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A NEW SPECIES OF *HELISCOMYS* (RODENTIA, HELISCOMYIDAE) FROM THE DUCHESNEAN (MIDDLE EOCENE) SIMI VALLEY LANDFILL LOCAL FAUNA, SESPE FORMATION, CALIFORNIA

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ABSTRACT

A paleontologic mitigation program at the Simi Valley Landfill and Recycling Center, Ventura County, California, has resulted in a significant new sample of isolated small mammal teeth from the Duchesnean (middle Eocene) Simi Valley Landfill Local Fauna of the Sespe Formation. Previously, only two teeth of *Heliscomys* were known from this local fauna. The new sample includes 43 additional teeth of *Heliscomys* and indicates that this sample represents a new species, herein named *Heliscomys walshi*. This is the oldest recognized species of the genus.

INTRODUCTION

The middle Eocene to early Miocene Sespe Formation of southern California has yielded abundant fossil mammals over the last seventy-seven years (e.g., Stock, 1932, 1935, 1936; Golz, 1976; Golz and Lillegraven, 1977; Mason, 1988; Kelly, 1990, 1992; Kelly et al., 1991; Kelly and Whistler, 1994, 1998; Whistler and Lander, 2003). Five superposed local faunas of middle Eocene age have been recognized from the middle member of the Sespe Formation exposed along the north side of Simi Valley, Ventura County, California (Kelly, 1990, 1992, Kelly et al., 1991). The youngest of these faunas is the Duchesnean Simi Valley Landfill Local Fauna from bed 30A (Natural History Museum of Los Angeles County locality 5876) of the middle member (Kelly et al., 1991). Based on magnetostratigraphy, Prothero et al. (1996) placed bed 30A within Chron 17r of the geomagnetic polarity time scale, or about 38.0 – 37.8 million years before present (Luterbacher et al., 2004; Lander, 2008). Recently, 345 isolated teeth of fossil mammals were recovered by wet screen sieving of bulk matrix from bed 30A during a long-term paleontologic mitigation program at the Simi Valley Landfill and Recycling Center (Lander, 2008). These teeth represent a significant increase in the samples of fossil mammals of the Simi Valley Landfill Local Fauna.

Based on two isolated molars, Kelly (1992) reported the occurrence of *Heliscomys* sp. from the Simi Valley Landfill Local Fauna. Kelly (1992) identified these teeth as upper molars, but Korth and Eaton (2004) correctly recognized that they represent lower molars. An additional 43 teeth of *Heliscomys* were recovered from bed 30A, which allow a detailed analysis of this taxon and indicate that it represents a new species. The purpose of this report is to describe this new species.

METHODS

Measurements of teeth were made with an optical micrometer to the nearest 0.01 mm. Cheek teeth cusp terminology follows Korth and Branciforte (2007, fig. 1) with the exception of certain cheek teeth accessory loph and lophid terms (preprotocrista, postprotocrista, and preprotocristid), which follow Szalay (1969, fig. 1) and Kelly (1992, figs. 1-2). Dental formulae follow standard usage (e.g., Korth, 1994). Upper and lower teeth are designated by uppercase and lowercase letters, respectively. All specimens were recovered by wet screen sieving of bulk matrix from bed 30A of the middle member of the Sespe Formation at the Simi Valley Landfill and Recycling Center during a mitigation program directed by Paleo Environmental Associates, Inc., for Waste Management of California, Inc. All specimens are deposited in the Vertebrate

Paleontology Section of the Natural History Museum of Los Angles County. Detailed locality data are available at this institution and also see Lander (2008).

Abbreviations and acronyms are as follows: ap, anteroposterior; CV, coefficient of variation; L, left; LACM, Natural History Museum of Los Angeles County; N, number of specimens; Ma, megannum (one million years in the radioisotopic time scale); OR, observed range; R, right; SD, standard deviation; tra, anterior transverse width; trp, posterior transverse width.

SYSTEMATIC PALEONTOLOGY

Order Rodentia Bowdich, 1821

Family Heliscomyidae Korth, Wahlert, and Emry, 1991

Genus *Heliscomys* Cope, 1873

Heliscomys walshi new species

Holotype—LP4, LACM 153717.

Type Locality—LACM 5876, bed 30A of middle member of the Sespe Formation, Simi Valley Landfill, Simi Valley, Ventura County, California.

Referred Specimens—LP4s, LACM 153718, 153719; LM1 or 2s, LACM 153715, 153721, 153722, 153723, 153724, 153725, 153726, 153727, 153740, 153748; partial LM1 or 2, LACM 153728; RM1 or 2s, LACM 153716, 153729, 153730, 153731, 153732; partial RM1 or 2, LACM 153733; LM3s, LACM 153754, 153755; Lp4 or Ldp4, LACM 153720. Lm1 or 2s, LACM 131452, 153734, 153735, 153736, 153739, 153741, 153742, 153743, 153744, 153745, 153749, 153750, 153751, 153752; Rm1 or 2s, LACM 131456, 153737, 153738, 153746, 153747, 153753; Lm3s, LACM 153756, 153757.

Fauna and Age—Simi Valley Landfill Local Fauna, middle Eocene (Duchesnean), or about 38.0 - 37.8 Ma.

Etymology—Named in honor of the late Steven L. Walsh of the Department of Paleontology, San Diego Natural History Museum, California, for his extensive contributions to our understanding of Eocene mammals of the Pacific Coast.

Diagnosis— *Heliscomys walshi* differs from all other species of *Heliscomys* by having the following: 1) large, well-developed paracone always present on P4 (equal in size to protocone); 2) P4 entostyle lacking; 3) M1-2 preprotocrista and postprotocrista present with latter moderately-developed and extending posterolabially across central valley between protoloph and metaloph; 4) p4 (or dp4) and m1-2 with anterolingually directed lophid present on hypoconid that crosses and interrupts middle central valley between metalophid and hypolophid; and 5) m1-2 stylar cusps (protostylid and hypostylid) usually less developed. Two subgenera of *Heliscomys* are recognized (*Syphyriomys* and *Heliscomys*), which are differentiated primarily by the size of P4 relative to that of M1 (Korth, 1995). *H. walshi* differs from species of *Heliscomys* (*Syphyriomys*) including *H.* (*S.*) *gregoryi* Wood, 1933, *H.* (*S.*) *hatcheri* Wood, 1935, *H.* (*S.*) *subtilus* (Lindsay, 1972), *H.* (*S.*) *ostranderi* Korth et al., 1991, and *H.* (*S.*) *macdonaldi* Korth and Branchiforte, 2007, by having P4 more reduced relative to M1-2 (mean P4 transverse width = 71% of mean M1-2 transverse width). It differs from species of *Heliscomys* (*Heliscomys*), including *H.* (*H.*) *vetus* (= *H. senex* Wood, 1935; but also see Korth, 1989; Bell, 2004; and Flynn et al., 2008), *H.* (*H.*) *medius* Korth, 2007a, and *Megaheliscomys mcgrewi* (= *H.* (*H.*) *mcgrewi* of Korth, 1989; also see Korth, 2007b) by having P4 less reduced relative to M1-2. Further differs from *H. vetus*, *H. ostranderi*, and *H. subtilus* by slightly smaller size, from *H. hatcheri*, *H. gregoryi*, *H. macdonldi*, and *H. medius* by smaller size, and *M. mcgrewi* by much smaller size. Further differs from *H. ostranderi* by having following: 1) when P4 paracone present in *H. ostranderi*, P4 paracone of *H. walshi* larger and much better developed; 2) p4 (or dp4) proportionately larger in size relative to m1-2; and 3) the p4 (or dp4) metaconid and protostylid are much better developed (relatively larger). Further differs from *Megheliscomys mcgrewi* by having P4 with much better developed cusps, including large paracone. It differs from *Passaliscomys priscus* Korth and Eaton, 2004, by having the following: 1) P4 paracone and protocone bases not as well separated, somewhat fused; 2) M1-2 hypostyle variably present; 3) M1-2 postprotocrista present that crosses and interrupts the central valley between the protoloph and metaloph; 4) M3 protocone and preprotocrista better developed; 5) m1-2 protostylids and hypostylids usually present; 6) m1-2 with anterolingually directed lophid present on hypoconid that crosses and interrupts middle central valley between metalophid and hypolophid; 7) m3 hypolophid more reduced relative to those of m1-2; and 8) smaller size.

Description—All of the specimens are isolated teeth. Without any intact upper or lower dentitions, it is not possible to distinguish with any certainty the first upper and lower molars from the second upper and lower molars, respectively. However, heliscomyid premolars and third molars (P4/p4 and M3/m3) are distinctive and can be easily distinguished from the first and second molars.

Three LP4s are present in the sample. They are four cusped (Figure 1A-C) and were probably obliquely orientated with the paracone positioned most anterior, as in other heliscomyid rodents. The paracone and protocone are very well developed and equal in size and height. Although the paracone and protocone are well separated for most of their height, their bases are closely oppressed. The metacone and hypocone are

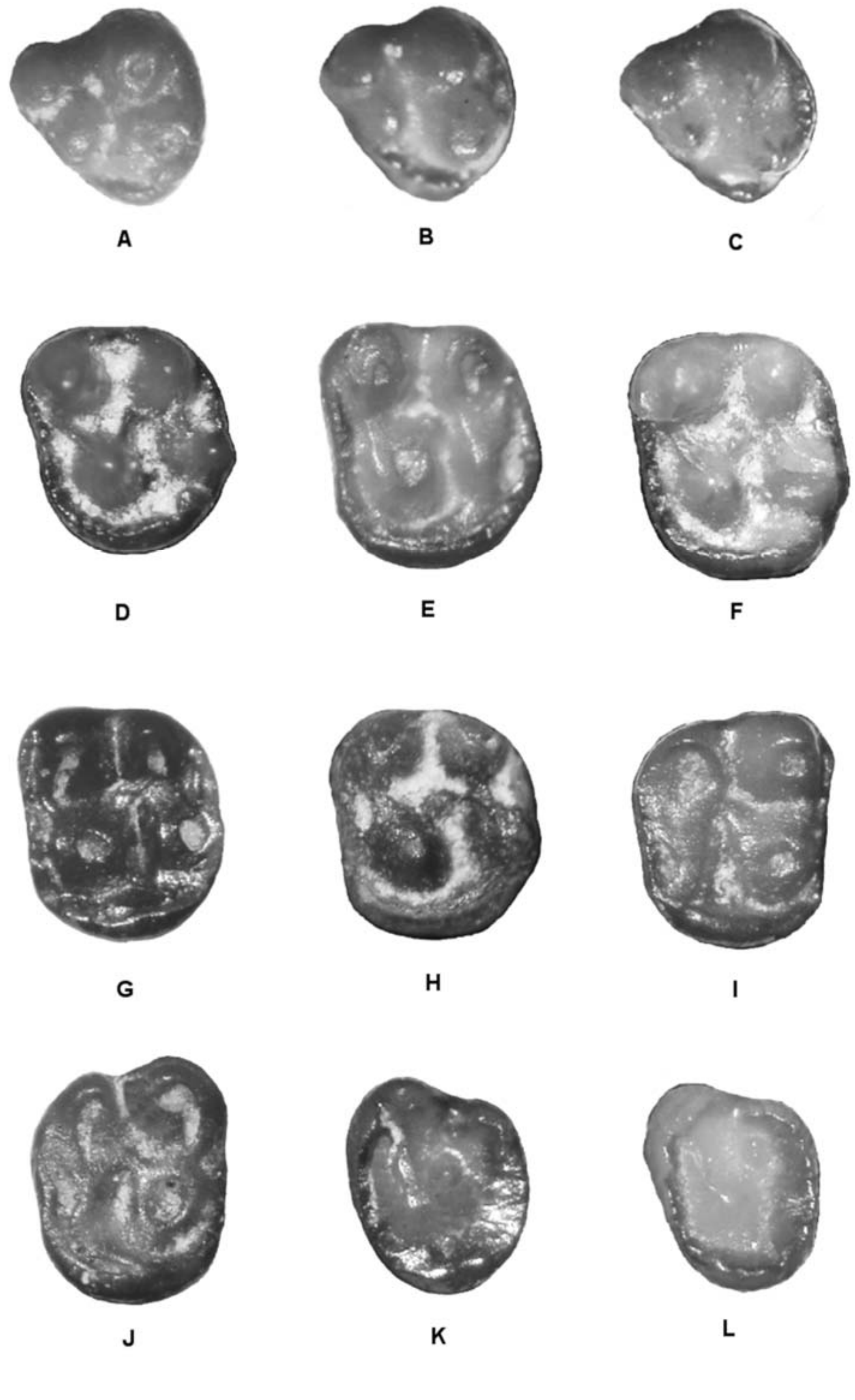

FIGURE 1. Upper teeth of *Heliscomys walshi* from Simi Valley Landfill Local Fauna. A, LP4, Holotype, LACM 153717. B, LP4, LACM 153718. C, LP4, LACM 153719. D, LM1 or 2, LACM 153715. E, LM1 or 2, LACM 152223. F, LM1 or 2, LACM 153224. G, LM1 or 2, LACM 153748. H, LM1 or 2, LACM 153725. I, RM1 or 2, LACM 153730. J, RM1 or 2, LACM 153729. K, LM3, LACM 153754. L, LM3, LACM 153755. All occlusal views, labial up, scale = 1 mm.

about equal in size. There are no transverse lophs connecting any the primary cusps. A lingual cingulum is present that extends posteriorly from near the anterolingual base of the protocone to near the lingual aspect of the hypocone. There are very small cuspules developed along the lingual cingulum, but there is no indication of a distinct entostyle or hypostyle present. A weakly-developed posterior cingulum is present on one premolar (Figure 1C) between the metacone and hypocone. It might be argued that the three upper premolars in the Sespe sample are deciduous. However, deciduous premolars of *Heliscomys* are rarely preserved, with only two specimens of *H. vetus* being previously known (Galbreath, 1962; Korth and Eaton, 2004). The probability of finding three deciduous premolars representing three individuals to the exclusion of any permanent premolars seems unlikely. Furthermore, although a paracone is present in the two known upper deciduous premolars of *Heliscomys*, it is distinctly smaller than the protocone (Galbreath, 1962). Also, a distinct hypostyle is present, which is lacking in the Sespe specimens. For these reasons, the Sespe specimens are regarded as permanent premolars. The P4s are smaller than the M1-2s with a mean width that is 71% of the M1-2 mean width.

Confident differentiation of first and second upper molars cannot be made, but they are distinguished from the first and second lower molars by their more rounded occlusal outlines with relatively greater transverse widths (not square). Most of the M1-2s in the sample are four cusped (paracone, metacone, protocone, and hypocone), but three specimens exhibit a weakly to moderately-developed hypostyle on the lingual cingulum (Figure 1D-J). A protostyle is lacking on all of the M1-2s. The paracone is well developed, slightly larger than the metacone and well separated from the metacone by a central valley. It is the most anteriorly positioned cusp on the crown. The protocone is the largest cusp. A weakly-developed lophid (preprotocrista) is often present that extends from protocone to the anterolingual base of the paracone. A moderately-developed loph (postprotocrista) is present in all of the M1-2s that extends from the posterolabial base of the protocone to the anterolingual base of the metacone and interrupts the central valley separating the protoloph (paracone and protocone) from the metaloph (metacone and hypocone). The metacone is slightly larger than the hypocone in unworn teeth, but, with wear, the hypocone is reduced more rapidly than the metacone. A weakly-developed loph is sometimes present extending from the anterolabial base of the hypocone to the anterolingual base of the metacone. The anterior and lingual cingula are well developed and continuous from the anterior base of the paracone to the posterolingual base of the hypocone. A moderately-developed posterior cingulum is usually present between the hypocone and metacone.

Two M3s are present in the sample. They can be easily distinguished from M1-2s by their occlusal outlines (Figure 1K-L), wherein the transverse posterior widths are more reduced relative to the transverse anterior widths. The M3 is three cusped. The well-developed paracone is largest cusp and positioned at the anterolabial corner of the tooth. The protocone is well developed, slightly smaller than the paracone, and centrally positioned. A distinct and relatively tall loph (preprotocrista) is present connecting the protocone to the paracone. A small distinct cusp is present that is positioned posterolabially between the posterior cingulum and the protocone. This cusp appears to be an accessory cusp, but could represent a rudimentary metacone. A continuous cingulum is present that begins at the lingual aspect of the protocone and extends nearly all the way around the tooth, wherein it is separated from the posterolabial base of the paracone by a small, but distinct valley. Very small cuspules are present along this cingulum, but a hypostyle is lacking.

A single lower premolar is present in the sample (Figure 2A). It is distinguished from m1-2 by its occlusal outline, wherein the anterior transverse width is much narrower than the posterior transverse width as compared with those of m1-2. There are four distinct, well-developed cusps, with two on the metalophid (metaconid and protostylid) and two on the hypolophid (entoconid and hypoconid). The metaconid and protostylid are well separated and of equal size. The entoconid is slightly larger than the metaconid and protostylid. The hypoconid is the largest cusp and possesses a distinct lophid that extends anteriorly into the central valley between the metalophid and hypolophid, terminating near the posterolabial base of the metaconid. The anterior cingulid is well developed with a slight indentation along its mid-anterior aspect and lacking an anterostylid. It extends from the anterior base of the metaconid to the anterior base of the protostylid. A moderately-developed labial cingulid is present between the protostylid and hypoconid that is interrupted at its midpoint by an extension of the central valley. Whether the tooth represents a deciduous or permanent p4 cannot be determined with certainty, but considering that the permanent P4s of the Sespe sample exhibit four well developed primary cusps including a large distinct paracone, it is quite possible that it is not deciduous. The only known deciduous p4s of *Heliscomys* are from a single specimen of *H. vetus* described by Galbreath (1962)

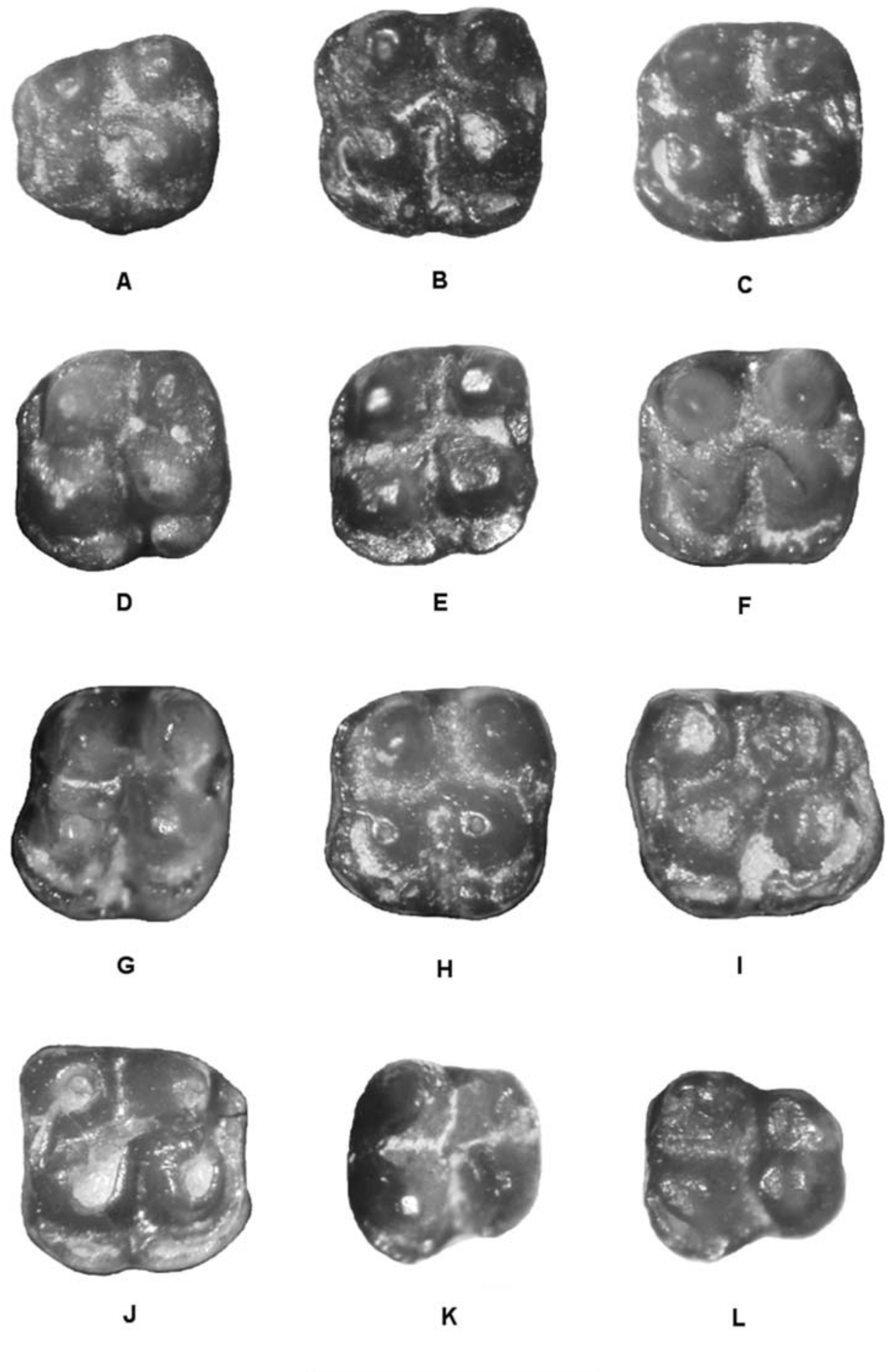

FIGURE 2. Lower teeth of *Heliscomys walshi* from Simi Valley Landfill Local Fauna. A, Lp4 or Ldp4, LACM 153720. B, Lm1 or 2, LACM 153742. C, Lm1 or 2, 153743. D, Lm1 or 2, LACM 153750. E, Lm1 or 2, LACM 13749. F, Lm1 or 2, LACM 153741. G, Lm1 or 2, LACM 153751. H, Lm1 or 2, LACM 153752. I, Rm1 or 2, LACM 153747. J, Rm1 or 2, LACM 153746. K, Lm3, LACM 153757. L, Lm3, LACM 153756. All occlusal views, labial down, scale = 1 mm.

TABLE 1. Measurements (in mm) of upper teeth of *Heliscomys walshi* from Simi Valley Landfill Local Fauna.

LACM #	P4 ap	P4 tra	P4 trp	M1 or 2 ap	M1 or 2 tra	M1 or 2 trp	M3 ap	M3 tra	M3 trp
153717	0.62	0.41	0.64						
153718	0.63	0.36	0.59						
153719	0.59	0.36	0.62						
153715				0.72	0.87	0.80			
153716				0.75	0.80	0.85			
153721				0.76	0.79	0.85			
153722				0.72	0.80	0.76			
153723				0.72	0.85	0.80			
153724				0.75	0.90	0.87			
153725				0.73	0.85	0.80			
153726				0.73	0.89	0.84			
153727				0.76	0.91	0.87			
153729				0.75	0.90	0.83			
153730				0.74	0.82	0.82			
153731				0.75	-	0.81			
153732				0.72	0.85	0.80			
153740				0.77	0.89	-			
153748				0.72	0.80	0.80			
153754							0.62	0.77	0.59
153755							0.57	0.74	0.62

TABLE 2. Measurements (in mm) of lower teeth of *Heliscomys walshi* from Simi Valley Landfill Local Fauna.

LACM #	p4 or dp4 ap	p4 or dp4 tra	p4 or dp4 trp	m1 or 2 ap	m1 or 2 tra	m1 or 2 trp	m3 ap	m3 tra	m3 trp
153734	0.75	0.57	0.66						
131452				0.70	0.72	0.75			
131456				0.73	0.81	0.82			
153734				0.82	0.75	0.78			
153736				0.82	0.79	0.85			
153737				0.79	0.78	0.79			
153738				0.77	0.70	0.74			
153739				0.78	0.73	0.73			
153741				0.76	0.67	0.70			
152742				0.82	0.77	0.78			
153743				0.77	0.74	0.71			
153744				0.80	0.73	0.76			
153745				0.75	-	0.73			
153746				0.80	0.77	0.80			
153747				0.90	0.72	0.75			
153749				0.75	0.80	0.78			
153750				0.78	0.78	0.74			
153751				0.80	0.86	0.85			
153752				0.81	0.76	0.80			
153753				-	-	0.72			
153756							0.68	0.66	0.52
153757							0.66	0.67	0.55

and one of *H. ostranderi* (Korth et al., 1991), which do exhibit a four cusped occlusal pattern with a metaconid present. However in *H. vetus*, the dp4 metaconid is considerably smaller than the protostylid, whereas in the Sespe specimen the metaconid is as large as the protostylid, similar to the corresponding cusps of the referred upper permanent premolars described above. In *H. ostranderi*, the dp4 is considerably smaller relative to m1-2 (e.g., dp4 ap = 72% of m1 ap), whereas the Sespe lower premolar is only slightly smaller than m1-2 (e.g., Sespe lower premolar ap = 94% of mean m1-2 ap), further suggesting that the Sespe lower premolar is not deciduous. However, confident assignment of the Sespe tooth to either p4 or dp4 cannot be made without a larger sample size.

The m1-2s are distinguished by their square occlusal outlines (Figure 2B-J). There are four well-developed, major cusps (metaconid, entoconid, protoconid, and hypoconid), all of about equal size. On most of the m1-2s, weakly-developed protostylids and hypostylids are present. Although in three specimens, protostylids and hypostylids are completely lacking, instead they have a number of very small cuspulids distributed along the labial cingulids (Figure 2F-G). When present, the protostylid and hypostylid are separated by a labial extension of the central valley. In all of the m1-2s, a distinct lophid extends anterolingually from the anterolingual aspect of the hypoconid and terminates near the posterolabial base of the metaconid. This loph extends across the central valley between the metalophid and hypolophid. The anterior cingulid is well developed with an indentation along its midpoint where a weakly-developed anterostylid is sometimes present. A weakly-developed preprotocristid is usually present that extends from the protoconid to the anterostylid and/or anterior cingulid. A moderately-developed posterior cingulid is present between the entoconid and hypoconid. A distinct swelling on the posterior cingulid is sometimes present and may represent a rudimentary hypoconulid.

Two m3s are represented in the sample (Figure 2K-L). They can be distinguished from m1-2 by having occlusal outlines wherein the metalophid is distinctly wider transversely than the hypolophid. They are four cusped (metaconid, entoconid, protoconid, and hypoconid). The metaconid and protoconid are large, well developed cusps with the protoconid slightly larger than the metaconid. The entoconid and hypoconid are also well developed, but smaller than the metaconid and protoconid, with the hypoconid slightly larger than the entoconid. The hypoconid lacks the anterolingual lophid present in m1-2, resulting in an uninterrupted central valley between the metalophid and hypolophid. A distinct, well-developed anterior cingulid is present that extends from the anterior base of the metaconid to the labial base of the protoconid.

Measurements of individual teeth and dental statistics are presented in Tables 1-3.

Discussion—The Sespe heliscomyid exhibits certain dental similarities to *Passaliscomys*, which is distinguished from *Heliscomys* by having all of the molars four cusped and lacking stylar cusps (protostyles, hypostyles, protostylids, and hypostylids), and by a P4 with four well-developed primary cusps, including a large paracone (Korth and Eaton, 2004). The Sespe heliscomyid P4 is also four cusped with a large, well-developed paracone that is equal in size to the protocone, differing from those of all other species of *Heliscomys*. However, the P4 protocone of the Sespe sample is not quite as well separated at its base from the base of the paracone as those of *Passaliscomys*. The M3 of the Sespe heliscomyid differs from that of *Passaliscomys* by having a more prominent protocone (relatively larger) and a taller, better developed preprotocrista. Also, the m1-2s of the Sespe heliscomyid differ from those of *Passaliscomys* by usually having protostylids and hypostylids present, as in species of *Heliscomys*. Korth and Eaton (2004) identified one tooth as a m3 of *Passaliscomys* and, if correctly referred, then *Passaliscomys* further differs from the Sespe heliscomyid by having a better developed (transversely wider) m3 hypolophid.

In all species of *Heliscomys* except *H. ostranderi*, a paracone is lacking or only very weakly developed on P4. In *H. ostranderi* from the late Eocene (early to middle Chadronian) of Wyoming and Montana, a P4 paracone is variably present (Black, 1965; Korth et al., 1991). When present, it is usually smaller than the protocone and its base is fused with that of the protocone (Korth et al., 1991; Korth and Eaton, 2004). The P4 of the Sespe heliscomyid is similar to those of *H. ostranderi* that are four cusped, but differs by lacking an entostyle, being smaller relative to M1-2 (mean P4 transverse width = 71% of mean M1-2 transverse width, whereas it is about 80% in *H. ostranderi*), and by having a relatively much larger paracone. The p4 of *Passaliscomys* is unknown. In *H. ostranderi*, the dp4 has four cusps present and the p4 has either three or four cusps present. The Sespe heliscomyid p4 (or dp4) has four well developed cusps, similar to the dp4 and some p4s of *H. ostranderi*, but differing from all other species of *Heliscomys* (Korth et al., 1991). The p4 (or dp4) of the Sespe heliscomyid differs from the dp4 and four cusped p4s of *H. ostranderi* by being proportionately larger in size relative to m1-2 and the metaconid and protostylid are much better developed (relatively larger). Although the Sespe heliscomyid exhibits some dental characters that appear intermediate between *Passaliscomys* and *H. ostranderi*, it is more similar morphologically to the latter, including the presence of stylar cusps on some of the M1-2s and most of the m1-2s. The Sespe heliscomyid appears to be the most pleisomorphic species of *Heliscomys*, suggesting it is not far removed from a common ancestor with *Passaliscomys*. Thus, the Sespe heliscomyid is herein referred to a new species of *Heliscomys*, *H. walshi*. It can be easily distinguished from all other species of *Heliscomys* by the differences listed above in the diagnosis. *H. walshi* is the oldest known species of *Heliscomys*.

TABLE 3. Dental statistics (in mm) for *Heliscomys walshi* from Simi Valley Landfill Local Fauna.

Position/Dimension		N	Mean	OR	SD	CV
P4	ap	3	0.61	0.59 – 0.63	0.02	3.3
	tra	3	0.38	0.36 – 0.41	0.03	7.9
	trp	3	0.62	0.59 – 0.64	0.03	4.8
M1 or 2	ap	15	0.74	0.72 – 0.77	0.02	2.7
	tra	14	0.85	0.79 – 0.91	0.05	5.9
	trp	14	0.82	0.76 – 0.87	0.03	3.7
M3	ap	2	0.60	0.57 – 0.62	0.04	-
	tra	2	0.76	0.74 – 0.77	0.02	-
	trp	2	0.61	0.59 – 0.62	0.02	-
p4 or dp4	ap	1	0.75	-	-	-
	tra	1	0.57	-	-	-
	trp	1	0.66	-	-	-
m1 or m2	ap	18	0.80	0.75 – 0.90	0.04	5.0
	tra	17	0.76	0.67 – 0.86	0.05	6.6
	trp	19	0.77	0.70 – 0.85	0.04	5.2
m3	ap	2	0.67	0.66 – 0.68	0.01	-
	tra	2	0.665	0.66 – 0.67	0.01	-
	trp	2	0.53	0.52 – 0.55	0.02	-

The only other reference to *Heliscomys* from the Duchesnean is an isolated P4 referred to *Heliscomys* sp. from the Lac Pelletier Lower Fauna of Saskatchewan, Canada (Storer, 1988). *H. walshi* can be easily distinguished from *H.* sp. by its much smaller size and by having a well-developed P4 paracone, and lacking a P4 entostyle. Similarly, the only other reference to *Passaliscomys* is cf. *Passaliscomys* sp. from the Duchesnean portion of the Dry Gulch Creek Member, Duchesne River Formation, Utah (Walsh and Murphy, 2007). This taxon has not been described, so comparison with *H. walshi* cannot be made. Another occurrence of *Heliscomys* is a Lm2 of *Heliscomys* cf. *H. vetus* from the Chadronian (late Eocene) Calf Creek Local Fauna, Cypress Hills Formation, Canada (Storer, 1978). *H. walshi* differs from this taxon by its smaller size and lacking large, well-developed hypostylids on m1-2.

Two other species that were originally referred to *Heliscomys,* but subsequently assigned to different genera (Skwara, 1988; Korth, 1989; Korth and Branciforte, 2007), are the heliscomyid *Tylionomys woodi* (McGrew, 1941) and *Ecclesimus tenuiceps* (Galbreath, 1948), which was reassigned by Korth (1989) to the Florentiamyidae Wood, 1936. *T. woodi* is only known from the p4-m1. *H. walshi* can be easily distinguished from *T. woodi* by having the following: 1) p4 (or dp4) is much larger relative to m1-2; 2) p4 (or dp4) and m1-2 with an anterolingually directed lophid present on the hypoconid that crosses the middle of the central valley between the metalophid and hypolophid; and 3) smaller size. *H. walshi* can be further distinguished from the only other species of *Tylionomys*, *T. voorhiesi* Korth and Barnciforte, 2007, by having the following: 1) P4 is larger relative to M1-2 with a large paracone present and the metacone and hypocone are about equal in size; 2) M1-2 with a postprotocrista that extends into the central valley between the protoloph and metaloph; and 3) stylar cusps are sometimes present on M1-2. *H. walshi* can also be easily distinguished from *E. tenuiceps* by having the following: 1) P4 with a large, well-developed paracone that is always present and lacking a hypostyle; 2) M1-2 with a postprotocrista that extends into the central valley between the protoloph and metaloph; 3) M3 is less reduced relative to M1-2; and 4) smaller size.

Additional taxa included in the Heliscomyidae are the Orellan *Apletotomeus crassus* Reeder, 1960 and *Akmaiomys incohatus* Reeder, 1960. The systematic status of *Akmaiomys* has been controversial (e.g., Black, 1965; Wood, 1980; Korth et al., 1991; Wahlert, 1993; Korth, 1994; Flynn et al., 2008), but Korth and Branciforte (2007) recently provided evidence that *Akmaiomys* should be regarded as a junior synonym of *Apletotomeus*. *H. walshi* can be easily distinguished from *A. crassus* and *A. incohatus* by having the following: 1) the p4 (or dp4) is less molariform, lacking an anteroconid, and slightly more reduced relative to m1-2; 2) the m1-2 stylar cusps are less developed; 3) m1-2 with an anterolingually directed lophid present on the hypoconid that crosses the middle of the central valley between the metalophid and hypolophid; and 3) smaller size. *H. walshi* further differs from *A. crassus* by having the m1-2 primary cusps of the metalophid (metaconid and protoconid) and hypolophid (entoconid and hypoconid) better separated, wherein they remain distinct and do not form transverse lophid connections when moderately worn.

Korth (1995) recognized two subgenera of *Heliscomys* based primarily on the proportions of the P4 to M1. In *Heliscomys* (*Syphryiomys*), the P4 is larger relative to the M1 (P4 transverse mean width =

80-90% of M1 transverse mean width), whereas in *Heliscomys* (*Heliscomys*), the P4 is smaller relative to M1 (P4 transverse mean width = 54-77% of M1 transverse mean width). Because the P4 width to M1 width is about 71% in the Duchesnean *Passaliscomys*, Korth and Eaton (2004) suggested that the primitive condition in heliscomyids is a moderately sized P4 that either progressively enlarged in the subgenus *Syphryiomys* or reduced in the subgenus *Heliscomys*. This assumption seems to be supported by the proportions of P4 and M1-2 in *H. walshi*, wherein the mean P4 transverse width is also 71% of the M1-2 mean transverse width. In addition, certain other characters of the cusps of *H. walshi* suggest they may also represent the primitive condition for heliscomyids. In *H. walshi*, there are remnants of lophs and lophids not usually seen in later heliscomyids, such as the M1-2 pre and postprotocristas, m1-2 preprotocristids, and the anterolingual lophid of the hypoconid of p4 (or dp4) and m1-2. Also, the molar stylar cusps of *H. walshi* are not as well developed as those of most later species of *Heliscomys*.

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