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NEW RECORDS OF SMALL MAMMALS FROM THE LATEST UINTAN (MIDDLE EOCENE) STRATHEARN LOCAL FAUNA, SESPE FORMATION, CALIFORNIA

Thomas S. Kelly

Research Associate, Department of Vertebrate Paleontology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, California 90007

ABSTRACT

A paleontologic resource impact mitigation program at the Simi Valley Landfill and Recycling Center, Ventura County, California, has resulted in the recovery of a large number of isolated small mammal teeth from the latest Uintan (middle Eocene) Strathearn Local Fauna of the Sespe Formation. New records for the Strathearn Local Fauna include the following: *Peradectes californicus*; *Centetodon* sp., cf. *C. aztecus*; *Batodonoides rileyi* new species; *Metanoiamys* sp.; *Microparamys* sp., cf. *M. tricus*; and *Griphomys* sp. In addition, new samples of *Herpetotherium* sp., cf. *H. knighti*, *Sespedectes singularis*, and *Simimys simplex* are documented for the fauna.

INTRODUCTION

The middle member of the Sespe Formation of Simi Valley, Ventura County, California, has yielded abundant fossil mammals of middle Eocene age (e.g., Stock, 1932, 1935, 1936a, 1936b; Golz, 1976; Golz and Lillegraven, 1977; Mason, 1988; Kelly, 1990, 1992, 2009, 2010a, 2010b; Kelly et al., 1991; Kelly and Whistler, 1994, 1998). In particular, an ongoing paleontologic resource impact mitigation program at the Simi Valley Landfill and Recycling Center is providing the best stratigraphically controlled record in North America for the Uintan-Duchesnean North American Land Mammal Age transition (Kelly et al., 2012). Five superposed local faunas of middle Eocene age have been recognized at the landfill: the late Uintan Tapo and Brea Canyon local faunas, the latest Uintan Strathearn Local Fauna, the early Duchesnean Pearson Ranch Local Fauna, and the middle Duchesnean Simi Valley Landfill Local Fauna (Kelly, 1990; Kelly et al., 1991, 2012). Previously, only seven localities were assigned to the Strathearn Local Fauna (Kelly, 1990; Kelly et al., 1991; Kelly and Whistler, 1994).

During the latest phase of the mitigation program, bulk matrix samples from three localities (LACM 7893, 7894, and 7895) were collected from reddish claystone beds above the Cañada de la Brea Fault (CDLBF) at the north end of the landfill and within the excavation area shown on the Excavation and Soil Stockpile Grading Plan submitted by Geosyntec Consultants on May 27, 2010 to Waste Management of California, Inc. Prior to the 2010 grading and earlier landfill expansions, three claystone beds were exposed along the south side of the ridge in the excavation area and another claystone bed, the lowest in the sequence occurring above the CDLBF, was exposed just east of the excavation area (Kelly et al., 1991:fig. 2). The first (lowest) claystone contained locality LACM 5871 (Kelly et al., 1991:fig. 2). Locality LACM 7893 occurred within the second claystone bed above the CDLBF and is laterally equivalent to locality LACM 5872 (Kelly et al., 1991:fig. 2), whereas localities LACM 7894 and 7895 occurred within the third claystone bed above the CDLBF. Based on the relative stratigraphic levels of known fossil localities in adjacent Brea Canyon and the fact that about 262-275 m of section are repeated above the CDLBF (Taylor, 1983; Kimmel et al., 1983; Mason, 1988; Kelly, 1990; Kelly et. al., 1991), the claystone beds containing localities LACM 7893, 7894 and 7895 are correlated to the two claystone beds at LACM (CIT) 128 below the CDLBF (Kelly et al., 1991: fig. 2) and assigned to the Strathearn Local Fauna (Figure 1). This correlation is supported also by magnetostratigraphic data presented by Prothero et al. (1996) who reported the following observations (in descending stratigraphic order): 1) the strata above the CDLBF at the landfill are within a normal interval, which contains localities LACM 5871,

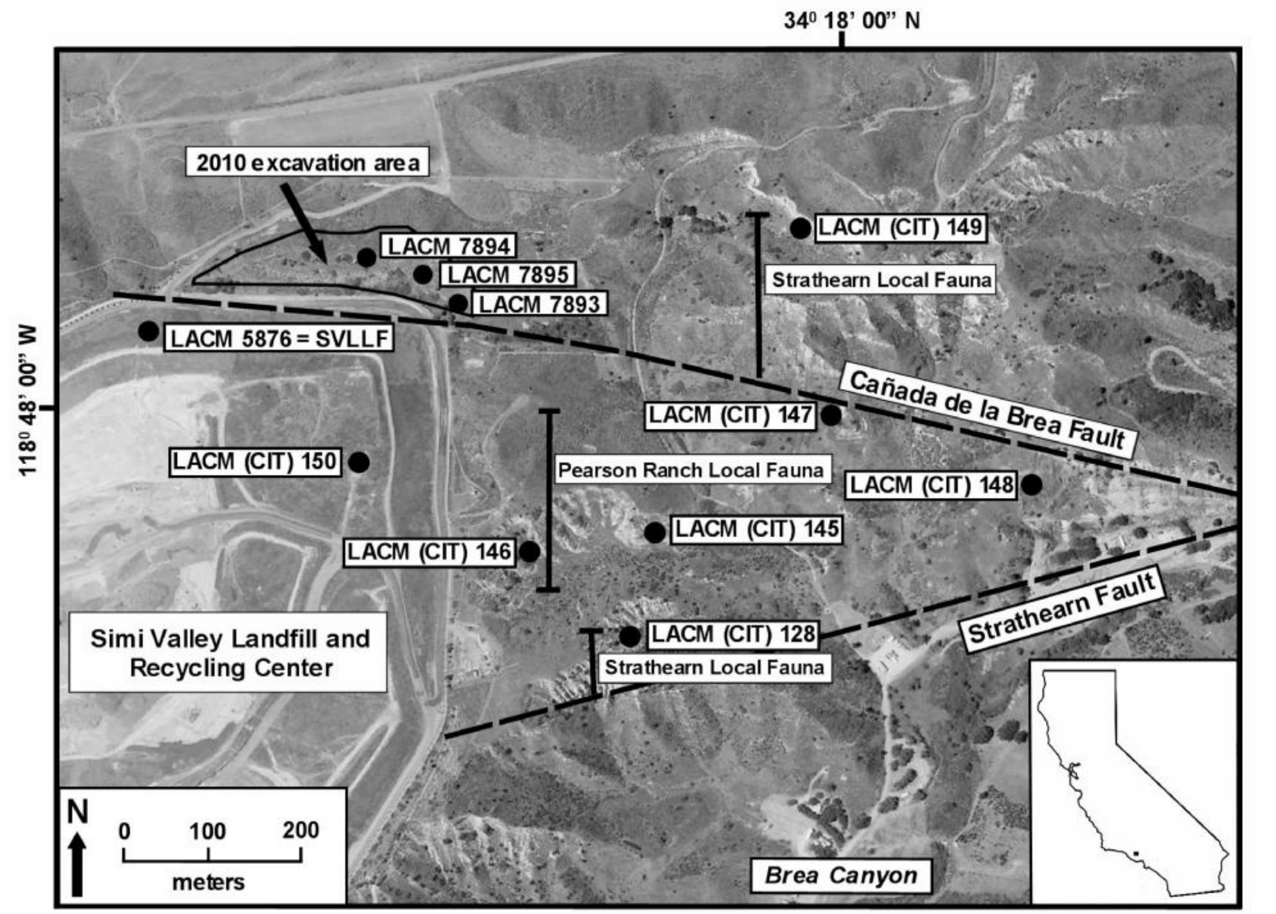

FIGURE 1. Aerial photograph of northeast side of Simi Valley Landfill and Recycling Center and adjacent Brea Canyon showing geographic position of the 2010 excavation area where localities LACM 7893, LACM 7894, and LACM 7895 were located and the relative geographic positions of LACM (CIT) localities that yielded the early Duchesnean Pearson Ranch Local Fauna and the latest Uintan Strathearn Local Fauna. Locality LACM 5876 yielded the middle Duchesnean Simi Valley Landfill Local Fauna (SVLLF). Index map showing geographic location of study area in California. Base photo after USGS Landsat EarthExplorer, 1:6,000.

5872, 7893, 7894, and 7895; 2) the strata directly below the CDLBF to a level just above the highest locality of the Pearson Ranch Local Fauna and containing the Simi Valley Landfill Local Fauna are within a reversed interval; and 3) the strata from the highest locality of the Pearson Ranch Local Fauna to the Strathearn Fault (SF) are within a normal interval, which includes the highest levels of the Strathearn Local Fauna at LACM (CIT) 128 just above the SF. Therefore, the normal interval above the CDLBF correlates with that portion of the normal interval lying just above the SF and containing LACM (CIT) 128. Kelly et al. (2012) reevaluated the Chron assignments of these magnetic intervals and assigned the normal interval containing the upper levels of the Strathearn Local Fauna and Pearson Ranch Local Fauna to Chron C19n and the overlying reversed interval containing the Simi Valley Landfill Local Fauna to Chron C18r.

Wet screening of the matrix samples from the new localities followed by heavy liquid separation of the fossils from the concentrates resulted in the recovery of 308 identifiable microvertebrate fossils, including mammal teeth, lizard specimens (jaws and osteoderms), and fish teeth. The purpose of this report is to document the new small mammal specimens from the Strathearn Local Fauna.

METHODS

Measurements of teeth were made with an optical micrometer to the nearest 0.01 mm. Dental terminology follows Rose (2006:fig. 2.2) for lipotyphlans, Marshall et al. (1990) for marsupials, Korth and Branciforte (2007) for geomyoids, Chiment and Korth (1996) for eomyids, and Korth (1994) for sciurids. Upper and lower teeth are designated by capital and lowercase letters, respectively. All specimens are deposited in the collection of the Department of Vertebrate Paleontology at the Natural History Museum of Los Angeles County.

Abbreviations are as follows: ap, greatest anteroposterior length; L, left; ln, natural log; R, right; tr, greatest transverse width; tra, anterior transverse width; trp, posterior transverse width. Institutional acronyms are as follows: LACM, Natural History Museum of Los Angeles County; LACM (CIT), California Institute of Technology vertebrate fossil localities and specimens, now housed at the LACM.

SYSTEMATIC PALEONTOLOGY

Cohort Marsupialia Illiger, 1811
Order Didelphimorpha Gill, 1872
Family Herpetotheriidae Trouessart, 1879
Genus *Herpetotherium* Cope, 1873
Herpetotherium sp., cf. *H. knighti* McGrew, 1959
Figures 2A-B, Table 1

Referred Specimens—From LACM 7894: partial Lm talonid, LACM 155965. From locality LACM 7895: LM1, LACM 156042; partial Lm talonid, LACM 156003.

Discussion—The LM1 (Figure 2A) is indistinguishable in size and occlusal morphology from those referred by Lillegraven (1976) to *Herpetotherium* sp., cf. *H. knighti* from the Uintan of the San Diego area, including well-developed stylar cusps B, C, and D. Although fragmentary, the other partial molars (e.g., Figure 2B) also agree well morphologically with those of San Diego sample of *H*. sp., cf. *H. knighti*. Kelly et al. (1991) previously recorded *H*. sp., cf. *H. knighti* in the Strathearn Local Fauna and the new specimens confirm their assignment.

Family Peradectidae Crochet, 1979
Genus *Peradectes* Matthew and Granger, 1921
Peradectes californicus (Stock, 1936a)
Figure 2C

Referred Specimens—From locality LACM 7894: Rm talonids, LACM 155925, 155966; Lm trigonids, LACM 155964, 155967; Lm talonid, LACM 155963. From locality LACM 7895: partial RM1 or M2, LACM 156104; partial upper molar, LACM 156163; partial Rm, LACM 156106; Rm trigonid, LACM 156107; Lm trigonid, LACM 156105; Lm talonid, LACM 156161.

Discussion—Eleven partial upper and lower molars agree well in size and occlusal morphology with those of the Uintan and Duchesnean samples of *Peradectes californicus* from the San Diego area and the Sespe Formation (Stock, 1936a; Lillegraven, 1976), and are referred to this species (e.g., Figure 2C). Although *P. californicus* has been previously recorded from the Tapo Canyon, Brea Canyon, and Simi Valley Landfill local faunas (Kelly, 1990, 2010a; Kelly et al., 1991; Kelly and Whistler, 1994), the new specimens represent the first record of the species in the Strathearn Local Fauna.

Order Soricomorpha Gregory, 1910
Family Geolabididae McKenna, 1960a
Genus *Centetodon* Marsh, 1872
Centetodon sp., cf. *C. aztecus* Lillegraven et al., 1981
Figures 2F-H, Table 1

Referred Specimen—From locality LACM 7894: partial Rm2, LACM 155880.

Discussion—The partial m2 is missing the anterior half of the trigonid and the apex of the metaconid (Figures 2F-H). It is characterized by having the following: 1) the protoconid is tall, sharp, and vertically orientated; 2) the metaconid is smaller than the protoconid; 3) the talonid is significantly lower in height than the trigonid; 4) the hypoconid is well-developed and labially positioned; 5) the hypoconulid is positioned lingually, close to the entoconid; 6) the cristid obliqua is medially concave and extends from the hypoconid to the posterior wall of the trigonid, terminating near metaconid-protoconid notch; and 7) labial and posterior cingulids are lacking. Although damaged, the positions of the talonid cusps, concave cristid obliqua, and tall, vertically orientated posterior wall of the trigonid are characters typical of *Centetodon* (Lillegraven et al., 1981). Lillegraven et al. (1981) described *Centetodon aztecus* from the Uintan Friars and Mission Valley formations of the San Diego area. Kelly and Whistler (1994) described *Centetodon* sp., cf. *C. aztecus* from the late Uintan Tapo Canyon and Brea Canyon local faunas. They refrained from a specific assignment because of the small sample size and certain discrepancies in the comparative sizes of the upper and lower molars in the Sespe sample. In size and occlusal morphology, the partial m2 from the Strathearn Local Fauna is indistinguishable from those of *Centetodon* sp., cf. *C. aztecus*. This is the first record of the genus in the Strathearn Local Fauna.

Genus *Batodonoides* Novacek, 1976
Batodonoides rileyi new species
Figures 3-5, Table 1

Holotype—Partial left dentary with partial p4-m3, LACM 156073.

Type Locality—LACM 7895.

Referred Specimens—From locality LACM 7895: partial LM1 or M2, LACM 156076; Rm trigonid, LACM 156108.

Fauna and Age—Strathearn Local Fauna, latest Uintan.

Etymology—Named in honor of James P. Riley, Environmental Engineer at Waste Management of California, Inc., for his conscientious support of the paleontologic mitigation program at the Simi Valley Landfill and Recycling Center over the last 10 years, which has greatly increased our knowledge of the biodiversity in the faunas from the Sespe Formation.

Diagnosis—Differs from all other species of *Batodonoides* by having the lower molar talonid widths narrower relative to the trigonid widths and talonids that are relatively more labially curved (arched) resulting in relatively greater elongation of talonids (especially m3). Further differs from *B. powayensis* Novacek, 1976, by having the following: 1) m1-3 hypoconulids much less developed, more labially positioned, and shorter in height; 2) m1-3 entoconids less developed; 3) m1-3 hypoconids and hypoconulids more closely appressed with the notches separating these cusps shallower; 4) paraconule and postparaconule crista of upper molars less developed; and 5) slightly larger size. Further differs from *B. vanhouteni* Bloch et al., 1998, by having the following: 1) labially positioned m1-3 hypoconulids; 2) weakly-developed m1-3 entoconids present; 3) well-developed m1-3 anterior cingulids; and 4) larger size. Further differs from *B. walshi* Kelly, 2010a, by having the following: 1) smaller size; 2) weakly-developed m1-3 entoconids present; and 3) hypoconid present on m1-3 with shallow notch separating it from the hypoconulid.

Description—The holotype left dentary has the lingual portion of the p4 talonid and partial m1-m3 preserved (Figure 3). The portion of the dentary containing the m3 is broken away from the rest of the dentary. The apexes of the metaconids on all of the molars are broken off and apexes of the protoconids are also broken off on m2-3. Despite the missing portions of the metaconids, it can be surmised that the metaconids are smaller than the protoconids because the diameters of the broken metaconid bases are significantly smaller than those of the protoconids. The lower molars decrease in size posteriorly.

The only character that can be distinguished on the partial p4 is that it possesses a distinct, labially positioned entoconid.

The m1 paraconid is a sharp cusp that is significantly lower than the protoconid. A thin paracristid connects the paraconid to the protoconid. The tall, sharp protoconid is the largest primary cusp.

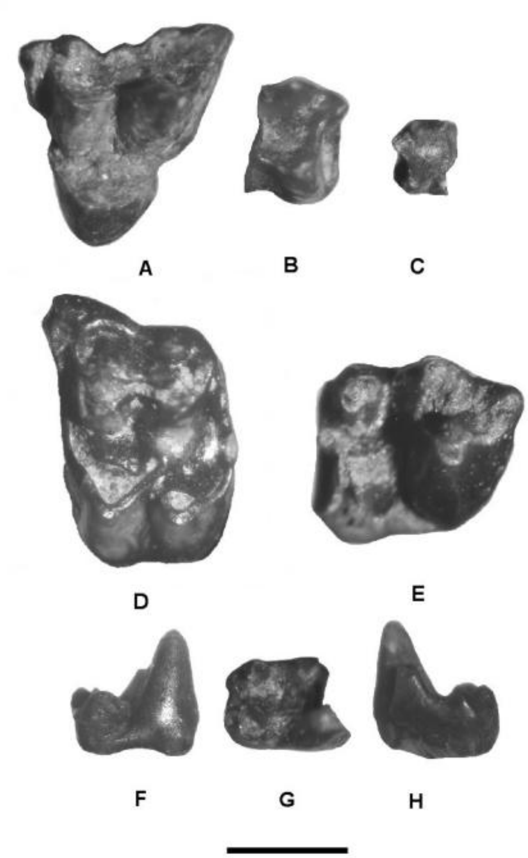

FIGURE 2. Marsupials and lipotyphlans from the Strathearn Local Fauna. A-B, *Herpetotherium* sp., cf. *H. knighti*: A, LM1, LACM 156042; B, Lm talonid, LACM 155965. C, *Peradectes californicus*, Rm talonid, LACM 155966. D-E, *Sespedectes singularis*: D, LM2, LACM 156071; E, Rm1, LACM 156050. F-G, *Centetodon* sp., cf. *C. aztecus*, partial Rm2, LACM 155880. A-E, and G occlusal views. F, labial view. H, lingual view. Scale bar = 1 mm.

A distinct, moderately-developed anterior cingulid is present. A very weakly-developed labial cingulid is present between the protoconid and hypoconid. The narrow talonid is much lower than the protoconid and curved labially giving it an elongated appearance. The entoconid is represented by a small, but distinct, bump along the lingual margin of the talonid. The hypoconulid is positioned labially at the posterior most point of the talonid. A shallow notch separates the hypoconid from the hypoconulid resulting in an indentation between these cusps in occlusal view. The hypoconid is a small and about equal in height to the hypoconulid. The width of the talonid is significantly narrower than that of the trigonid.

The m2 is very similar to the m1, but its trigonid is more anteroposteriorly compressed. Similarly, the m3 trigonid is also more anteroposteriorly compressed

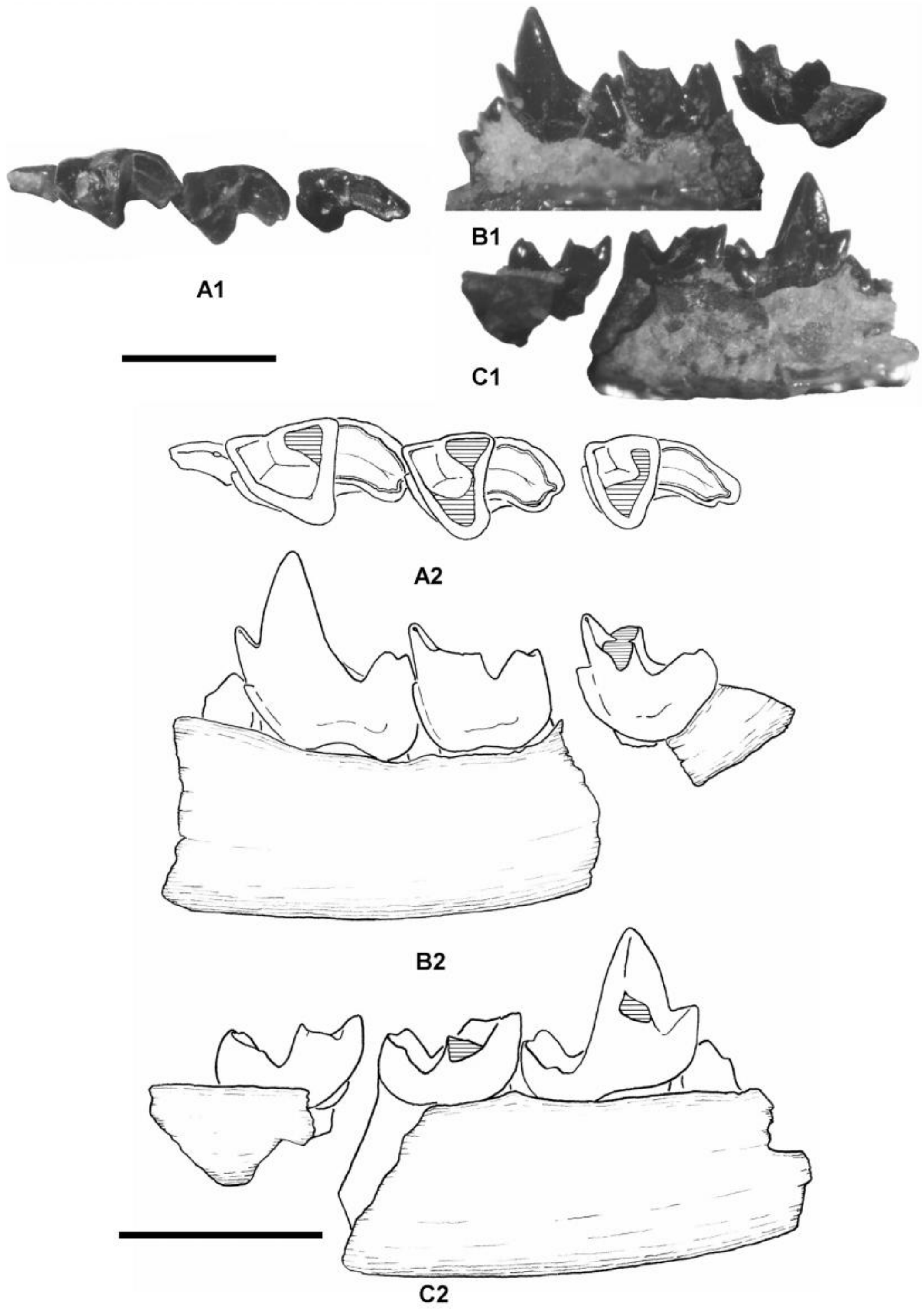

FIGURE 3. Holotype of *Batodonoides rileyi* new species from Strathearn Local Fauna. Partial left dentary with partial m1-3, LACM 156073. A1-A2, occlusal views. B1-B2, labial views. C1-C2, lingual views. Scale bars = 1 mm, cross hatched area = broken off portions.

than that of the m1. The m3 further differs from the m1-2 by having a slightly less developed entoconid and an even more elongated talonid.

TABLE 1. Dental measurements (in mm) of specimens from the Sespe Formation at the Simi Valley Landfill and Recycling Center.

Taxon/Specimens	ap	tr	tra	trp
Herpetotherium sp., cf. *H. knighti*				
LM1, LACM 156042	1.77	1.87	—	—
Batodonoides rileyi new species				
holotype, LACM 156073				
Lp4	—		—	—
Lm1	0.98		0.57	0.36
Lm2	0.82		0.56	0.34
Lm3	0.77		0.43	0.26
Centetodon sp., cf. *C. aztecus*				
partial Lm2,				
LACM 155880	—		—	0.82
Metanoiamys sp.				
Lm1 or m2,				
LACM 156013	1.06		0.85	0.93
Microparamys sp., cf. *M. tricus*				
Lp4, LACM 155918	1.58		1.08	1.35
Rm2, LACM 156069	1.58		1.57	1.65
Griphomys sp.				
partial LP4,				
LACM 156005	0.87		—	0.70

A partial LM1 or M2 was recovered from the same batch of concentrated matrix as that of the holotype dentary (Figure 4). It is missing the labial portion, broken off at about the level of the paracone and metacone. Overall, the enamel is somewhat abraded and the enamel surface surrounding the apex of the paracone is missing. Even in its fragmentary condition, certain characters can be distinguished. It is compressed anteroposteriorly. The paracone is taller and larger than the metacone and they are positioned relatively close to each other. The protocone is a tall, relatively sharp cusp. The postprotocrista extends posterolabially as a sharply inclined, continuous crest from the apex of the protocone to the lingual base of the metacone. There is no indication of a metaconule along the postprotocrista. The preprotocrista extends anterolabially from the apex of the protocone to an indistinct paraconule and then continues labially as a preparaconule crista to the broken edge of the tooth. Even though the enamel is abraded, a postparaconule crista can be discerned that extends posterolabially from the paraconule to the paracone. A distinct, thin precingulum and a well-developed postcingulum are present, but they do not extend across the lingual aspect of the protocone. The postcingulum has a distinct bump (incipient hypocone) near its lingual termination.

Discussion—*Batodonoides rileyi* can be easily distinguished from all other species of the genus by its distinctive lower molar talonid morphology. The widths of the m1-3 talonids of *B. rileyi* are narrower relative to the trigonid widths than in any other species (Table 2). The m1-3 talonids have greater labial curvature than those of other species, which results in an elongation of the talonid with the hypoconulid being more labially positioned. In *B. vanhouteni*, the talonids lack entoconids and hypoconulids (Bloch et al., 1998), whereas in *B. rileyi* weakly-developed entoconids are present and the hypoconulids are small, but distinct cusps, positioned labially at the posterior most points of the talonids. In *B. powayensis*, the talonids are more typical of those of other geolabidid genera and differ from those of *B. rileyi* by having better developed entoconids and taller, much better developed hypoconulids that are positioned more lingually (Novacek, 1976). The talonids of *B. rileyi* also differ from those of *B. powayensis* by having the hypoconids

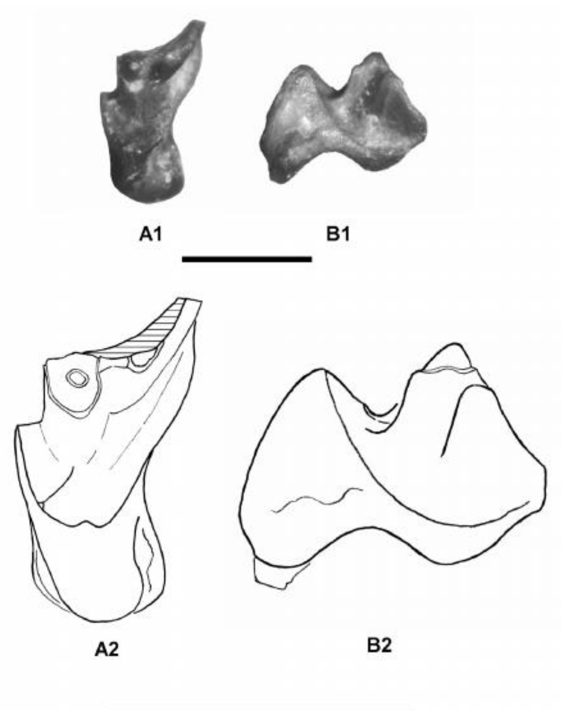

FIGURE 4. *Batodonoides rileyi* new species from Strathearn Local Fauna. Partial LM1, LACM 156076. A1-A2, occlusal views. B1-B2, posterior views. Scale bars = 1 mm.

and hypoconulids more closely appressed with shallower notches separating them. Similarly, the talonids of *B. rileyi* differ from those of *B. vanhouteni* by having shallower posterior notches. The talonids of *B. walshi* differ from those of all other species in being more sectorial, wherein they lack entoconids and have single, sharp posterior cusps, which are probably modified hypoconulids (Kelly, 2010a).

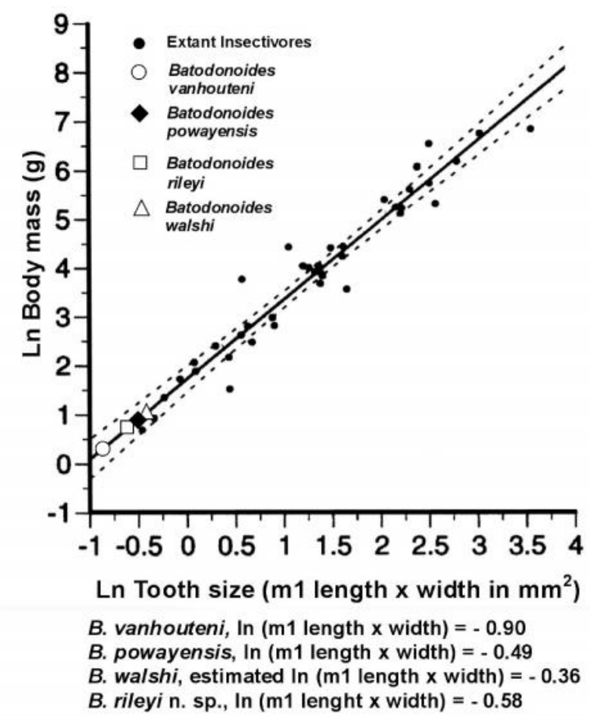

FIGURE 5. Plot correlating ln body mass to ln m1 tooth size of species of *Batodonoides* and other extant insectivores (modified after and following the methodology of Bloch et al., 1998), which indicates an estimated body mass of about 2 g for *B. rileyi*. Least-squares regression plot (solid line) and 95% confidence intervals (dashed curves). Least-squares regression equation: $f(x) = 1.628x + 1.726$, $r = 0.969$.

There appears to be a morphocline in the talonid morphology between late Uintan *B. powayensis*, latest Uintan *B. rileyi*, and middle Duchesnean *B. walshi*, with a progressive reduction and ultimate loss of the lower molar entoconids and hypoconids. However, in the earliest representative, Wasatchian *B. vanhouteni*, the lower molar entoconids are already absent, so polarity this character is questionable. Another possible scenario is that the differences in talonid morphologies represent dietary adaptations and do not reflect phylogeny (Kelly, 2010a). Confident determination for a phylogenetic sequence must await discovery of additional representatives of the genus from the large temporal gap that separates *B. vanhouteni* from the other species. Nevertheless, each species of *Batodonoides* can be easily distinguished by its own distinct talonid morphology.

The partial LM1 or M2 is very similar to those of other species of *Batodonoides* except that the paraconule and postparaconule crista are less distinct. However, this could also be partially a result of abrasion of the enamel on this tooth.

All of the species of *Batodonoides* are very small (Novacek, 1976; Bloch et al., 1998; Kelly, 2010a). Bloch et al. (1998) correlated the square surface areas of the first lower molars to the body masses of extant and fossil "insectivores." They estimated the body mass of *B. vanhouteni* at about 1.30 g., which would make it the smallest mammal to have ever lived. Following their methodology, the body mass of *B. rileyi* is estimated at about 2 g, making it larger than *B. vanhouteni*, but still among the smallest mammals known (Figure 5). Using the same methodology, the body masses of *B. powayensis* and *B. walshi* are successively larger than *B. rileyi*, but are still very small as compared with most extant “insectivores” (Figure 5).

The recognition of *Batodonoides rileyi* in the latest Uintan Strathearn Local Fauna increases our knowledge of the interspecific variation within the genus and represents a new taxon record for the fauna.

Order Erinaceomorpha Gregory, 1910
Family Amphilemuridae, Heller 1935 (including Sespedectidae, Novacek, 1985)
Sespedectes Stock, 1935
Sespedectes singularis Stock, 1935
Figures 2D-E

Referred Specimens—From locality LACM 7893: partial LM1 or M2, LACM 155867. From locality LACM 7894: RP4, LACM 155883; LP4, LACM 155957; partial RM1 or M2, LACM 155960; partial LM1s, LACM 155888, 155916; partial LM1 or M2s, LACM 155882, 155961; RM2s, LACM 155910, 155979; partial RM2, LACM 155954; RM3, LACM 155928; partial RM3s, LACM 155877, 155881; lower antemolar, LACM 155987; Rp2, LACM 155926; Rm1 or m2s, LACM 155873, 155895, 155955; partial Lm1 or m2s, LACM 155956, 155958, 155962, 155982; partial Rm2, LACM 155959; Rm3, LACM 155889. From locality LACM 7895: RI1, LACM 156132; RP4, LACM 156033; LM2, LACM 156071; partial RM1 or M2, LACM 156066; Rp4, LACM 156001; partial Rp4, LACM 156058; Rm1, LACM 156050; partial Lm1 or m2, LACM 156160; Rm3, LACM 155998.

Discussion—*Sespedectes singularis* is the second most abundant taxon in the new samples from the Simi Valley Landfill and Recycling Center (Figures 2D-E). Kelly et al. (1991) previously recorded *S. singularis* in the Strathearn Local Fauna, but the new specimens significantly increase the sample size of this species for the fauna. Novacek (1985) provided detailed descriptions of the cheek teeth of *S. singularis* and the new specimens do not provide any additional information for the species.

TABLE 2. Comparison of lower molar trigonid widths relative to talonid widths in species of *Batodonoides*.

Ratio	*B. vanhouteni*	*B. powayensis*	*B. rileyi*	*B. walshi*
m1 trp/m1 tra	0.80	0.80	0.63	—
m2 trp/m2 tra	0.68	—	0.61	0.74
m3 trp/m3 tra	—	0.65	0.60	0.71

Order Rodentia Bowdich, 1821
Family Eomyidae Deperet and Douxami, 1902
Metanoiamys Chiment and Korth, 1996
Metanoiamys sp.
Figure 6H, Table 1

Referred Specimen—From locality LACM 7895: Lm1 or m2, LACM 156013.

Discussion—The Lm1 or m2 is characterized by having the following: 1) relatively low-crowned; 2) the metalophid and hypolophid are low, but complete lophids connecting the protoconid to the metaconid and the hypoconid to the entoconid, respectively; 3) an isolated mesoconid that is positioned between the protoconid and hypoconid with a low, posteriorly inclined mesolophid extending from it a short distance into the central transverse valley; 4) a well-developed anterior cingulid that is open labially; 5) a well-developed anteroconid on the anterior cingulid that is connected to the metalophid by an adlophulid (accessory lophid); and 6) a distinct posterior cingulid that extends from the labial aspect of the hypolophid to the posteromedial edge of the entoconid, which together form a Y-shaped occlusal pattern.

The Lm1 or m2 agrees well in occlusal morphology with those of *Metanoiamys* and is confidently referred to the genus (Storer, 1987; Kelly, 1992, 2010b; Chiment and Korth, 1996; Kelly and Whistler, 1998; Kelly et al., 2012). The new specimen represents a small species of the *Metanoiamys* that is similar in size to *H. marinus* Chiment and Korth, 1996, and *M. parodoxus* Emry and Korth, 2012, slightly larger than *M. lacus* Storer, 1987, and smaller than *M. fantasma* Lindsay, 1968, *M. fugitivus* Storer, 1984, *M. agorus* Chiment and Korth, 1996, and *M. korthi* Kelly and Whistler, 1998. The Lm1 or m2 from the Strathearn Local Fauna exhibits similarities to both late Uintan and middle Duchesnean species of *Metanoiamys*. The incomplete ectolophid is more similar to those of the late Uintan species than to those of the middle Duchesnean *M. lacus* and *M. korthi*, in which the ectolophids are usually complete. However, Emry and Korth (2012) reported that in the early Chadronian *M. paradoxus*, the ectolophid is also incomplete, but in this species the mesoconid on m1-2 is usually connected to the posterior arm of the protoconid by a partial ectolophid that is moderately tall. The heights of the primary cusps and lophids (metalophid and hypolophid) of the *Metanoiamys* tooth from the latest Uintan Strathearn Local Fauna are relatively taller than those of the late Uintan species, but lower than those of the middle Duchesnean species. Thus, it appears to be intermediate in occlusal morphology and crown height between the late Uintan and middle Duchesnean species, indicating that it probably represents a new species. However, until a much larger sample is available, it is referred to *Metanoiamys* sp. This specimen is the first record of the genus in the Strathearn Local Fauna.

Family Ischyromyidae Alston, 1876
Microparamys Wood, 1959
Microparamys sp., cf. *M. tricus* (Wilson, 1940)
Figures 6J-K, Table 1

Referred Specimens—From locality LACM 7894: Lp4, LACM 155918. From locality LACM 7895: Rm2, LACM 156069.

Discussion—Kelly and Whistler (1994) described *Microparamys woodi* from the late Uintan Tapo Canyon and Brea Canyon local faunas and *Microparamys* sp., cf. *M. tricus* from the Brea Canyon Local Fauna. The localities that yielded *M. woodi* are stratigraphically well below those that yielded *M.* sp., cf. *M. tricus* (Kelly et al., 1991; Kelly and Whistler, 1994). In fact, localities LACM 5866 and 5869 that yielded *M.* sp., cf. *M. tricus* occur in the two highest stratigraphic levels assigned to the Brea Canyon Local Fauna. Kelly and Whistler (1994) noted that the occlusal morphology of *M.* sp., cf. *M. tricus* is very similar to that of *M. tricus* from the early Duchesnean Pearson Ranch Local Fauna, but differs by having the following: 1) smaller size; 2) the M2 postprotocrista is much more weakly developed and separated from the metaconal region by a labial continuation of the valley that separates the protocone from the hypocone; 3) the lingually directed crest from the mesostyle in the upper molars is slightly less developed; 4) the m1-2 anterior cingulid is slightly larger with a more prominent cusp at its the labial termination; 5) the m2 hypolophid is slightly less robust; and 6) the m3 postprotocristid is less developed. Based on these differences, they considered *M.* sp., cf. *M. tricus* as slightly less derived than *M. tricus*. In size and occlusal morphology the m2 (Figure 6K) from the Strathearn Local Fauna is indistinguishable from those assigned to *M.* sp., cf. *M. tricus*.

The p4 of *M.* sp., cf. *M. tricus* was previously unknown. Although the p4 from the Strathearn Local Fauna is well-worn with its enamel abraded (Figure 6J), the following characters can still be discerned: 1) the trigonid is significantly narrower than the talonid; 2) the protoconid is reduced and smaller than the well-developed metaconid; 3) the entoconid and hypoconid are well developed cusps that appear to lack a hypolophid between them; 4) the ectolophid is complete with a slight bulge near its center that may represent a mesoconid; and 5) the posterior cingulid is well developed, extending from the posterolingual corner of the hypoconid to the posterior base of the entoconid. The p4 occlusal morphology agrees well with those of *Microparamys* (e.g., see Wilson, 1940; Wood, 1962; Lillegraven, 1977; Kelly and Whistler, 1994) and its size is compatible with the m2 from the Strathearn Local Fauna (Table 1), strongly suggesting that the p4 belongs to the same species as the m2. Thus, the p4 is tentatively assigned to *M.* sp., cf. *M. tricus*. This is the first record of this taxon in the Strathearn Local Fauna.

Simimyidae Wood, 1980
Simimys Wilson, 1935b
Simimys simplex (Wilson, 1935a)
Figures 6A-F

Referred Specimens—From locality LACM 7893: Lm1, LACM 155868; Rm3s, LACM 155869, 155870; partial Lm3, LACM 155872. From locality LACM 7894: LM1s, LACM 155878, 155884, 155899, 155901, 155929, 155936, 155946; RM1s, LACM 155896, 155900, 155949; LM2, LACM 155906; RM2s, LACM 155907, 155908, 155909, 155943, 155945; LM3, LACM 155891; RM3s, LACM 155919, 155922; Lm1s, LACM 155874, 155938; Rm1s, LACM 155892, 155937, 155985; Lm2s, LACM 155898, 155902, 155904, 155917, 155932, 155933, 155939, 155940, 155948; Rm2s, LACM 155890, 155903, 155912, 155913, 155915, 155924, 155941, 155984; Lm3s, LACM 155893, 155905, 155920, 155931; Rm3s, LACM 155934, 155942. From locality LACM 7895: LM1s, LACM 156010, 156011, 156016, 156020, 156026, 156038, 156041, 156060, 156062, 156075, 156082; RM1s, LACM 156021, 156022, 156028, 156040, 156052, 156061, 156068, 156077; LM2s, LACM 156023, 156024, 156025, 156046, 156048, 156055, 156078; RM2s, LACM 156035, 156044, 156054, 156056, 156065, 156067; RM3s, LACM 155999, 156000, 156030, 156034, 156045, 156074, 156081; Lm1s, LACM 156039, 156088; Rm1s, LACM 156002, 156018, 156027, 156029, 156064, 156084, 156085; Lm2s, LACM 156012, 156037, 156053, 156059, 156086, 156090; Rm2s, LACM 156008, 156031, 156032, 156036, 156047, 156051, 156087, 156089, 156093; Lm3s, LACM 156004, 156014, 156015, 156017, 156019, 156049; Rm3s, LACM 156057, 156072.

Discussion—*Simimys simplex* (Figures 6A-F) is the most abundant taxon within the new samples from the Simi Valley Landfill and Recycling Center with all cheek tooth positions being represented. Lillegraven and Wilson (1975) provided a comprehensive description and complete analysis of *S. simplex*, so the new specimens do not provide any additional information on the species. *Simimys simplex* was previously recorded in the Strathearn Local Fauna by Kelly et al. (1991).

Family ?Geomyidae Gill, 1872
Griphomys Wilson, 1940
Griphomys sp.
Figure 6I, Table 1

Referred Specimen—From locality LACM 7895: partial LP4, LACM 156005.

Discussion—The partial P4 has the enamel surface abraded away along the lingual margin, including the apexes of the paracone and metacone. However, even in its damaged state, the following characters can be discerned: 1) the talon is narrower than the trigon; 2) the protoloph and metaloph are tall, complete crests connecting the protocone to the paracone and the hypocone to the metacone, respectively; 3) a short protoconal spur or mesocone extends posterolingually from the protocone into the central transverse valley; 4) a distinct anterior cingulum that extends from the protocone to the metacone; and 5) a tall, well-developed posterior cingulum that extends from the posterolingual corner of the hypocone to the metacone. The strongly bilophodont occlusal pattern, the presence of a small protoconal spur, and the arrangements of the connections of the anterior and posterior cingula are characters that are diagnostic for *Griphomys* (Wilson, 1940; Lindsay, 1968; Lillegraven, 1977; Kelly and Whistler, 1994).

Griphomys is a relatively rare taxon in the Sespe Formation. Based on a few specimens, Wilson (1940)

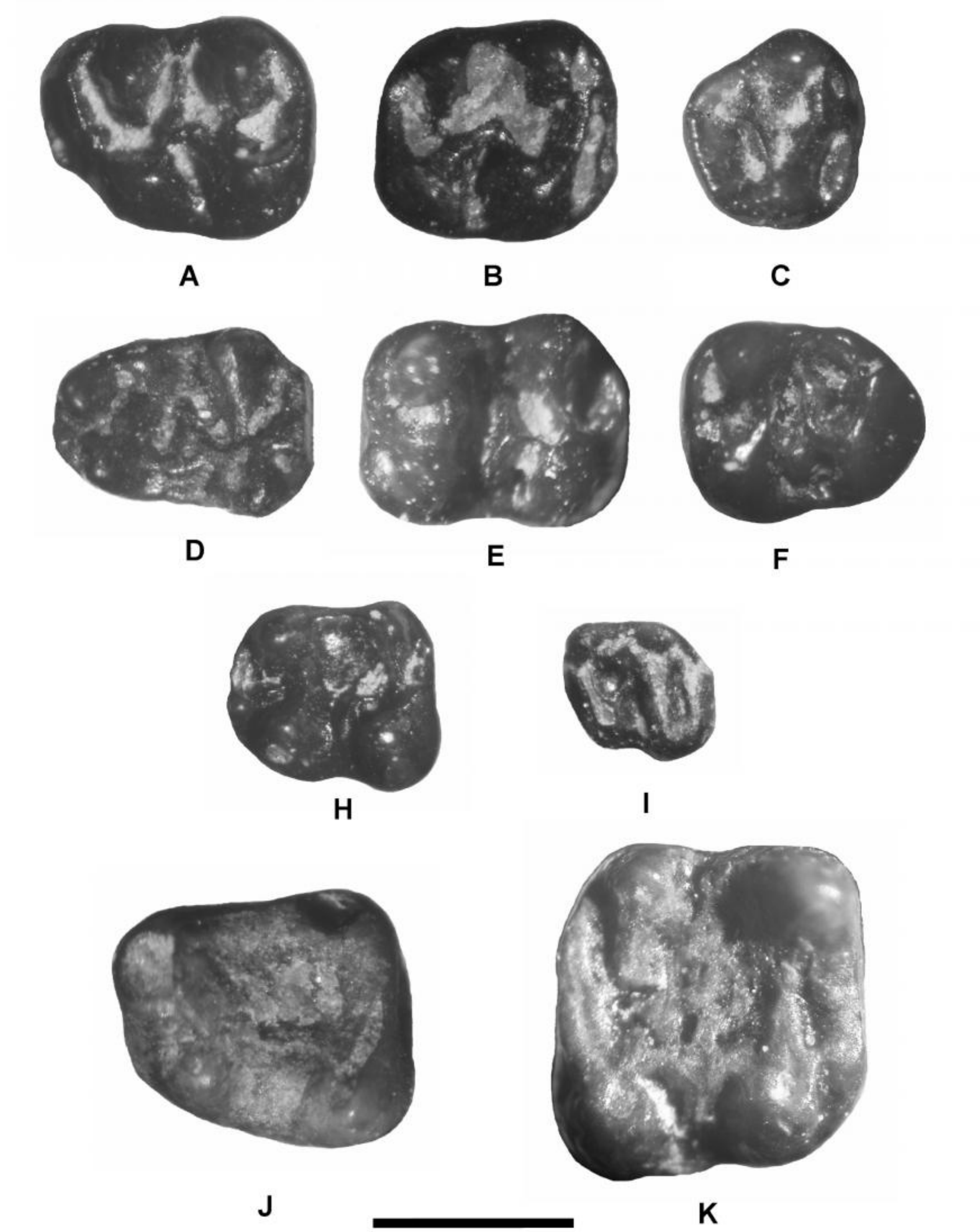

FIGURE 6. Rodents from the Strathearn Local Fauna. A-F, *Simimys simplex*: A, LM1, LACM 156060; B, RM2, LACM 156056; C, RM3, LACM 155922; D, Lm1, LACM 155874; E, Lm2, LACM 156053; F, Lm3, LACM 156017. H, *Metanoiamys* sp., Lm1 or m2, LACM 156013. I, *Griphomys* sp., partial LP4, LACM 156005. J-K, *Microparamys* sp., cf. *M. tricus*: J, Lp4, LACM 155918; K, Rm2, LACM 156069. All occlusal views, scale bar = 1 mm.

described *Griphomys alecer* from the late Uintan Tapo Canyon and early Duchesnean Pearson Ranch local faunas. Subsequently, Kelly and Whistler (1994) described a much larger sample of *G. alecer* from the Sespe Formation. Although Kelly et al. (1991) reported the occurrence of *G. alecer* in the Strathearn Local Fauna, this record is incorrect because *G. alecer* has been previously recorded only in the Tapo Canyon, Brea Canyon and Pearson Ranch local faunas (Wilson, 1940; Kelly and Whistler, 1994). Kelly and Whistler (1994) referred also an isolated m3 that Lindsay (1968) described from the Hartman Ranch Local Fauna of the type Sespe Formation to the species and confirmed Lillegraven's (1977) assignment of six teeth from the Laguna Riviera Local Fauna of the San Diego area to the species. Based on four isolated lower cheek teeth from the Camp San Onofre Local Fauna of San Diego County, Lillegraven (1977) described a second species, *G. toltecus*, which differs from *G. alecer* by having significantly larger teeth, the lingual end of the transverse valley is blocked by a wall and the metalophid, a stronger protoconal spur (= mesoconid ridge of Lillegraven [1977]) in the transverse valley, and a preprotocristid retained. The occlusal morphology of the P4 from the Strathearn Local Fauna is very similar to that of *G. alecer*. However, it differs from the P4s of *G. alecer* by being about 26% smaller in size. No P4s have been described for *G. toltecus*, but considering that its lower cheek teeth are significantly larger than those of *G. alecer*, one can assume that the Strathearn Local Fauna *Griphomys* was also significantly smaller than *G. toltecus*. The Strathearn Local Fauna *Griphomys* specimen probably represents a new species, but until a much larger sample is available, it is referred to *Griphomys* sp. This is the first record of the genus in the Strathearn Local Fauna.

CONCLUSIONS

For more than 20 years, an ongoing paleontologic resource impact mitigation program at the Simi Valley Landfill and Recycling Center has yielded thousands of middle Eocene fossils spanning the Uintan and Duchesnean North American Land Mammal Ages. During the latest phase, a new sample of small mammal fossils was recovered from localities LACM 7893, 7894, and 7895. Based on their stratigraphic positions, these localities are assigned to the Strathearn Local Fauna, making the new sample highly significant because only seven localities were previously known for the fauna.

New records for the Strathearn Local Fauna include the following: *Peradectes californicus*; *Centetodon* sp., cf. *C. aztecus*; *Batodonoides rileyi* new species; *Metanoiamys* sp.; *Microparamys* sp., cf. *M. tricus*; and *Griphomys* sp. Although Kelly et al. (1991) previously recorded *Sespedectes singularis* and *Simimys simplex* in the Strathearn Local Fauna, new specimens of these taxa were also recovered and significantly increased their sample sizes for the fauna. A revised faunal list for the Strathearn Local Fauna is presented in Table 3.

TABLE 3. Revised faunal list of the latest Uintan Strathearn Local Fauna (after Kelly, 1990; Kelly et al., 1991; Kelly and Whistler, 1994; and this paper).

- Actinopterygii
    - ?Lepisosteidae or Amiidae, gen. undet.
- Squamata
    - Xantusiidae
        - "*Palaeoxantusia*" sp., cf. "*P.*" *allisoni* Schatzinger, 1980
    - Iquanidae, gen. and sp. indet. (small)
    - Anguidae
        - ?Diploglossinae, gen. undet.
- Didelphimorphia
    - Herpetotheriidae
        - *Herpetotherium* sp., cf. *H. knighti* McGrew, 1959
    - Peradectidae
        - *Peradectes californicus* (Stock, 1936a)
- Lipotyphla
    - Amphilemuridae (or Sespedectidae)
        - *Sespedectes singularis* Stock, 1935
        - *Proterixoides davisi* Stock, 1935
    - Geolabididae
        - *Centetodon* sp., cf. *C. aztecus* Lillegraven et al., 1981
        - *Batodonoides rileyi* n. sp.
- Primates
    - Omomyidae
        - *Dyseolemur pacificus* Stock, 1934a
- Rodentia
    - Eomyidae
        - *Metanoiamys* sp.
    - Ischyromyidae
        - *Microparamys* sp., cf. *M. tricus* (Wilson, 1940)
        - *Mytonomys* sp., cf. *M. mytonensis* (Wood, 1962)
    - Geomyiodea, ?Geomyidae
        - *Griphomys* sp. (small)
    - Simimyidae
        - *Simimys simplex* (Wilson, 1935a)
- Artiodactyla
    - Hypertragulidae
        - *Simimeryx hudsoni* Stock, 1934b
    - Agriochoeridae
        - *Protoreodon "pumilus"* (Marsh, 1875) = ?*Eomeryx*, see Lander, 2011
    - Protoceratidae
        - *Leptoreodon stocki* Kelly, 1990
        - *Leptoreodon* sp., cf. *L. pusillus* Golz, 1976
    - ?Camelidae, gen. and sp. indet.
- Perissodactyla
    - Hyracodontidae
        - ?*Triplopus woodi* Stock 1936b

Kelly (1990) and Kelly et al. (1991) regarded the Strathearn Local Fauna as a transitional fauna and were uncertain as to whether the fauna should be assigned to the Uintan or Duchesnean. Recently, Kelly et al. (2012) reevaluated the local faunas from the middle member of the Sespe Formation. Based on magnetostratigraphy, radioisotopic data, and faunal comparisons, they provided new correlations of the middle Eocene faunas from the Sespe Formation to those from the type Duchesnean Duchesne River Formation of Utah, wherein they provided evidence that the Strathearn Local Fauna is latest Uintan and a correlative of the latest Uintan Randlett Local Fauna. Some of the new specimens reported on herein appear to further support their conclusions. For example, *Microparamys* sp., cf. *M. tricus*, which was previously known only from the highest stratigraphic levels of the late Uintan Brea Canyon Local Fauna, is slightly less derived than *M. tricus* of the early Duchesnean Pearson Ranch Local Fauna and *Metanoiamys* sp. appears less derived than middle Duchesnean *M. lacus* and *M. korthi*, but more derived than the late Uintan representatives of the genus.

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