Title
Pleistocene vertebrates of Silicon Valley (Santa Clara County, California)

Journal
PaleoBios, 33(0)

ISSN
0031-0298

Authors
Maguire, Kaitlin Clare
Holroyd, Patricia A.

Publication Date
2016-07-22

DOI
10.5070/P9331031767

PaleoBios 33:1–14, July 22, 2016

PaleoBios

OFFICIAL PUBLICATION OF THE UNIVERSITY OF CALIFORNIA MUSEUM OF PALEONTOLOGY

Kaitlin Clare Maguire and Patricia A. Holroyd (2016). Pleistocene vertebrates of Silicon Valley (Santa Clara County, California)

Cover photo: Painting by Karen Carr depicting California's Santa Clara Valley during the Pleistocene.

Citation: Maguire, K.C. & Holroyd, P. A. 2016. Pleistocene vertebrates of Silicon Valley (Santa Clara County, California). *PaleoBios*, 33. ucmp_paleobios_31767.

PaleoBios 33:1–14, July 22, 2016

Pleistocene vertebrates of Silicon Valley (Santa Clara County, California)

KAITLIN CLARE MAGUIRE[1, 2*] and PATRICIA A. HOLROYD[2]
[1] School of Natural Sciences, University of California, Merced, California 95343;
current address, U.S. Geological Survey, 970 Lusk Street, Boise, ID 83706, kmaguire@usgs.gov
[2] University of California Museum of Paleontology, 1101 Valley Life Sciences Bldg., Berkeley, CA 94720

Here we report on late Pleistocene fossil vertebrates from new and previously described localities in Santa Clara County, California. The three new localities and specimens include: a partial mammoth pelvis from UCMP V91128 (Lawrence Expressway E); a juvenile cranial specimen of *Mammuthus columbi* from UCMP V99597 (SCVWD "Lupe" Mammoth), now on display at the San Jose Children's Discovery Center; and a relatively diverse assemblage of medium- to large-sized mammals, including a nearly complete forelimb of *Paramylodon harlani* from UCMP V99891 (Babcock's Bones). We also reassess specimens and assemblages from the following eight previously known localities: Molecular Medicine Building (UCMP V90003); Alma Street Underpass at Page Mill Road (USGS M1203); Mountain View Dump (USGS M1227); Sunnyvale Sewer (USGS M1218); Calabaza, Sunnyvale Sewer (USGS M1218A); Matadero Creek (USGS M1001); Matadero Creek, Veteran's Hospital (USGS M1202); and Milpitas (UCMP V4916). All localities discussed, except Matadero Creek and Veterans Hospital, are mapped in areas with surficial Holocene deposits, and therefore, these Pleistocene-aged assemblages suggest that Pleistocene deposits are closer to the surface in Santa Clara County than may have been previously thought. Material described here highlights the needed resources for mitigation management in Santa Clara County.

Keywords: Quaternary, Pleistocene, Rancholabrean, Mammalia

INTRODUCTION

The Santa Clara Valley (also referred to as Silicon Valley or the South Bay) is a valley formed by the Guadalupe River and Coyote Creek as they flow north into San Francisco Bay. It is bounded to the west by the Santa Cruz Mountains and to the east by the Diablo Range. The surficial sediments forming the valley base are generally interpreted as undifferentiated Quaternary alluvium and thought to be Holocene in age (e.g., Helley et al. 1994, Brabb et al. 2000). Several Pleistocene-aged vertebrate fossils have been found in Silicon Valley suggesting Pleistocene strata are at shallow depths (Fig. 1). The earliest reports of vertebrates in the Santa Clara Valley appear to be from Branner et al. (1909) who noted an "elephant" tusk (likely mammoth), which was repeated by Hay (1927). The only synthetic report of vertebrate fossils from this region is a compilation of mammalian faunal lists provided by Jefferson (1991), based on a combination of limited published reports, personal communications from Charles A. Repenning in 1989 (U.S. Geological Survey) and by examination of specimen record output from the University of California Museum of Paleontology database, then stored using a database program called TAXIR. These faunal lists were also incorporated into the FAUNMAP and FAUNMAP II compilations on the distribution of North American Pleistocene mammal assemblages (Graham and Lundelius 1994, 2010).

Here we revisit these previously-published faunal lists and provide information on voucher specimens and additional geologic information as available. We also report new localities and associated finds that have been found since the compilation of Jefferson (1991). Our goals in doing so are to bring together relevant data on these sites so that there is a firmer foundation for updates to distributional records of Pleistocene vertebrates, for environmental impact assessment in this area, and for developing education and outreach materials for K–12 education and the general public.

MATERIALS AND METHODS

We examined 25 specimens from three new localities in the University of California Museum of Paleontology (UCMP) and approximately 185 specimens from previously reported localities in the Santa Clara Valley housed in the UCMP and the U.S. Geological Survey Collections in Denver,

**author for correspondence*

Citation: Maguire, K.C. & Holroyd, P. A. 2016. Pleistocene vertebrates of Silicon Valley (Santa Clara County, California). *PaleoBios*, 33. ucmp_paleobios_31767
Permalink: http://escholarship.org/uc/item/3k43832x

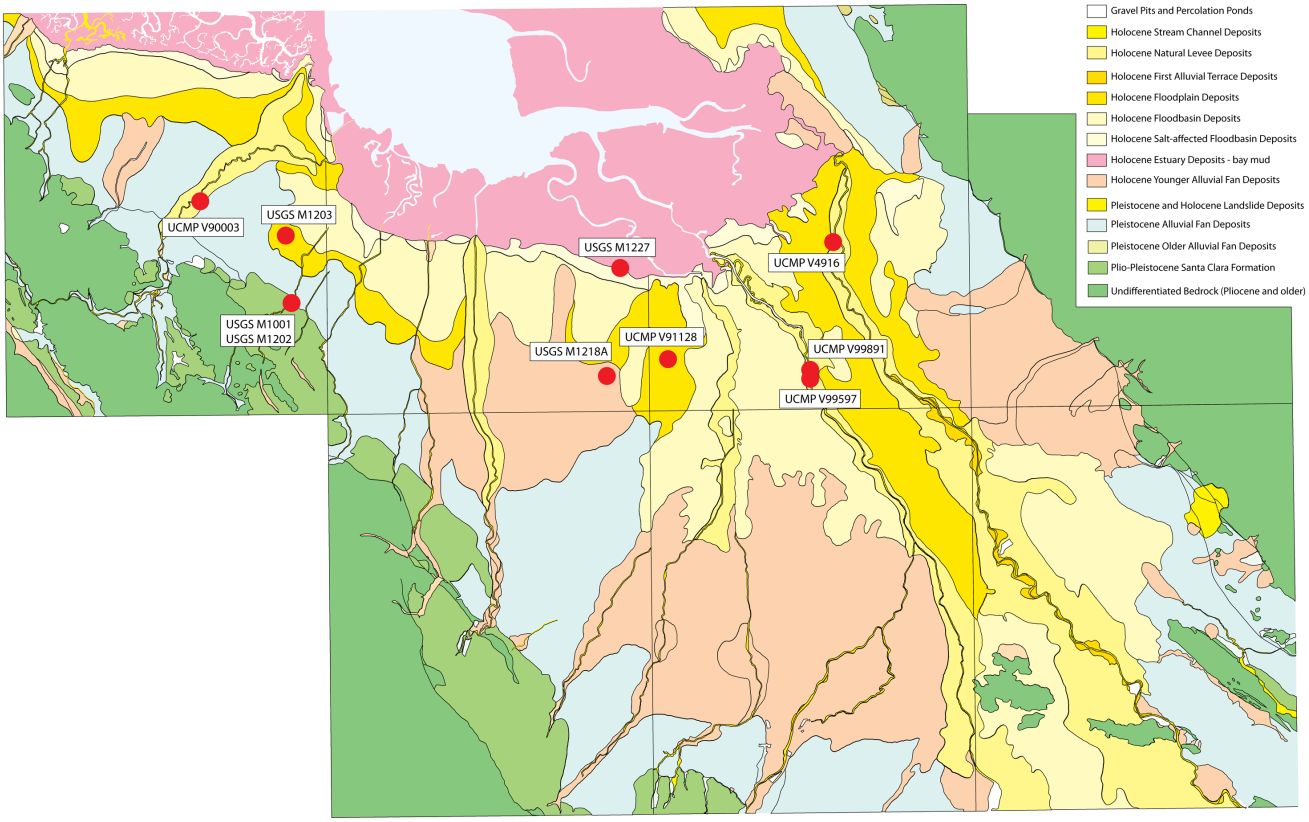


Figure 1. Geologic map of Silicon Valley (modified from Helley et al. 1994) with Pleistocene vertebrate sites indicated by red circles.

Colorado. Specimens included cranial and post-cranial elements. Length and width measurements were taken with Maxwell digital calipers and recorded as millimeters in the text. Specimens were collected as surface float or quarried depending on the locality (see details for each locality). Original collection notes are sparse, and any detail about collection of specimens is reported below.

Institutional abbreviations: **UCMP**, University of California Museum of Paleontology; UCMP V, prefix designation for UCMP localities; **USGS**, United States Geological Survey; USGS M, prefix designation for USGS localities originally housed in the Menlo Park, California office and subsequently transferred to USGS collections in Denver, Colorado; **USNM**, United States National Museum specimen number for USGS collections; UNS, unnumbered specimens from the USGS collections in Denver, Colorado; **YPM** VP, Yale Peabody Museum Vertebrate Paleontology specimen number.

RESULTS

Site Reports of New Localities

UCMP V91128, Lawrence Expressway E, San Jose, California

Background—The specimen, a partial pelvis of *Mammuthus* Brookes, 1828 (Fig. 2), was found in Sunnyvale, California, about 100 m northwest of the intersection of Oakmead Parkway and Lakeside Drive, and southeast of the I-101 and Lawrence Expressway interchange. It was discovered in "sandy gravel deposits 15 feet [~ 4.5 m] above sea level and 9 feet [~ 3 m] below the modern surface" by Ed Bardelmeier during a housing excavation and excavated by him and Barbara Bocek, a Stanford archeologist, according to data on file at UCMP.

Referred specimen—*Mammuthus*, UCMP 137236, partial pelvis (Fig. 2).

Discussion—We assign this specimen to *Mammuthus* rather than *Mammut* Blumenbach, 1799 based on the relatively gracile iliac crest (Olsen 1972), slight overhang of the acetabular lip relative to the acetabular fossa (Coates et al. 1971) and the presence of a distinct tuberosity proximal to the lip of the acetabulum at the base of the iliac crest (see figures 24–28 in Olsen 1972).

UCMP V99597, SCVWD Mammoth ("Lupe"), San Jose, California

Background—In July 2005 Roger Castillo, a local San Jose resident, noticed two tusks eroding out of the bottom of the Guadalupe River just downstream from the San Jose

Figure 2. *Mammuthus*, partial pelvis, UCMP 137236. **A.** Dorsal view. **B.** Lateral view.

International Airport and the West Trimble Road overpass, on land managed by the Santa Clara Valley Water District (SCVWD). The partial juvenile mammoth skull and skeletal elements were excavated by San Jose State University and UCMP in August of 2005 (Fig. 3). The partial skull, femur and part of the pelvis are on display in an educational exhibition at the Children's Discovery Museum in San Jose, the remainder of the material is housed at the UCMP. The bones were found in a hard pan about 3.5 m below the modern floodplain and 4.5 m below sea level (Andersen et al. 2008). The substrate was silty sand, mottled yellowish gray and reddish brown with clay-lined cracks (Andersen et al. 2008). Radiocarbon dates of two charcoal specimens from 65 cm below the hardpan were dated at 12,290 and 12,730 radiocarbon years (14,400 and 14,900 ybp) (Andersen et al. 2008). In addition, a bulk soil sample containing very little carbon from matrix near the mammoth femur was dated at 3,530 radiocarbon year (3,550 ybp). Prior mapping of the area excavated suggested a Holocene age but presence of associated *Mammuthus* material and charcoal dates suggest an older age for the deposits or Pleistocene deposits closer to the surface than previously thought. The specimen and the deposits surrounding it need to be re-dated in order to resolve the conflicting ages reported in Andersen et al. (2008).

Referred specimen—*Mammuthus columbi* (Falconer, 1857), UCMP 150077, ventral portion of a skull with partial left and right tusks, partial left and right M2 or M3, and left and right erupting M3 or M4 (Fig. 3); right and left partial ilia; right femur; incomplete left tibia; a complete left lunar and unidentifiable podial; and partial ribs. All specimens were found within 2 m of each other. A broken tusk tip was found associated with other cranial bones. The tusk tip was thin sectioned for museum display by E.T. Lamm from the Museum of the Rockies. A partial proximal left humerus of a juvenile was recovered from newly exposed gravels near the water pump (~60 m upstream) in deposits slightly below the rest of the material.

Discussion—Size of preserved elements and tooth morphology are consistent with assignment to *M. columbi*, the mammoth species that lived in California during the Pleistocene. The partial left M2 or M3 contains six plates, suggesting the entire tooth contained 10–12 plates, falling within the species range of *M. columbi* of six to 10 plates for the M2 and nine to 13 plates for the M3 (Haynes 1991). It

also falls within the range of five to 17 molar plates reported for the species at the Hot Springs Mammoth site (Agenbroad and Mead 1994). The right M2/M3 is broken into multiple pieces, and the third or fourth molars are not fully erupting, restricting observation of plate counts.

UCMP V99891, Babcock's Bones, San Jose, California

Background—In 2006 Craig Babcock, also a local San Jose resident, visited UCMP V99597 and collected additional material approximately 6–12m downstream from UCMP V99597 in the Guadalupe River. The material was found in a mud layer and not the hardpan layer in which UCMP 150077 was discovered. The specimens were collected after an overflow channel at the site had been cleaned out with heavy equipment by the Santa Clara Valley Water District, although the material was found in an area that was unscathed by the equipment.

Referred specimens—*Equus* sp. Linnaeus, 1758 (Fig. 4): UCMP 218831, worn lower cheek tooth (length = 26.6, width = 18.1; UCMP 218850, left third metacarpal (length =256.2; proximal width=54.7, proximal depth 36.1). *Capromeryx?* Matthew, 1902 (Fig. 5): UCMP 218832, right M3 (length = 18.5, width = 11.5); UCMP 218833, upper cheek tooth (length = 15.0, width = 8.9). *Camelops* sp. Leidy, 1854 (Fig. 6): UCMP 218834-218835, upper cheek tooth fragments. *Bison* sp. Hamilton Smith, 1827 (Figs. 7, 8): UCMP 218836, right M1 or M2 (length = 29.0, width = 18.9); UCMP 218837, right M1 or M2 (length = 27.3, width = 17.8); UCMP 218838, right M1 or M2 (length = 26.9, width = 14.0); UCMP 218839, incomplete lower molar; UCMP 218840, right m1 or m2 (length = 16.5, width = 12.2); UCMP 218841, right P2 (length = 28.2, width = 11.7); UCMP 218842, right m3 (length = 40.0, width = 16.6); UCMP 218843, distal radius-ulna (anteroposterior depth = 56.5, width = 100.1); UCMP 218844, metapodial. Bovidae indet. Gray, 1821: UCMP 218845, left proximal tibia; UCMP 218847, naviculocuboid. Artiodactyla indet. Owen, 1848 (Fig. 9): UCMP 218848, metapodial; UCMP 218846, astragalus. *Paramylodon harlani* (Owen, 1840) (Figs. 10–12): UCMP 218830, partial left forelimb including partial humerus, partial ulna, cuneiform, magnum, partial metacarpals III and IV, and the proximal phalanx III. Proboscidea indet. Illiger, 1811 (Fig. 9): UCMP 218849, femoral diaphysis. Mammalia indet. Linnaeus, 1758: UCMP 218851, vertebral fragment; UCMP 218852, dentary fragment.

Discussion—The *Bison* and *Equus* specimens recovered from Babcock's Bones are not assignable to species based on the limited available material. Species level identifications

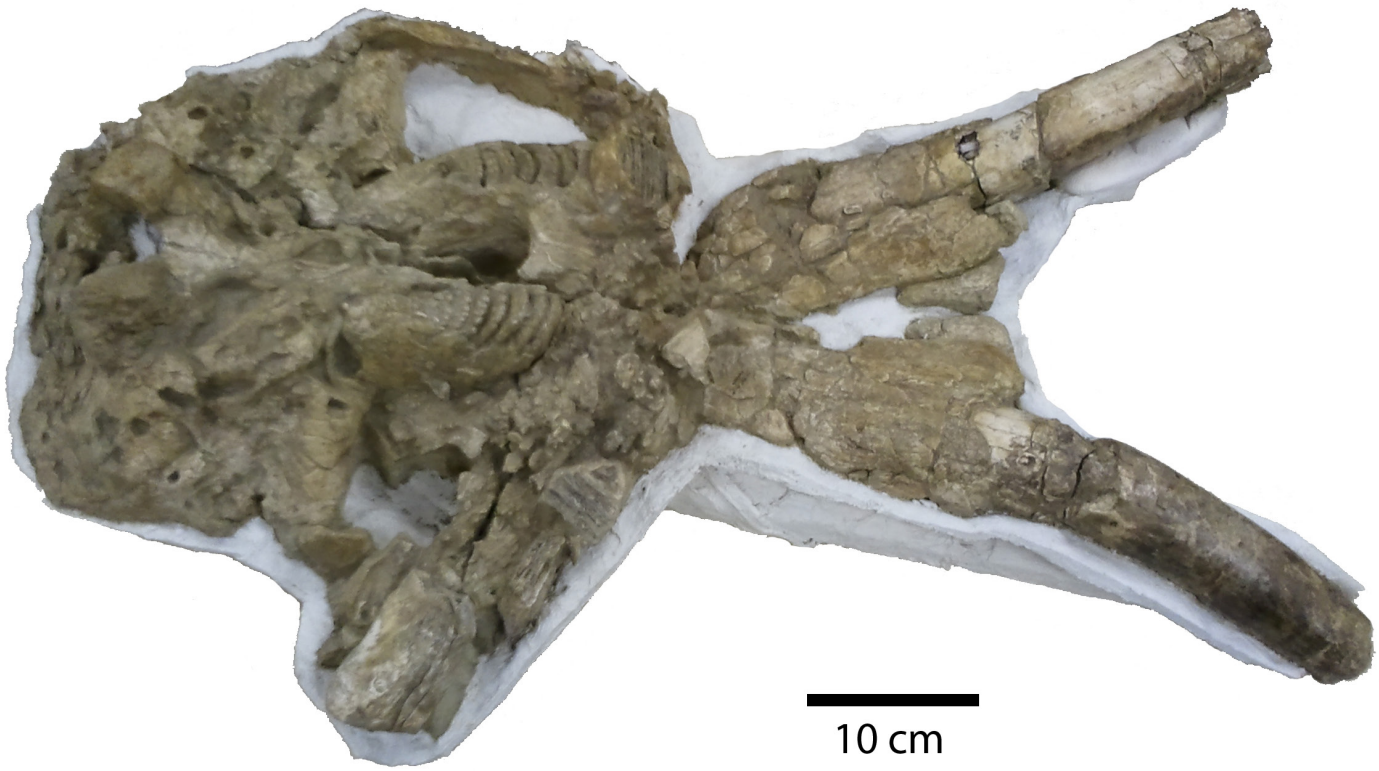


Figure 3. *Mammuthus columbi* skull in ventral view, UCMP 150077.

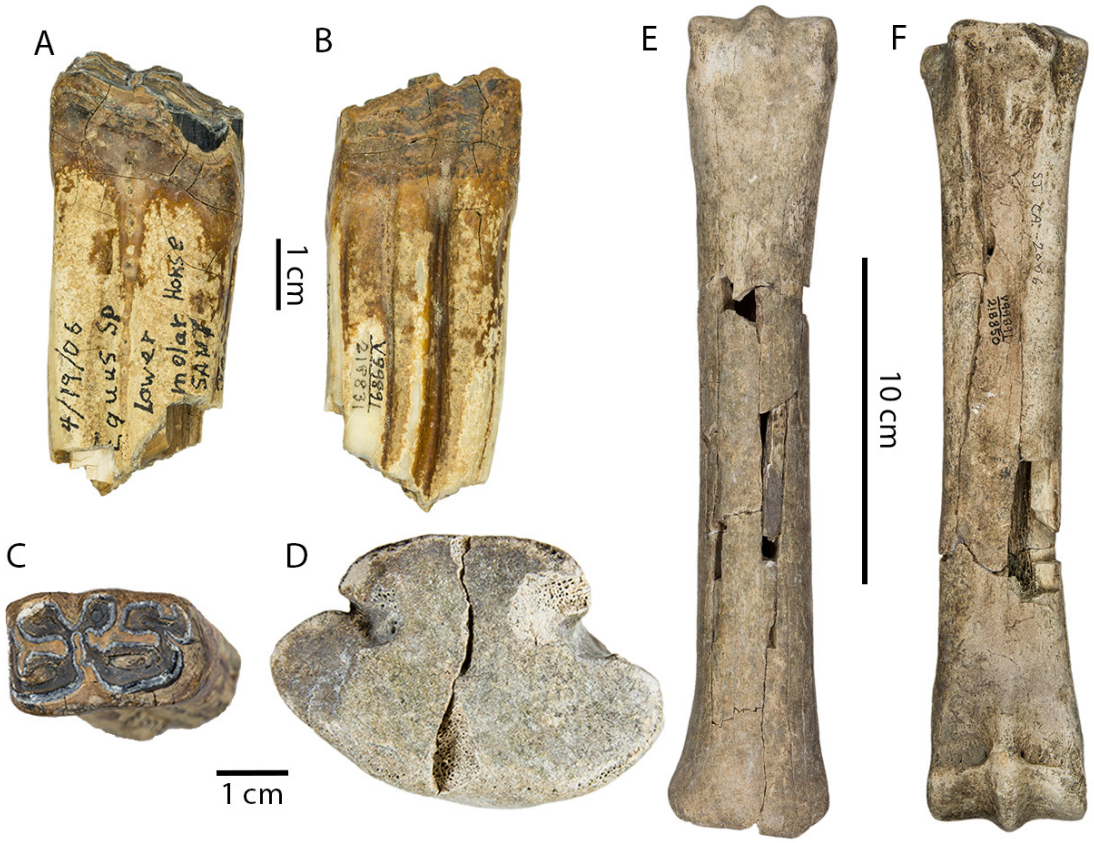


Figure 4. *Equus* sp. from UCMP V99891. **A-C.** Worn lower cheek tooth, UCMP 218831. **D-F.** Left third metacarpal, UCMP 218850.

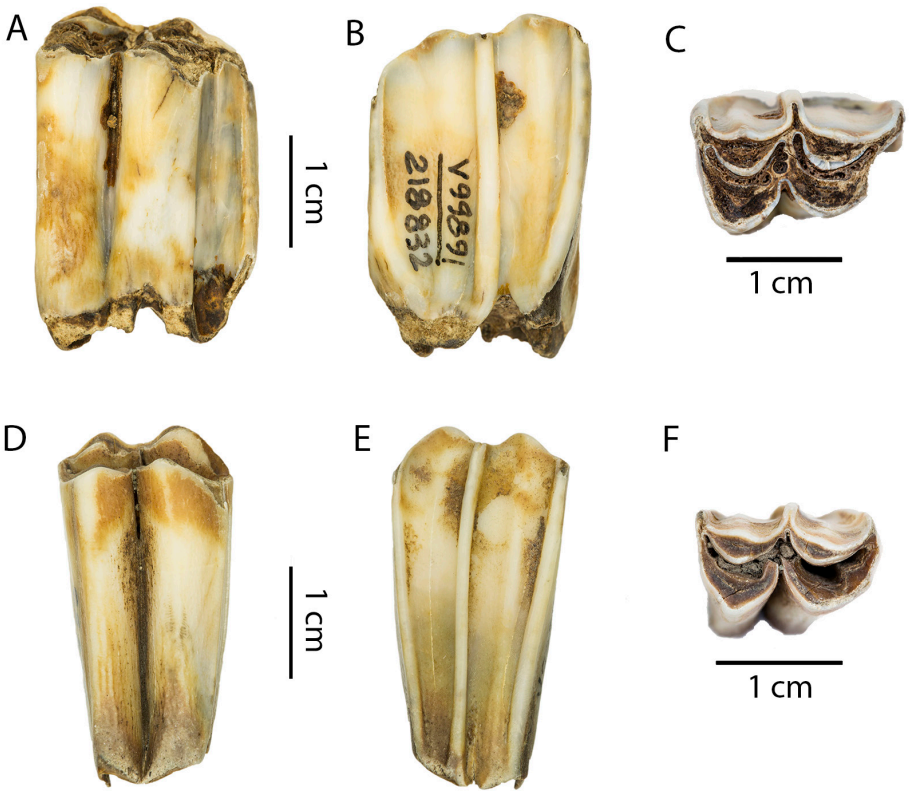


Figure 5. *Capromeryx?* from UCMP V99891. **A-C.** Right M3, UCMP 218832. **D-F.** Upper cheek tooth, UCMP 218833.

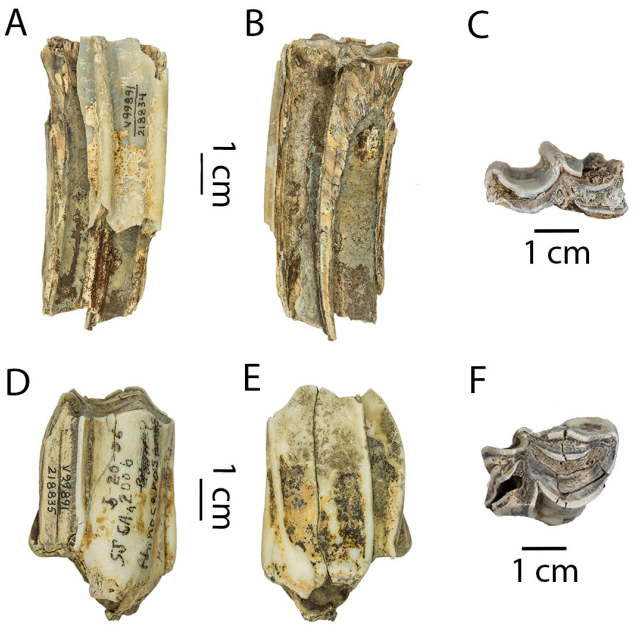


Figure 6. *Camelops* sp. from UCMP V99891. **A-C.** Upper cheek tooth fragment, UCMP 218834, **D-F.** Upper cheek tooth fragment, UCMP 218835.

cannot be made based on tooth morphology or size differences in these taxa (McDonald 1981, Scott 2004). The camelid specimen is assigned to *Camelops* based on the lack of cementum, distinguishing it from *Hemiauchenia* Gervais and Ameghino, 1880 (Webb 1974), and its reduced external styles and hypsodont crown (Honey et al. 1998). The *Camelops* specimen is not assigned to species because of its fragmentary nature and the uncertainty in species assignment based on a single tooth (Dalquest 1991). UCMP 218830 can clearly be attributed to *Paramylodon* Brown, 1903 versus *Megalonyx* Harlan, 1825 based on size and relatively more robust and shorter limb elements. In morphology the preserved elements match those described by Stock (1925) in his monographic treatment of sloths of La Brea (Stock 1925: figs. 72, 74, 75, 84, 88+plates 32–34) (Fig. 10). UCMP 218832 and 218833 match in size and morphology with those attributed to *Capromeryx minor* (Taylor, 1911) (e.g., Bravo-Cuevas et al. 2013); however, many individual teeth of *Capromeryx* are also difficult to distinguish from *Antilocapra* Ord, 1818 and modern domesticated sheep. Because these specimens are not dated and antilocaprid genera and

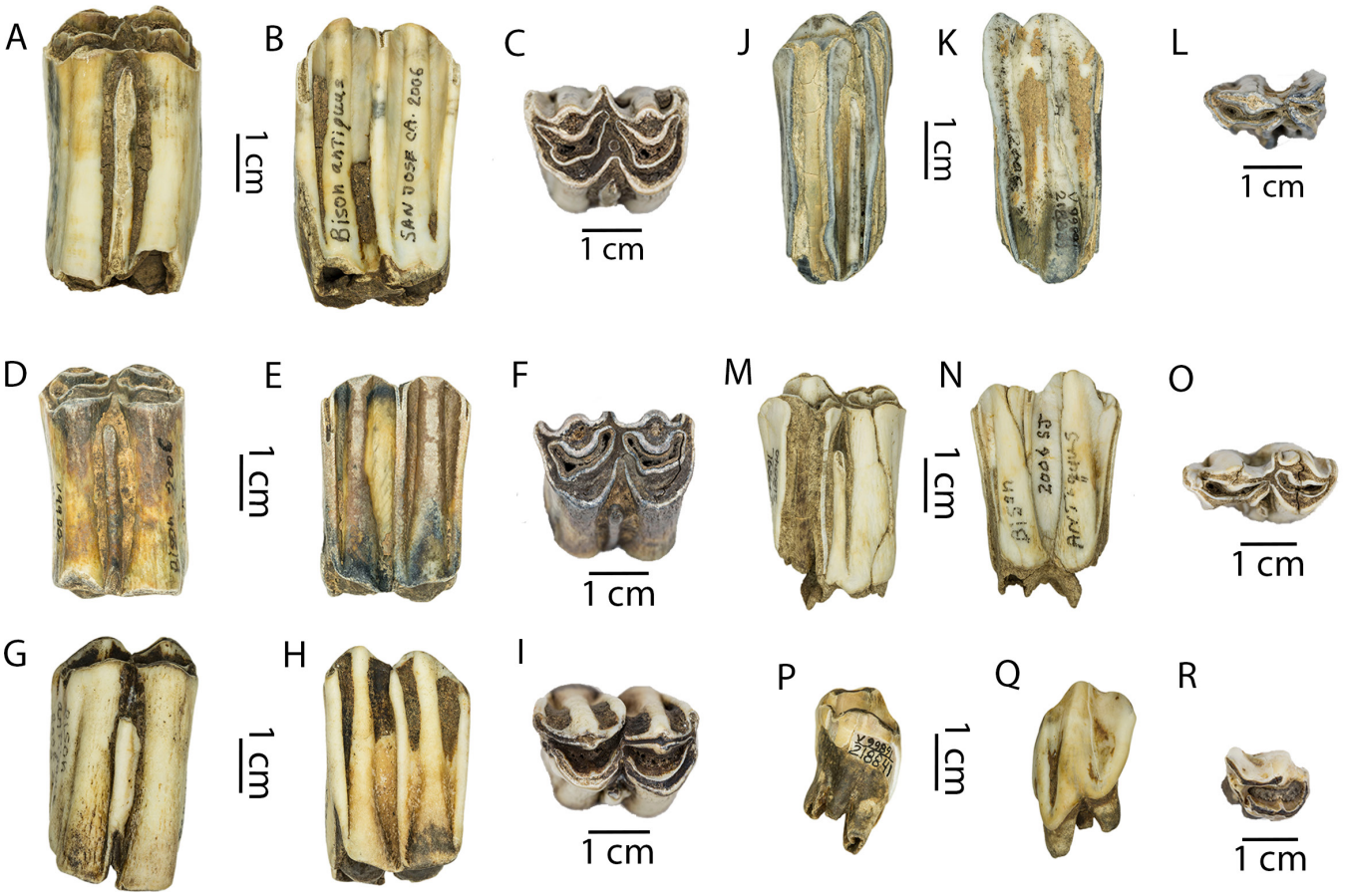


Figure 7. *Bison* sp. from UCMP V99891. **A-C.** Right M1 or M2, UCMP 218836. **D-F.** Right M1 or M2, UCMP 218837. **G-I.** Right M1 or M2, UCMP 218836. **J-L.** Incomplete lower molar, UCMP 218839. **M-O.** Right m1 or m2, UCMP 218840. **P-R**. Right P2, UCMP 218841.

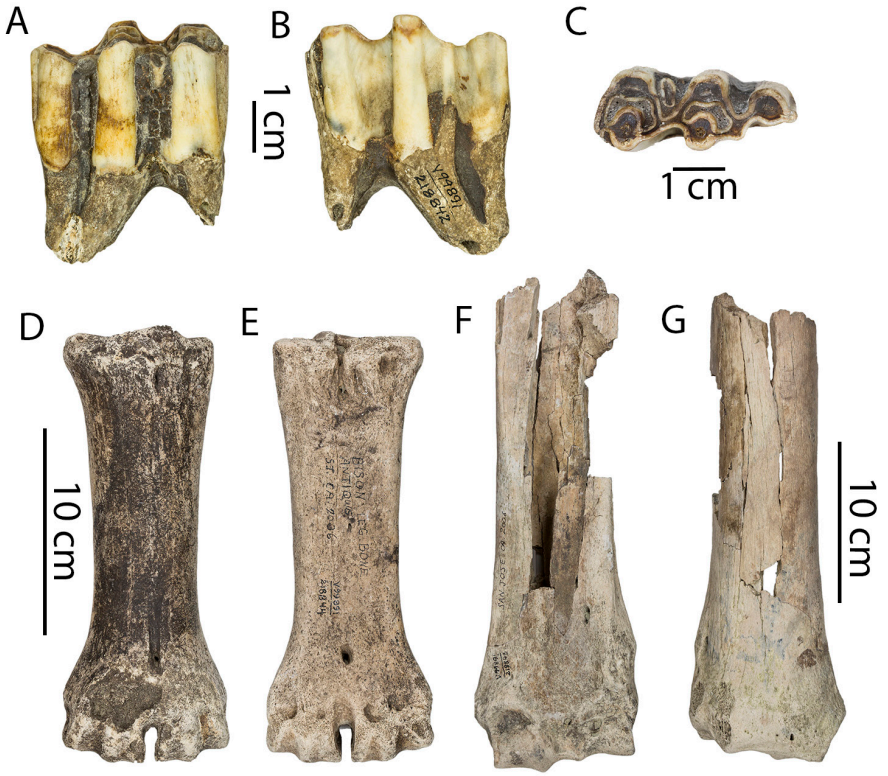
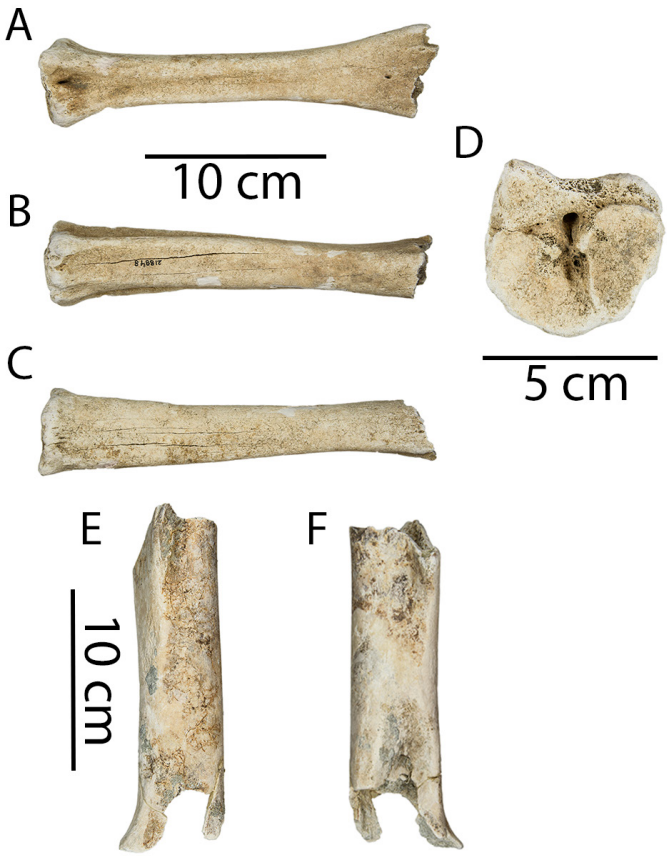


Figure 8. *Bison* sp. from UCMP V99891. **A-C.** Right m3, UCMP 218842. **D, E.** Distal radius-ulna, UCMP 218843. **F, G.** Metapodial, UCMP 218844.



species generally only differ in relative tooth proportions rather than size (Davis 2007), a more refined identification will need additional lines of evidence. UCMP 218848, an artiodactyl metapodial looks similar to a bovid but with a slender diaphysis. It is unclear whether it belongs to an extant or extinct species. UCMP 218846, a well-worn artiodactyl astragalus, is missing relevant morphological features to assign it properly to Bovidae or Camelidae Gray, 1821. Postcranial material referred to Bovidae is within the size of modern and extinct species and therefore not assignable to a lower taxonomic level. This site may have a mix of both Pleistocene and Holocene specimens, as is true of several Rancholabrean localities in the area. For example, the Pacheco localities east of the San Francisco Bay contain specimens of Holocene and Pleistocene vertebrates in close proximity (Tomiya et al. 2011). Given this, we cannot exclude the possibility that several of the specimens belong to modern taxa.

Previously Reported Localities

UCMP V90003, Molecular Medicine Building, Stanford University, Palo Alto, California

A single humeral diaphysis, UCMP 136495, was collected

< Figure 9. Artiodactyla metapodial from V99891, UCMP 218848. **E, F.** Proboscidea femoral diaphysis from V99891, UCMP 218849.

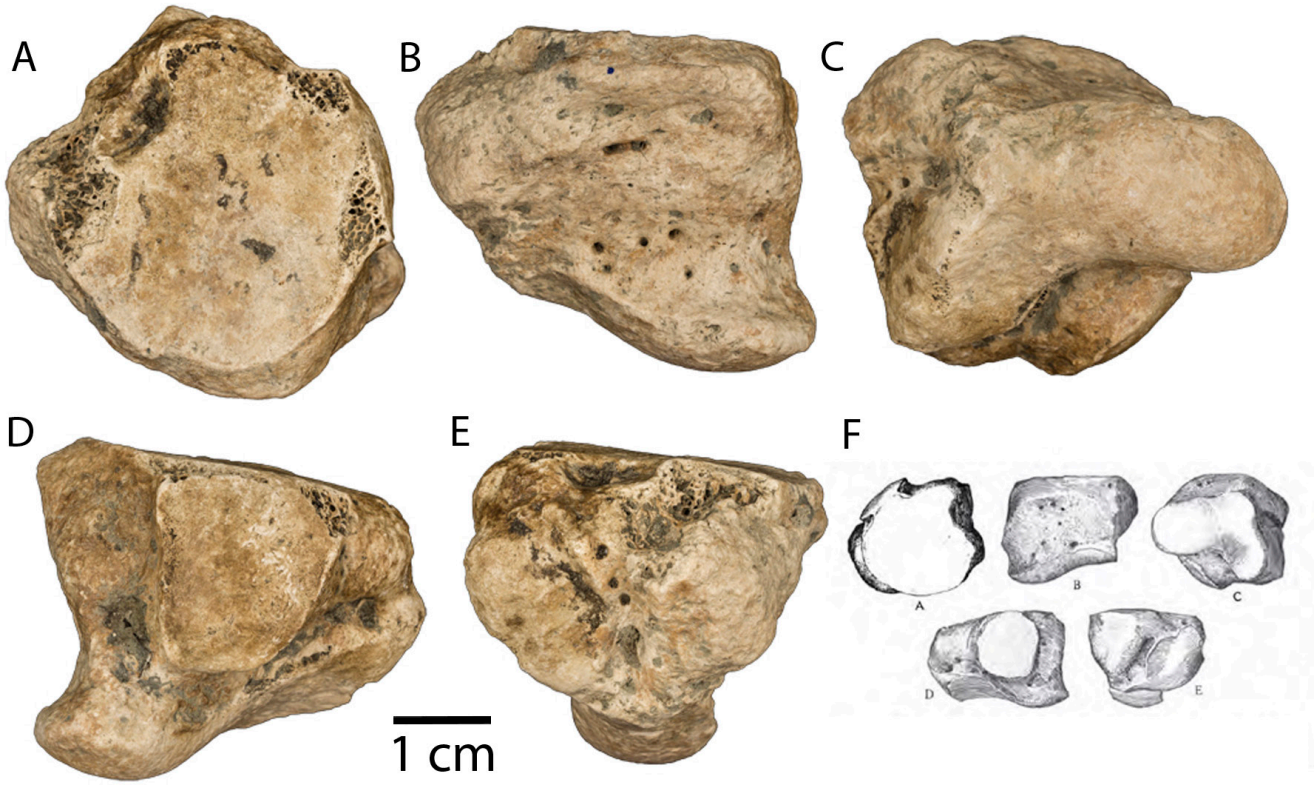
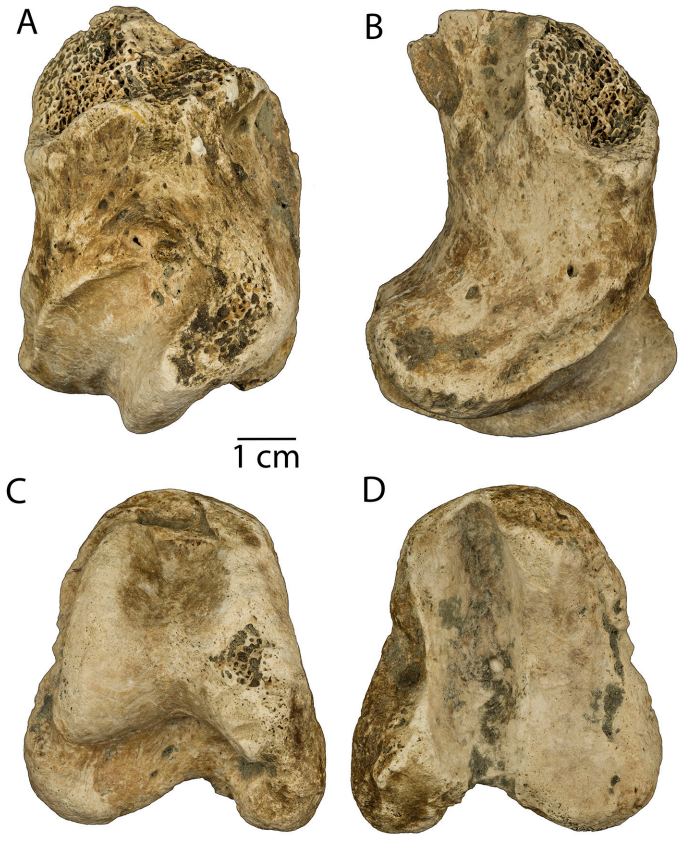


Figure 10. *Paramylodon harlani*, UCMP 218830, from UCMP V99891. **A.** Proximal view of cuneiform. **B.** Dorsal view of cuneiform. **C**. Distal view of surface of unciform. **D**. Palmar view showing facet for pisiform. **E.** Inner view with facet for lunar. **F.** Figure 72 from Stock (1925) with the same elements in the same orientation as presented here.



in March of 1987 by Stanford archeologist Barbara Bocek from the south wall foundation excavation for the Center for Molecular and Genetic Medicine building, north of Campus Drive and south of the Stanford Medical Center, on the northwest part of Stanford University campus. The specimen was recovered from sand deposits that had lenses of clay, 22 feet [~ 6.5 m] below the modern pre-existing surface. Jefferson (1991) reported *Bison latifrons* (Harlan, 1825) from here, based on the UCMP TAXIR output. The specimen has morphology consistent with *Bison*, i.e., the shaft is thickened and has a distinct torsion consistent with that of large bovids and inconsistent with camelids, proboscideans, or sloths. It is distinctly larger than comparable specimens associated with *Euceratherium* Sinclair and Furlong, 1904 from northern California caves. However, assignment to *B. latifrons* versus *B. antiquus* (Leidy, 1852) does not appear to be possible based on a mid-shaft, given the wide variability and overlap that has been reported in postcranial measurements of these *Bison* species (McDonald 1981), and we more

< **Figure 11.** *Paramylodon harlani*, UCMP 218830, from UCMP V99891. **A.** Left third metacarpal in dorsal view. **B.** Left third metacarpal in lateral view. **C.** Left first phalanx in distal view. **D.** Left first phalanx in proximal view.

Figure 12. Left partial ulna of *Paramylodon harlani*, UCMP 218830, from UCMP V99891. **A.** Lateral view. **B.** Medial view. **C.** Anterior view.

conservatively assign it to *Bison* sp.

USGS M1203 Alma Street Underpass at Page Mill Road, Palo Alto, California

This site was first reported in Jefferson (1991), who listed the presence of *Mammuthus* sp., *Equus* sp., and *Camelops* sp. based on personal communication from Repenning (1989). In the USGS collection, the only specimen reported for this locality is a scapula fragment (acromium process) of *Equus* sp. A note with the specimen indicates it was collected by Dave Hopkins. The specimen is housed in the USGS facility in Denver, Colorado.

USGS M1227 Mountain View Dump, Mountain View, California

A Rancholabrean-aged sedimentary deposit was exposed in Pit 1B of a series of quarries excavated at the Mountain View landfill in 1972, seven meters below sea level (Brown 1978). The bone layer was 1–2 m in thickness, covered about 75 sq. m, and consisted of sandy clay with pebbles (Brown 1978). The vertebrate material came from a silty and sandy stratum in the lower alluvial fan unit (Qof) representing Pliocene-Pleistocene gravel deposits. Bischoff and Rosenbauer (1981) reported that bones came from a 10-meter-deep refuse pit and provided dates on *Camelops* of 19,900 ±500 years (uncalibrated) for 230Th and 20,800 ±1,000 years (uncalibrated) for 231Pa. These dates correspond to seven wood samples dated between 20,800 and 23,600 using ^{14}C collected from the same deposit. Helley et al. (1972) reported the following radiocarbon dates on wood specimens from the site: 20,820 ±320; 21,960 ±520; 23,000 ±500 years BP at 6.1, 6.3, and 7.0 meters below sea level. Jefferson (1991) reported *Glossotherium harlani*, *Mammuthus columbi*, *Equus* sp., *Bison* sp. cf. *B. latifrons*, *Camelops* sp., *Odocoileus* sp. Rafinesque, 1832, *Dipodomys* sp. Gray, 1841, and *Neotoma fuscipes* Baird, 1857 based on personal communication from Repenning (1989). Helley et al. (1972) reported *Equus* sp., *Bison* sp., *Camelops* sp., *Mammuthus* sp., *Mylodon harlani*, *Neotoma cf. lucipes* [sic *fuscipes*], *Dipodomys* cf. *heermanni* Le Conte, 1853, *Eumeces*? Wiegmann, 1834 (now *Pleistodon* Duméril and Bibron, 1839 for North American species of this genus, [see Smith (2005) and Griffith et al. (2011)]) and several articulated partial skeletons of *Camelops hesternus* Leidy, 1873, again based on personal communication from Repenning (1972). Brown (1978) reported *B. latrifrons, C. hesternus*, *Odocoileus* sp., *Equus* (*Amerhippus*) sp. (Hoffstetter, 1950), *M. columbi*, *My.*

harlani, *Dipodomys* sp. cf. *D. heermanni*, *N. fuscipes*, *Thomomys* sp. Wied-Neuwied, 1839, indicating the bone material was often isolated and scattered but several articulated partial skeletons of *C. hesternus* were recovered. We confirmed the following identifications in the USGS collections: *Bison* sp.: USNM 23896, right mandibular ramus with p2-m3 and erupting p4 with dp4 still in place; UNS, scapula fragment, centrum and lower cheek tooth (length = 34.8, width = 18.1); *Camelops* sp.: USNM 184031, right and left forelimbs; UNS, two left proximal tibiae, three distal tibiae, astragalus, two partial scapulae, sacrum, ilium, vertebrae, incomplete upper cheek tooth; *Odocoileus* sp.: UNS, fragment of base of an antler; *Equus* sp.: USNM 184044, partial maxilla with 2 incisors; USNM 184040, petrosal and incus; USNM 184038, upper cheek tooth (length = 36.1, width = 29.8); UNS, upper cheek tooth (length = 31.8, width = 30.1), lower cheek tooth with broken crown, lower cheek tooth fragments, distal tibia, third metatarsal, juvenile innominate; *M. columbi*: USNM 184037, molar and tusk fragment; UNS, three incomplete thoracic vertebrae, miscellaneous tusk fragments; *Paramylodon harlani:* USNM 184033, distal humerus; USNM 184036, first sacral vertebra; USNM 184043, upper right fourth molar (length = 16.3, width = 29.9); UNS, unnumbered tooth fragments; *Dipodomys* sp. cf. *D. heermanni*: USNM 184041 calcaneum; Geomyidae Bonaparte, 1845: UNS, incisor. Overall we have reduced species level identifications to the generic level because given the material available, assignment to species is not possible, but have retained cf. to species attributions made by Repenning, as these indicated a comparison rather than identity. We did not see any material of *Thomomys* reported by Brown (1978) or of any lizard that could represent *Eumeces* (or *Pleistodon*) as reported by Helley et al. (1972). The two left proximal tibiae of *Camelops* sp. are of different sizes and of the three tibiae, two are of the same side and the third is the opposite side. In addition, the two scapula of *Camelops* sp. recovered are of different sizes. All of this, along with the complete right and left forearms of *Camelops* indicate there were several individuals of this genus in this deposit. There is an incomplete metapodial assigned to *C. hesternus* in the Mountain View Dump Locality in the USGS collection; however, there is a note with the specimen indicating the "Livermore Road Cut" collected by Dave Adam and Marvin Washington, so the provenance of this specimen is unclear. Specimens USNM 184034 (mandible and part of rostrum), USNM 184039 (tibia), USNM 23897 (left mandible and ramus) and an unnumbered specimen of a right maxilla reported in Brown (1978) were not seen at the USGS collection in Denver, Colorado. Brown (1978) also reported a complete worn upper tooth with USNM 184037 (*M. columbi*), but which was not seen in the USGS collections. A mandible of *N. fuscipes?* (USNM 184035) was removed by Repenning and was not seen in the collections. All specimens are housed at the USGS facility in Denver, CO. Some material was collected by Adele Panofsky and Dave Adam.

USGS M1218 Sunnyvale Sewer, Sunnyvale, California

Jefferson (1991) grouped this site with USGS M1218A (see below) and reported *Mammuthus columbi*, *Ursus* sp. Linneaus, 1758, *Equus* sp., *Bison* sp., *Camelops* sp., *Thomomys bottae* (Eydoux and Gervais, 1836), and *Spermophilus beldingi* Merriam, 1888 (now *Urocitellus* Obolenskij, 1927 after revision by Helgen et al. 2009) based on personal communication from Repenning (1989); however, M1218 and M1218A are separate localities in the USGS collections. Specimens assigned to USGS M1218 have labels indicating they were found near Briton Avenue, at the intersection of Briton and Taylor Avenue and at the "Fairoaks local" (Fig. 1). Material was collection by Marvin Washington in 1970 and Greg Frantz. We confirm the following identifications by Repenning: *Bison* sp., distal humerus, lower partial cheek tooth (length = 31.7, width = 21.7); *Camelops* sp., vertebrae, distal metapodial, enamel and tooth fragments; *Equus* sp., anterior portion of palate with two partial incisors and two partial canines; Ursidae Fischer, 1817, partial dentary that is extremely fragmentary with missing tooth crowns; and *Thomomys* sp., right partial dentary with incisor and m1. A label for a tusk fragment and molar of *M. columbi* was found in the collection but the actual fossils were not. *Camelops* sp. was originally identified as *C. hesternus* by Repenning and Jefferson (1991), but with the available material we can only confidently identify it to the genus (Dalquest 1991) although Baskin and Thomas (2016) argue that it is likely most Rancholabrean aged *Camelops* are *C. hesternus*. The camel and bison material were found two feet [~ 0.5 m] apart near the intersection of Briton and Taylor Avenues.

USGS M1218A Calabaza, Sunnyvale Sewer, Sunnyvale, California

The exact location of this locality is unknown but presumably it is close to Calabaza Creek and M1218, near a main sewer trunk line close to the railroad. This locality has also been referred to as the "Squirrel Locality" in field notes with specimens. Repenning identified the sciurid specimens as *Spermophilus beldingi* (now *Urocitellus beldingi*), the most western account of this species, which has a range today in the Sierra Nevada, extending northeast into Oregon and Idaho. We confirm assignment to *Urocitellus* and not the Santa Clara County resident *Otospermophilus* Brandt, 1884, because the P3 is not simple and reduced in relation to the

P4 as in *Otospermophilus* (Helgen et al. 2009): right dentary with incisors and m2-m3, complete skull with right incisor through M3 and left M1 through M3 and right and left complete dentaries, skull with missing rostrum and zygomatic arches with right P3 through M3 and left P4-M3 and right and left dentaries with p4 through m3, left dentary with m1-m3, left humerus, almost complete set of postcrania; *Thomomys*: partial maxilla with right and left P4 through M3 and partial incisors, upper and lower cheek teeth, skull fragments, dentary in matrix with exposed smooth incisors; Rodentia Bowdich, 1821: skull (unprepared); Equidae Gray, 1821 three partial incisors; *Camelops* sp.: two partial distal metapodials, metapodial diaphysis, calcaneum, scapula, two vertebrae, bone fragments. The presence of *Urocitellus* at this location warrants further investigation into the range extension of this genus into coastal lowlands California during the Pleistocene. Collectors at this locality were Marvin Washington in 1970-71 and Ken Lajoie in 1972.

USGS M1001 Matadero Creek, Palo Alto, California

Jefferson (1991) lumped this locality with M1202 (see below). We confirmed Repenning's identifications for the following uncatalogued specimens: Artiodactyla: lower cheek tooth (length = 10.9, width = 5.8); Leporidae Fischer, 1817: partial skull with the right P4-M2 and front incisors, left dentary with p2-m3 and ramus; Rodentia: distal femur epiphyses, proximal femur; Sciuridae: right femur; *Neotoma* sp. Say and Ord, 1825: right dentary with incisor and m1-m3, partial left dentary with m3 and partial m2; *Reithrodontomys* sp. Giglioli, 1874: left half of skull with M1-M3 and 2 incisors, lower left dentary with m1-m3, lower right dentary missing ramus with m1-m3, isolated M1 and M2; Reptilia Linnaeus, 1758: miscellaneous vertebrae and limb bone fragments. The USGS locality catalog card also listed an incisor fragment, P3, P4 and M1 of *Equus* but these were not found in their collections.

USGS M1202 Veterans Hospital, Matadero Creek, Palo Alto, California

Jefferson (1991) reported *Glossotherium harlani*, *Mammuthus* sp., *Equus* sp., *Capromeryx* sp., *Sylvilagus* sp. Gray, 1867, *Neotoma fuscipes*, *Reithrodontomys* sp. from Veterans Hospital, Matadero Creek, Palo Alto, thus lumping USGS M1001 and M1202. Jefferson (1991) does not list a source for identifications. We confirmed Repenning's identification of a distal humerus to Felidae. Along with the specimen was a note indicating it was found "near aqueduct crossing, base of Unit Q1 – upper soil". It was found along with shells of the high-spired mud snail Cerithidea Swainson, 1840 (also reposited in the USGS collection) and charcoal.

UCMP V4916, Milpitas, Milpitas, California

UCMP locality and accession records indicate that the single specimen (UCMP 39212, *Bison* right M1 (length=26.2, width=17.7)) was found by then plant pathology graduate student Allen Troxell in a pear orchard on Jackson Ranch approximately 1½ miles [~2.5 km] west of Milpitas and approximately 0.2 miles [~0.3 km] west of the channel of Coyote Creek. The specimen was reported to be from the soil or subsoil in a sandy layer at about two feet [~0.6 m] depth with an age of Recent or Pleistocene. Jefferson (1991) reported *Bison* from here based on the UCMP TAXIR output. We retain this identification because it is impossible to identify an isolated *Bison* molar to species (McDonald 1981).

YPM VP 45538

This specimen of *Equus* sp. in the Yale Peabody Museum is a lower molar. It is reported to be from San Jose but its exact location within the San Jose area and Santa Clara County is unknown.

Previously-Reported Localities Lacking Confirming Data or Specimens

In Jefferson (1991) there are a few records and localities for which we could find no additional information. Hay (1927) reported a tooth of *Mammut* found in 1909 by Dr. John C. Branner in loose worked gravel and coarse sand 33 feet [10 m] below the surface, but the exact location is unknown. Also reported in Hay (1927) was a tusk of *Mammuthus* sp. found in 1909 near Corte de Madera Creek, 2 miles [~ 3.2 km] southeast of Stanford University also by Dr. John C. Branner in gravel seven feet [~ 2 m] below the surface. A specimen of *Camelops* sp. found in "Rose Trombley's Back Yard" (questionably in San Jose) was reported by Jefferson (1991) as personal communication from Repenning in 1989.

DISCUSSION

The Santa Clara Valley was filled in by deposits eroding from the quickly uplifting Santa Cruz Mountains to the west and the Diablo Range to the east over the past couple millions of years. As sea level rose and fell over this time due to glacial/interglacial cycles, parts of the northern region of the valley filled in with water, depositing mud and clay layers. These processes led to a mix of alternating deposits of alluvium and mud in the Santa Clara Valley. Geological maps of the Santa Clara Valley indicate these deposits are largely Holocene with isolated areas of Pleistocene age (Fig. 1). All of the curated localities reported here, except for Veterans Hospital and Matadero Creek localities, fall within areas mapped as Holocene; however, fossils from these localities

demonstrate that older sediments and fossils (>10 ka) occur at or very near the surface in these areas. Therefore there may be a greater expanse of Pleistocene alluvium in the Santa Clara Valley than previously thought. The precise locations of Veterans Hospital and Matadero Creek localities are unknown and these sites are in an area mapped to have both Pleistocene and Holocene deposits; however, fossils from these localities clearly indicate a Pleistocene age. Given the amount, association and orientation of some of the fossils within the localities presented here, reworking of material likely did not occur, indicating the surrounding deposits are Pleistocene. Besides validating the existence of potentially more expansive Pleistocene deposits in the Santa Clara Valley and demonstrating that the Pleistocene fossils and sediments may be encountered at minimal depth, our compilation of records, dispersed as they are across different collections, demonstrate that the Quaternary alluvium of the Santa Clara Valley is perhaps more paleontologically sensitive than previously recognized and stresses the importance of paleontological mitigation in the Santa Clara Valley. Further, the discovery of the SCVWD Mammoth and Babcock Bones locations also demonstrates the importance of citizen scientists and the value in these resources for educational purposes.

There is a great need to radiocarbon date many of the sites reported here to consider them Pleistocene. For some localities, like the SCVWD Mammoth, reexamination of the deposits' age is needed to solve conflicting evidence. With radiocarbon ages, these localities and their specimens will be more valuable for faunal analyses that utilize this type of data in large databases such as FAUNMAP or Neotoma (neotoma.org). In addition, for localities that contain genera that span the Pleistocene and Holocene and include modern domesticated species, radiocarbon ages may aid in specimen identification.

Re-examination of previously published records of mammal localities in the Santa Clara Valley has revealed that many were likely identified to a lower taxonomic level in the original database records than justified by available material. In addition, localities listed in large databases such as FAUNMAP may be based on informal identifications and need to be revisited to check for accuracy. Whereas Jefferson (1991) was clear in citing the sources of data, reuse of these data in successive versions of FAUNMAP without verification has led to perpetuation of unverified records. Reverification is extremely important, as these large databases are often used for large scale analyses of biodiversity changes through time and across space. We urge circumspection about reuse of data based on unvouchered faunal lists. Our study also demonstrates the importance of rechecking specimens to confirm the validity of their taxonomic identification, as illustrated by the presence of *Urocitellus beldingi* in the Santa Clara Valley in the Pleistocene which is outside the current distribution of the species.

ACKNOWLEGEMENTS

Dave Strauss expertly photographed Figures 2 and 4–12. Kevin McKinney at USGS provided information on their holdings and access to collections. We would like to thank Greg McDonald and one anonymous reviewer for their helpful comments and Senior Editor Diane M. Erwin for production of this paper. Mark Goodwin provided access to notes and photos of the Lupe excavation. We would also like to thank the Santa Clara Valley Water District and San Jose Children's Museum; Craig Babcock for collection of specimens; the Council for Library and Information Resources for funding finding aids used to organize and make available data more accessible; and the W. M. Keck Foundation for funding cataloging of UCMP California Pleistocene vertebrates reported in this study. This is UCMP Contribution No. 2077.

LITERATURE CITED

Agenbroad, L.D. and J.I. Mead. 1994. The Hot Springs Mammoth Site: A Decade of Field and Laboratory Research in Paleontology, Geology, and Paleoecology. The Mammoth Site of South Dakota, Hot Springs, South Dakota. 457 pp.

Andersen, D.W., M.B. Goodwin, N.C. Shostak, C.M. Wentworth and J.C. Tinsley. 2008. A newly discovered mammoth in San Jose, California, poses a stratigraphic puzzle. *Geological Society of America Abstracts and Programs* 40(1): 59.

Baird, S. F. 1857 [1858]. Explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean. War Department. Mammals. 8(pt. 1):1-757 + 60 plates. Beverley Tucker, Printer, Washington, D.C.

Baskin, J., and R. Thomas. 2016. A review of Camelops (Mammalia, Artiodactyla, Camelidae), a giant llama from the Middle and Late Pleistocene (Irvingtonian and Rancholabrean) of North America. *Historical Biology* 28 (1-2):120-127, DOI:10.1080/08912963.2015.1020800

Bischoff, J.L. and R.J. Rosenbauer. 1981. Uranium series dating of human skeletal remains from the Del Mar and Sunnyvale Site, California. *Science* 213(4511):1003-1005.

Blumenbach, J.F. 1799. Handbuch der Naturgeschichte [6th Edition]. Dieterich, Göttingen, Germany. 708 pp.

Bonaparte, C.L. 1845. Catalogo Metodico dei Mammiferi Europei. G. Pirola, Milan, Italy. 36 pp.

Bowdich, T.E. 1821. An Analysis of the Natural Classifications of Mammalia, for the Use of Students and Travellers. J. Smith, Paris, 115 pp.

Brabb, E.E., R.W. Graymer, and D.L. Jones. 2000. Geologic map and map database of the Palo Alto 30' X 60' quadrangle, California:

U.S. Geological Survey Miscellaneous Field Studies Map MF-2332, U.S. Geological Survey, Menlo Park, CA.

Branner, J. C., J.F. Newsom, and R. Arnold. 1909. Geologic Atlas of the United States (No. 163), Santa Cruz Folio, California. U. S. Geological Survey, Washington, DC. Folio+11 pp.

Brandt, J.F. 1884. Observations sur les différentes espèces de sousliks de Russie, suivies de remarques sur l'arrangement et la distribution géographique du genre *Spermophilus*, ansé que sur la classification de la famille des écureuils (Sciurina) en général. *Bulletin Scientifique de l'Académie Impériale des sciences de Saint-Péterbourg* 1844:357-382.

Bravo-Cuevas, V. M., E. Jiménez-Hildalgo, M.A. Cabral-Perdomo, and J. Priego-Vargas. 2013. Taxonomy and notes on the paleobiology of the late Pleistocene (Rancholabrean) antilocaprids (Mammalia, Artiodactyla, Antilocapridae) from the state of Hidalgo, central Mexico. *Revista Mexicana de Ciencias Geológicas* 30(3):601-613.

Brookes, J. 1828. A Catalogue of the Anatomical and Zoological Museum of Joshua Brookes, Esq., F.R.S., F.L.S. etc. Taylor, London. 76 pp.

Brown, B. 1903. A new genus of ground sloth from the Pleistocene of Nebraska. *Bulletin of the American Museum of Natural History* 19:569-583.

Brown, J.L. 1978. Sedimentology of a Late Pleistocene and Holocene continental and estuarine deposit, Mountain View, California. M.S. thesis, San Jose State University, San Jose, CA.

Coates, D.R., S.O. Landry and W.D. Lipe. 1971. Mastodon bone age and geomorphic relations in the Susquehanna Valley. *Geological Society of America Bulletin* 82(7):2005-2010.

Dalquest, W.W. 1991. Problems in the nomenclature of North American Pleistocene camelids. *Annales Zoologici Fennici* 28(3/4): 291-299.

Davis, E. B. 2007 Family Antilocapridae. Pp. 227-240 in D.R. Prothero and S.E. Foss (eds.). The Evolution of Artiodactyls. John Hopkins University Press, Baltimore, Maryland.

Duméril A. M. C. and Bibron G. 1839. Erpétologie Générale ou Histoire Naturelle Complète des Reptiles. V, 1839, viii + 855 pp.

Eydoux, J.F.T., and P. Gervais. 1836. Sur le genre *Paephagomys* et quelques autres Rongeurs qui l'voisinent. Magasin de Zoologie, Paris 6:17-23.

Falconer, H. 1857. On the species of Mastodon and elephant occurring in the fossil state in Great Britain. Part 1. Mastodon. Quarterly *Journal of the Geological Society of London* 13:307-360.

Fischer, G. 1817. Adversaria Zoologica. *Mémoires de la Societé Impériale des Naturalistes de Moscou* 5:357-446.

Gervais, H. and F. Ameghino. 1880. Les mammiféres fossils de l'Amérique du Sud. Library F. Sary, Paris, France. 258 pp.

Giglioli, E. H. 1874. Richerche intorno alla distribuzione geografica generale o corologie degli animali vertebrati. III. Regione Boreo-Americana. Bolletino de la Societá alla Geografica Italiana 11:321-366.

Graham, R. W., and E.L. Lundelius, Jr. 1994. FAUNMAP: a database documenting late Quaternary distributions of mammal species in the United States. *Illinois State Museum Scientific Papers* 25 (1): 287 pp.

Graham, R. W. and E.L. Lundelius, Jr. 2010. FAUNMAP II: new data for North America with a temporal extension for the Blancan, Irvingtonian and early Rancholabrean. FAUNMAP II Database, version, 1.0.

Gray, J.E. 1821. On the natural arrangement of vertebrose animals. London Medical Repository 15:296-310.

Gray, J.E. 1841. A new genus of Mexican glirine Mammalia. Annals and *Magazine of Natural History, Series 1* 7:521-522.

Gray, J.E. 1867. Notes on the skull of hares (Leporidae) and picas (Lagomyidae) in the British Museum. *Annals and Magazine of Natural History, Series 3* 20:219-225.

Griffith, H., A. Ngo, and R.W. Murphy. 2011. A cladistic evaluation of the cosmopolitan genus *Eumeces* Wiegmann (Reptilia, Squamata, Scincidae). *Russian Journal of Herpetology* 7(1):1-16.

Hamilton Smith, C. 1827. Supplement to the order Ruminantia. Pp. 33-274 in G. Cuvier and G.B. Whitakker (eds.). The Animal Kingdom Arranged in Conformity with its Organization 5. Cambridge University Press, Cambridge.

Harlan, R. 1825. Fauna Americana: being a description of the mammiferous animals inhabiting North America. Anthony Finley, Philadelphia. 388 pp.

Hay, O. P. 1927. The Pleistocene of the western region of North America and its vertebrated animals. *Carnegie Institute of Washington Publication* 322B:1-346.

Haynes, G. 1991. Mammoths, Mastodonts, and Elephants: Biology, Behavior, and the Fossil Record. Cambridge University Press, Cambridge. 413 pp.

Helgen, K. M.; F. Cole, F. Russel, L. E. Helgen, and D. E. Wilson. 2009. Generic revision in the Holarctic ground squirrel genus Spermophilus. *Journal of Mammalogy* 90(2): 270–305. doi:10.1644/07-MAMM-A-309.1

Helley, E.J., D.P. Adam and D.B. Burke. 1972. Late Quaternary stratigraphic and paleontological investigations in the San Francisco Bay area. Pp. 19-29 in U.S. Geological Survey Staff and J.C. Cummings (eds.). Progress report on the U.S. Geological Survey Quaternary studies in the San Francisco Bay area: Guidebook for the Friends of the Pleistocene, Oct. 6-8, 1972.

Helley, E.J., R.W. Graymer, G.A. Phelps, P.K. Showalter, and C.M. Wentworth. 1994. Preliminary Quaternary geologic maps of Santa Clara Valley, Santa Clara, Alameda, and San Mateo counties, California: A digital database: *U.S. Geological Survey Open-File Report* 94-231. < http://geo-nsdi.er.usgs.gov/metadata/open-file/94-231/>

Hoffstetter, R. 1950. Algunas observactiones sobre los caballos fósiles de la América del Sur. *Amerhippus* gen. nov. *Boletín informacionaes Cientificas Nacionales* 3:426-454.

Honey, J.G., J.A. Harrison, D.R. Prothero and M.S. Stevens. 1998. Camelidae. Pp. 439-462 in C.M. Janis, K.M. Scott, and L.L. Jacobs (eds.). Evolution of Tertiary Mammals of North America Volume 1: Terrestrial Carnivores, Ungulates, and Ungulatelike Mammals. Cambridge University Press.

Illiger, C. 1811. Prodromus Systematis Mammalium et Avium Additis Terminis Zoographicis Utriusque Classis. Salfeld, Berlin, Germany. 301 pp.

Jefferson, G.T. 1991. A Catalogue of Late Quaternary Vertebrates

from California: Part Two, Mammals. *Natural History Museum of Los Angeles County, Technical Reports* 7:1–129.

Le Conte, J. L. 1853. [Remarks on the genus Dipodomys]. *Proceedings of the Academy of Natural Sciences of Philadelphia* 6:224-225.

Leidy, J. 1852. Memoir on the extinct species of American ox. Smithsonian *Contributions to Knowledge* 5(3):1-20.

Leidy, J. 1854. Description of a fossil apparently indicating an extinct species of the camel tribe. *Proceedings of the Academy of Natural Sciences of Philadelphia* 7:172–173.

Leidy J. 1873. Contributions to the extinct vertebrate fauna of the western territories. US Geological Survey of the Terrirtories Report. 1:14–358.

Linnaeus, C. 1758. Systema Naturae per Regna Tria Naturae, Secundum Classis, Ordines, Genera, Species cum Characteribus, Differentiis, Synonymis, Locis, [Tenth Edition, Volume 1]. Laurentii Salvii, Stockholm, Sweden. 824 pp.

McDonald, J.N. 1981. North American bison: their classification and evolution. University of California Press, Berkeley. 316 pp.

Matthew, W. D. 1902. List of the Pleistocene fauna from Hay Springs, Nebraska. *Bulletin of the American Museum of Natural History* 16:317-322.

Merriam, C. H. 1888. Description of a new spermophile from California. Annals of the New York Academy of Sciences 4:317-321.

Obolenskij, S. 1927. A preliminary review of the palaearctic sousliks (*Citellus* and *Spermophilopsis*). *Comptes Rendus de l'Academie des Sciences de l'URSS, A* 12:188–193.

Olsen, S. J. 1972. Osteology for the Archaeologist: American Mastodon and the Woolly Mammoth; North American Birds: Skulls and Mandibles; North American Birds: Postcranial Skeletons. *Papers of the Peabody Museum of Archaeology and Ethnology* 56(3-5): 186 pp.

Ord, G. 1818. Antilocapra. *Journal of Physique de Chimie et d'Histoire Naturelle Arts Paris* 87:149-151.

Owen, R. 1840. Fossil Mammalia. Pp. 1-111 in C. Darwin (ed.). The Zoology of the Voyage of H.M.S. Beagle under the Command of Captain Fitzroy, during the Years 1832-1836. Smith Elder, London.

Owen, R. 1848. Description of teeth and portions of jaws of two extinct anthracotherioid quadrupeds (*Hyopotamus vectianus* and *Hyop. bovinus*) discovered by the Marchioness of Hastings in the Eocene deposits on the N.W. coast of the Isle of Wight: with an attempt to develop Cuvier's idea of the classification of pachyderms by the number of their toes. *Quarterly Journal of Geological Society of London* 4:103-141.

Rafinesque, C. S. 1832. Description of some of the fossil teeth in a cave in Pennsylvania. *Atlantic Journal and Friend of Knowledge* 1:109-110

Say, T. and G. Ord. 1825. A new genus of Mammalia proposed, and a description of the species upon which it is founded. Journal of the *Academy of Natural Sciences, Philadelphia* 4:345–349.

Scott, E. 2004. Pliocene and Pleistocene horses from Porcupine Cave. Pp. 264-279 in A.D. Barnosky (ed.) Biodiversity Response to Climate Chance in the Middle Pleistocene: The Porcupine Cave Fauna from Colorado. University of California Press, Berkeley.

Sinclair, W.J. and E.L. Furlong. 1904. *Euceratherium*, a new ungulate from the Quaternary caves of California. University of California Publications; *Bulletin of the Department of Geology* 3:411–418.

Smith, H.M. 2005. Plestiodon: a replacement name for most members of the genus Eumeces in North America. *Journal of Kansas Herpetology* 14:15-16.

Stock, C. 1925. Cenozoic gravitrade edentates of western North America with special reference to the Pleistocene Megalonychinae and Mylodontidae of Rancho La Brea. *Carnegie Institute of Washington Publication* 331:1-206.

Swainson, W. 1840. A treatise on malacology or shells and shellfish. London, Longman. viii + 419 pp., available online at http://www.biodiversitylibrary.org/item/33450

Taylor, W.P. 1911. A new antelope from the Pleistocene of Rancho La Brea. *University of California Publications, Bulletin of the Department of Geology* 6:191-197.

Tomiya, S., J.L. McGuire, R.W. Dedon, S.D. Lerner, R. Setsuda, A.N. Lipps, J.F. Bailey, K.R. Hale, A.B. Shabel and A.D. Barnosky. 2011. A report on late Quaternary vertebrate fossil assemblages from the eastern San Francisoc Bay region, California. *PaleoBios* 30(2):50-71.

Webb, S.D. 1974. Pleistocene Llamas of Florida, with a brief review of the Lamini. Pp. 170-214 in S.D. Webb (ed.). Pleistocene mammals of Florida. University Press of Florida, Gainsville.

Wied-Neuwied, M. Z. P., 1839. Eine neue Gattung der Wühlmäuse. Acta Physico-Medica Academiæ Caesareæ Leopoldino. Carolinæ Naturæ Curiosorum, 19(pt. 10):375-384.

Wiegmann A. F. A. 1834. Herpetologia Mexicana, seu Descriptio Amphibiorum Novae Hispaniae, quae Itineribus Comitis de Sack, Ferdinandi Deppe et Chr. Guil. Schiede in Museum Zoologicum Berolinense Pervenerunt, C. G. Lüderitz, Berlin, vi+54 pp.