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PALEONTOLOGY AND GEOLOGY OF THE BADWATER CREEK AREA, CENTRAL WYOMING

Pt. 9. Additions to the cylindrodont rodents from the late Eocene

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In an earlier description of the late Eocene cylindrodonts present in the Badwater faunas, two specimens from locality 6 were referred to *Pareumys* sp. (Black, 1970a:209). At the time, no upper cheek teeth that might belong to that species were recognized. Later, while studying the ischyromyids in the Badwater faunas (Black, 1971), one maxillary fragment with M¹-M³ and three isolated upper molars were encountered, all from locality 6, which appear to pertain to *Pareumys*. This additional material establishes the presence of a new species of *Pareumys* at Badwater somewhat similar to *Pareumys milleri* known from the Myton Member of the Uinta Formation in northeastern Utah.

Since 1969 much additional work has been done at Badwater, particularly at locality 20 (Black, 1969) where a K/Ar date of 41.2 ± 1.4 m. y. has been obtained on a tuff immediately below the fossil-bearing silts. Included in the assemblage from locality 20 are at least two and possibly three species of cylindrodonts. Two species are represented by excellent jaws, and this material is described here.

The cylindrodonts from locality 20 are all somewhat more advanced than those from the other Badwater late Eocene localities, and this is

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seen in other taxa as well. This suggests that the fauna from locality 20 is somewhat younger than that from localities 5, 6, 7, Wood and Rodent. The date of 41.2 ± 1.4 m. y. is close to that suggested for the Uintan-Duchesnean boundary, 40 million years (McKenna, Russell, West, Black, Turnbull, Dawson, and Lillegraven, 1973). If this is indeed the case, the classic Uinta B and C faunas would be older, with Uinta B possibly at 45-46 m. y. and Uinta C at 43-44 m. y.

Specimens are in the Carnegie Museum of Natural History (CM) and Texas Tech University Museum (TTU-P) collections. This research was supported by National Science Foundation grants GB-7801 and GB-30840X and by the Institute of Museum Research, Texas Tech University. All measurements are in millimeters. When two transverse measurements are given, the first is the width across the protoloph or metalophid, the second is the width across the metaloph or hypolophid.

Family Cylindrodontidae
Genus *Pareumys* Peterson
Pareumys cf. *P. guensburgi*
Figures 1-4

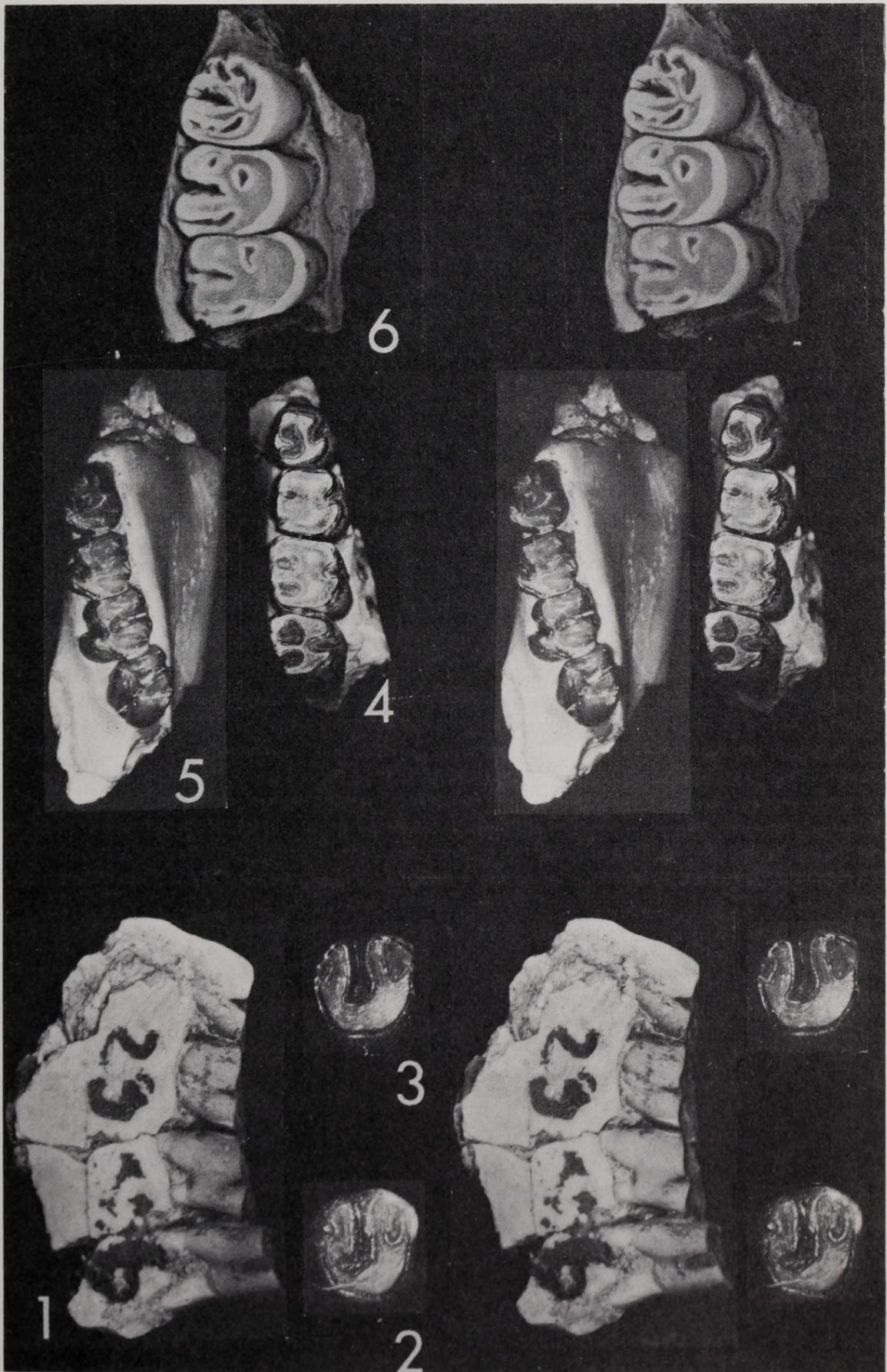
REFERRED SPECIMENS: CM 23806, RP₁ -M₁; TTU-P 6118, RM¹⁻²; 6119, RM¹⁻²; 6120, LM₂.
HORIZON AND LOCALITY: Late Eocene, ?Duchesnean, all from locality 20, Hendry Ranch Member, Tepee Trail Formation.

DESCRIPTION: The lower cheek teeth here referred to *Pareumys guensburgi* (Black, 1970b) are so similar in size and morphology to the La Point type specimen as to be almost identical. The slight differences in measurements are easily attributable to differences in measuring technique. CM 23806 has both M₁ and M₂ extremely worn, even more so than in the type of *P. guensburgi*. On P₁ of the Badwater specimen the hypolophid is not complete as it is in the type specimen. In other features the lower cheek teeth agree completely.

The two upper molars are unilaterally hypsodont with a broad straight internal border that has no trace of separation of the protocone and hypocone down the lingual face of the teeth, quite in contrast to the condition in *Jaywilsonomys* (Ferrusquia-Villafranca and Wood, 1969). Both teeth are moderately worn, however, and there could have been a slight separation when unworn. On both upper molars the metalophid is incomplete with a valley between the metaconule and the internal face of the protocone-hypocone. The metaconule connects posteriorly to the posterior cingulum. A small pit is isolated at the posterobuccal corner of the teeth between the posterior cingulum and metacone. At the stage of wear rep-

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Figs. 1-4. *Pareumys* cf. *P. guensburgi*. 1. Lateral view, CM 23806, x5. 2. TTU-P 6118, RM¹⁻², x5. 3. TTU-P 6119, RM¹⁻², x5. 4. CM 23806, RP₁ -M₃, x5. Fig. 5, *Pseudocylindrodon* near *P. tobeyi*, CM 23805, LP₁ -M₃, x5. Fig. 6, *Pareumys lewisi*, Type, CM 14407, LM¹-M³, x5.



resented, the metaconule is rather indistinct within the metalophid but was certainly never as large as in *Jaywilsonomys*. There is no mesostyle on either tooth.

DISCUSSION: At the time Ferrusquia-Villafranca and Wood (1969) published their paper on *Jaywilsonomys* from the early Oligocene of Chihuahua, Mexico, the description of *Pareumys guensburgi* (Black, 1970b) was in press. There are a number of similarities between *P. guensburgi* and the smaller of the two species of *Jaywilsonomys*, *J. pintoensis*. Both species have cheek teeth that are higher crowned than those of other species of *Pareumys* and with hypoconids displaying a definite anterior torsion. However, the species are distinct in that there is no lingually displaced and separate hypocone on the molars of *P. cf. P. guensburgi*. Although the lower molars of all known specimens of *Pareumys guensburgi* are well worn, there does not appear to have been any metalophid (metalophulid 11 of Wood) across the rear of the trigonid basin except in FMNH (Field Museum of Natural History) PM 14978 where there is a short protoconid spur on M_2 . In *Jaywilsonomys* the metalophid is interrupted, but distinct metaconid and protoconid spurs remain. These are evidently essentially absent in *P. guensburgi*.

Because of the absence of a distinct, lingually displaced hypocone on the upper molars, I prefer to retain the Utah and Badwater specimens in the genus *Pareumys*. They do, however, appear to be close to the possible ancestry of *Jaywilsonomys*, although too advanced in metalophid reduction to be in the main line of descent.

MEASUREMENTS IN MM. OF *Pareumys* CF. *P. guensburgi*

	TTU-P 6118	TTU-P 6119
RM ^{1 or 2}		
a-p	2.50	2.50
tr	3.05	3.20
	CM 23806	
P ₁ a-p	2.00	
tr	1.60	
tr	2.15	
M ₁ a-p	2.25	
tr	2.15	
tr	2.55	
M ₂ a-p	2.45	
tr	2.45	
tr	2.60	
M ₃ a-p	2.35	
tr	2.50	
tr	2.40	

***Pareumys lewisi*² new species**

Figure 6

TYPE: CM 14407, left maxillary fragment with M¹-M³.

HYPODIGM: Type and CM 16881, 16883, 19745, all upper molars; CM 15989 and 15990, lower molars.

HORIZON AND LOCALITY: Late Eocene, Uintan, all from locality 6, Hendry Ranch Member, Tepee Trail Formation.

DIAGNOSIS: Larger than *Pareumys milleri*; not as hypsodont as *P. guensburgi*; lophs of lower molars low; no distinct hypocone on M¹-M³; metaloph with connection to posterior cingulum and protocone.

DESCRIPTION: The upper molars are unilaterally hypsodont with the lingual crown height being about twice that of the buccal height. Unworn teeth showing little interdental wear are almost square in occlusal outline. The type, CM 14407, is of an old individual and shows considerable interdental wear. This combination of interdental wear with occlusal wear changes the occlusal outline from square to transversely elongate. There is no distinct hypocone, but the internal border is straight and swollen along its entire length. The anterior cingulum is raised into a rather high, heavy crest, and immediately behind it is a deep, very narrow valley between the anterior cingulum and protoloph. The protoloph passes straight across the crown of the tooth from the paracone to the protocone, and except for CM 19745 there is no evidence of a protoconule within this loph. The metaloph is short and joins the inner slope of the protocone through a very thin ridge about half way down the inner face of that cusp. The metaconule is large and is joined not only to the internal face of the protocone but also posteriorly to the posterior cingulum. With advanced wear two small lakes are formed. One lies between the metaconule, posterior cingulum and protocone. The central valley between the metaloph and protoloph is narrow but deep and opens onto the external face of the teeth. The mesostyle is variously developed. In one specimen it is quite small and fused into the posterior face of the paracone (CM 16883), whereas in the type and also in CM 19745 the mesostyle is separate from both the paracone and the metacone, and partially dams the central valley.

The third upper molar is the smallest of the upper molars, with a reduced metacone and posterior cingulum area. As on M¹ and M², the metaconule is quite large and joined to both the protocone and the posterior cingulum. The central valley between the protoloph and metaloph on M³ is completely closed buccally.

The lower molars have been described (Black, 1970a:209-211) and this description is repeated here:

"Both molars are low crowned and have low lophids, much lower than those of *Pseudocylindrodon tobeyi*. The hypolophids are somewhat lower than those of *Pareumys milleri* or *P. grangeri*. The two Badwater teeth are appreciably longer than wide, another *Pareu-*

²Named for Arnie Lewis, who found the type specimen.

mys character in contrast to *Pseudocylindrodont*. The hypoconids of *Pareumys* sp. are not swollen nor do they show any anterior torsion as they do in the higher-crowned cylindrodonts. The posterolophids are low and the hypoconulids indistinct. The central and posterior valleys are broad and shallow. There is no metastylid. On CM 15990 the posterior protoconid arm passes into the metaconid slope isolating the trigonid basin from the talonid. These two teeth are slightly larger than either the first or second molars of *Pareumys milleri* or *P. grangeri* and the cusps and crests of the Badwater specimens are somewhat lower than in the Uinta species. In all other respects, however, they are quite close to CM 2938, the type of *P. milleri*."

AFFINITIES: The relationships of the upper teeth here assigned to *Pareumys lewisi* were not recognized at the time the manuscript on the Badwater cylindrodont rodents was completed. In that paper (Black, 1970a) I assigned the two lower molars from locality 6 to *Pareumys* sp., but the upper molars were then thought to pertain to a new species of *Plesispermophilus* (Black and Dawson, 1966; Dawson, 1968:367). Therefore this material was not critically examined at the time of preparation of the manuscript on cylindrodonts. It is now obvious that these specimens do pertain to a cylindrodont rodent and the material is sufficient to warrant description of a new species of *Pareumys*.

Pareumys lewisi is a large species of the genus. Although not as large as *P. guensburgi* of the late Duchesnean (Black, 1970b), it is larger than *P. milleri*, *P. grangeri*, and *P. troxelli* (Burke, 1935) of the Uintan. Its cheek teeth are lower crowned than those of *P. guensburgi* and they display complete metalophids on the lower molars with no anterior twisting of the hypoconids. The upper molars are similar to those referred to *Pareumys* near *grangeri* by Wilson (1940, Plate 1, Figs. 4 and 5) but they are considerably larger. The lower molars are not as hypsodont as are those of *P. guensburgi*. In most respects *P. lewisi* appears to be closer to *P. milleri* than to *P. guensburgi*.

MEASUREMENTS IN MILLIMETERS

Pareumys lewisi

	CM 14407		CM 19745	CM 16883	CM 16881
M ¹ a-p	2.25	M ¹ or 2			
tr	3.25	a-p	2.20	2.30	2.35
		tr	3.00	3.10	3.00
M ² a-p	2.20				
tr	3.25				
M ³ a-p	2.25				
tr	2.90				
	CM 15989	CM 15990			
M ₁ or 2					
a-p	2.55	2.55			
tr	2.35	2.30			
tr	2.40	2.30			

Pareumys sp.

MATERIAL: CM 25405, RM₁-M₂; TTU-P 4885, RM₃ from locality 20.

DISCUSSION: The RM₁-M₂ is very badly worn. As far as can be discerned these two specimens are morphologically similar to the specimens referred to *P. guensburgi*. However, they are significantly larger than known material of that species. They may either represent a third species of *Pareumys* or merely an extremely large individual of *P. guensburgi*.

MEASUREMENTS IN MM.

	CM 25405	TTU-P 4885
M ₁ a-p	2.45	
tr	—	
tr	—	
M ₂ a-p	3.00	
tr	2.80	
tr	2.85	
M ₃ a-p		3.00
tr		2.70
tr		2.50

Genus *Pseudocylindrodon* Burke
Pseudocylindrodon near *P. tobeyi*
 Figure 5

REFERRED SPECIMENS: CM 23805, LP₁-M₃; TTU-P 4882, RM¹⁻²; 6122, LM¹⁻²; 6121, RM¹⁻²; 4884, RdP₁; 4883, RM₁₋₂.

HORIZON AND LOCALITY: Late Eocene, late Uintan, all from locality 20, Hendry Ranch Member Tepee Trail Formation.

DESCRIPTION: The specimens from locality 20 are all slightly smaller than those previously described for *Pseudocylindrodon tobeyi* from the Wood and Rodent localities, closely approaching in size specimens of *P. medius* and *P. neglectus* (Black, 1965:12-13). In most characters of the occlusal surface these teeth show only the most minor changes from the conditions in *P. tobeyi*. The cheek teeth appear to be more hypsodont with the lingual valleys more nearly closed and the hypocone somewhat more swollen than in *P. tobeyi*. There is a strong hypolophid on P₄, as in *P. medius*, and as seen in one specimen of *P. tobeyi*. Metastylids are absent on the lower molars as in *P. tobeyi* and *P. medius*.

The portion of the mandible preserved in CM 23805 is quite similar to that of *P. medius*, although it is somewhat larger. The mandible is rather short and stout with only a weakly defined masseteric fossa, which terminates below the anterior end of M₂. The mental foramen is single, as in *P. medius*, rather than double, as in *P. neglectus*.

DISCUSSION: This sample is extremely close in morphology to the teeth of *P. tobeyi*, but the population represented appears to be some-

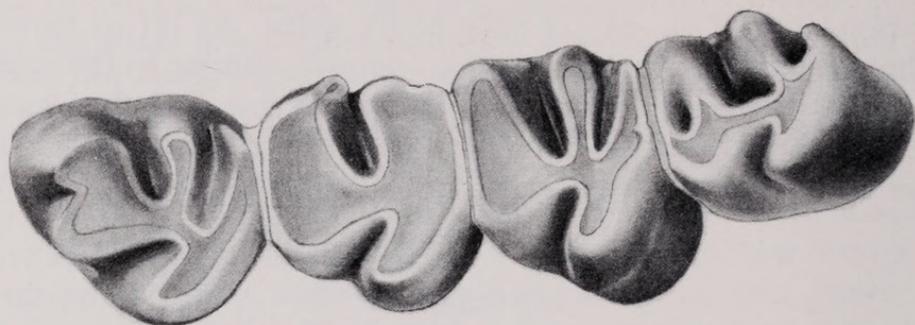


Fig. 7. *Pseudocylindrodon medius*, x10. CM 10954, LP₁-M₃.

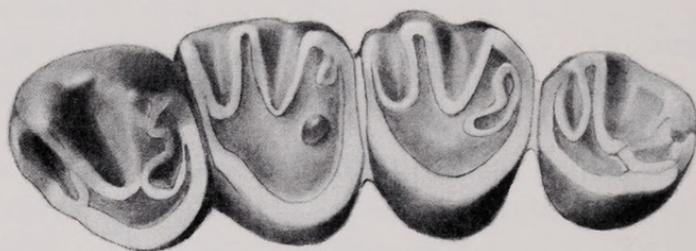


Fig. 8. *Pseudocylindrodon medius*, x10. CM 10000, LP₄-M₃.

what advanced over that known from the Wood and Rodent localities. There is every indication that this represents evolution in place over what is probably no more than a 1 to 2-million-year period.

In such characters as a decrease in size, increase in hypsodonty and greater closure of the lingual valley of the molars, this lineage is moving towards the condition seen in *P. medius* from McCarty's Mountain, Montana. *P. tobeyi* and *P. near P. tobeyi* also resemble *P. medius*, and differ from *P. neglectus* in the presence of a hypolophid on P₄, in the absence of metastylids on the lower molars, and in having a single mental foramen.

The sequence *Pseudocylindrodon tobeyi* to *P. near P. tobeyi* to *P. medius* appears to be an excellent example of phyletic speciation within a limited geographic area of northwestern Wyoming and southwestern Montana. The measurements given of *P. medius* are taken from an unpublished manuscript on the McCarty's Mountain rodents, and illustrations of *P. medius* (Figs. 7-8) are included for comparative purposes. It

would appear that most of the evolutionary history of *Pseudocylindrodon* has been restricted to the intermontane Rocky Mountain region covering a period of probably no more than 6-7 million years from approximately 43 or 44 million years to 36 or 37 million years ago.

MEASUREMENTS IN MM. OF *Pseudocylindrodon*

	<i>P. tobeyi</i> (Means)	<i>P. nr. P. tobeyi</i>	<i>P. medius</i> (Means)
M ^{1 or 2} a-p	1.92	1.71 (TTU-P 4882)	1.75
tr	2.11	2.28	2.20
dP ₄ a-p		1.90 (TTU-P 4884)	
tr		1.15	
tr		1.50	
P ₃ a-p	1.94	1.86 (CM 23805)	1.86
tr	1.23	1.33	1.21
tr	1.85	1.83	1.75
M ₁ a-p		1.75	1.75 (TTU-P 4883)
tr	M _{1 or 2}	1.44	1.63
tr	a-p 1.96	2.03	1.79
	tr 1.69		1.90
M ₂ a-p		1.79	1.70
tr	tr 1.95		
tr		1.68	1.69
tr		2.00	1.99
M ₃ a-p	2.06	1.75	1.71
tr	1.81	1.69	1.58
tr	1.74	1.60	1.49

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