First Record of *Leptodontomys* (Rodentia: Eomyidae) in the Clarendonian (Miocene) of the Southern Great Plains

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The first occurrence of *Leptodontomys* (Rodentia: Eomyidae) in the Clarendonian North American Land Mammal Age of the southern Great Plains is reported. *Leptodontomys* sp. is represented by a lower left m1 or m2 from the Whisenhunt Quarry, Beaver County, Oklahoma. The specimen was recovered from about 500 kg of sediment that was processed by using a system of nested coarse and fine mesh screen boxes. In addition to the eomyid, this sample of sediment produced insectivore (Soricidae and Talpidae) and rodent (Castoridae, Cricetidae, and Zapodidae) taxa similar to those previously reported from this locality.

INTRODUCTION

In 1990, I accompanied W. W. Dalquest to a fossil locality (Whisenhunt Quarry) in Beaver County, Oklahoma. Based on fossils collected and described by Dalquest et al (1996), a Clarendonian North American Land Mammal Age (late Miocene) of the locality was established, and it became the first microvertebrate fossils producing locality of this age in Oklahoma. Therefore, in spring of 1998, additional sediment was collected from the Whisenhunt Quarry in order to obtain additional microvertebrates.

By using different matrix processing methods, additional fossils were recovered from the site including teeth, cranial, and postcranial elements from fish, amphibians, reptiles, and small mammals. The mammals recovered included soricid shrews; talpid moles; and castorid, murid, zapodid, and eomyid rodents. All taxa but the eomyid were previously reported from the Whisenhunt Quarry (Dalquest et al 1996).

Previously, eomyids have been reported from two localities in the late Miocene of the southern Great Plains. One taxon, *Kansasimys dubius*, was discovered at the Edson Quarry about 9 km south of Edson, Sherman County, Kansas and described by Wood (1936). The second, *Comancheomys rogersi*, was collected from the Coffee Ranch local fauna near Miami, Hemphill County, Texas (Dalquest 1983). Both of these local faunas are Hemphillian in age (Wood 1936, Dalquest and Patrick 1989, Korth 1994, Tedford et al 2004). In addition to these finds from the southern Great Plains, two additional occurrences of Hemphillian eomyids are known. The type specimen for the genus, *Leptodontomys oregonensis*, was described by Shotwell (1956) from the McKay Reservoir local fauna, Umatilla County, Oregon. The second eomyid, *Ronquillomys wilsoni*, was described by Jacobs (1977) from the Redington local fauna of San Pedro Valley, Arizona. Korth (1994) synonomyzed both *R. wilsoni* and *C. rogersi* with *K. dubius*. However, McKenna and Bell (1997) retained *Ronquilomys* and *Comancheomys* as separate genera along with *Kansasimys*. Herein, I follow the taxonomy of McKenna and Bell (1997).

The oldest known species of *Leptodontomys* in North America is *L. douglassi* from the Arikareean (Oligocene) of Slope County, North Dakota (Burke 1934, Korth and Bailey 1992). Geologically younger species of *Leptodontomys* in North America include the following: *L. quartzi* from Malheur County,

Oregon (Shotwell 1967), which is considered Barstovian (Miocene) in age (Korth 1994); *L. russelli* (Barstovian) from Saskatchewan, Canada (Storer 1970a,b; 1975); *L. stirtoni* (Barstovian) from Barstow, San Bernardino County, California, (Lindsay 1972); several species of *Leptodontomys* (Barstovian/Hemingfordian) from Eastgate, Churchill County, Nevada (Smith 2002); and *Leptodontomys* sp. (Hemingfordian) from Santa Barbara County, California, which were incorrectly identified by Lindsay (1974) as the European eomyid genus, *Eomys* (see Korth 1994). Except for *L. oregonensis,* the youngest eomyids in North America are *K. dubius* and *C. rogersi* from Hemphillian deposits in Kansas (Wood 1936) and Texas (Dalquest 1983), respectively, and *R. wilsoni* from Arizona (Jacobs 1977).

Kansasimys, *Comancheomys*, and *Ronquillomys* are much larger than any known species of *Leptodontomys*. The eomyid recovered from the Whisenhunt Quarry is much smaller than any eomyid reported from the Hemphillian (Table 1). Based on morphology (Fig. 1), the fossil eomyid from Oklahoma (OMNH 72076) belongs to the genus *Leptodontomys*. Thus, this specimen, a single lower left m1 or m2, represents the only *Leptodontomys* known from the southern Great Plains during the Clarendonian. At present, the only other *Leptodontomys*

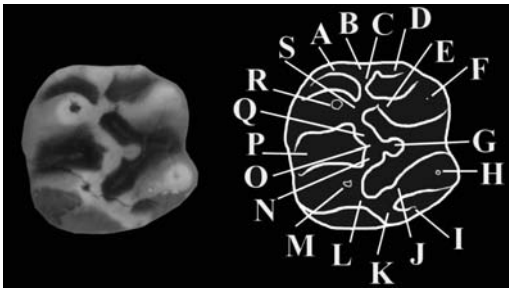

Figure 1. Lower left m1 or m2 (OMNH 72076) and explanatory drawing in occlusal view (top is mesial, and left is labial); A, labial arm of anterior cingulid (anterolophid); B, anteroconid; C, adlophulid; D, lingual arm of anterior cingulid; E, lingual arm of metalophid; F, metaconid; G, mesolophid; H, entoconid; I, posterior cingulid (posterolophid); J, lingual arm of hypolophid; K, hypoconulid; L, labial arm of hypolophid; M, hypoconid; N, Posterior arm of ectolophid; O, mesoconid; P, labial part of central basin; Q, anterior arm of ectolophid; R, protoconid; and S, labial arm of metalophid.

Table 1. Measurements (mean, observed range, and *n*; all in mm) of lower m1 or m2s of *Leptodontomys*. Data of *Leptodontomys* taken from [a]Korth and Bailey (1992); [b]Barstow Formation (Lindsay 1972) and [c]Vedder locality (Lindsay 1974), [d]Quartz Basin and [e]Black Butte faunas (Shotwell 1967); [f]Storer (1975); and [g]Whisenhunt Quarry (OMNH 72076). AP, greatest anteroposterior length; T, greatest transverse width.

Taxon	Characters	
	AP	T
[a]*Leptodontomys douglassi*	0.98, 0.94-1.00, 4	0.91, 0.82-0.96, 4
[b]*L. stirtoni*	0.91, 0.80-0.97, 9	0.75, 0.72-0.81, 5
[c] *L.* sp.	0.82, 1	.083, 1
[d]*L. quartzi*	0.74, 0.68-0.81, 5	0.75, 0.72-0.81, 5
[e]*L.* sp.	0.89, 0.76-1.02, 5	0.88, 0.77-1.00, 5
[f]*L. russelli*	0.75, 1	-
[g]*L.*sp.	0.87, 1	0.84, 1

reported from the Clarendonian of North America is, *L.* sp, from Malheur County, Oregon (Shotwell 1967).

MATERIALS AND METHODS

Dalquest et al (1996) indicated the sediment from the Whisenhunt Quarry was difficult to process because of the presence of diatomaceous clays. They processed 9072 kg of sediment, which produced about "one gallon of concentrate per 100 kg of matrix". Dalquest et al (1996) did not provide a weight for the concentrate of matrix per gallon container. I processed about 500 kg of sediment from the Whisenhunt Quarry following the methods outlined by Cifelli et al (1996). This method is more elaborate than that used by Dalquest et al (1996) as two sizes of screen boxes are used during screenwashing with water. Subsequent to the screenwashing with water, the dried matrix concentrate is placed in kerosene and acid baths. The kerosene reduced the amount of detritus by about 50% with no harmful effects to the fossils. The acid bath reduced the diatomaceous clays by 45% and did not harm the fossils. All measurements, unless otherwise indicated, are in millimeters (mm) and were obtained with a Reflex microscope (see MacLarnon 1989).

Abbreviations are as follows: KUVP, University of Kansas Museum of Natural History, Collection of Vertebrate Paleontology, Lawrence, Kansas; MWSU, Midwestern State University, Wichita Falls, Texas (these specimens were donated to the Texas Memorial Museum, University of Texas, Austin by W. W. Dalquest); OMNH, Sam Noble Oklahoma Museum of Natural history, Norman, Oklahoma; OMNH V, Sam Noble Oklahoma Museum of Natural History locality number; ROM, Royal Ontario Museum, Ontario, Canada; UCMP, University of California Museum of Paleontology, Berkeley, California; UO, University of Oregon Museum of Natural History, Eugene, Oregon; AP, greatest anteroposterior length; T, greatest transverse width.

SYSTEMATIC PALEONTOLOGY

Family Eomyidae Winge, 1887
Subfamily Eomyinae Winge, 1887
Tribe Eomyini Winge, 1887
Leptodontomys Shotwell, 1956
Leptodontomys sp.

Referred specimen. A lower left m1 or m2 (OMNH 72076).

Description. A lower left m1 or m2 that preserves the proximal-most part of the two anterior roots and a complete, single, large, anteroposteriorly-compressed posterior root. The tooth is low crowned and unworn on the occlusal surface (Fig. 2).

The trigonid is slightly wider than the talonid. Overall, the tooth is slightly longer than wide. All basins (anterior, central, and posterior) are equally deep and open.

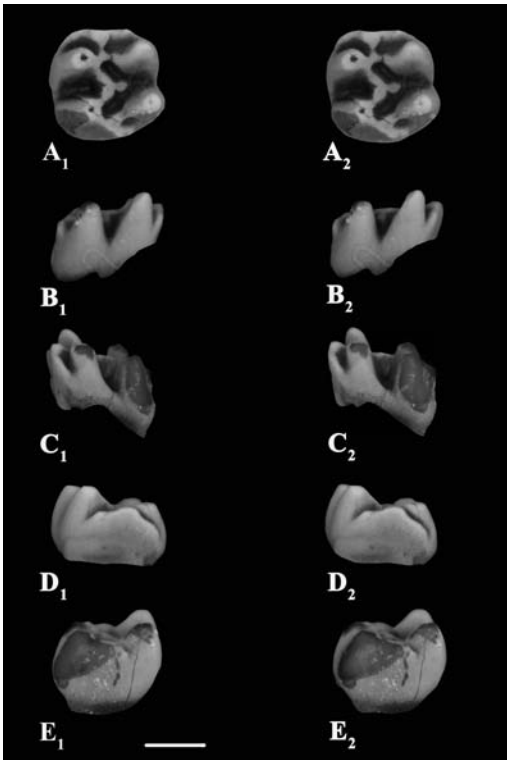

Figure 2. Stereo pairs of lower left m1 or m2 (OMNH 72076) of *Leptodontomys* sp. from the Whisenhunt Quarry, Beaver County, Oklahoma: A_{1-2}, occlusal views; B_{1-2}, lingual views; C_{1-2}, labial views; D_{1-2}, mesial views; and E_{1-2}, distal views. Scale bar equals 0.5 mm.

The anterior cingulid is anteroposteriorly expanded centrally, narrows transversely, traverses nearly the entire width of the tooth, and is slightly sigmoid shaped. It attaches low near the anterolabial base of the protoconid and gradually ascends lingually as it reaches the anteroconid, then descends lingually in a gradual fashion to join the metaconid. The anteroconid is distinct, centrally located within the anterior cingulid, and possesses an adlophulid which joins labial to the center of the metalophid. The adlophulid will not disappear with additional wear to the occlusal surface. The lingual arm of the metalophid is more distinct than the labial arm. The anterior and posterior arms of the ectolophid are bent and attach to the posterolingual and anterolingual parts of the protoconid and hypoconid, respectively. The mesoconid is distinct, with a short, straight mesolophid that extends midway between the lingual margin of the tooth and mesoconid. A posteriorly bent hypolophid joins the hypoconid to the ectoconid. The lingual arm of the hypolophid is more distinct than the labial arm. A hypolophulid occurs along the middle of the hypolophid and is where the posterior cingulid arises. The posterior cingulid extends lingually, but ends prior to reaching the entoconid.

COMPARISONS AND DISCUSSION

Korth (1994) listed five species of *Leptodontomys* (*L. douglassi*, *L. stirtoni*, *L. quartzi*, *L. russelli*, and *L. oregonensis*) from Tertiary deposits of North America. Characteristics used to separate lower cheekteeth of *Leptodontomys* from other eomyids are provided by Burke (1934), Lindsay (1972), Korth and Bailey (1992), and Smith (2002). The sister taxon of *Leptodontomys* is *Adjidaumo* (Korth and Bailey 1992, Smith 2002), which shares many features of the occlusal surface, and thus it is apparent why these taxa have been mistaken for each other in past accounts (Burke 1934, Storer 1970a, b Lindsay 1972 Storer 1975). However, a few of the more striking characters of *Leptodontomys* molars, which separate them from *Adjidaumo*, molars include a lateral reduction of anterior cingulid; a central basin deeper than anterior and posterior basins; a short mesolophid; and a hypolophid directly united with posterior cingulid. These features occur in most species of *Leptodontomys*, but not in *Adjidaumo*. Therefore, the m1 or m2 from the Whisenhunt Quarry is that of a *Leptodontomys*. Excluding size, two of the more distinguishing features of *Leptodontomys* sp. from the Whisenhunt Quarry are the crown height and attachment of the adlophulid, which unites labially on the metalophid (labially to the center of the metalophid; see Smith 2002).

The molar from the Whisenhunt Quarry is easily distinguished from all earlier forms in being higher crowned. It is distinguished from *L. douglassi* and *L. stirtoni* in being smaller (Fig. 3). In addition, it differs from *L. douglassi* in having the labial and lingual arms of the anterior cingulid of equal length; adlophulid unites labially on the metalophid; anterior and posterior basins are equal in depth to the central basin; and anterior arm of ectolophid is bent. The Whisenhunt Quarry *Leptodontomys* molar differs from those of *L. stirtoni* in having a less distinct mesoconid and straighter and shorter mesolophid. It also has both arms of the ectolophid that are bent; metastylid is absent; and posterior basin is open, but not distinct.

The *Leptodontomys* molar from Whisenhunt is larger than those of *L. quartzi* and *L. russelli*. There are no lower molars known for *L. oregonensis*. The Oklahoma molar differs from *L. quartzi* (holotype; UO 22689) in having a less distinct mesolophid and less distinct posterior cingulid that is open laterally. The Whisenhunt tooth differs from *L. russelli* in having a distinct anteroconid; a distinct mesolophid; all basins are equal in depth; and a more distinct posterior cingulid. Of the four known species of *Leptodontomys* in which the m1 or m2 is known,

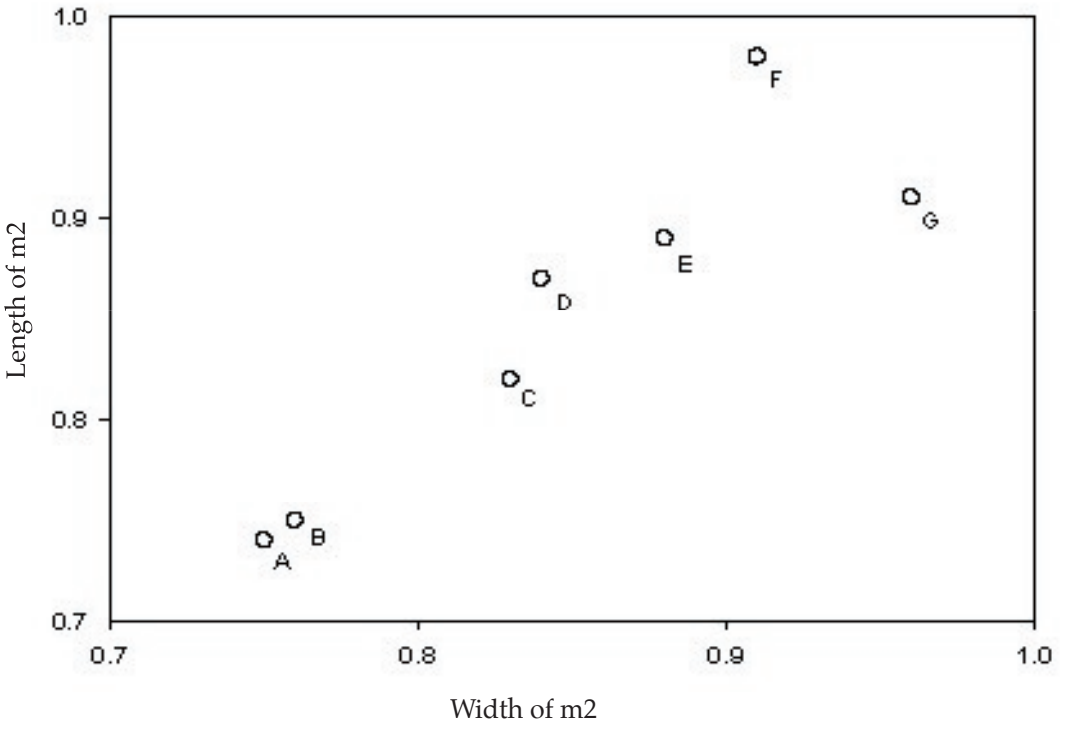

Figure 3. Mean length and width measurements (mm) of the m1 or m2 of *Leptodontomys* species taken from literature and from the Whisenhunt Quarry specimen (OMNH 72076). Letters represent: A, *L. quartzi* (Shotwell 1967); B, *L. russelli* (Storer 1975); C, *Leptodontomys* sp. from Vedder locality (Lindsay 1974); D, *Leptodontomys* sp. from Whisenhunt Quarry; E, *Leptodontomys* sp. from Black Butte fauna (Shotwell 1967); F, *L. douglassi* (Burke 1934, Korth and Bailey 1992); and G, *L. stirtoni* (Lindsay 1972).

the Whisenhunt specimen is most similar to *L. quartzi* in lacking a metastylid, while having an adlophulid that does not join the metalophid centrally and a posterolophid that is open laterally.

The *Leptodontomys* sp. from Whisenhunt differs in several characteristics possessed by *Leptodontomys* sp. (UO 25283) from the Black Butte local fauna studied by Shotwell (1967). The Black Butte local fauna is also Clarendonian in age. Based on current policies, this and other specimens housed at the University of Oregon, Museum of Natural History are not readily available for comparison. However, *Leptodontomys* sp. (UO 25283) is figured in Shotwell (1967) and measurements are provided. The Black Butte specimen is also figured in Engesser (1979), but it is drawn as a left tooth not a right tooth as figured in Shotwell (1967). The *Leptodontomys* sp. from Whisenhunt differs from the *Leptodontomys* sp. from Black Butte in that the former has an adlophulid attached labial of center and lacks a mesolophid. No lateral views of *Leptodontomys* sp. are given in Shotwell (1967), and so no comparisons of crown height are provided.

CONCLUDING REMARKS

More than 90% of all microvertebrates recovered from Whisenhunt during this project were discovered in the fine-fraction of concentrate rather than the coarse-fraction. This

result is interesting because, despite their use of coarse mesh only, Dalquest et al (1996) recovered isolated shrew teeth of equal or smaller size than the *Leptodontomys* molar. Thus, it is unlikely their study was biased toward the recovery of larger microvertebrates rather than smaller microvertebrates.

Based on the current fossil record, teeth of *Leptodontomys* are rare at most localities except for an early Barstovian locality in Nevada (Smith 2002). Because eomyids are rare in the fossil record and about 9072 kg of sediment were processed by earlier workers (Dalquest et al 1996), the recovery of additional specimens of *Leptodontomys* from Whisenhunt is not promising. Prior to this study, the only known occurrence of *Leptodontomys* from Clarendonian deposits was from Oregon. Thus, the presence of *Leptodontomys* in the southern Great Plains during this time is a great range extension for this taxon. It is probable that *Leptodontomys* sp. from Whisenhunt is one of the last surviving North American members of the eomyid lineage that began in the Eocene. *Leptodontomys* sp. from Whisenhunt may represent a new species of eomyid from the southern Great Plains, but I hesitate to name a new species on such meager material.

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