The background of the cover is a detailed, light-colored photograph of numerous fossilized trilobites. The trilobites are arranged in various orientations, showing their characteristic three-lobed body structure. The fossils are set against a dark, almost black background, which makes the lighter, textured surfaces of the trilobites stand out. The overall appearance is that of a scientific or paleontological specimen collection.

Rodents of the Bridgerian
(Middle Eocene)
Elderberry Canyon
Local Fauna of Eastern Nevada

ROBERT J. EMRY
and
WILLIAM W. KORTH

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(Middle Eocene) Elderberry Canyon
Local Fauna of Eastern Nevada

*Robert J. Emry
and William W. Korth*



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ABSTRACT

Emry, Robert J., and William W. Korth. Rodents of the Bridgerian (Middle Eocene) Elderberry Canyon Local Fauna of Eastern Nevada. *Smithsonian Contributions to Paleobiology*, number 67, 14 pages, 5 figures, 1989.—The Elderberry Canyon Local Fauna, presently represented by more than 40 vertebrate taxa, including at least 30 mammals, occurs in carbonate rocks assigned to the Sheep Pass Formation, near Ely, Nevada. Among the mammals, nine rodent species, representing four families, are recognized. *Reithroparamys delicatissimus*, and *R. cf. R. huerfanensis* are species previously known from the Rocky Mountain region; *Microparamys sambucus* and *Pauromys exallos* are new species assigned to genera commonly occurring in Eocene faunas elsewhere; *Elymys complexus* is a new genus and species of minute rodent thought to be related to *Simimys* and questionably assigned to the family Zapodidae; *Sciuravus*, *Mattimys*, and *Knightomys* are represented by material not assignable to species; and another unidentified ischyromyid completes the roster of rodents presently known in the assemblage. The fauna as a whole, and the rodents in particular, share the greatest homotaxial similarity with early Bridgerian (early middle Eocene) faunas elsewhere, allowing a confident early Bridgerian age assignment for the Elderberry Canyon Local Fauna. The composition of this rodent assemblage suggests that faunal interchange was relatively unrestricted from southern California through Nevada to the Rocky Mountain region in Bridgerian time.

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Rodents of the Bridgerian (Middle Eocene) Elderberry Canyon Local Fauna of Eastern Nevada

*Robert J. Emry
and William W. Korth*

Introduction

The Elderberry Canyon Local Fauna (Emry, in press), the first Eocene mammalian fauna reported from the Great Basin, occurs in carbonate rocks referred to the Sheep Pass Formation near Ely, in White Pine County, Nevada. The quarryable concentration of bone that has produced the fauna was discovered in 1975 by Dr. Thomas Fouch of the U.S. Geological Survey, who guided one of us (Emry) to the locality in the summer of 1976, and assisted in collecting more of the bone-bearing limestone. The delicate and time consuming job of extracting the fragile fossil material from the limestone, by etching in dilute formic acid, has proceeded almost uninterrupted since that time, with additional rock being collected in 1977, 1979, 1980, and 1983. The Elderberry Canyon Local Fauna, as presently known, includes at least 40 taxa of vertebrates, more than 30 of which are mammals (Emry, in press). This report describes in detail the nine species of rodents presently known from Elderberry Canyon.

The order of authorship of this report is alphabetical, and does not necessarily indicate the order of greatest contribution, which we consider to have been nearly equal and complementary.

ABBREVIATIONS.—Acronym prefixes denoting institutional collections are: AMNH (American Museum of Natural History, New York); CM (Carnegie Museum of Natural History, Pittsburgh); FMNH-PM (Field Museum of Natural History, Chicago); USNM (National Museum of Natural History,

Washington); YPM (Yale Peabody Museum, Yale University); YPM-PU (original Princeton University number of specimen now at Yale Peabody Museum).

When used with dental notations, L = left and R = right. Also in dental notations, an upper case letter indicates upper or maxillary teeth, and a lower case letter indicates lower or dentary teeth (for example P4 is the upper fourth premolar, and m1 is the lower first molar).

In dental descriptions and measurements, a-p = anteroposterior and tr = transverse. In lower dentitions, two transverse measurements may be indicated; tra is across the anterior, or trigonid, part of the tooth, and trp is across the posterior, or talonid, part.

ACKNOWLEDGMENTS.—The one contribution prerequisite to any study of the fauna that might have been undertaken was the discovery of the Elderberry Canyon bone bed by Dr. Thomas D. Fouch of the U.S. Geological Survey. We gratefully acknowledge Dr. Fouch for this as well as for guiding the senior author to the locality and helping to collect additional limestone for preparation. We thank Dan Chaney, John Flynn, Frederick Grady, Arnold Lewis, and Michael Pechacek for ably assisting, at one time or another, in the increasingly difficult task of collecting additional rock in the field. The formic acid preparation process has been administered for more than a decade now, first by Frederick Grady and then by Dan Chaney, both of the Vertebrate Paleontology Preparation Laboratory at the NMNH. The figures were rendered by Jennifer Emry. For their helpful critical reviews of the manuscript we thank Dr. John E. Storer of the Saskatchewan Museum of Natural History and Dr. Robert W. Wilson of the Museum of Natural History at the University of Kansas.

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Order RODENTIA Bowdich, 1821

Family ISCHYROMYIDAE Alston, 1876

Subfamily REITHROPARAMYINAE Wood, 1962

Genus *Reithroparamys* Matthew, 1920

TYPE SPECIES.—*Paramys delicatissimus* Leidy, 1871.

RANGE.—Wasatchian to Uintan (early to middle Eocene) of North America.

REFERRED SPECIES.—*R. sciuroides* (Scott and Osborn, 1887); *R. debequensis* Wood, 1962; *R. huerfanensis* Wood, 1962; *R. ctenodactylops* Korth, 1984.

DISCUSSION.—In the latest review of the genus *Reithroparamys*, Wood (1962) recognized seven valid species. Korth (1984) named a new species, *R. ctenodactylops*, from the Wasatchian of Wyoming, and transferred two Wasatchian species, *R. atwateri* and *R. pattersoni*, to a new genus *Acritoparamys*.

One of the Bridgerian species named by Wood (1962), *R. matthewi*, is based on two specimens. The type specimen (YPM 13399-1) consists of both mandibular rami of one individual. The molars of the holotype are less lophate than the lower cheek teeth of its contemporary *R. delicatissimus*, and also lack the partial hypolophid that is characteristic of all other species of *Reithroparamys*. The single referred specimen of *R. matthewi* (YPM 14631; listed as YPM 13398-1 by Wood, 1962:138) is considerably more lophate than the holotype and does have a distinct partial hypolophid. Wood (1962) concluded that *R. matthewi* is more advanced than *R. delicatissimus*, basing his reasoning on features of the referred specimen. However, the single referred specimen of *R. matthewi* does not differ in size (see Wood, 1962, tables 46, 48) or in morphology from many referred specimens of *R. delicatissimus*, and should be referred to that species. This leaves *R. matthewi* represented only by the holotype, which, for the morphologic reasons mentioned above, cannot be referred to *Reithroparamys*. The lower cheek teeth of the holotype of *R. matthewi* do have features seen in *Acritoparamys*, and appear to be indistinguishable from lower cheek teeth of *A. wyomingensis* (= *Microparamys wyomingensis* Wood, 1959; = *Paramys wyomingensis* West, 1969, 1973). Thus, based on the type specimen, *Reithroparamys matthewi* Wood, 1962, is considered a junior synonym of *Acritoparamys wyomingensis* (Wood, 1959a).

Wood (1962) referred *Plesiarctomys sciuroides* Scott and Osborn, (1887) from the Uinta Formation of Utah, to *Leptotomus* Matthew (1910). This species is clearly referable to *Reithroparamys* and distinct from *Leptotomus* because of (1) smaller size; (2) rostrum of the skull short and tapered anteriorly; (3) posterior edge of nasal bones even with posterior edge of premaxillaries; (4) auditory bullae large, ossified, and attached to the skull; (5) posterior margin of anterior root of the zygoma even with the posterior half of P4; (6) upper incisor with a shallow central groove; (7) tibia slender and elongated;

(8) P4 not showing anteroposteriorly compressed triangular shape, as in *Leptotomus*; and (9) partial hypolophid present on lower molars. On the posterior part of the skull of *R. sciuroides* (YPM-PU 11555) a fragment of cranium has a low non-central temporal crest (i.e., not a single sagittal crest). This crest, and the configuration of the parasagittal crests on the anterior portion of the skull of *R. sciuroides*, are similar to those on the skull of *R. delicatissimus* (AMNH 12561; see Wood, 1962, fig. 41). The rostrum of YPM-PU 11555 appears broader than that of AMNH 12561, but this is merely due to dorsoventral crushing of the *R. sciuroides* skull.

These characters of the skull, and also of the tibia, that are shared by these two species, *R. sciuroides* and *R. delicatissimus*, are not seen in other ischyromyid genera. Both P4's of the type of *R. sciuroides* are very heavily worn and have some minor breakage along their lingual margins, eliminating any possibility of determining whether or not these teeth ever possessed a hypocone. Wood (1962) stated that there is no trace of a hypocone on P4 of *R. sciuroides* (YPM-PU 11555), which would make it unlike any other known reithroparamyine (Korth, 1984:26). However, Scott and Osborn (1887, pl. XI, fig. 1c) originally figured the type specimen of *R. sciuroides* with a hypocone on P4. Because the first illustration of the specimen shows a P4 hypocone that could have been removed by subsequent breakage, and because all other features of the skeleton and dentition of the type specimen of *R. sciuroides* are similar to those of other *Reithroparamys*, the species is transferred to that genus.

Reithroparamys gidleyi (Peterson, 1919) is known from a single specimen, CM 3461, which is a partial jaw with m1-m2. These teeth are almost identical in size to those of *R. sciuroides* (see Wood, 1962, tables 33, 34, 48). The heavily worn condition of these teeth in the type of *R. sciuroides* precludes comparing most of their crown morphologies to those of *R. gidleyi*. However, in the few features that can be compared (presence of partial hypolophid, size of trigonid, occlusal outline) the two species appear to be identical. This, combined with the fact that the holotypes of both *R. gidleyi* and *R. sciuroides* are from the same horizon of the Uinta Formation, make it reasonable to assume that the two specimens represent but one species.

Five species of *Reithroparamys* are recognized here, *R. ctenodactylops* and *R. debequensis* from the Wasatchian, *R. huerfanensis* and *R. delicatissimus* from the Bridgerian, and *R. sciuroides* from the Uintan.

Reithroparamys delicatissimus (Leidy, 1871)

TABLE 1

REFERRED SPECIMENS.—USNM 336407, 336408, 417489–417492, all isolated lower molars; and USNM 336406, RP4.

DISCUSSION.—*Reithroparamys delicatissimus* is the largest rodent presently represented in the Elderberry Canyon Local Fauna. Considering the volume of limestone already processed

TABLE 1.—Measurements (in millimeters) of teeth of *Reithroparamys delicatissimus* from Elderberry Canyon Quarry.

USNM #	p4			m1 or m2			m3		
	a-p	tra	trp	a-p	tra	trp	a-p	tra	trp
336407	3.11	2.08	2.06						
336408				3.22	2.98	3.15			
417489				3.31	2.69	2.86			
417491				3.18	2.63	3.04			
417490							4.05	2.95	2.87
417492							3.58	2.81	2.68
	P4								
	a-p	tr							
336406	2.42	2.98							

from the site, it seems likely that if larger rodents occur there they would have been found. This suggests that the absence of larger ischyromyids is due to taphonomic, or possibly local environmental, controls. The isolated teeth referred here to *R. delicatissimus* do not differ detectably from the topotypic material described by Wood (1962).

Reithroparamys cf. *R. huerfanensis* Wood, 1962

FIGURE 1; TABLE 2

REFERRED SPECIMEN.—USNM 336409–336414, 417493, 417494, all isolated upper cheek teeth; USNM 336415, a partial maxilla with LDP3-M1; and USNM 417495, partial maxilla with LM1-M2.

DESCRIPTION.—DP3 small, single rooted; single main cusp at anterolingual corner of tooth with low continuous shelf on all sides. DP4 triangular in occlusal outline, expanded anteriorly in parastylar area; anterior cingulum running from buccal slope of protocone to buccal margin of tooth, bowing anteriorly at parastyle; hypocone distinct, smaller and lingual to protocone; metaconule single, larger than protoconule; small cuspule buccal to protoconule; mesostyle anteroposteriorly

elongate; posterior cingulum extending from hypocone to buccal margin of tooth. P4 not represented in the Elderberry Canyon sample.

M1 similar morphologically to those of *R. delicatissimus* (see Wood, 1962); protoloph and metaloph less lophate than in *R. delicatissimus*; protoconule a distinct cusp slightly anterior to paracone; a small cusp present along a small loph running anterobuccally from the protocone, sometimes represented by a distinct crest running between protoloph and anterior cingulum; metaconule doubled; conules large and of subequal size, slightly smaller than metacone; mesostyle relatively large; all other morphology appears to be as in *R. delicatissimus*.

M2 longer buccally than M1; protoconule less distinct and more lingually positioned than in M1; otherwise similar in all features to M1.

M3 lacking hypocone and metacone; metaconule doubled, conules small; cuspule anterobuccal to protocone distinct; tooth expanded posterobuccally.

DISCUSSION.—No upper molars have previously been described for *Reithroparamys huerfanensis*. The specimens listed above are referred to this species because they are of the right size (Table 2), and because of their general similarity to the upper cheek teeth of *R. delicatissimus*. These teeth are smaller than those of *R. delicatissimus* and differ morphologically in their more cuspsate lophs, and the presence of an accessory cuspule or lophule anterior and buccal to the protocone. This lophule is a distinct feature of most primitive aplodontids (see Rensberger, 1975). *Reithroparamys huerfanensis* also shares several other features with early aplodontids: (1) the masseteric fossa placed more anteriorly on the mandible; (2) a distinct (though not complete) hypolophid on the lower molars; (3) doubled metaconule on the upper molars, a feature seen in *Prosciurus vetustus*, the earliest known species of *Prosciurus*, from the Chadronian of Montana.

Currently, the earliest aplodontid recognized is *Spurimus*



FIGURE 1.—Upper dentition of *Reithroparamys* cf. *R. huerfanensis* from Elderberry Canyon Quarry: A, USNM 336415, LdP3-M1; B, USNM 336412, LM1 or M2; C, USNM 336410, LM3. (All in occlusal aspect, all approximately $\times 16$, bar = 1 mm.)

TABLE 2.—Measurements (in millimeters) of teeth of *Reithroparamys* cf. *R. huerfanensis* from Elderberry Canyon, Quarry.

USNM #	dP3		dP4		M1		M2		M3	
	a-p	tr	a-p	tr	a-p	tr	a-p	tr	a-p	tr
336415	0.46	0.81	2.04	2.21	2.35	2.90				
336411			2.19	2.38						
336414			2.19	2.37						
417494					2.31	2.73	2.25	2.73		
417495					2.24	2.97	2.29	2.86		
336409*					2.45	2.74				
336412*					2.28	2.60				
336413*					2.23	2.43				
336410									2.64	2.54

*M1 or M2

Black, (1971) from the Uintan of Wyoming, which is not a likely ancestor for *Prosciurus* Matthew (1903) but which may be ancestral to *Pelycomys* Galbreath (1953), which ranges from Chadronian to Whitneyan (Korth, 1986).

The similarities of the dentition of *R. huerfanensis* to that of the type species of the genus, *R. delicatissimus*, are close enough to include *R. huerfanensis* in this genus. However, the similarities seen between *R. huerfanensis* and primitive *Prosciurus* suggests that the origin of Aplodontidae might be found within the Reithroparamyinae.

If these upper teeth are correctly assigned to *R. huerfanensis*, then the presence of this taxon in the Elderberry Canyon Local Fauna is perhaps the best indicator, among the known rodents, of earliest Bridgerian time (= Gardnerbuttean sensu Stucky, 1984).

Subfamily MICROPARAMYINAE Wood, 1962

Genus *Microparamys* Wood, 1959a

Microparamys sambucus, new species

FIGURE 2; TABLE 3

TYPE SPECIMEN.—USNM 336417, left ramus of mandible with i1 and m1-m2.

LOCALITY AND HORIZON.—Elderberry Canyon Quarry, near Ely in White Pine County, Nevada, from rocks referred to the Sheep Pass Formation.

AGE.—Early Bridgerian (early Middle Eocene).

REFERRED SPECIMENS.—USNM 336392–336403, 336419, 336428, 404716, 417479–417488, 417498, 417499; all isolated cheek teeth.

DIAGNOSIS.—Lower molars with anterior cingulum terminating buccally in small cuspule, and separated from metaconid; posterior arm of protoconid complete to metaconid; entoconid separate from posterolophid with a partial hypolophid extending into talonid basin; mesoconid small and circular; metastylids minute to absent; metaconule on upper molars very small to absent and metaloph incomplete or weakly connected to protocone.

ETYMOLOGY.—From the Latin *sambucus* (elder), the genus

of elderberry.

DESCRIPTION.—Mandible slender; masseteric fossa terminating anteriorly below anterior end of m2; mental foramen high and just anterior to p4. Lower incisor laterally compressed with flattened anterior face. All other features of mandible obscured due to crushing of USNM 336417 (the only mandibular specimen).

Dp4 is the smallest cheek tooth; metaconid larger than protoconid; minute cuspule anterior and slightly lingual to protoconid; trigonid buccolingually compressed; entoconid small, isolated with short hypolophid running posterobuccally, ending anterior to posterolophid; posterolophid separated from entoconid by groove; mesoconid small, circular; no ectolophid present.

The occlusal outline of m1 and m2 is rectangular; m1 slightly smaller than m2; anterior cingulum short, separated from metaconid by shallow groove and ending buccally in a distinct cuspule; posterior arm of the protoconid extends entire width of trigonid to base of metaconid, closing trigonid posteriorly; mesoconid small and circular; entoconid separated from posterolophid with short hypolophid curving anterobuccally, often fusing with posterolophid at center; ectolophid weakly developed or absent.

The posterior part of m3 is narrower than the anterior part, and the posterolophid is bowed posteriorly, but this tooth is otherwise similar to the more anterior molars.

USNM 404716 is a fragment of+ maxilla with P3 and alveolus for P4. P3 is small, single rooted, with a conical crown; on the portion of the maxilla anterior to P3 a small bony knob is preserved, similar to that described in earlier species of *Microparamys* (Korth, 1984:39).

DP4 is similar to that of *M. minutus* (Dawson, 1968:339); triangular in occlusal outline; protoloph incomplete; protoconule minute, sometimes doubled; anterior cingulum running entire width of tooth from protocone; metaconule elongate swelling along metaloph; metaloph curving anteriorly, connected to protocone by small, thin loph; posterior cingulum running entire width of tooth; hypocone slightly smaller than protocone, positioned posterior and lingual to protocone.

P4 has a small hypocone; protoconule reduced; metaconule

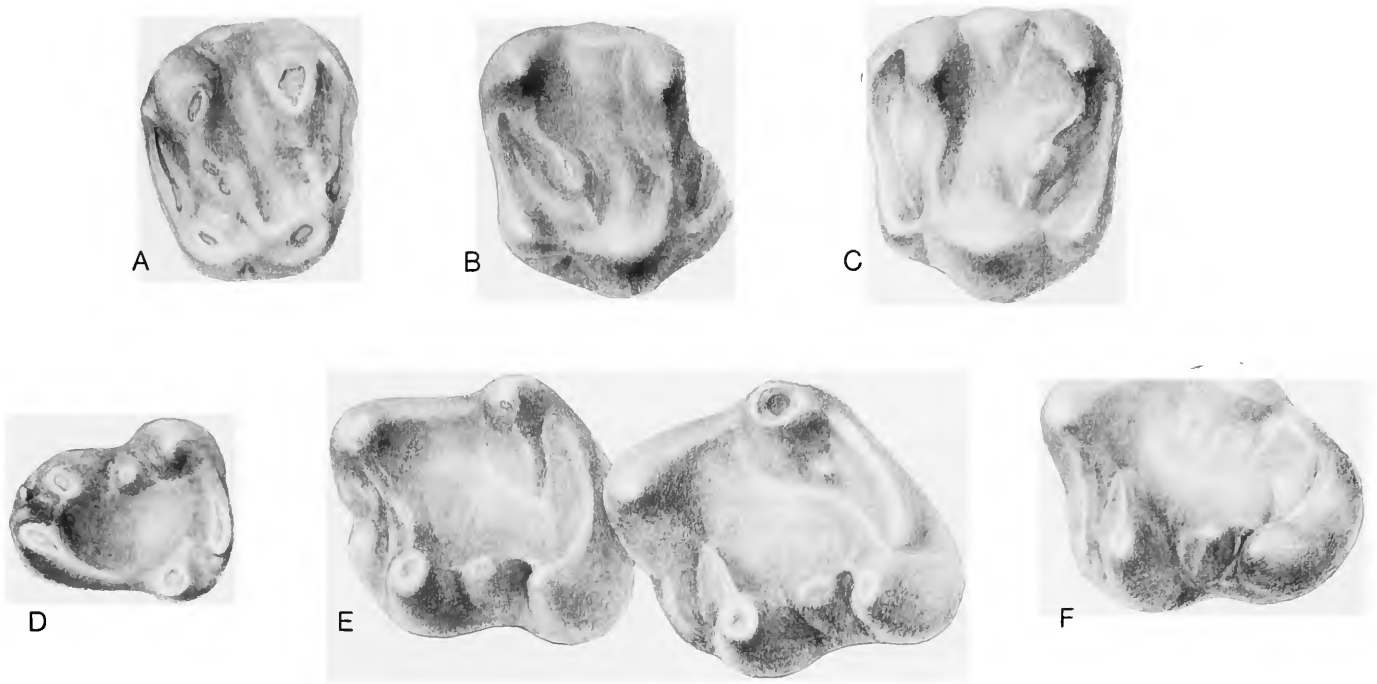


FIGURE 2.—Dentition of *Microparamys sambucus*, new species, from Elderberry Canyon Quarry: A, USNM 417488, RP4; B, USNM 336392, RM1 or M2; C, USNM 417482, LM1 or M2; D, USNM 417486, Rdp4; E, USNM 336417 (type), Lm1-m2; F, USNM 417484, Lm3. (All in occlusal aspect, all approximately $\times 17$, bar = 1 mm.)

doubled but minute; metaloph not continuous with protocone; mesostyle anteroposteriorly elongate; anterior and posterior cingula extending entire width of tooth.

M1 and M2 are indistinguishable from one another as separate teeth; protoconule absent, protoloph continuous from paracone to protocone; metaconule absent, reduced to part of loph, or multiple minute cuspsules; metaloph connected to protocone by weak loph, separated from protocone on one specimen.

M3 is similar to the anterior molars in the morphology of the anterior cingulum and protoloph, but the metaloph, metacone, and hypocone are absent; tooth expanded anterobuccally; posterior cingulum forms rim around posterior half of tooth.

Measurements in millimeters of the holotype are: m1, a-p = 1.43, tra = 1.22, trp = 1.46; m2, a-p = 1.53, tra = 1.41, trp = 1.60. Statistics of measurements of the entire sample of *Microparamys sambucus* are given in Table 3.

DISCUSSION.—*Microparamys sambucus* differs from the Bridgerian *M. minutus* and is similar to the later species *M. dubius* and *Microparamys* sp. D (Wood, 1962) in: (1) anterior cingulum of lower molars with buccal cuspsule; (2) posterior arm of protoconid complete; (3) hypolophid present; (4) metastylid reduced. The lower molars of *Microparamys sambucus* differs from those of the Uintan *M. dubius* (Dawson, 1966, 1974) in having a metastylid (though quite reduced), having only a partial hypolophid that does not extend the entire

width of the talonid, and having a valley separating the anterior cingulum from the metaconid. *Microparamys* sp. D (Wood, 1962) from the Uintan of California differs from *M. sambucus*

TABLE 3.—Statistics of measurements of teeth, including those of holotype, of *Microparamys sambucus* from Elderberry Canyon Quarry. (Abbreviations: N = number of specimens; M = mean; OR = observed range of measurements; S = standard deviation; CV = coefficient of variation; measurements in millimeters.)

		N	M	OR	S	CV
dp4	a-p	4	1.22	1.15-1.32	.06	5.3
	tr	4	1.26	1.18-1.38	.09	00.0
P3	a-p	1	0.39			
	tr	1	0.34			
P4	a-p	1	1.16			
	tr	1	1.32			
M1 or M2	a-p	6	1.49	1.40-1.66	.09	5.9
	tr	7	1.67	1.49-1.84	.12	7.3
M3	a-p	1	1.48			
	tr	1	1.49			
dp4	a-p	3	1.36	1.17-1.46	.13	9.7
	tra	3	0.82	0.68-0.93	.10	12.0
	trp	3	1.03	0.98-1.13	.07	6.6
m1 or m2	a-p	5	1.53	1.43-1.67	.10	6.2
	tra	5	1.37	1.18-1.53	.15	10.7
	trp	5	1.49	1.36-1.60	.09	5.9
m3	a-p	1	1.84			
	tra	1	1.59			
	trp	1	1.59			

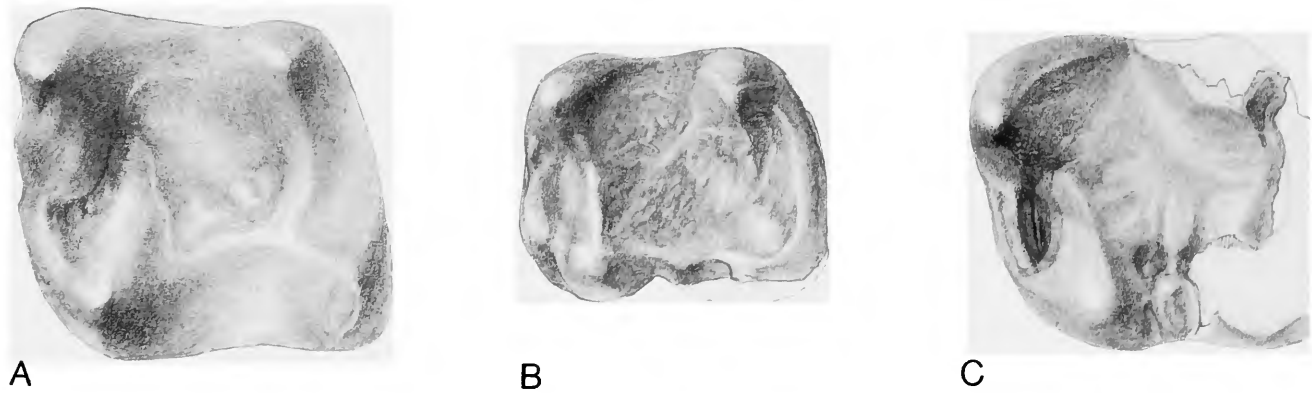


FIGURE 3.—Lower molars of indeterminate ischyromiid, *Mattimys* sp., and *Knightomys* sp. from Elderberry Canyon Quarry: A, Ischyromyidae, species indeterminate, USNM 417496, Lm1 or m2; B, *Mattimys* sp., USNM 336416, Lm1; C, *Knightomys* sp., USNM 336419, Lm2. (All in occlusal aspect, all approximately $\times 20$, bar = 1 mm.)

by the same features as does *M. dubius* as well as by the presence of a crescentic mesoconid not seen in *M. sambucus*. The weak connection of the metaloph to the protocone on the upper cheek teeth of *M. sambucus* is not known in any other species of *Microparamys*.

It seems likely that *M. sambucus* is ancestral to *M. dubius* and *Microparamys* sp. D, based on their shared derived similarities, which are absent in the other Bridgerian species *M. minutus*. *Microparamys sambucus*, *M. dubius*, and *Microparamys* sp. D may represent a distinct lineage of *Microparamys* separate from all other known North American species.

Ischyromiid, species indeterminate

FIGURE 3A

REFERRED SPECIMEN.—USNM 417496, Lm1 or m2.

DESCRIPTION.—Small tooth (a-p = 1.95 mm; tra. = 1.96 mm; tp = 1.82 mm); approximately square in occlusal outline; anterior cingulum short, continuous from metaconid to protoconid; metaconid anterior to protoconid; posterior arm of protoconid extending half the width of the tooth; enamel of talonid basin rugose; ectolophid connecting protoconid to hypoconid; mesoconid minor swelling on ectolophid; metastylid absent; hypolophid continuous from entoconid to hypoconid; posterior cingulum running entire width of tooth from hypoconid.

DISCUSSION.—USNM 417496 is similar to *Microparamys* in size and occlusal outline, but differs from it in the presence of rugose enamel in the talonid basin, anterior cingulum continuous with the protoconid and posterolophid continuous with the entoconid. The only genera that are of similar size to USNM 417496 and that have rugose enamel are *Mattimys* and *Lophiparamys*. However, both these genera have buccally free

anterior cingula as in *Microparamys*. All of the features that separate USNM 417496 from *Microparamys* are features of paramyines. The complete hypolophid of USNM 417496 is virtually unknown in paramyines and reithroparamyines. Among all the ischyromyids except *Ischyromys* itself, only a few species of *Leptotomus* have lower molars with complete hypolophids (Black, 1971; Nelson, 1974).

Family SCIURAVIDAE Miller and Gidley, 1918

Genus *Sciuravus* Marsh, 1871

Sciuravus species

TABLE 4

REFERRED SPECIMENS.—USNM 336389-336391, all isolated upper molars.

DISCUSSION.—Measurements of these teeth from Elderberry Canyon show that they fall within the size range of either *Sciuravus nitidus* or *S. eucristadens* (Wilson, 1938a:133; Dawson, 1968, table 4; Table 4, this paper). However, these species can be distinguished from one another only by characters of the lower dentition (Dawson, 1968), so no specific identification can be made at present on the material available from Elderberry Canyon.

TABLE 4.—Measurements (in millimeters) of teeth of *Sciuravus* species from Elderberry Canyon Quarry.

USNM #	dP4		M1 or m2	
	a-p	tr	a-p	tr
336404	1.82	2.10		
336408	1.84	2.03		
336389			2.60	2.82

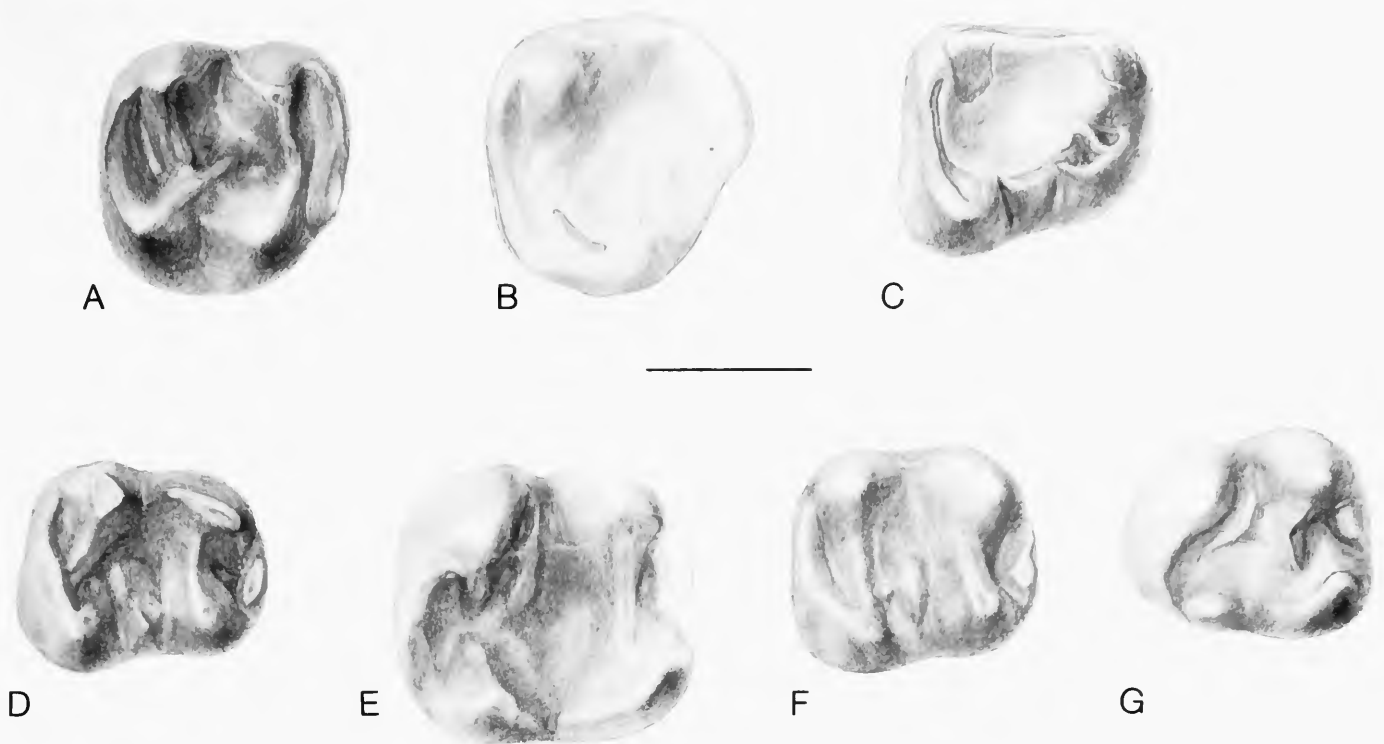


FIGURE 4.—Dentition of *Pauromys exallos*, new species, from Elderberry Canyon Quarry: A, USNM 336423, LM1 or M2; B, USNM 336429, LM3; C, USNM 336401, Rp4; D, USNM 336425 (type), Rm1; E, USNM 336427, Lm2; F, USNM 336426, Rm2; G, USNM 336420, Lm3. (All in occlusal aspect, all approximately $\times 18$, bar = 1 mm.)

Genus *Pauromys* Troxell, 1923

Pauromys exallos, new species

FIGURE 4; TABLE 5

TYPE SPECIMEN.—USNM 336425, Right m1.

HORIZON AND LOCALITY.—Elderberry Canyon Quarry, near Ely, in White Pine County, Nevada, from rocks referred to the Sheep Pass Formation.

AGE.—Early Bridgerian (early middle Eocene).

REFERRED SPECIMENS.—USNM 336418, 336420–336424, 336426, 336427, 336429, 336430, and 417474; all isolated cheek teeth.

DIAGNOSIS.—Largest species of the genus; p4 nearly equal to m1 in length; mesoconid buccolingually elongate on lower cheek teeth; hypolophid on lower molars complete or represented by two lophs originating from entoconid and hypoconid, respectively.

ETYMOLOGY.—From the Greek, *exallos* (very different).

DESCRIPTION.—Only specimen of p4 (USNM 336401) heavily worn; trigonid buccolingually compressed, metaconid largest cusp; mesoconid buccolingually elongate; entoconid separated from posterolophid with short hypolophid; no distinct hypoconulid present; length of p4 nearly equals that of m1.

The m1 is narrower anteriorly than posteriorly; anterior cingulum ending buccally in small cuspule, separate from protoconid; posterior arm of protoconid extends entire width of tooth to base of metaconid; no ectolophid present; mesoconid elongate, running slightly posterolingually; hypolophid complete from entoconid to hypoconid, or arises from both entoconid and hypoconid and disappears at its center, lingual half fusing with posterolophid; entoconid separated from posterolophid.

Except for being broader anteriorly and slightly larger, m2 is similar to m1; m3 with trigonid as in m2; hypolophid greatly reduced or absent; posterolophid convex posteriorly, lengthening the anteroposterior dimension of the tooth.

M1 or M2 nearly square in outline; hypocone subequal to protocone in size; conules absent, submerged in continuous lophs; anterior cingulum running nearly the entire width of tooth parallel to and separated from protoloph; posterobuccally directed loph from protocone and anteriorly directed loph from center of metaloph fuse at center of tooth; small anterobuccally directed loph arises from junction of previously mentioned lophs.

M3 protoloph as in anterior molar; anterior cingulum extends entire width of tooth; posterior lophule from protocone absent on USNM 336429, present on USNM 417474; hypocone small, buccal and posterior to protocone; low, broad

TABLE 5.—Measurements (in millimeters) of teeth of *Pauromys exallos* from Elderberry Canyon.

USNM #	p4			m1			m2			m3		
	a-p	tra	trp	a-p	tra	trp	a-p	tra	trp	a-p	tra	trp
336401	1.36	0.96	1.32									
336425*				1.34	1.04	1.20						
336430				1.29	0.93	1.13						
336418							1.40	1.19	1.20			
336424							1.45	1.20	1.25			
336426							1.37	1.15	1.17			
336427							1.65	1.48	1.59			
336420										1.46	1.18	0.95
336421										1.42	1.08	0.93
336422										1.34	1.14	1.09
336429										1.43	1.35	1.18
	M1 or M2			M3								
	a-p	tr		a-p	tr							
336423	1.33	1.49										
404695			1.23	0.99								
417474			1.20	1.24								

*Holotype

lophule running from hypocone to center of tooth on USNM 336429, absent on USNM 417474; metacone absent; posterior cingulum extends from hypocone to buccal margin of tooth; tooth not expanded posteriorly.

DISCUSSION.—*Pauromys exallos* is approximately 50% larger than any species of *Pauromys* previously described (Dawson, 1968, table 6; Wood, 1959b, table 1; Korth, 1984, table 14; this paper, Table 5) and does not show any reduction of p4 with respect to the molars, as is the case in other species of *Pauromys*. In all other features, *P. exallos* is nearly identical to the other, smaller species. The only morphological difference, other than size, is that the hypolophid is either complete, or arises from both the hypoconid and entoconid of the lower molars of *P. exallos*.

In size, *P. exallos* approaches the unnamed species of sciuravid described by Dawson (1968:348) from the early Bridgerian Powder Wash locality of Utah, but differs from that species by possessing elongate mesoconids and posteriorly closed trigonids on the lower molars, and in having upper molars more nearly square (width and length nearly equal) in occlusal outline and with an accessory lophule at the center of the upper molar arising from the junction of the lophs from protocone and hypocone. Except that it is much larger, *P. exallos* also resembles *Namatomys* in some features, and in these respects tends to bridge the sciuravid-comyid gap.

Genus *Knightomys* Gazin, 1961

Knightomys species

FIGURE 3C

REFERRED SPECIMEN.—USNM 336419, Lm2, incomplete.

DESCRIPTION.—Small tooth (a-p = 1.89 mm; tra = 1.78 mm; trp = 1.68 mm); anterior cingulum continuous from

metaconid to protoconid; posterior arm of protoconid ending lingually at base of metaconid, closing trigonid basin; mesoconid large, transversely elongate, and isolated, connecting to lingual extension; entoconid isolated, not connecting to posterolophid; very short hypolophid extending into talonid basin from entoconid; hypoconid and posterolophid damaged; no hypoconulid observable.

DISCUSSION.—USNM 336419 is referable to *Knightomys* based on the morphology of the entoconid (separated from posterolophid with rudimentary hypolophid) and mesoconid (isolated with lingual extension). In size, USNM 336419 is within the range of *K. depressus* (see Korth, 1984, table 10) but is morphologically closer to *K. huerfanensis* in having more bulbous cusps and a short, distinct hypolophid. USNM 336419 differs from both *K. depressus* and *K. huerfanensis* in having the anterior cingulum continuous with the protoconid, a feature seen in *K. minor* and *K. senior*.

Both *K. depressus* and *K. huerfanensis* have been reported from the earliest Bridgerian (= Gardnerbuttean, Korth, 1984). The presence of *Knightomys* in the Elderberry Canyon assemblage does not extend the known geologic range of the genus, nor does it suggest an earlier age for the fauna than is indicated by its other elements.

Family ?ZAPODIDAE Coues, 1875

Genus *Elymys*, new genus

TYPE SPECIES.—*Elymys complexus*, new species.

RANGE.—Early Bridgerian (early middle Eocene) of Nevada.

DIAGNOSIS.—Minute rodent; dental formula 1/1,0/0,1/0,3/3; cheek teeth lophate and brachydont; P4 small, peg-like tooth; molars longer than wide; hypocones large and conules absent

on M2-M3, minute on M1; mesoloph and mesolophids lacking; complete endolophs and ectolophids on molars.

ETYMOLOGY.—For Ely, Nevada, town near Elderberry Canyon Quarry where all specimens were recovered; and Greek *mys*, mouse. The gender is masculine.

DISCUSSION.—The dental formula of *Elymys* is identical to that of zapodid rodents. The reduction of P4 to a small single rooted peg is also similar to all dipodoid rodents. The occlusal morphology of the cheek teeth of *Elymys* is similar to those of both *Simimys* Wilson (1935) from the Uintan of California and *Plesiosminthus* Viret (1926), the earliest sicistine rodent, which ranges from the late Eocene of Asia to the Miocene of North America and Europe. *Elymys* differs from both these genera by lacking mesoloph and mesolophids on the cheek teeth and a distinct anteroconid on m1. It is similar to *Simimys* in the occlusal outline of M1 and the bifurcation of the protoloph of the same tooth, but differs from *Simimys* in its dental formula. *Plesiosminthus* not only shares the same dental formula with *Elymys*, but both genera also have complete ectolophids and endolophs on the molars.

Simimys has been considered both a cricetid and zapodid since its original description. Emry (1981:13) reviewed the taxonomic history of *Simimys* and concluded that it was best referred to "Muroidea, Family *incertae sedis*." Almost concurrently, Wood (1980) erected a new family Simimyidae to accommodate this problematical genus. *Elymys* is assigned to the Zapodidae because of its dental formula, but also because of the general dental similarities between it and *Plesiosminthus*. The most likely phylogenetic position for *Elymys* may be as ancestral to both *Simimys* and later zapodids. A lineage leading toward *Simimys* could be derived from *Elymys* by the development of mesoloph and mesolophids and loss of ectolophids on the cheek teeth, and the loss of P4. Another lineage leading to the zapodids could be derived from *Elymys* by the "squaring" of M1 and development of mesoloph and mesolophids on the cheek teeth. The loss of P4 in *Simimys* may warrant allocation of this genus to a separate family; if so the family should be closely allied with Zapodidae, possibly under Dipodoidea, and most likely being derived from an *Elymys*-like ancestor.

Elymys complexus, new species

FIGURE 5; TABLE 5

TYPE SPECIMEN.—USNM 404720, right maxilla with P4-M3.

HORIZON AND LOCALITY.—Elderberry Canyon Quarry, near Ely, in White Pine County, Nevada, from rocks referred to the Sheep Pass Formation.

AGE.—Early Bridgerian (early middle Eocene).

REFERRED SPECIMENS.—USNM 404691–404704, 404706–404715, 404717–404719, 417469–417473, 417475–417476, 417478, 417497; all isolated cheek teeth.

DIAGNOSIS.—Only known species of the genus.

ETYMOLOGY.—From the Greek *complexus* (complex).

DESCRIPTION.—Cheek teeth lophate and very brachydont; dental formula 1/1, 0/0, 1/0, 3/3; P4 small single rooted peg, circular in occlusal outline; all molars rectangular in occlusal outline, longer (anteroposteriorly) than wide.

M1 with four major cusps (paracone, metacone, protocone, hypocone) subequal in size; rectangular in shape with slight anterior expansion at anterobuccal corner; buccal cusps transversely elongated, lingual cusps obliquely compressed; anterior cingulum separated from and parallel to protoloph, extending from buccal margin to buccal slope of protocone, free lingually; protoloph curving anterobuccally from protocone and lingually from paracone, uniting at protoconule; small lophule arising anterobuccally from protoconule, ending short of the anterior cingulum; distinct endoloph connecting protocone and hypocone; hypocone slightly more lingual than protocone; metaloph continuous from metacone to hypocone with an anterior bend similar to that of protoloph but with no accessory lophule; posterior cingulum running entire width of tooth arising from hypocone, separated from metacone at buccal end; small mesostyle present.

M2 similar in morphology to M1 but lacking anterobuccal expansion; protoloph bowed anteriorly, but continuous from paracone to protocone with no protoconule or accessory lophule; anterior cingulum connected to protoloph by short anteriorly directed lophule arising just buccal to protocone; hypocone more crescentic than on M1 and aligned with protocone; all other features as in M1.

M3 smaller than anterior molars; anterior cingulum and protoloph as in M2; hypocone greatly reduced or absent; metacone reduced and obliquely compressed; posterior cingulum continuous with metacone.

The anterior part of m1 is narrower than the posterior part; metaconid and protoconid are subequal in size; anterior cingulum short, arising from protoconid, curving anteriorly, ending at base of metacone; posterior arm of protoconid continuous to metaconid, slightly curving posteriorly; ectolophid connecting hypoconid to protoconid, aligned directly anteroposteriorly; minute mesoconid variably present on ectolophid; posterolophid curving posteriorly from hypoconid and running entire width of tooth; hypolophid extends buccally from entoconid across talonid, complete to entoconid on some specimens.

Like m1, m2 is rectangular in outline, but its trigonid is wider than in m1; on m2 the anterior cingulum extends the entire width of tooth, connected by small lophule arising from protoconid; small cuspule (?anteroconid) present at junction of anterior cingulum and lophule; posterior arm of protoconid (metalophid II) continuous from protoconid to metaconid, bowed posteriorly; ectolophid as in m1; hypolophid complete and bowed posteriorly as in metalophid; all other morphology as in m1. No specimens of m3 have been recognized.

DISCUSSION.—The zygomaseteric structure of *Elymys* is not preserved in any of the known specimens. It is likely that

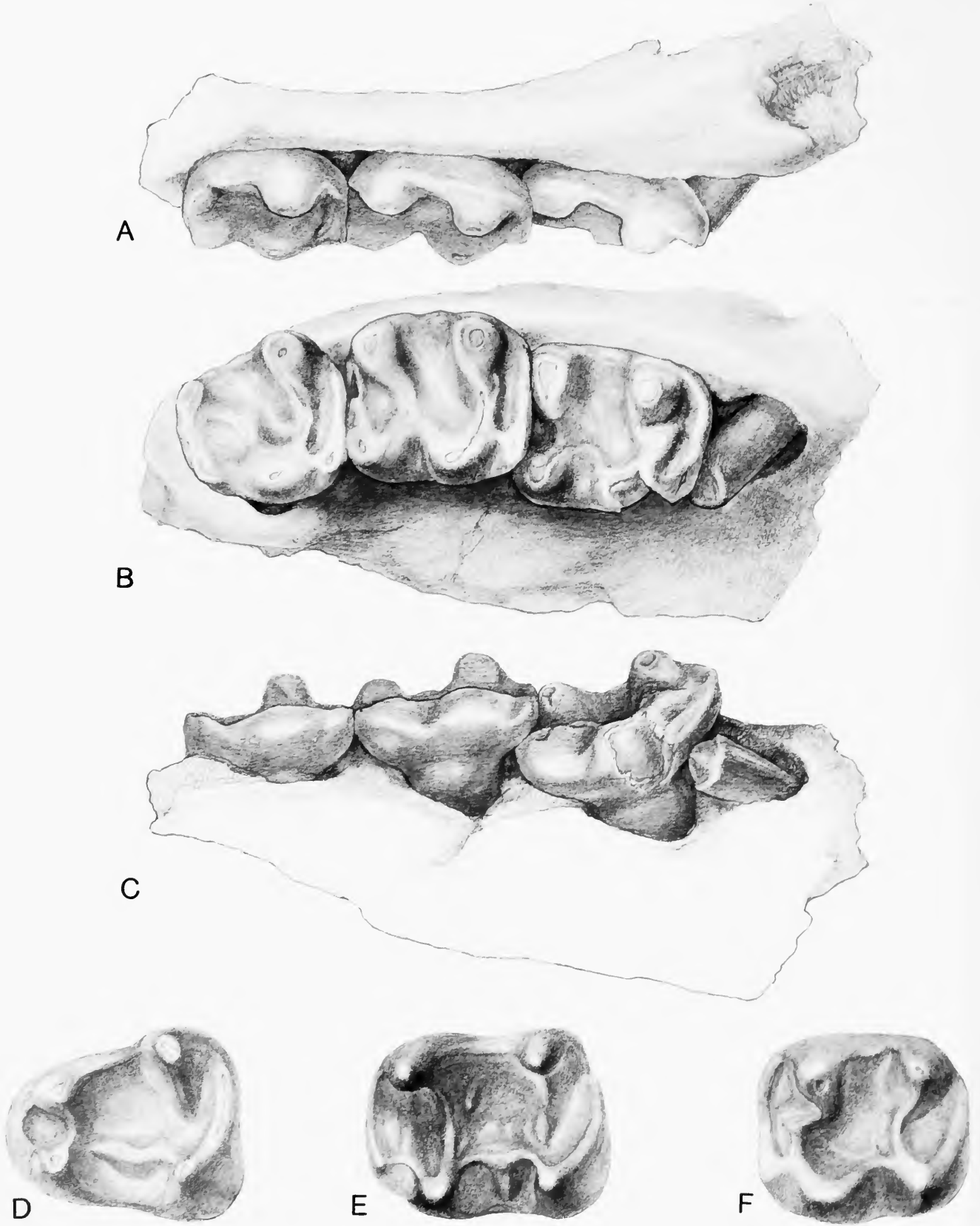


FIGURE 5.—Dentition of *Elymys complexus*, new species, from Elderberry Canyon Quarry: A-C, USNM 404720 (type), right maxilla with P4-M3, in A, buccal; B, occlusal; and C, lingual views. D, USNM 404702, Lm1, occlusal view; E, USNM 404703, Lm2, occlusal view; F, USNM 417497, LM1, occlusal view. (All approximately $\times 35$, bar = 1 mm.)

TABLE 6.—Statistics of measurements of teeth of *Elymys complexus* from Elderberry Canyon Quarry. (Abbreviations as in Table 3; measurements in millimeters.)

		N	M	OR	S	CV	TYPE
P4	a-p	1	0.24				0.24
	tr	1	0.26				0.26
M1	a-p	10	0.95	0.78-1.03	.07	7.3	0.78
	tr	9	0.90	0.70-1.01	.08	9.4	0.70
M2	a-p	9	0.91	0.75-1.00	.08	8.6	0.80
	tr	10	0.86	0.72-0.94	.08	8.9	0.72
M3	a-p	5	0.80	0.72-0.83	.04	5.0	0.72
	tr	5	0.81	0.70-0.88	.06	7.4	0.70
m1	a-p	5	0.97	0.86-1.12	.12	12.5	
	tra	6	0.64	0.55-0.74	.06	9.9	
	trp	5	0.77	0.69-0.86	.07	8.6	
m2	a-p	6	1.02	0.98-1.06	.03	2.7	
	tra	5	0.83	0.80-0.89	.04	4.8	
	trp	6	0.85	0.80-0.89	.03	3.9	

Elymys had either the primitive condition for rodents, protrogomorphic, or was derived toward dipodoid hystricomorphy, as is known to be the case in its presumed nearest relatives, *Simimys* and the zapodids (see Emry, 1981).

Dawson (1966) described an isolated upper molar from the Uintan of Utah, which she compared at length with *Simimys*. This specimen, CM 9951, and the species that it represents, is also derivable from *E. complexus*, and may be on the lineage toward true zapodids. If this specimen is an M1, which is suggested by the anterobuccal extension of its protoconule, it has a reduced parastylar area as in *Plesiosminthus*, and has a well-developed mesoloph. However, in CM 9951 the endoloph is not complete and the anterior cingulum is distinct from the protoloph, conditions not seen in later zapodids.

Family ?EUTYPOMYIDAE Miller and Gidley, 1918

Genus *Mattimys* Korth, 1984

Mattimys species

FIGURE 3B

REFERRED SPECIMEN.—USNM 336416, left m1.

DESCRIPTION.—Anterior cingulum separated from protoconid and ending buccally in small cuspule; metaconid and protoconid subequal in size; posterior arm of protoconid continuous to apex of metaconid; mesoconid small, circular; ectolophid continuous from protoconid to hypoconid; hypolophid originating from entoconid, ending in center of talonid; small metastylid present on posterior slope of metaconid; rugosities of enamel in center of talonid as in *M. kalicola* (Korth, 1984, fig. 32); small, distinct hypoconulid at center of posterolophid.

DISCUSSION.—USNM 336416 closely resembles m1 of *Mattimys kalicola* in nearly all occlusal features. It differs from *M. kalicola* in having a complete ectolophid and metastylid,

and in being slightly longer anteroposteriorly (a-p = 1.65 mm; tra = 1.35 mm; trp = 1.25 mm). USNM 336416 differs from the Uintan *Janimus* (Dawson, 1966; Storer, 1984) in having less pronounced irregularities of the enamel in the talonid basin. It is quite possible that USNM 336416 represents the same species as FMNH PM 15193, from the Bridger Basin (West, 1973), previously referred to either *Janimus* or *Mattimys* (Korth, 1984:62).

Conclusions

Nine species of rodents, representing four families, are presently recognized in the Elderberry Canyon Local Fauna. *Reithroparamys delicatissimus* is previously known only from Bridgerian faunas. The undetermined species of *Sciuravus* is larger than the only known Wasatchian species, *S. wilsoni*, and is similar in size to the Bridgerian species *S. eucristadens* and *S. nitidus*. *Pauromys* is known in both Bridgerian and latest Wasatchian faunas, as is *Mattimys*. The only rodent in the Elderberry Canyon assemblage that is otherwise known only from a very restricted horizon is *Reithroparamys huerfanensis*, which has heretofore been known only from the earliest Bridgerian of Colorado. Unfortunately, all of the specimens from Elderberry Canyon assigned to this species are upper cheek teeth, and all other teeth from early Bridgerian horizons are lower dentitions, so allocation of the Elderberry Canyon material is not certain. A precise biostratigraphic age cannot be determined solely on the basis of the rodents currently known, but what they do suggest, coupled with the greatest homotaxial similarities of the whole known fauna (Emry, in press), gives a fairly secure early Bridgerian date to the Elderberry Canyon assemblage.

The largest rodent presently known from Elderberry Canyon is *Reithroparamys delicatissimus*, which is an intermediate sized ischyromyid. No specimens have so far been recognized as *Paramys*, perhaps the most common rodent in Wasatchian and Bridgerian faunas elsewhere, nor have the larger, but rarer, manitshine rodents been seen at Elderberry Canyon. Considering the volume of limestone that has been processed to recover the material presently known, and the size of the collection, which includes a variety of small insectivores, condylarths, carnivores, etc., it seems likely that the larger rodents would have been found by now if they were present in the fauna. If the absence of *Paramys* and other larger rodents is real, then it suggests that the Elderberry Canyon assemblage may represent either a special environmental situation, or may be just the result of selective sorting by taphonomic factors. Since *Microparamys* and *Paramys* commonly (nearly always) occur together in other Wasatchian and Bridgerian faunas, it seems unlikely that the *Microparamys* that occurs at Elderberry Canyon would have required special environmental conditions not suitable for *Paramys*. Certain taphonomic factors, such as concentration by a predator that did not prey on animals larger than *Reithroparamys*, might account for the absence of larger

rodents even though they may have been a part of the paleocommunity.

Another rodent that seems to be missing from the Elderberry Canyon assemblage is the small rodent *Mysops*. Several species of *Mysops* are recognized from the Bridger Formation (Wilson, 1938b), which has yielded rodents of similar size, as well as those that are much larger. The various species of *Mysops* are smaller than *Microparamys sambucus* and larger than *Elymys complexus*. Therefore, if size were the controlling factor in the species preserved in the Elderberry Canyon fauna, then *Mysops* would be expected there too. This leaves the possibility that *Mysops* was excluded from the paleocommunity by competition with the minute *Elymys*.

The Elderberry Canyon Local Fauna is certainly geologically older than the numerous mammalian local faunas from southern California, summarized by Golz and Lillegraven (1977) and Lillegraven (1979), which appear to be latest Bridgerian at the oldest, and more probably early Uintan and younger. There is significant homotaxial similarity, however,

between the early Uintan faunas of California and those of the same age in the Rocky Mountain region, after which time endemism becomes progressively greater through the end of the Eocene. Lillegraven (1979) postulated that in Bridgerian time faunal interchange was relatively unrestricted between the Rocky Mountain region and southern California, through a corridor of tropical to subtropical lowlands that included southern Nevada. The Elderberry Canyon assemblage occurs along what would have been the northern margin of this corridor. This fauna as a whole, and the rodents in particular, surely demonstrate that interchange was relatively unrestricted at least between Nevada and the Rocky Mountain region in early Bridgerian time. And though the similarities in rodents seem to be greatest with the Rocky Mountain region, the presence of *Elymys*, which seems to be closely related to *Simimys*, one of the more common rodents in the southern California Eocene (see, for example, Lillegraven and Wilson, 1975), suggests freedom of interchange between Nevada and California as well.

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