

Explanation of Figures 55 to 66

Unless otherwise indicated, figures are  $\times 1$ ; specimens coated with ammonium chloride, except as noted.

Figures 55–60. *Palaeatractus crassus* Gabb, 1869. Figure 55: LACMIP cat. no. 11550, from LACMIP loc. 10744, neotype, aperture,  $\times 3$ . Figure 56: LACMIP cat. no. 11552, from LACMIP loc. 10744, hypotype, section showing lack of folds on columella,  $\times 3$ , uncoated. Figures 57, 58: LACMIP cat. no. 11551, from LACMIP loc. 10744, hypotype; Figure 57, back,  $\times 3$ ; Figure 58, apical view,  $\times 3$ . Figures 59, 60: LACMIP cat. no. 11553, from UCLA loc. 4214, hypotype; Figure 59, right side; Figure 60, aperture.

Figures 61–66. *Saturnus dubius* (Packard, 1922). Figure 61: LACMIP cat. no. 11556, from LACMIP loc. 10079, section showing lack of folds on columella, hypotype, uncoated.

Table 7

Measurements (mm) of *Palaeatractus crassus* (Gabb, 1869).

	H	D	Hp	Dp	Ha	A	Dp/ Hp
LACMIP 11550	10.9*	6.5	1.9	3.5	2.3*	68°	1.8
LACMIP 11551	7.8	4.4	1.4	2.6	2.5	66°	1.9
LACMIP 11552	6.5	4.9	—	—	—	—	—
LACMIP 11553	20.0*	19.6	2.8	5.6	4.7	86°	2.0

\* Specimen incomplete. Abbreviations decrypted in Introduction.

*Palaeatractus crassus* Gabb, 1869

(Figures 55–60)

*Palaeatractus crassus* GABB, 1869:148, pl. 26, fig. 26;  
COSSMANN, 1901:82, text fig. 24; WENZ, 1941:1222, fig. 3476.

**Diagnosis:** Small pyriform shells with a low spire, thick shell, slightly twisted columella, simple outer lip, incrustated inner lip, and a strong, overall sculpture of squarish nodes.

**Description:** Shell small, pyriform, thick; spire low; whorls five, rounded; suture impressed. Surface marked by prominent, straplike spiral ribbons, crossed by irregular axial ribs or lines; axial ribs variable in size, number, and disposition, but generally of nearly even distribution, producing squarish nodes or tubercles at intersections with spiral ribbons; interspaces showing numerous fine growth lines. Aperture broad in middle, acute posteriorly, extended anteriorly into moderate and slightly twisted canal; outer lip simple; inner lip thick, expanded roundly onto body whorl, extending adapically beyond aperture, with a well defined margin; columella without folds.

**Neotype:** LACMIP cat. no. 11550. STEWART (1927) was unable to find Gabb's specimens of this species. In their absence, a neotype is herein chosen from LACMIP loc. 10744 (= CIT 1255).

**Hypotypes:** LACMIP cat. nos. 11551–11552 from LACMIP loc. 10744 (= CIT loc. 1255), French Creek, north of Swede Basin; 11553 from UCLA loc. 4214, Little Cow Creek, Shasta Co., California.

**Dimensions:** See Table 7.

**Original type locality:** From the Shasta Group, from a canyon in the foothills, a mile (1.6 km) south of the road from Colusa to the Sulphur Springs near the eastern margin of the Coast Range, Colusa County, California.

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Figures 62, 63, 65: LACMIP cat. no. 11554, from LACMIP loc. 10079, hypotype; Figure 62, aperture; Figure 63, back; Figure 65, right side. Figures 64, 66: LACMIP cat. no. 11555, from LACMIP loc. 10079, hypotype; Figure 64, aperture; Figure 66, back. Photographs 55, 56, 61–64 by Susuki; 57–60, 65 by De Leon.

**Locality of the neotype:** LACMIP loc. 10744, French Creek, north of Swede Basin, Shasta Co., California.

**Distribution:** Redding Formation, Frazier Siltstone Member and near the base of the Melton Sandstone Member, Swede Creek Valley, Redding area, Shasta Co.; Great Valley Series, Colusa Co., California. ANDERSON (1958: 26) listed this species from the second conglomerate above the base of the Pacheco Group on Bear Creek, Colusa Co., but the specimens have not been found at either the California Academy of Sciences or the University of California, Berkeley, Museum of Paleontology.

**Geologic age:** Turonian.

**Remarks:** The sculpture of squarish, flat nodes is distinctive. Weathering causes the nodes to become pitted and produces a more ornate, pseudocancellate effect (Figure 55).

Although GABB (1869) indicated that his lot of fossils from south of the road from Colusa to the Sulphur Springs, Colusa County was from the Shasta Group, which is of Early Cretaceous age, this species has not been found associated with others of Early Cretaceous age and is present in beds of Turonian age in the Redding area. ANDERSON (1938:131) interpreted Gabb's locality to be in the first range of foothills on the west side of the Sacramento Valley and south of the road between Colusa and Wilber Springs. He referred this locality to the younger "Chico" beds rather than the older "Shasta" strata. We have not seen any collection that might be from this vicinity, and there is no record of any such collection in the literature. The possibility that a collector might stumble upon this locality and provide toptype or near toptype specimens cannot be ruled out, but the probability that the Redding area specimens are correctly determined is very large. The selection of this neotype provides additional characteristics for recognizing the genus and the species, and for classifying the genus.

COSSMANN (1901) referred three species to *Palaeatractus*: *P. minimus* (Hoeninghaus in Goldfuss, 1844) and *P. roemeri* Holzapfel, 1888, from Vaals, Netherlands, "near Aix-la-Chapelle" = Aachen; and "*Voluta*" *rhomboidalis* ZEKELI, 1852, from Gosau, Austria. ZEKELI's (1852) figure of "*V.*" *rhomboidalis* (pl. 14, fig. 9) has a more angular whorl profile, less twist to the anterior canal, and lacks the expanded, thickened inner lip of *P. crassus*. STOLICZKA's (1867: 120, pl. 10, fig. 21, 21a) "*V.*" *rhomboidalis* from the Arrialoor Group (Campanian-Maastrichtian) of southern India has a more rounded whorl profile similar to that of *P. crassus*, and may not be Zekeli's species. The Indian form also does not show the expanded demarked inner lip of *P. crassus*, and Stoliczka suggested that in "*V.*" *rhomboidalis* the sculpture diminishes with maturity, which is not true for *P. crassus*. None of these is a convincing *Palaeatractus*.

GABB (1869:148) gave the dimensions of his figured specimen as "Length .62 inch [=16 mm]; width .45 inch [=11.43 mm]; length of aperture .5 inch" [=12.7 mm]; but

he drew a size bar (GABB, 1869:pl. 26, fig. 26) 0.8 inch (=20.32 mm) long. WENZ (1941:1223, Abb. 3476) reprinted Gabb's figure, which is 39 mm (=1.5 inches) high, and more than twice Gabb's described height but less than two times his diagrammed height, as being 1/1. Three of the four specimens from Swede Basin in the Redding area are small (6.5 to 10.9 mm high) and close to the height(s) indicated by GABB (1869), but one is larger (20.0 mm high). This specimen, although incomplete and larger than Gabb's size bar, is considerably smaller than Gabb's (or Wenz's) figure. Size range of the Redding specimens is probably representative of the species.

The specimen from CASG loc. 1552, north end of the Shale Hills in Antelope Valley, Kern Co., California, identified by ANDERSON (1958:58) as *Palaeatractus crassus* is not this species, but is instead a volute resembling *Konistra biconica* (ANDERSON, 1958). Although ANDERSON (1958) suggested that these beds were of Coniacian age, MATSUMOTO (1960:80) indicated that they are late Campanian-early Maastrichtian in age.

#### *Saturnus* Saul & Popenoe, gen. nov.

Type species: *Siphonalia dubius* Packard, 1922, from the Turonian of Southern California.

**Diagnosis:** Shell fusiform, spire fairly high; whorls angularly shouldered posteriorly with a moderate ramp. Growth lines prosocline at suture, strongly sinused at shoulder, and broadly arcuate across flank. Sculpture of spiral ribbons over riding collabral ribs; collabral ribs strong, rounded, accentuated by nodes at shoulder, dying out above and below. Aperture notched posteriorly at shoulder, siphonal canal curved to left; outer lip smooth; columella smooth; inner lip well marked and forming a narrow pseudoubilicus at fasciole.

**Discussion:** *Saturnus* resembles *Deussenia* Stephenson, 1941, from the Late Cretaceous of the Gulf Coast, but lacks a subsutural collar, having only a subsutural welt. The posterior end of the aperture makes a broad angle rather than a narrow channel as in *Deussenia*. Although the notch in the growth line at the shoulder is suggestive of a turrid, and *Saturnus* bears some resemblance to *Knefastia* Dall, 1919, the shoulder notch of *Saturnus* is shallow and its growth line is similar to that of melongenids.

The genus is named for the Roman god of agriculture, *Saturnus*, and is of masculine gender.

#### *Saturnus dubius* (Packard, 1922)

(Figures 61–66)

*Siphonalia dubia* PACKARD, 1922:431, pl. 35, fig. 5.

**Diagnosis:** As for the genus.

**Description:** Medium-sized fusiform shells with a spire about one-third total shell height; pleural angle about 47°; protoconch unknown; suture appressed with a slight subsutural welt; body constricted posteriorly to form a shallow

Table 8  
Measurements (mm) of *Saturnus dubius* (Packard, 1922).

	H	D	Hp	Dp	Ha	Hs	A	R	Dp/Hp	Hp/Hs
LACMIP 11554	62.8	25.8	12.3	17.8	21.0	8.5	47°	10	1.4	1.4
LACMIP 11555	27.5*	14.8	7.6	13.7	—	4.9	44°	9	1.8	1.6
LAMCIP 11556	30.4*	20.7	—	—	—	—	46°	—	—	—

\* Specimen incomplete. Abbreviations decypted in Introduction.

ramp, slightly swollen below nodose shoulder, and tapering anteriorly. Sculpture of strong, broad, rounded collabral ribs, about 10 per whorl, arising at shoulder and dying out on flank, all overridden by flat-topped spiral ribbons narrower than interspaces, four or five ribbons on whorl flanks of spire, at least 12 on body whorl flank, and about six on ramp. Growth lines prosocline at suture, becoming strongly opisthocline on ramp, sinused at shoulder, becoming orthocline over periphery and base. Aperture rather ear-shaped with a broad posterior notch and a stronger notch at shoulder; anterior canal elongate, slightly twisted, and inclined to the left; inner lip moderately thick, well demarked, rounded parietally, forming an elongate chink-like pseudumbilicus along fasciole.

**Holotype:** UCBMP cat. no. 12304.

**Hypotypes:** LACMIP cat. no. 11554–11556 from LACMIP loc. 10079 (= CIT loc. 1164), south side Silverado Canyon, Santa Ana Mts., Orange Co., California.

**Type locality:** "from the Chico of the Santa Ana Mountains, Orange Co., California" (Packard, 1922).

**Dimensions:** See Table 8.

**Geologic age:** Turonian.

**Distribution:** Known from several localities, all near the top of the Baker Canyon Member or the base of the overlying Holz Shale Member, Ladd Formation, Santa Ana Mountains, Orange Co., California.

**Remarks:** PACKARD's (1922:431) specimen was imprecisely located, and he was unable to determine the horizon of this species. It resembles *Deussenia ripleyana* Harbison, 1945, from the Ripley Formation of the Gulf Coast but is higher spired, has stronger and fewer collabral ribs, and a fasciole with a very narrow pseudumbilicus. The aperture has a broader posterior notch and a stronger, wider shoulder notch.

Family FASCIOLARIIDAE Gray, 1853

Subfamily FASCIOLARIINAE Gray, 1853

Genus *Drilluta* Wade, 1916

Type species: *Drilluta communis* Wade, 1916, by original designation, from the Maastrichtian of Tennessee.

**Diagnosis:** Rather slender fusiform shells with a spire about half total shell height. Whorls posteriorly constricted

to a roughened subsutural collar. Sculpture usually dominated by strong collabral transverse ribs; spiral sculpture well developed on basal slope, less frequently on periphery. Aperture notched posteriorly, siphonal canal of moderate length and slightly inclined to left. Inner lip callus thin; columella with a strong plait anterior to one or two weaker folds (SOHL, 1964:205).

**Discussion:** WADE (1916), STEPHENSON (1941), and PILSBRY & OLSSON (1954) considered *Drilluta* to belong to the Volutidae, but WENZ (1943:1418) placed it in the Conacea. SOHL (1964:205) considers it close to *Bellifusus* Stephenson, 1941 (type species *Odontofusus curvicostata* Wade, 1926, Maastrichtian, Gulf Coast), and places it in the Fasciolaridae.

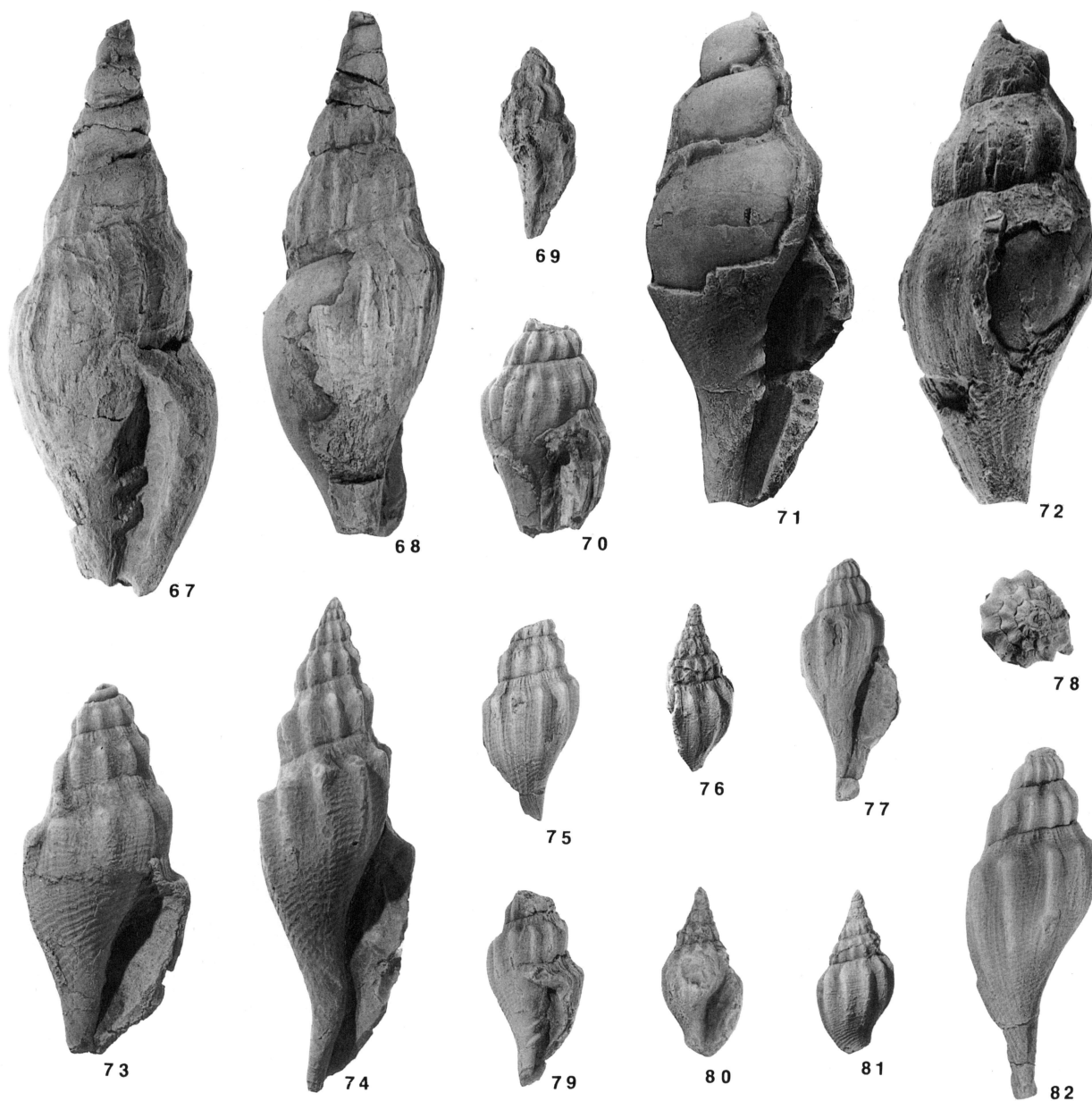
*Drilluta jacksonensis* (Anderson, 1958)

(Figures 67–72)

*Volutoderma? jacksonensis* ANDERSON, 1958:174, pl. 21, fig. 1.

**Diagnosis:** A large *Drilluta* with a weakly developed subsutural collar, moderately strong shoulder, elongate body whorl, 13 to 18 wide-spaced strong, sigmoidal collabral ribs, and faint spiral sculpture on base of body whorl and siphonal neck. Shoulder at about mid whorl height on spire.

**Description:** Shell large, elongate fusiform, apical angle about 33°; spire broken but probably approximately of same length as body whorl; whorls of spire about one-third broader than high, with a steeply sloping, moderately broad and very shallowly concave ramp to noded shoulder, shoulder at about mid whorl height, flanks slightly convex; suture sinuous, appressed, with weakly developed, wrinkled subsutural collar; body whorl with a steeply sloping concave ramp to noded shoulder, gently convex lateral areas, and concave gently tapering, moderately long siphonal portion; axial sculpture of 13 to 18 rather widely spaced, collabral ribs to the whorl; ribs concave toward aperture, most strongly developed on shoulder of whorl, diminishing and disappearing rapidly anteriorly, and usually more or less obsolete on the concave ramp; spiral sculpture of close-set, faint, revolving lines usually apparent only on base of body whorl and siphonal neck. Aperture narrow, parietal border of aperture shallowly excavated; columella of medium length, nearly straight, bearing prox-



## Explanation of Figures 67 to 82

All specimens coated with ammonium chloride; unless otherwise indicated figures are  $\times 1$ .

Figures 67–72. *Drilluta jacksonensis* (Anderson, 1958). Figures 67, 68: CAS cat. no. 445.16 from CAS loc. 445, holotype; Figure 67, aperture; Figure 68, left side. Figure 69: LACMIP cat. no. 11584 from LACMIP loc. 10778, hypotype, aperture. Figure 70: LACMIP cat. no. 11562 from LACMIP loc. 10771, hypotype, aperture. Figures 71, 72: LACMIP cat. no. 11557 from LACMIP loc. 10750, hypotype; Figure 71, aperture; Figure 72, back.

Figures 73–82. *Drilluta sicca* sp. nov. Figure 73: CAS cat. no. 445.31 from CAS loc. 445, holotype, aperture. Figure 74: LAC-

MIP cat. no. 11563 from LACMIP loc. 10903, paratype, aperture. Figures 75, 79: LACMIP cat. no. 11566 from LACMIP loc. 10903, paratype; Figure 75, back view; Figure 79, aperture showing columellar folds.

Figures 76, 80, 81: LACMIP cat. no. 11559 from LACMIP loc. 10810, paratype; Figure 76, right side,  $\times 2$ ; Figure 80, aperture,  $\times 2$ ; Figure 81, back,  $\times 2$ . Figures 77, 78, 82: LACMIP cat. no. 11565 from LACMIP loc. 10769, paratype; Figure 77, aperture; Figure 78, apical view; Figure 82, left side,  $\times 1.5$ . Photographs 67–70, 73–82 by De Leon; 71, 72 by Susuki.

Table 9  
Measurements (mm) of *Drilluta jacksonensis* (Anderson, 1958) and *D. sicca* sp. nov.

	H	D	Hp	Dp	Ha	Hs	A	R	Dp/Hp	Hp/Hs
<i>D. jacksonensis</i>										
CAS 445.16	85.0*	33.9	16.2	23.8	47.0*	8.7	33°	17	1.5	1.9
LACMIP 11557	70.6*	30.0	14.4	23.0	27.9*	7.0	35°	14	1.6	2.1
LACMIP 11558	32.0*	14.8†	7.6	10.8†	—	4.0	32°†	13	1.4	1.9
LACMIP 11562	32.0*	15.0†	7.8	10.0	—	4.0	40°†	14	1.3	2.0
LACMIP 11584	27.8*	11.5	5.0	7.8	11.4	2.7	41°	13	1.6	1.8
<i>D. sicca</i>										
CAS 445.31	56.5*	26.3†	12.8	18.6	25.6	8.9	37°	10	1.4	1.4
LACMIP 11559	12.8*	6.1	1.9	4.0	6.5	1.5	43°	12	2.1	1.3
LACMIP 11560	11.4*	5.6	2.0	—	—	1.2	—	11	—	1.7
LACMIP 11561●	—	—	—	—	—	—	39°	12	—	—
LACMIP 11563	70.0	22.3	11.7	16.0	31.0	9.0	32°	10	1.4	1.3
LACMIP 11564●	54.7*	—	8.4	—	—	5.5	—	—	—	1.5
LACMIP 11565	34.7*	16.0	7.0	11.0	12.5	4.5	41°	11	1.6	1.6
LACMIP 11566	29.2*	14.7	7.5	13.0	—	4.7	38°	12	1.7	1.6
UW 91830	33.7*	13.7	6.5	10.5	14.3	4.5	45°	12	1.6	1.4

\* Specimen incomplete; † specimen crushed; ● latex pull. Abbreviations decypted in Introduction.

imally three oblique prominent revolving folds, anterior fold strongest; no basal fasciole.

**Holotype:** CASG cat. no. 445.16.

**Hypotypes:** LACMIP cat. nos. 11557 from LACMIP loc. 10750 (= CIT loc. 1264); 11562 from LACMIP loc. 10771 (= CIT loc. 1209), Salt Creek; 11584 from LACMIP loc. 10778 (= CIT loc. 1195; UCLA loc. 4416), Stinking Creek, Shasta Co., California.

**Dimensions:** See Table 9.

**Type locality:** CASG loc. 445, Forty-nine mine, two miles (3.2 km) south of Phoenix, Jackson Co., Oregon.

**Distribution:** Redding Formation, Bellavista Sandstone Member, Stinking Creek, Melton Sandstone Member, Little Cow Creek area, Shasta Co., California.

**Geologic age:** Turonian.

**Remarks:** Although ANDERSON (1958) described this species as lacking spiral sculpture, faint spiral lines are present on the base of the body whorl and siphonal neck. *Drilluta jacksonensis* differs from *D. sicca* in having more and narrower collabral ribs, fainter spiral sculpture, and a weaker shoulder that is at about mid whorl on the spire. *Drilluta jacksonensis* has a more inconspicuous subsutural collar than does *D. sicca* and than have other species of *Drilluta*. Of three similar Gulf Coast genera, *Drilluta* (large, collared), *Paleopsephaea* Wade, 1926 (type species *P. mutabilis* Wade, 1926, medium sized, not collared), and *Bellifusus* (medium sized, collared), *D. jacksonensis* is most like *Drilluta* in size, shape, and columellar folds. Among Gulf Coast species of *Drilluta*, *D. jacksonensis* is most similar to *D. communis* (WADE, 1916:459, pl. 23, figs. 5–6; SOHL, 1964:

205, pl. 27, figs. 12–13, 20–22) in size and shape, but has a wider ramp and more poorly developed subsutural collar.

*Drilluta sicca* Saul & Popenoe, sp. nov.

(Figures 73–82)

**Diagnosis:** A volutiform *Drilluta* with moderately developed, wrinkled collar, slightly concave ramp, and 10–12 strongly shouldered, nearly straight collabral ribs per whorl. On spire, shoulder at about two-thirds whorl height.

**Description:** Shell medium sized, elongate volutiform; apical angle about 40°; spire shorter than body whorl; whorls of spire about one-third broader than high, with a sloping, moderately broad, and very shallowly concave ramp to noded shoulder; shoulder at two-thirds whorl height; flanks rather straight; suture sinuous, appressed with moderately developed, wrinkled subsutural collar; body whorl with concave ramp to noded shoulder, barely convex lateral areas, and concave, gently tapering, moderately long siphonal portion. Sculpture of 10 to 12 rather widely spaced, nearly straight, sharp collabral ribs per whorl, over-ridden by spiral riblets, weak on ramp and shoulder, stronger abapical to the mid-flank. Aperture narrow, parietal border of aperture shallowly excavated; columella bearing two oblique, moderately strong folds, anterior fold stronger, and a faint third, posterior fold; inner lip thin, of moderate width, rounded on the base of the whorl.

**Holotype:** CASG cat. no. 445.31.

**Paratypes:** LACMIP cat. nos. 11559–11561 from LACMIP loc. 10810 (= CIT loc. 1207), Dry Creek; 11563 from LACMIP loc. 10771 (= CIT loc. 1209), Salt Creek;