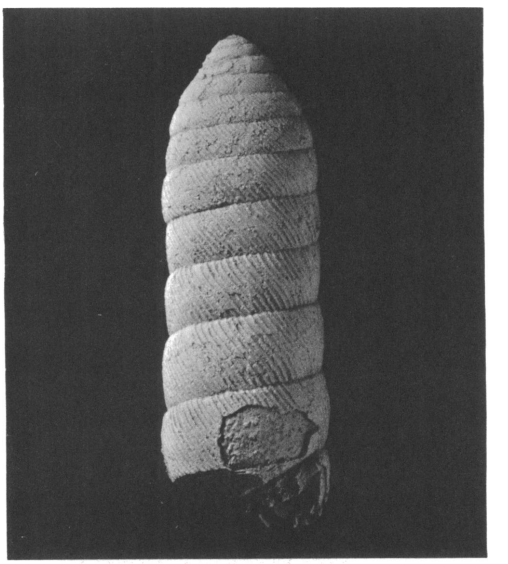

FIG. 5. *Holospira?* sp., A.M.N.H.:I.P. No. 28285/1; length, 13.0 mm.; Tabernacle Butte locality 13. × 5.

A.M.N.H.:I.P. No. 28286/1, one internal mold. Laney Shale Member of the Green River Formation, early middle Eocene, south of Elk Mountain, Sublette County, Wyoming, locality 10, A.M.N.H.:I.P. No. 27916, three fragmentary internal molds.

FAMILY UROCOPTIDAE

? *HOLOSPIRA* MARTENS, 1860

Holospira? sp.

Figure 5

DISCUSSION: The fossil specimens are spires which do not retain the

aperture or last few whorls and therefore lack the significant features of folds and lamellae which occur frequently in the family. The parts of the columella visible in the fossils are hollow and without lamellae. So far as general shape, size, and sculpture go the fossils may represent the genus *Holospira* of Mexico, Texas, New Mexico, and Arizona.

OCCURRENCE AND MATERIAL: Bridger Formation, late middle Eocene, Tabernacle Butte area, Sublette County, Wyoming: Locality 5, A.M.N.H.:I.P. No. 27914, in part, one fragmentary internal mold of about three whorls of spire. Locality 13, A.M.N.H.:I.P. No. 28285/1, a spire consisting of the first seven whorls, with well-preserved shell; A.M.N.H.:I.P. No. 27913, in part, a fragmentary internal mold of about seven whorls of spire.

CLASS MAMMALIA

ORDER INSECTIVORA

SUPERFAMILY DELTATHERIDIOIDEA[1]

FAMILY PALAEORYCTIDAE?

SUBFAMILY DIDELPHODONTINAE

DIDELPHODUS COPE, 1882

Didelphodus altidens (Marsh, 1872), McKenna, new combination

Figure 6

Centetodon altidens MARSH, 1872, Amer. Jour. Sci., ser. 3, vol. 4, p. 214.
Phenacops incerta MATTHEW, 1909, Mem. Amer. Mus. Nat. Hist., vol. 9, p. 535.

MATERIAL: A.M.N.H. No. 55698, left M^2; collected by McKenna, 1959.

HORIZON AND LOCALITY: Late Bridgerian, Bridger Formation, Elk Mountain-Tabernacle Butte area, Sublette County, Wyoming; locality 5 of McGrew and others (1959), "*Hyopsodus* Hill."

DESCRIPTION: Small M^2 with transversely elongate crown and with paracone and metacone widely separated; conules distinct; otherwise as in *Didelphodus absarokae*. Anteroposterior length, 2.8 mm.; width, 5.3 mm.

DISCUSSION: This tooth is the fifth known specimen of a Bridgerian

[1] The validity of this name is questionable under the International Code of Zoological Nomenclature adopted by the XV International Congress of Zoology, London, July, 1958, published in 1961. No substitute is proposed at this time.

didelphodontine insectivore. The first to be described, Y.P.M. No. 13516, from the upper Bridger, was made the type of *Centetodon altidens* by Marsh. The second specimen to be described was a fragmentary lower jaw with worn and damaged teeth (A.M.N.H. No. 12091) from the Bridger C_4 collected at Henry's Fork, Wyoming, in 1904. Matthew (1909, p. 535) made this the type of *Phenacops incerta*, a new genus and species. A right lower jaw with one and a half molars, A.M.N.H. No. 56614, was collected from low in the Bridger C about 4 feet above the lower conspicuous limestone layer north of Lone Tree, Wyoming, by R. M. Alf, 1961. Still another specimen, a maxillary fragment with M^1, was collected near Tabernacle Butte by Patterson, 1961.

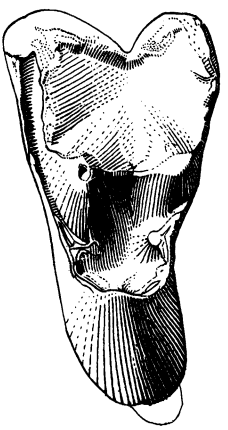

FIG. 6. *Didelphodus altidens* (Marsh, 1872), A.M.N.H. No. 55698, left M^2; locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," late Bridgerian of the Tabernacle Butte area, Sublette County, Wyoming; occlusal view. × 10.

The type of *P. incerta* was not compared with the type of *Centetodon altidens*, but it is doubtful if comparison would have been fruitful in view of the damaged condition of the type of *P. incerta*. Nor did Matthew compare the type of *Centetodon altidens* with any of the available specimens of *Didelphodus*. He regarded the former as a talpid (1909, p. 299). *Phenacops* was referred with a query to the Leptictidae, but Matthew stated that insofar as could be judged from the lower jaw the genus could be a chiropteran, an insectivore, or a creodont. Nine years later Matthew (1918) again placed *Phenacops* in the Leptictidae, stating (p. 571): "*Didelphodus*, *Phenacops*, and other genera are of very doubtful affinities but can not easily be placed in any other family. They may prove to be creodonts; the skeleton is unknown." In the same paper Matthew stated (p. 582), "The

problematic Bridger genus *Phenacops* appears to be an ally of *Didelphodus*, and for the present both may be referred provisionally to the Leptictidae, although not nearly related to the typical members of that family." *Didelphodus* was referred tentatively to the Deltatheridiidae by the authors of that family, Gregory and Simpson (1926). Later Simpson (1928) expanded the argument for inclusion of *Didelphodus* in the Deltatheridiidae and stated that *Phenacops* is apparently related to *Didelphodus*. In 1935 and 1937 Simpson referred the Didelphodontinae to the Deltatheridiidae with a query. In 1937 he stated: "On present evidence it seems well to retain Matthew's subfamily Didelphodontinae, for *Didelphodus*, *Gelastops*, *Acmeodon*, and probably *Phenacops*." At about the same time, *Puercolestes* was added to the Deltatheridiidae by Reynolds (1936). Simpson (1945, p. 48) placed *Puercolestes* in the subfamily Didelphodontinae with *Gelastops*, *Didelphodus*, and *Phenacops*, but *Acmeodon* was placed in the Leptictidae. The latter action may have arisen through oversight (see also Gazin, 1949, p. 221), because *Emperodon*, which Simpson had earlier (1937, p. 107) listed as a synonym of *Gelastops*, was listed as a valid leptictid genus in 1945. McDowell (1958, pp. 176–180, 204–206) merged the Deltatheridiidae with the Palaeoryctidae,[1] mainly on dental evidence, and excluded the Palaeoryctidae from the Insectivora *sensu stricto* (= Lipotyphla of Haeckel, 1866), mainly on supposed basicranial evidence. Similarity to *Apternodus* and to creodonts was claimed. McKenna (1960a, pp. 86–88), on the basis of dental evidence, referred the Didelphodontinae to the Palaeoryctidae with a query and the Palaeoryctidae to the Deltatheridioidea, *faute de mieux*, tentatively in agreement with McDowell (1958). The Deltatheridioidea were referred to the creodont Carnivora, *faute de mieux*. The superfamily Deltatheridioidea was placed in the doubtfully useful carnivore suborder Creodonta because of a close dental similarity between the molars of various didelphodontine genera and those of the Miacidae. The miacids possess carnassial teeth and usually well-developed anterior and posterior cingula on the upper molars. The ancestors of the miacids are unknown, particularly those of the subfamily Miacinae, but the didelphodontine insectivores seem to represent a stock from which the miacids and also the oxyaenoids may have differentiated. On the basis of unpublished studies of the cranial anatomy of *Oligoryctes* and *Apternodus*, the Deltatheridioidea are regarded here as members of

[1] McDowell (p. 180), without presenting evidence, claimed that the name Palaeoryctidae has priority over Deltatheridiidae. In present orthography, Palaeoryctidae Simpson, 1931, is antedated by Deltatheridiidae Gregory and Simpson, 1926. The group concept dates from Palaeoryctae Winge, 1917. Under the Code (Arts. 11e, 36, 37), Palaeoryctidae dates from Winge, 1917 (see Winge, 1941).

the Insectivora, which does not preclude close relationship to the miacids and oxyaenoids, however, although the common ancestry of insectivores and carnivores almost certainly must have been pre-Paleocene.

The type of *Centetodon altidens* and the recently found Tabernacle Butte *Didelphodus* M^2 support the opinion of Matthew (1918) that *Didelphodus* and *Phenacops* are closely related. Indeed, on present evidence the two genera must be regarded as synonymous and *Centetodon altidens* accepted as the prior synonym of *Phenacops incerta.* Fortunately, from a nomenclatural standpoint, *Centetodon altidens* is not the type of *Centetodon.* The type, *Centetodon pulcher,* is shown by Robinson in the present paper to be a geolabidine erinaceid. When the material then available is considered, *Phenacops* should not have been named; A.M.N.H. No. 12091 is a remarkably poor specimen on which to base a genus and species. Nevertheless, "*Phenacops*" *altidens* is clearly a didelphodontine insectivore and is certainly distinct from any of the described species of *Didelphodus,* if only because of its somewhat smaller size, the reduction[1] of P_1, and the transverse nature of the referred upper molar. For these reasons *Phenacops* is here placed in synonymy with *Didelphodus,* and the type species, *Phenacops altidens* (=*P. incerta*), is transferred to the genus *Didelphodus* as a valid late Bridgerian species. *Didelphodus altidens* (Marsh, 1872), new combination, is the latest known member of the insectivore subfamily Didelphodontinae.

SUBFAMILY APTERNODONTINAE

Undescribed genus and species

Soricidae?, genus and species indeterminate, SIMPSON, *in* McGrew and others, 1959, Bull. Amer. Mus. Nat. Hist., vol. 117, art. 3, p. 151.

MATERIAL: C.M. No. 13627, fragmentary left lower jaw with M_1–M_3, angular process, and part of coronoid process; and A.M.N.H. No. 55689, edentulous lower jaw fragment discussed by Simpson.

LOCALITY: Locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," Tabernacle Butte area, Sublette County, Wyoming; late Bridgerian, Bridger Formation.

DISCUSSION: The specimen (A.M.N.H. No. 55689) that Simpson referred to the Soricidae with a query is an apternodontine insectivore similar to *Oligoryctes.* A discussion of both specimens from locality 5 is

[1] This is a similarity to *Gelastops.* In *Acmeodon* P_1 previously has been identified as P_2, P_1 being considered missing. An alveolus for P_2 is present behind P_1 on the type specimen, A.M.N.H. No. 16599, as recently prepared by Leigh Van Valen.

included in a review of the Apternodontinae being prepared by McKenna. There is no need to repeat the description and figures here. The species also occurs in the early Bridgerian of Utah.

SUPERFAMILY LEPTICTOIDEA

FAMILY LEPTICTIDAE, *SENSU STRICTO*

PALAEICTOPS MATTHEW, 1899

Palaeictops bridgeri (Simpson, 1959b), McKenna, new combination

Diacodon bridgeri SIMPSON, 1959, Amer. Mus. Novitates, no. 1966, p. 1.

MATERIAL: Type only, A.M.N.H. No. 56032, right lower jaw with P_4–M_3.

HORIZON AND LOCALITY: Bridger Formation, late Bridgerian, locality 6 of McGrew and others (1959), Tabernacle Butte area, Sublette County, Wyoming.

DISCUSSION: Simpson's (1959b) beautifully illustrated discussion of this third known specimen of a Bridgerian leptictid did not take into account work done by Gazin (1952, p. 19, and especially 1956a, pp. 15–17). Gazin has revived *Palaeictops* for *P. bicuspis*, *P. tauricinerei*, *P. pineyensis*, and *P. minutus* (the last-named was transferred to *Leptacodon* by McKenna, 1960a, p. 53). Gazin retained *Diacodon pearcei* and transferred *Prodiacodon concordiarcensis* to *Diacodon*, the type of which is *D. alticuspis*. *Diacodon? septentrionalis* was not discussed.

According to Gazin, *Diacodon* differs from *Palaeictops* in that it possesses a decidedly short P_4, with narrow, much-reduced talonid. If this is accepted as indicative of separate generic rank for *Palaeictops*, the Tabernacle Butte specimen must be placed in that genus at this time. As Simpson (1959b, p. 3) has pointed out, *P. bridgeri* is closely similar to and may be descended from *P. bicuspis*. Future collecting and study of associated upper and lower dentitions of *Hypictops*, *Parictops*, various species of *Diacodon*, and *Palaeictops bridgeri* may be expected to modify the taxonomy of these forms.

Matthew (1909, p. 342) mentioned that *Viverravus? nitidus* Marsh, 1872, the type specimen of which is Y.P.M. No. 11888, was probably a lower milk molar of some insectivore related to the Leptictidae, but was virtually indeterminate. The tooth appears to be either dP_4 or P_4 of a leptictid, as Matthew suggested. If a P_4, as it may be because of its excellently developed roots, the tooth is distinct from P_4 of *Palaeictops bridgeri* by reason of its somewhat smaller size and double paraconid. Possibly the tooth is a P_4 of *Hypictops syntaphus* Gazin, 1949, but the lower teeth of that

form are as yet either unknown or unrecognized. Simpson (1959b) believed that *Hypictops syntaphus* was probably a smaller animal than *Palaeictops bridgeri*. Y.P.M. No. 11888 is approximately the correct size to be a P_4 of *Hypictops*, and the double paraconid may be related in some way to the cuspidate P^3 of that genus. There is no similarity to the paraconid of P_4 of *Parictops multicuspis*. Y.P.M. No. 11888 is not related to *Entomodon comptus* Marsh, 1872, as suggested by Schlosser (1887). The type of *Entomodon comptus*, Y.P.M. No. 13506, appears to be an M_1 of a small species of *Thinocyon*. It appears possible, therefore, that *Viverravus? nitidus* will eventually prove to be a prior synonym of *Hypictops syntaphus*. At present the question cannot be settled.

SUPERFAMILY ERINACEOIDEA

FAMILY ERINACEIDAE

SUBFAMILY GEOLABIDINAE

CENTETODON MARSH, 1872

Centetodon pulcher Marsh, 1872

Figure 7

Centetodon pulcher MARSH, 1872, Amer. Jour. Sci., ser. 3, vol. 4, p. 209.
Hypacodon praecursor MCKENNA, 1960, Univ. California Publ. Geol. Sci., vol. 37, no. 2, p. 148.

MATERIAL: C.M. No. 13612, fragment of a left lower jaw with unworn M_2–M_3.

HORIZON AND LOCALITY: Locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," Bridger Formation, late Bridgerian, Tabernacle Butte area, Sublette County, Wyoming.

DESCRIPTION: Teeth the size of those of the types of *Centetodon pulcher* and *Hypacodon praecursor* (probable synonyms), but the jaw is not so deep. M_2 longer and taller than M_3; paraconid low and crest-like; metaconid almost as tall as protoconid, both cusps forming a ridge; talonid basined, hypoconid the largest cusp, entoconid the smallest cusp, hypoconulid well developed. M_3 smaller than M_2; trigonid similar to that of M_2; talonid reduced, with very small entoconid and a lingual margin sloping from the hypoconulid to the base of the trigonid.

DISCUSSION: Marsh (1872, p. 209) described the generotypic species *Centetodon pulcher* from a jaw fragment, Y.P.M. No. 13507, bearing an M_3. Marsh called attention to a large single cusp on the talonid, and certainly the talonid of this form is unique. Seen from above, the talonid has two cusps, a hypoconid and a hypoconulid. The lingual margin of the tooth

slopes abruptly downward and forward from the hypoconulid and has no indication of an entoconid. The trigonid of *Centetodon* is anteroposteriorly compressed and has a spatulate paraconid anterior to the protoconid and not on the midline as in *Diacodon*, *Palaeictops*, and other leptictids.

FIG. 7. *Centetodon pulcher* Marsh, 1872. *Above:* C. M. No. 13612, left M_2–M_3, locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," late Bridgerian of the Tabernacle Butte area, Sublette County, Wyoming; occlusal and buccal views. *Below:* Type specimen, Y.P.M. No. 13507, fragmentary jaw with right M_3; occlusal view. All photographs retouched. × 10.

Centetodon pulcher is known from several specimens in the Yale collection. Unworn teeth are carried in less robust jaws than worn teeth, indicating that the jaw deepened as the animal grew older.

Assignment of *Centetodon* to the Geolabidinae is based on material in the Yale collections, especially Y.P.M. No. 13619 (type of *Hypacodon praecursor* McKenna, 1960b, p. 148) which appears to be conspecific with *Centetodon pulcher*.

Centetodon? *bacchanalis* (McGrew, 1959), Robinson, new combination

Diacodon bacchanalis McGREW, *in* McGrew and others, 1959, Bull. Amer. Mus. Nat. Hist., vol. 117, art. 3, p. 150.

MATERIAL: Type, A.M.N.H. No. 55687, fragmentary left lower jaw with worn M_2–M_3.

HORIZON AND LOCALITY: Late Bridgerian, Bridger Formation, locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," Tabernacle Butte area, Sublette County, Wyoming.

DISCUSSION: McGrew (1959, p. 150) placed the type and two other specimens in this species and assigned it to *Diacodon*. The type has worn teeth, and generic assignment would be difficult with only the one specimen. The upper molar figured by McGrew (*ibid.*, fig. 6), A.M.N.H. No. 55688, may pertain to this species, but such assignment is doubtful without definitely associated material. The M_3 (misprinted M_2 in McGrew, 1959), A.M.N.H. No. 55686, which McGrew referred to this species, has three well-developed talonid cusps and belongs to neither *Centetodon* nor *C.? bacchanalis*.

A.M.N.H. No. 55687 is well enough preserved to show the placement of the paraconid of M_3 and the outline of the lingual margin of the talonid. These characters indicate that the previous assignment to *Diacodon* is erroneous and that the species may belong to *Centetodon*. McGrew's figure of the type (*ibid.*, fig. 5) indicates an entoconid on M_3. I (Robinson) fail to find any indication of this cusp on the specimen; the lingual margin of the talonid is convex, but it does not have any constriction that indicates a separation of a hypoconulid and an entoconid.

GEOLABIS COPE, 1884

Geolabis sp., cf. *Geolabis marginalis* (Cope, 1873)

Figure 8

Herpetotherium marginale COPE, 1873, Synopsis of new Vertebrata from the Tertiary of Colorado, obtained during the summer of 1873, p. 6.

Embassis marginalis (Cope, 1873) COPE, 1874, Ann. Rept. Geol. and Geogr. Surv. Territories, for 1873, F. V. Hayden, p. 468.

Geolabis rhynchaeus COPE, 1884, *in* Hayden, Report of the United States geological and geographical survey of the Territories, vol. 3, p. 808.

Metacodon mellingeri PATTERSON AND MCGREW, 1937, Publ. Field Mus. Nat. Hist., geol. ser., vol. 6, p. 258.

Geolabis marginalis (Cope, 1873) MCKENNA, 1960, Univ. California Publ. Geol. Sci., vol. 37, no. 2, p. 137.

MATERIAL: A.M.N.H. No. 55657, fragmentary right lower jaw with unworn P_4–M_1.

HORIZON AND LOCALITY: Bridger Formation, late Bridgerian, locality 15 of McGrew and others (1959), Lost Mountain, Tabernacle Butte area, Sublette County, Wyoming.

DESCRIPTION: P_4 with low paraconid on lingual side of tooth; metaconid tall, directly linguad from protoconid; protoconid taller than metaconid, as tall as protoconid of M_1; talonid with small lingual basin and deep buccal groove for occlusion with the paracone of P_4. M_1 with distinct paraconid; metaconid slightly anterior to protoconid; protoconid

and metaconid forming a crest; talonid basined, with the hypoconid the largest cusp, the entoconid the smallest, and the hypoconulid slightly larger than the entoconid. The animal was the size of *G. marginalis*.

DISCUSSION: The occurrence of *Geolabis* in late Bridgerian sediments in the Tabernacle Butte area is interesting but not unexpected. I (Robinson)

FIG. 8. *Geolabis* sp., cf. *G. marginalis* (Cope, 1873), A.M.N.H. No. 55657, fragmentary jaw with right P_4–M_1; locality 15 of McGrew and others (1959), Lost Mountain, late Bridgerian of the Tabernacle Butte area, Sublette County, Wyoming. *Above:* Buccal view. *Below:* Lingual view. Both photographs retouched. × 10.

do not place A.M.N.H. No. 55657 in *G. marginalis* for two reasons: (1) only two teeth are present on the Bridgerian specimen and that is not sufficient material for comparison; and (2) there is an appreciable difference in age between the Bridgerian and the Oligocene.

A.M.N.H. No. 55657 is closely similar to Y.P.M. No. 13609, cf. *Myolestes dasypelix*, figured by McKenna (1960b, p. 146, fig. 4).

FAMILY ERINACEIDAE

SUBFAMILY UNCERTAIN

TALPAVUS MARSH, 1872

Talpavus sp., cf. *Talpavus nitidus* Marsh, 1872

Talpavus nitidus MARSH, 1872, Amer. Jour. Sci., ser. 3, vol. 4, p. 128.

Nyctitherium nitidus (Marsh) MATTHEW, 1909, Mem. Amer. Mus. Nat. Hist., vol. 9, pt. 6, p. 538.

Diacodon bacchanalis, referred specimen, MCGREW, *in* McGrew and others, 1959, Bull. Amer. Mus. Nat. Hist., vol. 117, art. 3, p. 150.

MATERIAL: A.M.N.H. No. 55686, fragmentary right lower jaw with M_3 (misprinted M_2 in McGrew and others, 1959, p. 150) and part of the ascending ramus.

HORIZON AND LOCALITY: Late Bridgerian, Bridger Formation, locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," Tabernacle Butte area, Sublette County, Wyoming.

DISCUSSION: This specimen was referred to *Diacodon bacchanalis* by McGrew (*in* McGrew and others, 1959, p. 150), but appears to represent a species of *Talpavus*. It also resembles *Entomolestes grangeri* Matthew, 1909, from the Bridger B near Lyman, Wyoming. It differs from *E. grangeri*, however, in possessing a distinct, almost vespiform constriction between the trigonid and the talonid, a higher trigonid, and a better-defined hypoconulid. As in *E. grangeri*, the entoconid is the highest talonid cusp (in contrast to *Centetodon? bacchanalis*), and the hypoconid shows some wear. In most Nearctic Eocene erinaceids the hypoconid becomes increasingly shelf-like with wear, and the entoconid furnishes the only relief on the talonid.

A specimen from Myton Pocket in the Uinta Formation, C.M. No. 12061, a fragmentary left lower jaw with P_4–M_3, is very similar to A.M.N.H. No. 55686 and to the type of *Talpavus nitidus*, Y.P.M. No. 13511, and is probably congeneric with them. The Carnegie Museum specimen differs from *Entomolestes grangeri* in having a well-developed metaconid and a low, lingual paraconid on P_4. M_1–M_2 are very similar to those of the type of *Talpavus nitidus*.

SCENOPAGUS MCKENNA AND SIMPSON, 1959

Scenopagus edenensis (McGrew, 1959), Robinson, new combination

Diacodon edenensis MCGREW, *in* McGrew and others, 1959, Bull. Amer. Mus. Nat. Hist., vol. 117, art. 3, p. 148.

Scenopagus mcgrewi MCKENNA AND SIMPSON, 1959, Amer. Mus. Novitates, no. 1952, p. 2.

MATERIAL: Type: A.M.N.H. No. 55685, fragmentary right lower jaw

with M_1–M_3, locality 10 of McGrew and others (1959), Laney Shale Member of the Green River Formation (see Bradley, 1959), Sublette County, Wyoming. Referred specimens from Tabernacle Butte and vicinity: A.M.N.H. No. 56034, fragment of a left lower jaw with M_3 referred by McKenna and Simpson (1959) to *Scenopagus mcgrewi*, from University of California V-5628, 150 yards southeast of University of Wyoming 6 and at the same level, upper Bridger Formation, Elk Mountain and Tabernacle Butte area, Sublette County, Wyoming; and A.M.N.H. No. 56035, fragment of a left maxilla with P^3–M^2, type of *Scenopagus mcgrewi*, also from University of California V-5628.

Discussion: Both the *Scenopagus edenensis* jaw from the Laney Shale locality and the one from the younger site near Tabernacle Butte lack the premolars. However, a specimen from the upper faunal zone of the Huerfano Formation, A.M.N.H. No. 17483, has P_4–M_3 preserved and shows, as suggested by Simpson (*in* McKenna and Simpson, 1959, p. 6), that *Scenopagus edenensis* is definitely not a leptictid; it is an erinaceid. The differences mentioned by McKenna and Simpson (1959, p. 6) between A.M.N.H. No. 55685 and No. 56034 seem to be of subspecific rank or of individual variation. Ten lower jaw fragments of *Scenopagus edenensis* from the Bridger Formation are available; four of these possess M_3. These specimens are A.M.N.H. Nos. 55685 and 56034, from locality 10 and U.C.M.P. V-5628; and A.M.N.H. No. 12619 and Y.P.M. No. 13612–1, from the type Bridger.

Simpson (*in* McKenna and Simpson, 1959, p. 6) stated that *Scenopagus mcgrewi* was more closely related to *Diacodon edenensis* (=*S. edenensis*) than the latter was to true leptictids. Additional material in the collections of the Carnegie Museum indicates that the two species are synonymous, although subspecies may be involved. Carnegie Museum specimens from the Green River Formation of Utah, only slightly older than the Tabernacle Butte specimens, have more parts of the animal represented and show more clearly the variation in size. *Scenopagus mcgrewi* was based on a fragment of maxilla which is larger than any of the jaw material at hand with which to compare it, but maxillae from Utah are morphologically similar and slightly smaller and can be occluded with jaws of *S. edenensis*.

ORDER CHIROPTERA

FAMILY UNCERTAIN

Undescribed genus and species

Figure 9

Material: A.M.N.H. No. 55696, fragmentary right lower jaw with

M_2, alveoli of M_3, and the coronoid process.

HORIZON AND LOCALITY: Late Bridgerian, Bridger Formation, locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," Elk Mountain and Tabernacle Butte area, Sublette County, Wyoming.

DESCRIPTION: The jaw is broken off behind the coronoid process and in front of M_2; the coronoid process is rounded on top, the anterior edge sloping almost vertically downward to the gum line. The masseteric fossa is deep, bounded in front by a sharp ridge and below by a more rounded ridge; a small ridge is present at the level of the tooth line on the internal

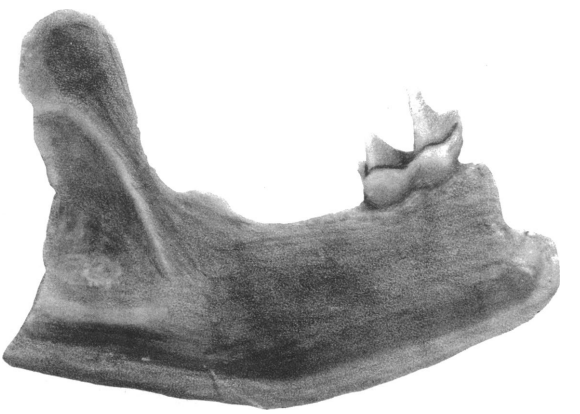

FIG. 9. Chiropteran. A.M.N.H. No. 55696, lower jaw fragment with right M_2; locality 5 of McGrew and others (1959), "*Hyopsodus* Hill," late Bridgerian of the Tabernacle Butte area, Sublette County, Wyoming. Buccal view. Photograph retouched. × 10.

side of the coronoid; a muscle scar extends forward from this ridge and ends in a boss halfway between the rear alveolus of M_3 and the leading edge of the coronoid.

M_2 is similar to molars of many small insectivorous mammals; the trigonid is shorter anteroposteriorly than the talonid; the paraconid is cuspate, smaller than the protoconid, and very similar to the paraconid of *Nyctitherium velox*. The protoconid is large and sectorial; the metaconid is missing, but the size of the scar indicates a large cusp; the talonid has a well-developed hypoconid and entoconid; the hypoconulid is absent. The tooth is bound in front, on the buccal side, and at the rear by a large, distinct cingulum which begins below the paraconid and ends in the entostylid behind the entoconid. A small cuspule is present immediately buccad of the entostylid. The basal margin of the jaw slopes upward at

an incline of 30 degrees below the rear alveolus of M_3.

DISCUSSION: This specimen is interesting because it demonstrates the presence of bats at Tabernacle Butte in the Eocene. The similarity to *Eptesicus* is striking, and the fossil may be related to that living genus. The formation of the entostylid from the cingulum distinguishes the cusp from a hypoconulid derived from a metalophid or similar hypoconid-entoconid crest.

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