

A New *Homalopoma* from Southern California
Resembling *Parviturbo acuticostatus*:
A Case of Mimicry?

BY

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(2 Plates; 2 Text figures)

FOR THE LAST SEVERAL YEARS the Invertebrate Zoology Section of the Los Angeles County Museum of Natural History has been giving special attention to marine mollusks in the minute to microscopic size range, particularly from subtidal rocky areas where systematic collecting was virtually impossible prior to the advent of SCUBA diving as a collecting method. As a result of these efforts substantial numbers of specimens of many undescribed or poorly known subtidal species are now available and with study may provide answers to many perplexing questions. So it is with the species dealt with in this paper.

Parviturbo acuticostatus (Carpenter, 1864) (family Skeneidae) and *Homalopoma radiatum* (Dall, 1918) (= *Leptothyra paucicostata* var. *fenestrata* Dall, 1919 ex Bartsch MS) (family Turbinidae), two quite unrelated species, have long been confused in the literature, as an examination of their synonymies will attest. This confusion was no doubt contributed to by the inadequacy of the original descriptions but seems to me to be more basic than that. The discovery of a previously unrecognized, though not rare, species of *Homalopoma*, virtually identical in size, shape, color and sculpture with *Parviturbo acuticostatus* may provide a convincing explanation of this confusion. The new species is separable from many specimens of *P. acuticostatus* only on generic and familial characters easily missed if not specifically looked for. This similarity may be the result of mimicry, an interesting adaptation for survival found in a number of species of animals, most notably the insects, but apparently little known in the Mollusca. Although it cannot be stated with certainty whether *P. acuticostatus* or the new *Homalopoma* are exhibiting true mimicry, parallel evolution,

or coincidental convergence, the circumstantial evidence provided by shell characters and geographic distribution suggests the first. The new species is also very similar to *H. radiatum*, the species to which it is most closely related, and from which it differs chiefly in quantitative characters.

The first suggestion of the discovery arose when I observed, during routine sorting of specimens from a subtidal Catalina Island station, that *Homalopoma radiatum* and *Parviturbo acuticostatus* appeared to intergrade. The improbability of this spurred a thorough examination of these species in the Museum collection and led to the isolation of 103 specimens of a new species from 32 different stations. The new species had been intermixed and about equally divided between the 72 lots of *Parviturbo acuticostatus* and 56 lots of *Homalopoma radiatum* in the collection, which in itself is suggestive of its similarity to both. Although it is easily separable from *Parviturbo* by qualitative generic characters, a statistical evaluation was necessary to establish objective criteria for separating it from *H. radiatum*. Descriptions and figures of the 3 species are given here to facilitate their correct determination. A statistical comparison of the new species with *H. radiatum*, and the evidence relating to mimicry will be found in the discussion that follows the description of the new species.

I wish to gratefully acknowledge the help and encouragement received from Dr. James H. McLean during the preparation of this paper, from suggesting the name for the new species to reading and criticizing the drafts. I also wish to thank Mr. Bert Draper for taking the photographs of the Los Angeles County Museum specimens and

Dr. McLean for photographing holotypes in the United States National Museum and California Academy of Sciences.

Institutions mentioned in the text and their abbreviations are as follows:

LACM	Los Angeles County Museum of Natural History
LACMIP	Invertebrate Paleontology Section, Los Angeles County Museum of Natural History
CAS	California Academy of Sciences, San Francisco
USNM	United States National Museum (Smithsonian Institution)

Parviturbo acuticostatus (Carpenter, 1864)

(Figures 2, 11 - 18, 24, 25, 27, 28)

- Liotia acuticostata* Carpenter, 1864 (July, *vide* DALL, 1909): 159 (lectotype [designated by PALMER, 1958: 146] USNM 16282, Catalina Island, California, 10-20 fms.). — CARPENTER, 1864 (August): 612 (list), 652 (description); (reprint 1872: 98, 138). — OLDROYD, 1927, 2 (3): 170 (in part). — STRONG, 1934: 437; plt. 29, figs. 7-9. — (not TRYON, 1888, 10: 109; plt. 36, fig. 1 = *Homalopoma radiatum* (Dall, 1918)).
- Fossarus angiolus* DALL, 1919: 350 (Holotype USNM 271503, Todos Santos Bay, Baja California). — OLDROYD, 1927, 2 (3): 70.
- "*Liotia acuticostata bristolae* Baker, 1929" — STRONG, 1934: 438; plt. 29, figs. 13-15 (not BAKER, 1929).
- Arene acuticostata* (Carpenter, 1864). — BURCH, 1946, #57: 25, 26 (distribution list). — PALMER, 1958: 146; plt. 19, figs. 12, 13 (lectotype).
- Parviturbo acuticostatus* (Carpenter, 1864). — McLEAN, 1969: 23; fig. 9.6. — McLEAN *in* KEEN, 1971: 343; fig. 121.

Description: Shell small, globose, uniformly white, 3 whorled, narrowly umbilicate; sculpture of 2 spiral cords per whorl visible on the spire, 6 evenly spaced spiral cords on the body whorl plus one on the umbilical wall; axial sculpture of fine, sharp, closely spaced lamellae between the spiral cords on the spire, becoming more or less obsolete on the body whorl of the adult, where they are replaced in many specimens from north of Latitude 29° N in central Baja California by more widely spaced, broad, rounded axial ribs on the upper part of the whorl, forming squarish pits; aperture circular, outer lip thickened and slightly constricted in the adult, interior porcelaneous; operculum chitinous, multispiral, 5 to 6 whorled, light brown.

Dimensions of Adults: height 2.1 - 2.8 mm; modal height 2.6 mm; width 2.1 - 2.9 mm; modal width 2.7 mm.

Distribution: Aumentos Rock, Monterey Peninsula, California (LACM sta. 72-90, 36°38'N; 121°55'12"W) south to Cabo San Lucas, Baja California (LACM sta. 66-12, 22°08'N; 109°54'W) and into the Gulf of California as far as Isla Cerralvo, near La Paz, Baja California (LACM sta. 66-25, 24°10'N; 109°55'W) and including all of the southern California Channel Islands and offshore banks (numerous LACM stations) and Isla Guadalupe, Baja California (LACM sta. 65-42, 29°00'N; 118°02'W, and other stations), intertidal to 100 m on rock and gravel bottoms. Specimens referred to this species by STRONG (1934: 438) under the name *L. a. bristolae* from the Gulf of California are undoubtedly *Parviturbo stearnsi* (Dall, 1918), which differs chiefly in having 3 spiral cords in the early whorls instead of 2 (see McLEAN *in* KEEN, 1971: 345; fig. 124).

Fossil Occurrence: Upper Pliocene: San Diego Formation (LACMIP localities 305 and 305A). Lower Pleistocene: Lomita Marl (LACMIP Localities 64 and 435). Upper Pleistocene: Palos Verdes Sand (LACMIP Localities 66-2, 136 and 4685).

Homalopoma radiatum (Dall, 1918)

(Figures 1, 3 - 6 and 19 - 23; Tables 1 - 3)

- "*Liotia acuticostata* Carpenter." — TRYON, 1888, 10: 109; plt. 36, fig. 1 (not CARPENTER, 1864).
- Liotia acuticostata* var. *radiata* DALL, 1918: 8 (Holotype USNM 223291, off South Coronado Island, Baja California).
- Leptothyra paucicostata fenestrata* DALL, 1919: 358 (ex Bartsch MS; Holotype USNM 193796a, Monterey, California).
- Liotia acuticostata radiata* Dall, "1919" — DALL, 1921: 173 (list). — OLDROYD, 1927, 2 (3): 170.
- Leptothyra paucicostata fenestrata* "Bartsch," 1919. — DALL, 1921: 172 (list). — OLDROYD, 1927, 2 (3): 168 (type locality cited incorrectly as "Tiajuana, Lower California").
- Liotia acuticostata bristolae* BAKER, 1929: 72 (unnecessary replacement name for *L. a. radiata* Dall, 1918). — (not STRONG, 1934: 438; plt. 29, figs. 13-15 = *Parviturbo acuticostatus* (Carpenter, 1864)).
- Liotia acuticostata supranodosa* STRONG, 1934: 438 (ex Carpenter MS; Holotype CAS 5472, San Diego, California).
- Homalopoma fenestratum* [(Dall)]. — KEEN, 1937: 37 (list).
- Homalopoma paucicostatum fenestratum* ("Bartsch," 1919). — BURCH, 1946, #57: 23 (distribution list).
- Arene acuticostata* var. *supranodosa* (Strong, "1933"). — BURCH, 1946, #57: 25 (distribution list).
- Arene acuticostata* var. *bristolae* (Baker, 1929). — BURCH, 1946, #57: 26 (distribution list).
- Homalopoma supranodosum* (Strong). — KEEN, 1947: 1
- Homalopoma fenestratum* (Dall, 1919). — McLEAN, 1969: 24; fig. 10.4.

Homalopoma radiatum (Dall, 1918). — SMITH & CARLTON, 1975: 503 (list).

Description: Shell small, globose, imperforate; color variable from white with minute flecks of pink on the spiral cords to solid pink and brown, with most specimens having easily visible spots or blotches of pink and brown on a white ground; nucleus smooth, one whorled; post nuclear whorls $3\frac{1}{2}$; sculpture of 2 spiral cords visible per whorl on the spire, 7 evenly spaced spiral cords on the body whorl, the 7th (basal) cord usually broader than the 6th; axial sculpture of short rib segments on the upper part of the last 1 to $1\frac{3}{4}$ whorls creates 2 rows of strong quadrilateral pits between the 1st and 3rd spiral cords, weaker pits are occasionally visible below the 3rd spiral cord; aperture circular, outer lip thickened and slightly constricted in adults; interior nacreous, iridescent pink and green in fresh specimens; columella with strong node at base, 2 additional nodes, one at the top of the columella and one on the lower lip are visible on most adult specimens; operculum calcareous, multispiral, 5 - 7 whorled, nucleus central, outer surface granular, translucent white.

Dimensions of Adults: height 2.8 to 3.9 mm; modal height 3.3 mm; width 2.9 to 3.9 mm; modal width 3.4 mm (a statistical summary and analysis of the variation of selected characters will be found in the discussion that follows the description of the new species).

Distribution: Aumentos Rock, Monterey Peninsula, California (LACM sta. 72-90, 36°38'N; 121°55'12"W) south to Sacramento Reef, south of Isla San Geronimo, outer coast of Baja California (LACM sta. 71-91, 29°43'42"N; 115°45'36"W), including all of the southern California Channel Islands and offshore banks (numerous LACM stations). Subtidal to 100 m, on rock and gravel bottom, rarely intertidal.

Fossil Occurrence: Upper Pliocene: San Diego Formation (LACMIP localities: 305, 305A, 305C, 318, 319, and 323); Fernando Formation (LACMIP Locality 1219). Lower Pleistocene: Lomita Marl (LACMIP Localities 64 and 435).

Taxonomic Discussion: Because of the confusion surrounding the nomenclature of this species and the number of synonyms under which it has been known, I am reinstating the earliest available name for the species, *Homalopoma radiatum* (Dall, 1918), despite the fact that it had been unnecessarily suppressed as a secondary homonym. This new use of the oldest name has already been adopted by Carlton in SMITH & CARLTON (1975).

Liota acuticostata var. *radiata* Dall, 1918, was suppressed by BAKER (1929: 72) as a junior homonym of *Delphinula radiata* Kiener, 1839 (p. 7; pl. 4, fig. 9). Kiener's taxon is a junior synonym of *Arene cruentata* (Mühlfeld, 1829), a Caribbean species and type species of *Arene* H. & A. Adams. In 1888, TRYON (10: 111) allocated Kiener's taxon to *Liota* "section" *Arene*, and Baker, noting this, apparently suppressed Dall's name on purely nomenclatural grounds, without realizing that Dall's name applied to *Homalopoma*.

Arene radiata (Kiener, 1839) and *Homalopoma radiatum* (Dall, 1918) are secondary homonyms (originally described in different genera) and are no longer in the same family.

The International Rules of Zoological Nomenclature direct the revival of secondary homonyms rejected after 1960, if the two species in question are no longer believed to be congeneric. However, the Rules offer no directions concerning secondary synonyms rejected before that date, apparently leaving the decision of whether to revive an earlier name to the judgment of individual authors. Despite the current use of a junior synonym, *Homalopoma radiatum* is not so familiar to biologists that reinstatement

Explanation of Figures 3 to 18

(All Figures × 15)

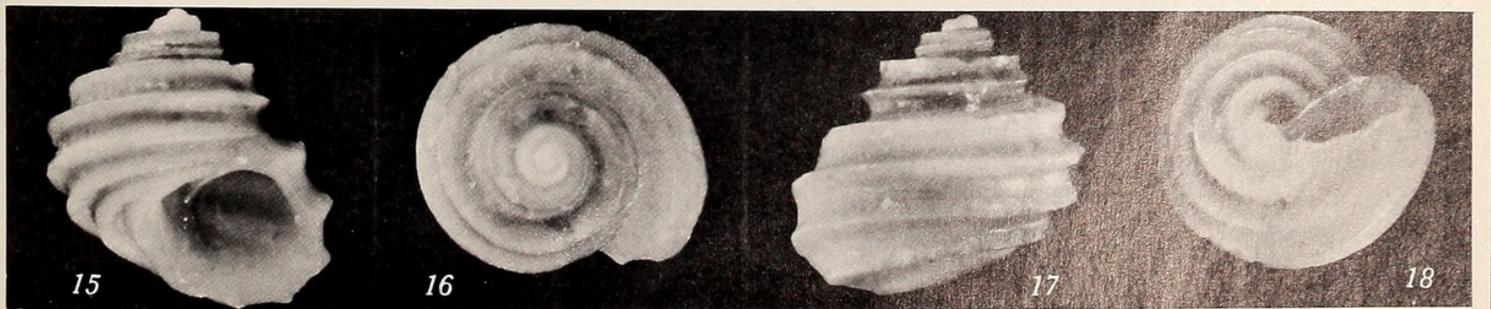
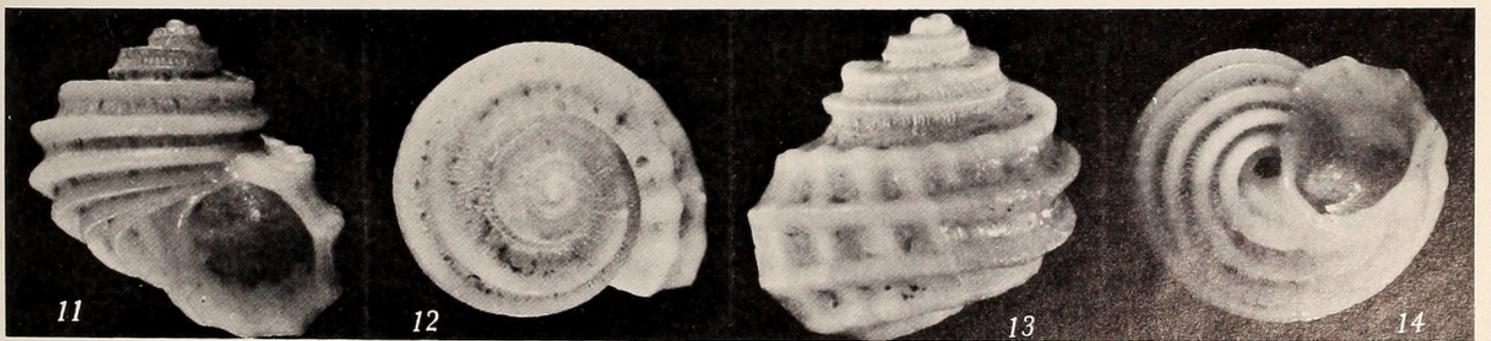
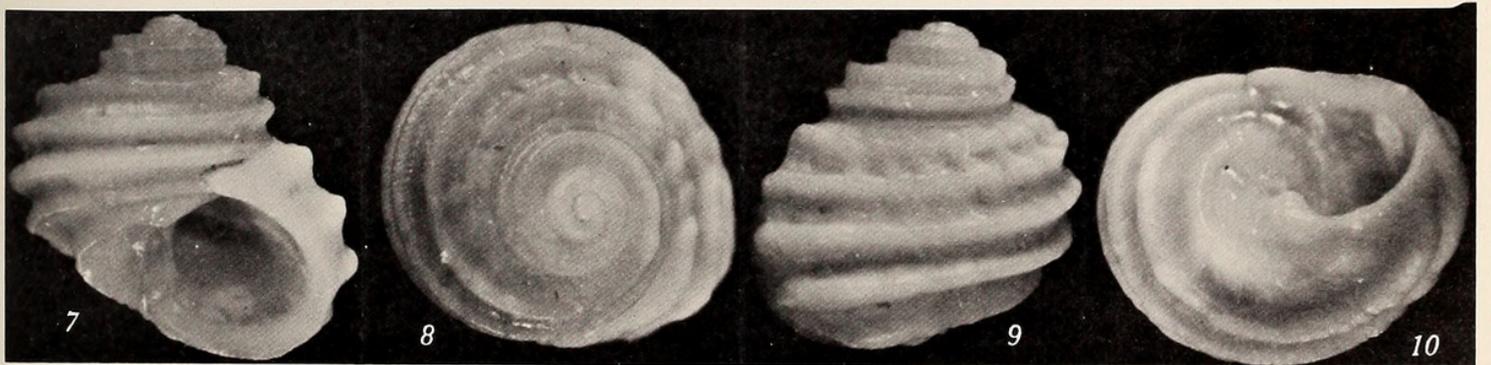
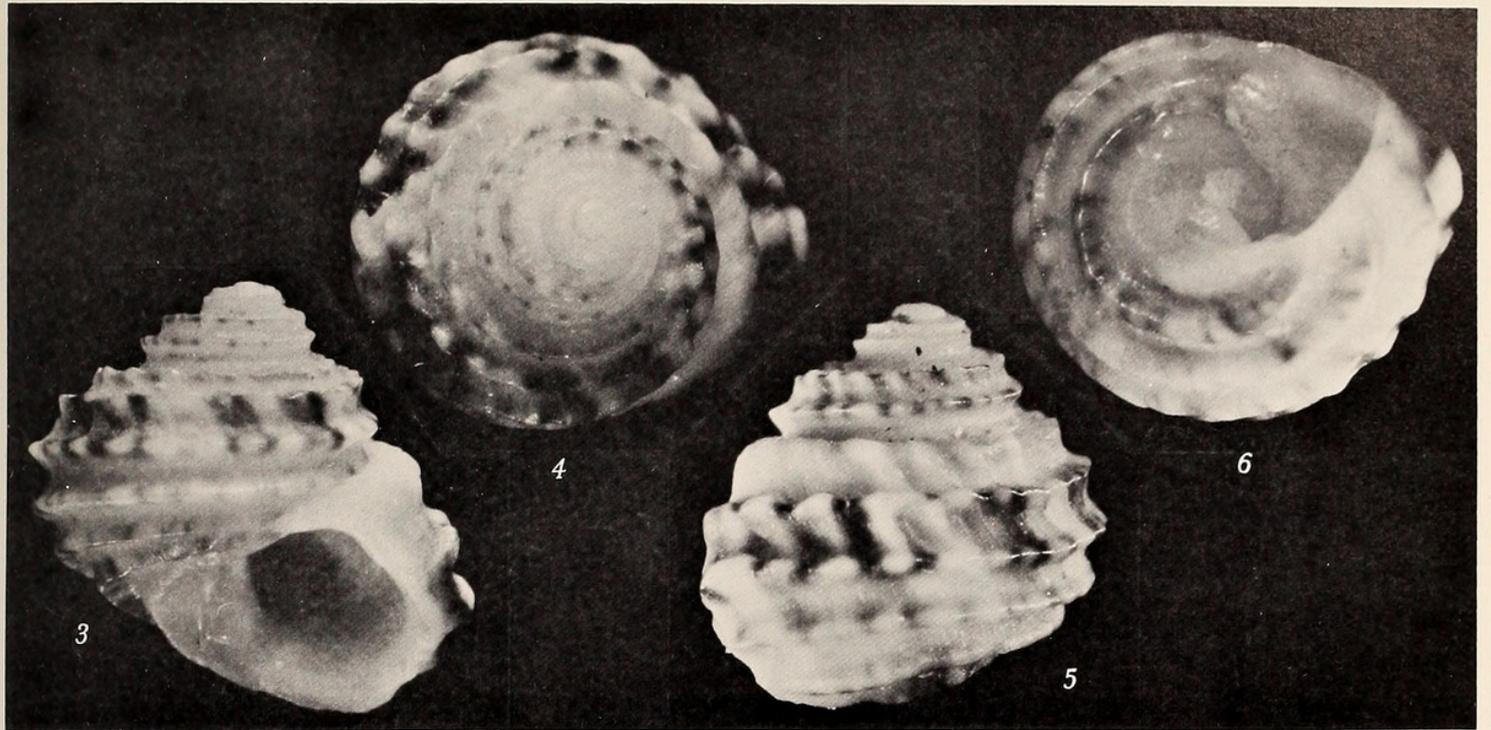
Figures 3 to 6: *Homalopoma radiatum* Dall, 1918. LACM 69-34, Cortez Bank, 66 km SW San Clemente Island, Los Angeles, California (32°26'N; 119°07'30"W), 12 - 27 m on granite cliffs and boulders. Leg. J. H. McLean, October 4 and 5, 1969. Height 3.4 mm; width 3.5 mm

Figures 7 to 10: *Homalopoma mimicum* LaFollette, spec. nov. Holotype LACM 1765. LACM 71-148; 6½ fm bank, 6.4 km SW Isla San Martin, Baja California (30°25'23"N; 116°08'12"W), 24 - 30 m

rocks and coarse sand. Leg. J. H. McLean & P. M. Oringer, April 3 and 4, 1966. Height 2.4 mm; width 2.3 mm

on volcanic rubble. Leg. J. H. McLean, October 17, 1971. Height 2.6 mm; width 2.7 mm

Figures 11 to 18: *Parviturbo acuticostatus* (Carpenter, 1864). Figures 11 - 14: Pitted form. LACM 71-97, Sugarloaf Rock, Descanso Bay, Baja California (32°13'18"N; 116°58'W), 27 to 33 m on talus slope. Leg. J. H. McLean, October 1, 1971. Height 2.5 mm; width 2.5 mm. Figures 15 - 18: Unpitted form. LACM 66-12, Cabo San Lucas, Baja California (22°52'N; 109°54'W), 7 - 30 m on



of the original name would be a hardship. I believe that in this case reinstatement of the earliest name will contribute to nomenclatural stability and am therefore taking this action.

Homalopoma mimicum LaFollette, spec. nov.

(Figures 1, 2, 7 - 10, and 26; Tables 1 - 3)

Description of Holotype: Shell small, globose, imperforate, uniformly white; nucleus smooth, one whorled; post-nuclear whorls $3\frac{1}{4}$, demarcated from the nucleus by the abrupt beginning of spiral sculpture; sculpture of 2 spiral cords visible per whorl on the spire, 7 spiral cords on the body whorl, the 1st subsutural cord emerging on the last $\frac{3}{4}$ turn; the 1st 6 spiral cords strong and evenly spaced, the 7th (basal) cord much weaker and close to the 6th; axial sculpture of short rib segments appearing near the suture on the last $\frac{1}{2}$ whorl, giving an undulating appearance to the 1st and 2nd spiral cords and forming squarish pits between them, weaker pits visible between the suture and the 1st spiral cord, pitting absent below the 2nd spiral cord; aperture circular, outer lip thickened and somewhat constricted; interior nacreous, iridescent pink and green, the iridescence weakly visible externally between the spiral cords; columella with a strong node near the base, a weaker one above and a 3rd on the lower lip; operculum calcareous, multispiral, 6 whorled, nucleus central, outer surface somewhat granular, translucent white, showing light brown through from the inside.

Dimensions: height 2.6 mm; width 2.7 mm.

Type Material: Holotype LACM No. 1765; 5 paratypes LACM No. 1766; 1 paratype USNM.

Type Locality: LACM sta. 71-148, $6\frac{1}{2}$ fathom bank, 6.4 km SW of Isla San Martin, Baja California ($30^{\circ}25'23''$ N; $116^{\circ}08'12''$ W), 24 - 33 m on volcanic rubble, leg. James H. McLean, 17 October 1971 (R/V *Searcher* sta. 222). Holotype and 6 paratype specimens.

Variation: 42 adult specimens varied as follows: Post-nuclear whorls 3 to $3\frac{1}{2}$; spiral sculpture of 7 cords on the body whorl, the 7th (basal) cord varying from obsolete or very weak to equal in strength to the adjacent (6th) spiral cord; axial sculpture of short rib segments near the suture appearing on the final $\frac{1}{3}$ to 1 full whorl, forming squarish pits between the 1st and 2nd spiral cords in all specimens, weaker pits between the suture and 1st spiral cord in 50% of the specimens, and much weaker pits between the 2nd and 3rd spiral cords in 10% of the specimens; a prominent node at the base of the columella is

present in all specimens, a 2nd node above it, at the point where the 6th spiral cord enters the aperture, and a 3rd node on the lower lip are visible in most fully mature specimens; all specimens show a definite adult stage with the outer lip thickened and somewhat constricted.

Dimensions of 50 adult specimens: Height 2.1 - 2.9 mm; modal height 2.4 mm; width 2.2 - 2.9 mm; modal width 2.5 mm (a statistical summary and analysis of the variation of selected characters will be found in the discussion).

Distribution: Off Point Pinos, Monterey Peninsula, California (LACM sta. 64-14, $36^{\circ}38'N$; $121^{\circ}58'W$) south to Sacramento Reef, south of Isla San Geronimo, outer coast of Baja California (LACM sta. 71-91, $29^{\circ}43'42''N$; $115^{\circ}45'36''W$), including all of the southern California Channel Islands and offshore banks (numerous LACM stations). Subtidal to 100 m, on rock and gravel bottoms, rarely intertidal.

Fossil Occurrence: Lower Pleistocene: Lomita Marl (LACMIP Locality 435, 136 specimens). Upper Pleistocene: Palos Verdes Sand (LACMIP locality 4685, 1 specimen). The Lomita Marl specimens differ from the Recent ones in being slightly larger on the average and in the 7th (basal) spiral cord being obsolete in all specimens examined.

Discussion: Adults of *Homalopoma mimicum*, the smallest of the eastern Pacific species of the genus, may easily be distinguished from *Parviturbo acuticostatus* by several qualitative characters. Adults of *H. mimicum* are imperforate, have a node at the base of the columella, a nacreous interior and a calcareous operculum, while *P. acuticostatus* has an umbilicus, lacks the node, has a porcelaneous interior and a chitinous operculum. *Homalopoma mimicum* lacks the fine axial lamellae between the spiral cords on the juvenile whorls typical of *P. acuticostatus*. Additionally, the squarish pits which characterize *H. mimicum* are lacking or faint in 20-80% of the specimens of *P. acuticostatus* in their area of range overlap.

The juveniles of *Homalopoma mimicum* are somewhat more difficult to distinguish as they are umbilicate; the columellar node is much less prominent; and the pitting, characteristic of the adult, may not yet have developed. The absence of axial lamellae, the presence of interior nacre, and the calcareous operculum should enable determination of live collected or well preserved specimens, however.

Homalopoma radiatum may be distinguished from *Parviturbo acuticostatus* by all of the above characters in

addition to being considerably larger and having pink or brown, or both, color markings.

Separation of *Homalopoma mimicum* from *H. radiatum*, the species to which it is most closely related, may be rather more difficult in some cases. The 4 characters on which I have separated them: size, color pattern, distribution of pitting, and relative strength of the basal spiral cord, all overlap to a limited degree and must be examined in concert to reliably distinguish borderline cases. Fortunately, these characters seem to vary independently so that the probability of a specimen being indeterminate on all 4 characters is extremely small.

A sample of 57 adult specimens of *Homalopoma radiatum* from the LACM collection was statistically analyzed and compared with the 42 adult specimens of *H. mimicum* on hand. (After the analysis was completed, another 8 adults of the new species were added to the collection. These have been incorporated in the data on size and color only.) All unbroken adult specimens in the selected lots of *H. radiatum* were used for analysis, regardless of condition, so that the data would be as representative of typical museum specimens as possible. The lots used were systematically selected from throughout the range of *H. radiatum*, even though no geographic variation has been observed in either species.

Size: The most obvious difference between the 2 species is size, the modal (most common) height and width for *Homalopoma mimicum* being 2.4 and 2.5 mm, while *H. radiatum* has a modal height and width of 3.3 and 3.4 mm, 40% higher and more than twice the volume. The size distribution of each species is graphically represented in Figure 1. To simplify presentation, the following calculations are based on the arithmetic mean of height and width for each specimen, which I will call size.

$$\text{size} = \frac{H+W}{2}$$

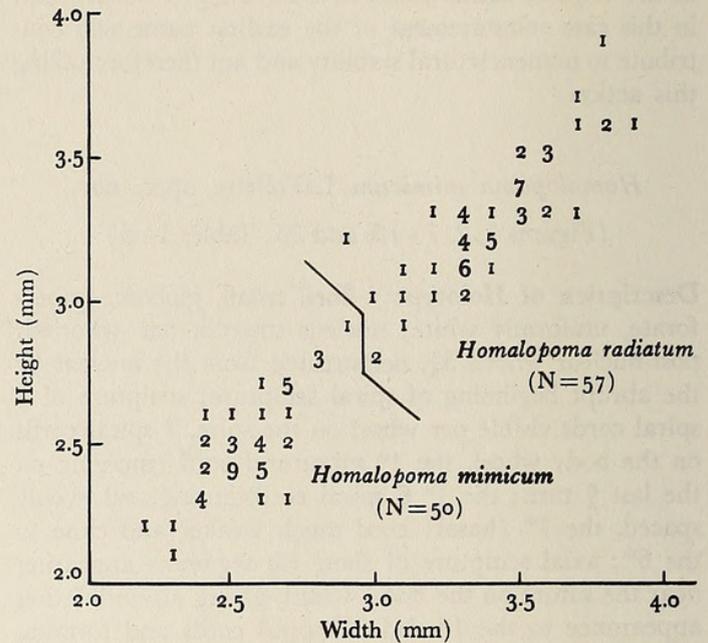


Figure 1

Size Distribution of Adult Specimens of *Homalopoma mimicum* and *Homalopoma radiatum* by Height and Width

The mean size for *H. mimicum* is 2.518 mm with a standard deviation of 0.148 mm; the mean size for *H. radiatum* is 3.334 mm with a standard deviation of 0.208 mm. The difference between the mean sizes of the 2 species is highly significant ($Z = 9.94$), and the standard deviations also differ significantly ($\alpha = 0.01$; $F_{ar\ 56,49} = 1.98$). The optimal size dividing point between the 2 species is 2.86 mm (2.29 standard deviations from each mean). Based on this dividing point, the index of predictive association

Explanation of Figures 19 to 28

(All Figures $\times 15$)

Figures 19, 20: *Liotia acuticostata* var. *radiata* Dall, 1918 [= *Homalopoma radiatum* (Dall, 1918)]. Holotype USNM 223291, off South Coronado Island, Baja California. Height 3.4 mm; width 3.5 mm

Figures 21, 22: *Leptothyra paucicostata fenestrata* Dall, 1919 [= *Homalopoma radiatum* (Dall, 1918)]. Holotype USNM 193796a, Monterey, California. Height 3.5 mm; width 3.7 mm

Figure 23: *Liotia acuticostata supranodosa* Strong, 1934 [= *Homalopoma radiatum* (Dall, 1918)]. Holotype CAS 5472, San Diego, California. Height 3.6 mm; width 3.7 mm (STRONG, 1938)

Figures 24, 25: *Liotia acuticostata* Carpenter, 1864 [= *Parviturbo*

acuticostatus (Carpenter, 1864)]. Lectotype USNM 16282, Catalina Island, California, 18-36 m. Height 2.8 mm; width 2.7 mm (CARPENTER'S (August 1864) published dimensions are "Long. 0.12, ... Lat. 0.10, ..." = height 3.0 mm; width 2.5 mm)

Figure 26: *Homalopoma mimicum* LaFollette, spec. nov. Paratype LACM 1766, Sta. LACM 71-148. Showing operculum. Height 2.5 mm; width 2.6 mm

Figures 27, 28: *Fossarus angiolus* Dall, 1919 [= *Parviturbo acuticostatus* (Carpenter, 1864)]. Holotype USNM 271503, Todos Santos Bay, Baja California. Height 2.5 mm; width 2.2 mm [DALL'S (1919) published dimensions are: height 2.25 mm; width 1.75 mm]

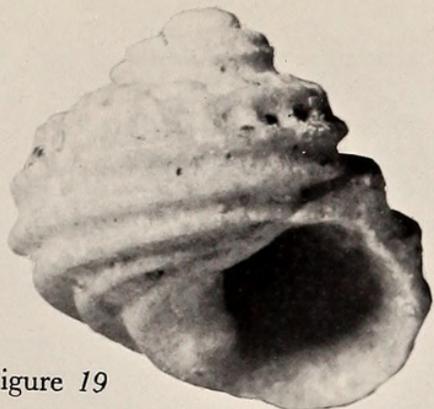


Figure 19



Figure 20

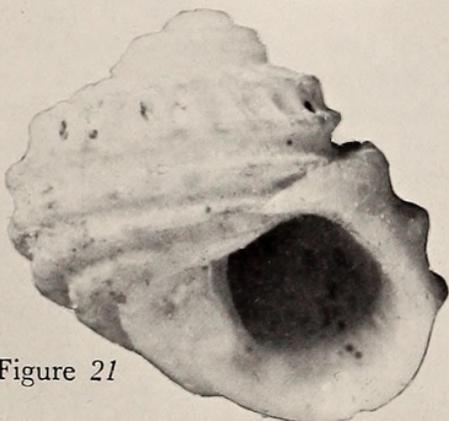


Figure 21



Figure 22

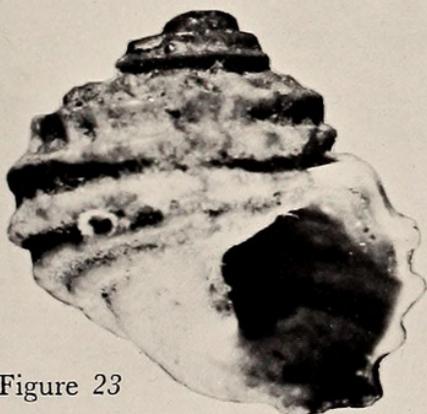


Figure 23

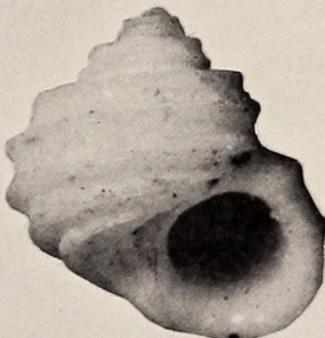


Figure 24



Figure 25

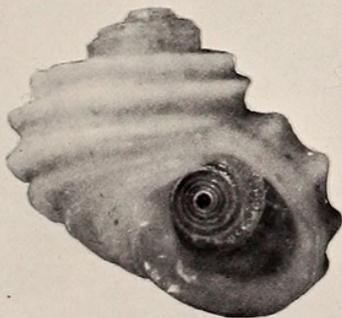


Figure 26

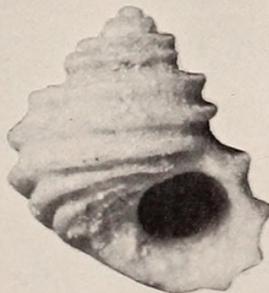


Figure 27



Figure 28



Lafollette, P I. 1976. "A NEW HOMALOPOMA FROM SOUTHERN CALIFORNIA USA RESEMBLING PARVITURBO-ACUTICOSTATUS A CASE OF MIMICRY." *The veliger* 19, 68–76.

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