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A NEW GENUS OF APORRHAIID GASTROPOD FROM SOUTHERN CALIFORNIA

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ABSTRACT—A paleoecological study of the Point Loma Formation (Upper Cretaceous, southern California) resulted in the discovery of a new genus assigned to the gastropod family Aporrhaidae. The individuals recovered provide the basis for the designation of *Teneposita* n. gen. based upon *T. laeva* n. sp. *Teneposita* is characterized by two delicate labral digitations, a short opposing digitation, and elongate anterior and posterior canals. *Teneposita laeva* is one of the smallest aporrhaidids yet described.

INTRODUCTION

THE POINT LOMA Formation is exposed 3 miles (4.8 km) southeast of Carlsbad, California, as an isolated body of Upper Cretaceous strata (Figure 1). At this location the formation consists of easily eroded mudstone to sandy mudstone that weathers to form a mostly covered slope. Construction of the Carlsbad Research Center temporarily exposed a fresh, unweathered, 17-m-thick section of mudstone. A well-preserved molluscan assemblage was recovered for paleoecologic study near the base of the section (Los Angeles County Museum of Natural History, section of invertebrate paleontology, LACMIP locality 7792). *Teneposita laeva* n. gen. and sp. was the most abundant gastropod collected within this assemblage from the Carlsbad Research Center. Comparative material was available from a collection made previously during construction upon the El Camino Real (LACMIP locality 4898).

The Point Loma Formation is overlain by sandstones of the Eocene La Jolla Group and in turn overlies the Cretaceous Lusardi Formation (Figure 2; for review, see Bottjer and Link, 1984). The Point Loma at the Carlsbad Research Center is a bioturbated gray mudstone with a few thin beds of very fine-grained sandstone and calcareous concretionary horizons. The sand content of the formation increases eastward until, at the El Camino Real, it is lithologically a sandy mudstone with numerous beds of sandstone and a few cobble-filled channels (Bartling and Abbott, 1984). Bartling and Abbott (1984) interpreted the Point Loma at Carlsbad to have been deposited in a shallow marine basin. Paleobathymetric interpretations based upon foraminifers indicate deposition proceeded in water depths typical of an inner shelf setting (Sliter, 1968).

PALEOECOLOGY

Teneposita occurs as the dominant taxon in a Late Cretaceous *Teneposita*-*Limopsis* paleocommunity with the pelecypods *Limopsis* sp., *Indogrammatodon* sp., *Corbula* sp., *Crassatella* spp., *Ostrea* sp., and *Glycymeris* sp. at the Carlsbad Research Center (Loch, 1986; Loch and Bottjer, 1986). Conspecific pelecypod taxa occur along the El Camino Real (LACMIP locality 4898). The pelecypod specimens from the Carlsbad Research Center occur as diminutive forms of the El Camino Real specimens, typically exhibiting a 50-60 percent reduction in maximum size (Loch, 1986). Ichnological evidence suggests that the Carlsbad Research Center mudstones behaved thixotropically while the El Camino Real sandy mudstone acted plastically (Loch, 1986; Loch and Bottjer, 1986). The size reduction of the Carlsbad Research Center pelecypods is probably due to foundering in the soft mud before attaining sizes typical of those individuals which developed upon the firmer sandy mudstone substrate. *Teneposita laeva* is not, however, the diminutive equivalent of any other taxon.

The naticid gastropod *Euspira* sp. was the dominant predator preserved within the mud bottom community. Naticid boreholes, while common in the pelecypods, were not seen in any of the 301 *Teneposita* specimens examined. The elongate digitations may have been difficult for naticids to manipulate.

SYSTEMATIC PALEONTOLOGY

Phylum MOLLUSCA Linnaeus, 1758
Class GASTROPODA Cuvier, 1797
Order MESOGASTROPODA Thiele, 1925
Family APORRHAIIDAE Phillipi, 1836
TENEPOSITA n. gen.

Type species.—*Teneposita laeva* n. sp.

Diagnosis.—Small (<3 cm), high-spired aporrhaid gastropod; typical alate outer lip drawn into two unequal labral digitations; inner lip moderately callused, callus extending across columellar axis and into an opposing third digitation; posterior canal adnate to spire, extending beyond apex; anterior canal directed ventrally at base of body whorl continuing long and straight; aperture elliptical; apertural denticulations along peripheral margin of outer lip; spire ornamented with spiral threads and transverse ribs in later whorls.

Discussion.—The Aporrhaidae comprise a very diverse family of gastropods with at least 32 assigned genera (Taylor and Sohl, 1962). Generic distinctions are based, at least in part, upon: 1) the character of the alate outer lip; 2) the nature of the anterior canal; and 3) the presence and position of a posterior canal.

Teneposita compares most favorably with a suite of aporrhaidids that feature a high spire of 6+ whorls, 1-2 carinae on the body whorl, and a long (>½ spire height), generally straight anterior canal which is largely free of connection with any labral digitations. *Spinigera* d'Orbigny, 1850, and *Diempteris* Piette, 1876, are distinctive in the addition of varices to each whorl (*Spinigera*) or the penultimate whorl (*Diempteris*). *Anchura* Conrad, 1860, *Dicroloma* Gabb, 1868, and *Piettia* Cossmann, 1904, each lacks a posterior canal attached to the spire, and in *Dicroloma* and *Piettia* the major labral digitation is directed anteriorly. The delicacy and number of digitations of *Ceratosiphon* Gill, 1870, resembles *Teneposita*, but the opposing digitation in *Ceratosiphon* is lacking or occurs as a branch of the anterior canal (Kase, 1984). The outline of *Helicaulax* Gabb, 1864, is similar to *Teneposita* in featuring both anterior and posterior canals and a large, curving, labral digitation which is posteriorly directed. In *Helicaulax*, however, the posterior canal is not in contact with the entire length of the spire as it is in *Teneposita*. Further, *Helicaulax* lacks the second labral and distinctive opposing digitation of *Teneposita*.

Tessarolax Gabb, 1864, bears the closest resemblance to *Teneposita*. The two genera have the following additional features

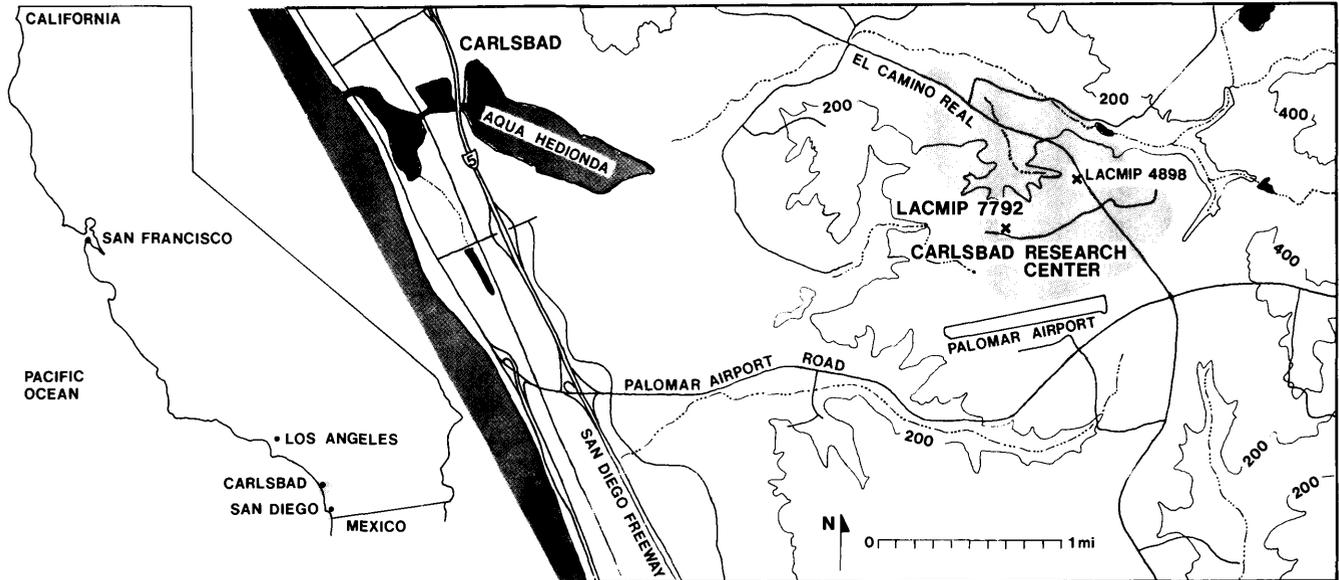


FIGURE 1—Index map of the Carlsbad, California, region showing the location of LACMIP locality 7792. Approximate outcrop area of the Point Loma Formation is highlighted. Elevations given in feet.

in common: a bicarinate body whorl, two labral digitations, a posterior canal that extends beyond the apex, a long anterior canal, and ventral callus that is drawn beyond the columella into a projection. The posterior canal in *Tessarolax*, however, bends across the ventral surface of the spire. The anterior canal in *Tessarolax* is gently curved and relatively shorter than in *Teneposita*. The major labral digitation in *Tessarolax* lacks the distinct curvature seen in *Teneposita*. Unfortunately, *Tessarolax* accretes callus over the entirety of the spire making many comparisons difficult. Features such as the shape and ornamentation of the aperture, the nature of the opposing projection, and the ornamentation of the spire are obscured on *Tessarolax*. The degree of callus deposition appears, however, to be a generic level trait further separating the two taxa rather than an ontogenetic variable.

Two of these comparative genera have been recovered from the Point Loma Formation. *Anchura gibbera* Webster, 1983, has been recovered from the Carlsbad Research Center (Sundberg and Riney, 1984). Deposits of the Point Loma near San Diego, California, have yielded specimens of *Tessarolax distorta* Gabb, 1864 (Sundberg, 1984).

Etymology.—*Teneposita* is compounded from *tener*, Latin, for “delicate,” and *positus*, Latin, meaning “placed or arranged”; in reference to the delicate digitations arranged about the margin of the conch.

TENEPOSITA LAEVA n. sp.
Figure 3.1–3.4

Diagnosis.—Same as for the genus.

Description.—Shell small (<3 cm), high-spired; spire of 6–7 whorls including nucleus of four whorls, nucleus bearing thin carina on third and fourth whorls, otherwise smooth; transverse crescentic ribs beginning on fifth or sixth whorl quickly overprinted within one-quarter whorl by 9–12 spiral threads, which obscure nuclear carina; ornamentation becoming stronger abapically; single thick carina reasserted in the penultimate (sixth to seventh) whorl; thick carina joined by a second carina on body whorl, both continuing across outer lip, diverging at distal margin; ornamentation other than carinae and growth lines nearly

lost on outer lip; carinae extending beyond thickened distal margin of outer lip, drawn in to labral digitations; anterior labral digitation smaller, directed anteriorly; major labral digitation posterior, scythe-like, gently curving towards posterior, extend-

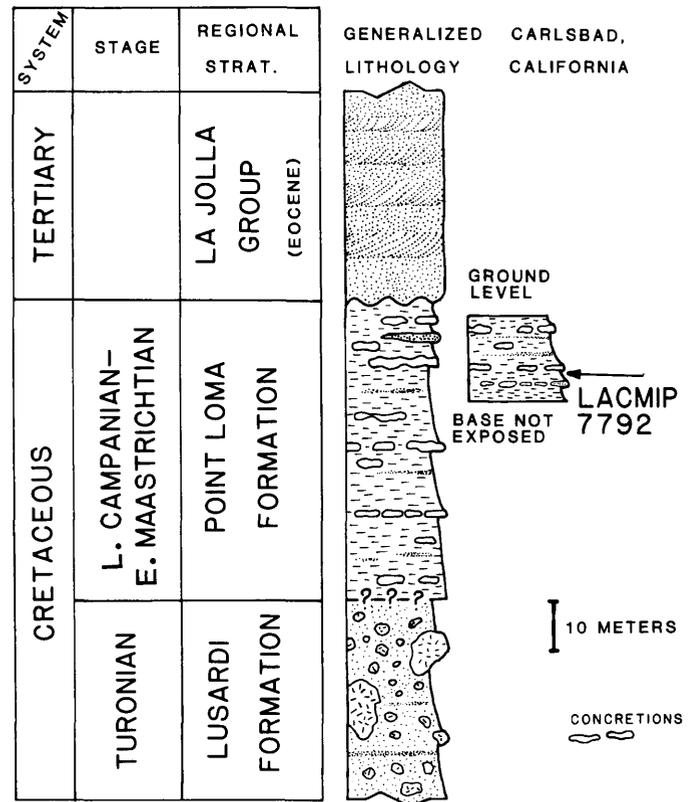


FIGURE 2—Generalized stratigraphic relations for the Late Cretaceous rocks near Carlsbad, California. Position of the 17 m mudstone section has been graphically estimated. After Kennedy and Moore (1971) and Nordstrom (1970).

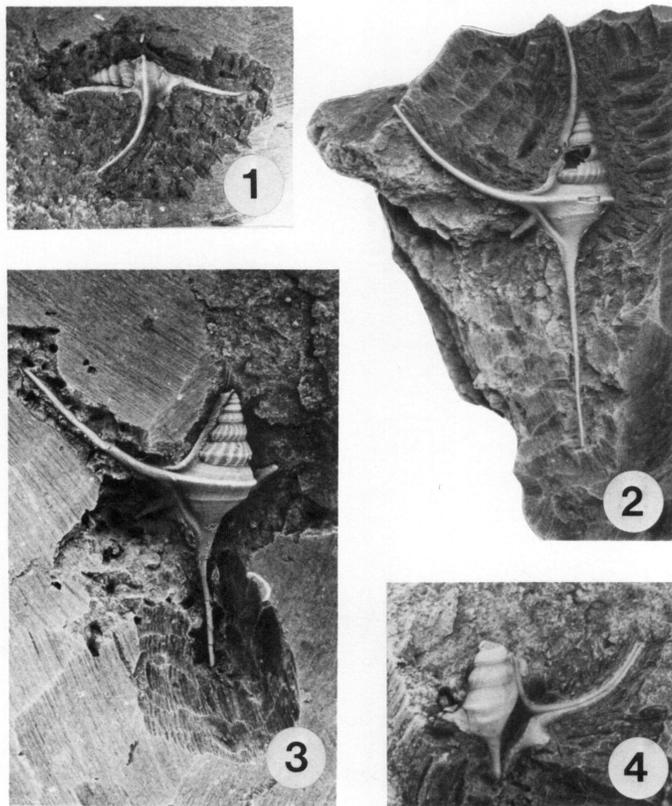


FIGURE 3—*Teneposita laeva* n. gen. and sp. from the Point Loma Formation, Campanian (Cretaceous) of southern California. 1, paratype, lateral view, $\times 2$, LACMIP 7204; 2, holotype, abapertural view, $\times 2$, LACMIP 7199; 3, paratype, abapertural view with complete spire, $\times 3$, LACMIP 7200; 4, paratype, apertural view, $\times 3$, LACMIP 7205. All illustrated material recovered from LACMIP locality 7792.

ing to the height of apex; callus added about aperture, thickening outer lip and forming 8–9 apertural denticulations; inner lip also callused, callus extending across columella and into short, spike-like, opposing third digitation; callus extending along spire, merging with posterior canal, canal continues adnate to spire, beyond spire arcing gently away from the columellar axis and somewhat dorsally; groove present on ventral surface of posterior canal, large labral digitation, and opposing digitation; aperture elliptical and drawn into anterior canal; anterior canal long and thin, bent slightly at the base of body whorl and directed ventrally; length of anterior canal up to 10 percent greater than that of spire and body whorl combined (Table 1).

Remarks.—*Teneposita laeva* is one of the smallest aporrhoids described, with a maximum length for the spire and body whorl of less than 1 cm. The dimensions listed in Table 1, while

TABLE 1—Measurements (in mm) of the holotype of *Teneposita laeva* n. gen. and sp. (LACMIP 7199).

Number of whorls	8
Spire angle	40°
Diameter of penultimate whorl	3.4
Diameter of 4th whorl	0.8
Length of large labral digitation	9.8
Total specimen length:	25.6
Length of body whorl and spire	9.8
Length of anterior canal	11.3
Length of posterior canal beyond apex	5.5

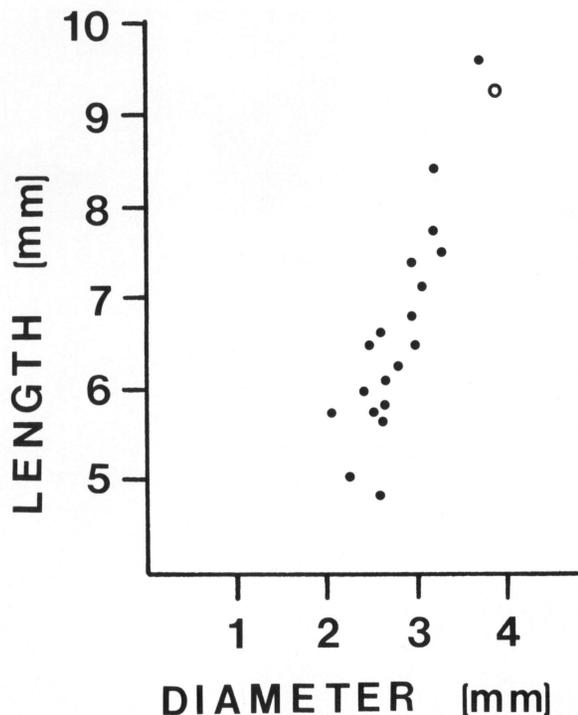


FIGURE 4—Bivariate plot for *Teneposita laeva* n. gen. and sp. of the combined length of the body whorl and the spire against the diameter of the penultimate whorl for specimens from LACMIP locality 7792. Holotype is indicated as "O." All paratypes except LACMIP 7203 are included.

nonstandard, do characterize the unusual proportions of *Teneposita laeva*. Figure 4 illustrates the range and variability of the spire and body whorl dimensions, regardless of breakage to the digitations during sediment lithification or specimen preparation.

Juveniles, which are usually recovered crushed, are infrequent. They may be distinguished from the mature specimens by the absence of carinae on the last preserved whorl and their lack of digitations.

Teneposita laeva occurs in rock of late Campanian or possibly early Maastrichtian age. The recovery of *Baculites lomaensis* Anderson, 1958, from the bulk samples which yielded *Teneposita* is indicative of the late Campanian or questionably the early Maastrichtian according to Matsumoto (1959) and Anderson (1958). Sliter (1968) recovered foraminifers of the *Globotruncana rosetta* Zone from the lower third of the Point Loma Formation at Carlsbad, below the level of LACMIP locality 7792. He considered these forms as indicative of the late Campanian. Foraminifers of this zone, however, co-occur with ammonites of early Maastrichtian age in the Great Valley of California (L. R. Saul, personal commun.).

Etymology.—*laeva*, Latin, "left hand"; referring to the arrangement of the digitations and canals in a manner similar to the fingers on the left hand, with the opposing third digitations as the thumb.

Material.—A total of 301 specimens of *Teneposita laeva* was recovered from the type locality (LACMIP locality 7792). Specimens were dissected from mudstone blocks taken 5 m above the base of a temporary cut bank which had exposed 17 m of stratigraphic section within the upper third of the Point Loma Formation at the Carlsbad Research Center. The section was located 3 miles (4.8 km) southeast of Carlsbad, San Diego Coun-

ty, California (San Luis Rey 7.5' quadrangle, California). The El Camino Real locality (LACMIP locality 4898) yielded only a limited number of fragments. Few additional specimens have been recovered during grading operations at the Carlsbad Research Center and these are housed at the San Diego Museum of Natural History (San Diego Society of Natural History locality 3162).

All of the type material was collected from LACMIP locality 7792 and is housed at the Los Angeles County Museum of Natural History. The designated holotype is LACMIP 7199 (Figure 3.2). Six paratypes were selected and assigned LACMIP 7200–7205.

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