The Buccinid Gastropod *Deussenia* From Upper Cretaceous Strata of California

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Abstract. Rare specimens of three new species of the Late Cretaceous buccinid gastropod *Deussenia* Stephenson, 1941, are reported from California. *Deussenia sierrana* sp. nov. is from lower Campanian strata in the Chico Formation in the Pentz area, Butte County, northern California. *Deussenia californiana* sp. nov. is from upper middle to lower upper Campanian strata in the Tuna Canyon Formation in the Garapito Creek area, eastern Santa Monica Mountains, Los Angeles County, southern California. *Deussenia pacifica* sp. nov. is from uppermost Maastrichtian or possibly lowermost Paleocene strata in the Dip Creek area, northern San Luis Obispo County, central California. These three new species are the only known occurrences of this genus from the Pacific coast of North America. *Deussenia* has been reported before only from upper Santonian to lower Campanian strata at the mouth of the Mzamba River (Pondoland, Transkei) in South Africa and from Campanian to Maastrichtian strata in Texas and the Gulf Coast of the United States.

INTRODUCTION

Late Cretaceous buccinid gastropods are relatively uncommon on the Pacific coast of North America. Recent inspection of previously collected material resulted in the detection of three new species of genus *Deussenia* from widely separated locales in California (Figures 1, 2). It is the purpose of this paper to describe and name these species. They significantly extend the biogeographic range of *Deussenia*, which was previously known only from Upper Cretaceous rocks in South Africa and southeastern United States.

Abbreviations used are: CASG, California Academy of Sciences, Geology Section, San Francisco; CSUC, Department of Geology & Physical Science, California State University, Chico; CSUN, Department of Geological Sciences, California State University, Northridge; LACMIP, Natural History Museum of Los Angeles County, Invertebrate Paleontology Section.

SYSTEMATIC PALEONTOLOGY

Superorder CAENOASTROPODA Cox, 1959

Order NEOASTROPODA Thiele, 1929

Family BUCCINIDAE Rafinesque, 1815

Subfamily MELONGENINAE Gill, 1871

Discussion: Stephenson (1941) questionably assigned his genus *Deussenia* to family Bucbinidae, but he gave no discussion as to why he chose this family. Sohl (1964) assigned *Deussenia* to family Melongenidae, and he also gave no discussion for the basis of this assignment. Melongenids have pyriform fusiform shells, usually shouldered whors, a long anterior canal, and a smooth columella (Wenz, 1943; Davies & Eames, 1971; Rosenberg, 1992). These morphologic features are present on all species of *Deussenia* Stephenson, 1941, including the new species described here. Ponder & Warén (1988) regarded melongenids to be a subfamily of Bucinidae. Akers & Akers (1997) did likewise and, furthermore, placed genus *Deussenia* in subfamily Melongeninae.

Genus *Deussenia* Stephenson, 1941

Type species: *Deussenia cibolensis* Stephenson, 1941, by original designation; Upper Cretaceous (upper Maastrichtian) Kemp Formation of the Navarro Group, eastern Texas.

Discussion: *Deussenia* resembles the Upper Cretaceous bucciniform *Aliofusus* Stephenson, 1941, but *Deussenia* differs from *Aliofusus* by having a stronger subsutural collar, less inclined growth lines on the collar, and straighter axial ribs. *Aliofusus* has axial ribs that are curved and follow the outline of the outer lip.

*Deussenia* superficially resembles the Upper Cretaceous volutid genus *Volutomorpha* Gabb, 1877, but *Deussenia* lacks volutid characteristics in that it has no
fold(s) on the columella, no posterior notch, and no sigmoidal deflection of growth lines near the suture. Furthermore, *Deussenia* differs from *Volutomorpha* by having a higher spire, a shorter body whorl, a twisted anterior end, and more dense ornamentation.

Prior to this present study, only 10 other species have been placed in genus *Deussenia*, and Sohl (1964:200) listed them. All are of Late Cretaceous age. Four of the species are from upper Maastrichtian strata in eastern Texas, but Sohl (1964) believed that some of these names might be synonyms because they are (1) distinguished on minor differences in shape and ornament, (2) all are from the same stratigraphic horizon in a limited geographic area, and (3) the number of available specimens of these four species are so few that it is not possible to determine whether or not the minor differences are significant.

Four of the other known species of *Deussenia* are found in upper Campanian to Maastrichtian or upper Maastrichtian strata in Texas, Mississippi, and Tennessee, and are found, to a lesser degree, in similar age strata in Alabama and Georgia (Stephenson, 1941; Sohl, 1964; Akers & Akers, 1997). The other two known species of *Deussenia* are from upper Santonian to lower Campanian strata at the mouth of the Mzamba (= Umzamba) River, Pondoland, Transkei, South Africa (Sohl, 1964). These latter two species were questionably assigned by Sohl (1964) to genus *Deussenia*.

*Deussenia sierrana* Squires & Saul, sp. nov. (Figures 3–5)

**Diagnosis:** A small-shelled species of *Deussenia* with a prominent suture cord, subtabulate body whorl shoulder, and nearly obsolete body whorl sculpture.

**Description:** Shell small, 25 mm high (incomplete); fusiform; spire of medium height, about two-fifths of total height of shell; spiral angle about 45°. Protoconch not preserved. Whorls 6 (estimated). Upper spire whorls lowly convex, smooth. Ramp concave, constricted, and well differentiated starting on more mature half of ante-penultimate whorl and continuing onto penultimate and body whorls; ramp widest (about 0.75 mm) on body whorl. Ramp always bordered posteriorly by a prominent suture cord and always bordered anteriorly by a subtabulate shoulder. Prominent suture cord somewhat undulatory on body whorl. On penultimate whorl, subtabulate shoulder with low axial ribs. Body whorl sculpture mostly obsolete, with faint spiral ribbing near neck area on ventral face. Growth lines prosocline on ramp; sharply flexed (sinused) and opisthocline on subtabulate shoulder; broadly prosocline on most of body whorl; nearly straight on whorl base; and strongest near outer lip where growth rugae develop. Aperture elongate, anterior end (incomplete) slightly twisted to left. Columella smooth, with a
Discussion: Geologic age: Late Cretaceous (early Campanian).

Distribution: Chico Formation, informal Pentz Road member of Russell et al. (1986), Pentz area, Butte County, northern California.

Dimensions of holotype: Height 25 mm (incomplete at both extremities), width 11.2 mm.

Holotype: LACMIP 12717.

Type locality: CSUC loc. PN32, latitude 39°39'08"N, longitude 121°35'50"W.

Distribution: All specimens coated with ammonium chloride.

Cryptorhytis pseudorigida

Figure 3-5. Figures 6-9. Deussenia sierrana were considered by Watkins & Gohre (unpublished MS) to represent a fully marine, shoreface deposit. Specimens from Beds 3 and 16, and Greyling (1992) recorded "C." pseudorigida from Beds 9, 11, and 16. Klinger & Kennedy (1980), on the basis of the ammonite fauna, placed the rocks of this debate, both species are of late Santonian to early Campanian age and are about the same age as D. sierrana.

Explanation of Figures 3 to 12

All specimens coated with ammonium chloride.

Figures 3-5. Deussenia sierrana Squires & Saul, sp. nov., holotype LACMIP 12717, CSUC locality PN32, Pentz area, height 25 mm. ×2.6. Figure 3. Apertural view. Figure 4. Abapertural view. Figure 5. Right-lateral view showing outline of outer lip.

Figures 6-9. Deussenia californiana Squires & Saul, sp. nov., CSUN loc. 153, Garapito Creek area. Figures 6-8. Holotype LACMIP 12718, height 11 cm, ×1. Figure 6. Apertural view. Figure 7. Abapertural view. Figure 8. Apertural view with a portion of body whorl removed to better show the columella. Figure 9. Paratype LACMIP 12719, apertural view, height 10.75 cm, ×0.8.

Figures 10-12. Deussenia pacifica Squires & Saul, sp. nov., holotype CASG 61598.01, CASG loc. 61598, Dip Creek area, ×1.9. Figure 10. Apertural view. Figure 11. Abapertural view. Figure 12. Right-lateral view.
Deussenia californiana Squires & Saul, sp. nov.  

(Figures 6-9)

**Diagnosis:** A large-shelled species of *Deussenia* with a rounded body whorl shoulder bearing about 20 low and narrow axial ribs, and with numerous spiral ribs over the entire body whorl.

**Description:** Shell large, up to 13 cm high (estimated); fusiform; spire of medium height, about two-fifths of total height of shell; spiral angle about 50°. Protoconch not preserved. Whorls 6 1/2 (estimated). Spire whorls tabulate, steep-sided with axial ribs stronger than spiral ribs. Posterior part of body whorl constricted to a moderately broad and lowly concave ramp, with spiral ribs weaker on ramp than on area of greatest inflation of whorl. Body whorl elongate, with greatest inflation from rounded shoulder to medial part of whorl. Body whorl sculptured by about 20, narrow and widely spaced axial ribs, becoming obsolete toward medial part of whorl, and numerous and closely spaced spiral ribs over entire body whorl, persisting onto the ventral surface of the neck. Axial ribs more prominent than spiral ribs on posterior half of body whorl. Aperture elongate-lenticular, anterior end twisted to left. Columella smooth.

**Dimensions of holotype:** Height 11 cm (tip of spire and extreme anterior end both missing); width 5.8 cm.

**Holotype:** LACMIP 12718.

**Type locality:** CSUN loc. 153, latitude 34°07' N, longitude 118°34' W.

**Paratype:** LACMIP 12719.

**Distribution:** Tuna Canyon Formation, south fork of Garapito Creek, eastern Santa Monica Mountains, Los Angeles County, southern California.

**Geologic age:** Late Cretaceous (late middle to early late Campanian) = Metaplacenticeras pacificum ammonite zone.

**Discussion:** Only two specimens have been found, and both are internal molds. The paratype is larger (estimated total height 13 cm, width 6.5 cm), but most of its spire is missing. The paratype shows spiral ribbing on the neck of the body whorl (Figure 9), whereas on the holotype the spiral ribbing in this area is not preserved.

*Deussenia californiana* is similar to *Deussenia cibolensis* Stephenson (1941:332–333, pl. 64, figs. 13, 14; Akers & Akers, 1997:figs. 183–184) from the Upper Cretaceous Kemp Clay [also referred to as the Kemp Formation] in eastern Texas. Modern workers (e.g., Sohl, 1964:fig. 12; Elder, 1996) correlated the Kemp Clay to the upper Maastrichtian Stage. The new species differs from *D. cibolensis* by having a much less tabulate body whorl shoulder, no tubercles on the body whorl shoulder, and narrower spiral ribs on the body whorl.

*Deussenia californiana* is also similar to *Deussenia pseudorigida* (Rennie, 1930:227–228; Woods, 1906:321–322, pl. 39, figs. 2a–2c; pl. 40, fig. 1) from upper Santonian to lower Campanian rocks in the Mzamba Formation in South Africa (see “Discussion” under *D. serrana* sp. nov.). The new species differs from *D. pseudorigida* by being narrower just anterior to the concave ramp, by having narrower and more numerous narrower axial ribs, and by having weaker spiral ribs on the anterior half of the body whorl.

The type locality of *Deussenia californiana* in the Garapito Creek area in the eastern Santa Monica Mountains, Los Angeles County, southern California, plots in cartographic unit “Kss” (unnamed Upper Cretaceous strata) of Dibblee’s (1992) map, which is the most recently published geologic map of the region. Rocks belonging to unit “Kss” in the Temescal Canyon-Santa Ynez Canyon just southeast of Garapito Creek were assigned by Colburn (1996) to the Upper Cretaceous Tuna Canyon Formation of Yerkes & Campbell (1979). This formation was deposited by turbidity currents on submarine fans (Yerkes & Campbell, 1979, 1980; Dibblee, 1992), and unit “Kss” represents a dominantly sandy facies. Unit “Kss” in the region of Garapito Creek corresponds to “member D” mentioned by Popeneo (1973) and to the so-called “upper Chico” Formation utilized by Carey & Colburn (1978). Popeneo (1973:26–27) reported that “member D” rocks were probably deposited as turbidites and that the mollusk fossils are shallow-marine forms that might have been transported from their regular habitat into somewhat deeper water. Carey & Colburn (1978) reported that these same rocks represent middle-fan channelized turbidites containing lenses of concentrated shallow-marine molluscan shells that appear to have been transported.

The paleoenvironment of the Tuna Canyon Formation closely resembles that of the Chatsworth Formation of Colburn et al. (1981) in the Simi Hills just to the north of the Santa Monica Mountains. According to Dibblee (1992), the Tuna Canyon Formation is probably equivalent to the Chatsworth Formation in the Simi Hills.

Based on the presence of the ammonite *Metaplacenticeras pacificum sensu stricto* (Smith, 1900), Popeneo (1973) assigned a late Campanian age to the rocks at CSUN loc. 153. Subsequent detailed collecting at this type locality of *D. californiana* yielded this ammonite, as well as the gastropods Anchura phaba Elder & Saul, 1996, Volutoderma magna Packard, 1922, and Zinsitys kingi (Gabb, 1864); the bivalves Crassatella elongata Anderson, 1958, Indogrammatodon sp., Cucullaea sp., Pinna sp., (closed valved), Pterotrigonia evansana (Meek, 1858), Inoceramus sp., Clisococulus dubius (Gabb, 1864), an isognomid, and a venerid. The presence of *Metaplacenticeras pacificum sensu stricto* is very age diagnostic because this species constitutes the *Metaplacenticeras pacificum* ammonite zone (after Matsumoto, 1960), which is of middle to early late Campanian age (Elder &
Saul, 1996). The geologic ranges of both Zinsitys kingii and Anchura phaba are correlative to the M. pacificum zone (Saul, 1988; Elder & Saul, 1996).

At LACMIP loc. 27002, which is in the general area of CSUN loc. 153, the bivalves Glycymeris (Glycymerita) veatchii (Gabb, 1864), Pterotrigonia evansana (Meek, 1858), Cymbophora triangulata (Waring, 1917), Calva sp., and Yaadia sp. were also found. The exact location of LACMIP loc. 27002 is not known, but is undoubtedly in the immediate area of CSUN loc. 153.

The mollusks at CSUN loc. 153 must have undergone post-mortem transport from shallow-water sites into deep-water, submarine-fan paleoenvironments of the Tunca Canyon Formation. Several of the species found at CSUN loc. 153 or in the immediate vicinity (e.g., Anchura phaba, Volutoderma magna, Crassatella elongata, Cymbophora triangulata, Glycymeris (Glycymerita) veatchii, Pterotrigonia evansana, and Pinna sp.) were normal-marine, shallow-depth dwellers (10 to 50 m) that also have been reported as transported remains in bathyal submarine-fan deposits of Campanian age in the Chatsworth Formation in the Simi Hills (Saul & Alderson, 1981).

**Etymology:** The species is named for the state of California.

*Deussenia pacificana* Squires & Saul, sp. nov.
(Figures 10–12)


**Diagnosis:** A medium-shelled species of *Deussenia* with a subtabulate body whorl shoulder, bearing about 11 moderately strong axial ribs, and with prominent, closely spaced spiral ribs on body whorl.

**Description:** Shell medium in size, 31 mm high (incomplete); fusiform; spire of medium height, about two-fifths of total height of shell; spiral angle about 55°. Protoconch not preserved, and spire sculpture not preserved. Whorls about 4 1/2 (estimated). Upper part of body whorl constricted somewhat to broad, slightly concave ramp. Body whorl with about 11 (estimated) moderately strong and widely spaced axial ribs; strongest on shoulder and becoming obsolete toward base of whorl. Body whorl with prominent, closely spaced spiral ribs persisting onto neck area. Aperture elongate-lenticular. Columella smooth.

**Dimensions of holotype:** Height 31.5 mm, width 16 mm (incomplete at both extremities, especially the anterior end).

**Holotype:** CASG 61598.01 [ex Stanford University 30031].

**Type locality:** CASG loc. 61598, latitude 120°55′40″N, longitude 35°43′45″W.

**Distribution:** Unnamed formation at Dip Creek, south shore of Lake Nacimiento, San Luis Obispo County, central California.

**Geologic age:** Late Cretaceous (latest Maastrichtian) or possibly earliest Paleocene.

**Discussion:** Only a single specimen has been found. It is small in size and could be a juvenile form.

Taliaferro (1944) referred the Dip Creek strata to his “Dip Creek Formation,” but Durham (1968) referred to them as unnamed Upper Cretaceous and lower Tertiary rocks. At Dip Creek, the mollusks are shallow-marine forms that have undergone post-mortem transport and are within deep-water turbidites in beds of coarse-grained grit or conglomerate (Grove, 1986). More detailed geologic mapping is needed in the area before the Dip Creek section can be assigned to a formation. The outcrops along Dip Creek are usually covered by waters behind the Lake Nacimiento dam but are exposed during drought years (Squires & Saul, 1993). One can collect fossils along the nearby ridge top, but these specimens are harder to find and are more poorly preserved than those along the lake shore.

The Dip Creek fauna contains some mollusks that resemble genera or species usually considered to indicate a Cretaceous age, as well as some indicative of a Paleocene age. Taliaferro (1944) reported an unidentified ammonite from the fauna, and Saul (1983) reported a fragment of another ammonite, probably a Neophylloceras. Kirby & Saul (1995) reported a fragment of the bivalve Roudaria. These fossil remains suggest that at least the lower part of the section is of very Late Cretaceous age and that the upper half of the section, where the new species was collected, is no younger than earliest Paleocene. Based on specimens of *Turritella peninsularis adelaideana* (Merram, 1941) and *T. webbi* (Saul, 1983), Saul (1983) assigned the Dip Creek mollusks to a latest Maastrichtian and possibly an earliest Paleocene age. This age assignment was followed by Saul (1986) and Squires & Saul (1993).

**Etymology:** The new species is named for the Pacific Ocean.

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LITERATURE CITED


Stephens, L. W. 1941. The larger invertebrate fossils of the Navarro Group of Texas (exclusive of corals and crustaceans and exclusive of the fauna of the Escondido Formation). The University of Texas Publication 4101:1-641, pls. 1-95.


APPENDIX

LOCALITIES CITED


CSUN 153. [= LACMIP 11975.] At elevation of 1450 ft., in bottom of south fork of Garapito Creek, 533 m (1750 ft.) S and 521 m (1710 ft.) E of the intersection of the San Bernardino base line and Los Angeles City boundary, U.S. Geological Survey Topanga quadrangle (7.5 minute, 1952, photo-revised, 1967), Santa Monica Mountains, Los Angeles County, southern California. Unnamed strata. Age: Late middle Campanian. Collector: John Alderson, 1974-1987. [See Fritsche’s (1973) map for a plot of this locality on a detailed topographic base.]

LACMIP 10833. Fossiliferous layers cropping out in beds of small gullies in field along Pentz Road [formerly Durham-Pentz Road], approximately 290 m (950 ft.) S and 107 m (350 ft.) E of NW corner of section 25, T. 1 N, R. 3 E, U.S. Geological Survey Cherokee quadrangle (7.5 minute, 1970), Butte County, northern California. Chico Formation, Pentz Road member (informal) of Russell et al. (1986). Age: Early Campanian. Collector: W. P. Popenoe, 1931.