

The Genus *Seila* in the Eastern Pacific

(Mollusca : Gastropoda)

BY

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(2 Plates; 1 Text figure)

INTRODUCTION

THE GENUS *Seila*, as represented in the western American coastal waters, has been given little attention in recent years. Those authors who have included mention of species in the genus have recognized only 2 species and have in general recognized the name *Seila assimolata* (C. B. Adams, 1852) for those from the Panamic-Galapagan province, and *S. montereyensis* Bartsch, 1907 for those from the Southern California province. References to any possible overlapping of these species geographically have been very limited and uncertain. The purpose of this paper is to clarify the distinguishing features of the 2 taxa named above with their geographic ranges and taxonomy, and to provide descriptions and photographs of 2 additional species from the Panamic-Galapagan province, one a new species.

All specimens of *Seila* collected in eastern Pacific waters examined by the authors appear to belong in the genus *Seila* based upon similarity of the shape of their aperture to that shown by A. ADAMS (1861: 131), with small to minute high spired shells, spiral sculpture of raised ribs and a well defined anterior canal.

Historically, the genus *Seila* has not been a taxonomic entity as long as some of its species have. First described as a subgenus in Germany by ARTHUR ADAMS (1861: 131) naming *Triphoris (Seila) dextroversus* (A. Adams & Reeve, 1850) [plt. 11, fig. 31; Korea Strait; 46 fms.] as type for the subgenus by original designation. BARTSCH (1907: 177) elevated the subgenus *Seila* to full generic rank, giving no reason for so doing.

The genus *Seila* is represented in the intertidal and offshore fauna of the west American coast from Mendocino

County, north Central California south to the Galápagos Islands and northern Perú. We have found no reports of the genus being represented beyond these limits, either north or south, on the American coast, but distribution seems to be quite continuous between these points with an overlap of the only Southern California species, *Seila montereyensis*, into the Panamic-Galapagan province. No overlap of the Panamic-Galapagan species, *S. assimolata*, into the Southern California province has been verified. Fossil specimens of the 2 species have been reported from the Pleistocene and Pliocene faunas, but the geographic ranges have not been extended by these findings.

Of the west American *Seila*, the first named was *S. assimolata*, described as *Cerithium assimilatium* by C. B. ADAMS (1852: 374). This species was later placed in the genus *Cerithiopsis* by H. & A. ADAMS (1853-1858: 240) and finally in the genus *Seila* by BARTSCH (1907: 178). Two species of *Seila*, *Cerithiopsis kanoni* and *C. moreleti*, both of de Folin, 1867, have been synonymized by KEEN (1971: 415) with *S. assimolata*. We have been unable to see copies of de Folin's publications. However, TRYON (1887: 174) provided translations of de Folin's descriptions and copies of his figures (1887: plt. 36, figs. 60, 62) and from these it is our opinion that *S. kanoni* is not a synonym of *S. assimolata*, and the description and figure of *S. moreleti* are too vague to justify considering it as synonymous with either of the recognized west American species. *Seila kanoni* will be discussed later as a valid species. The next west American species to be recognized and described was *S. montereyensis* BARTSCH (1907: 177, 178).

Relatively little is known of the life habits of these small mollusks. The animal is small for the size of its shell, has a foot less than twice the length of the aperture, rather

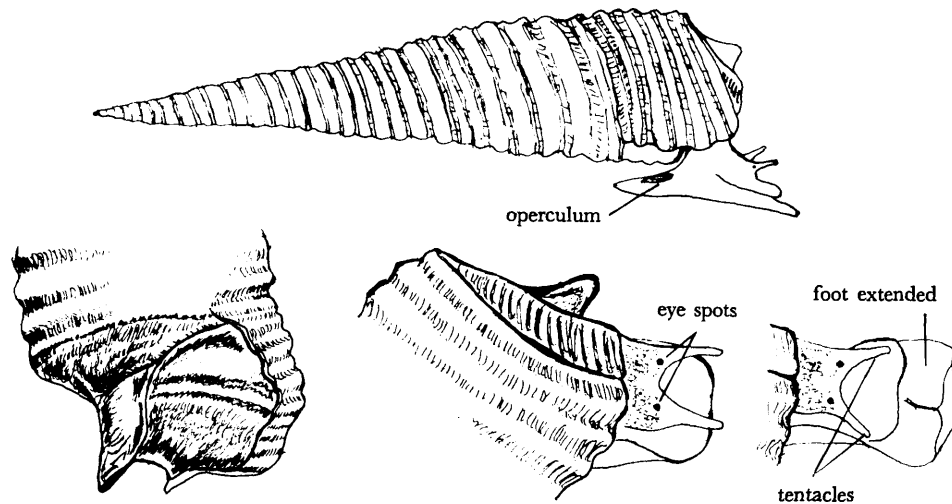


Figure 31

Seila assimolata

Shell and animal as seen in aquarium

short, nearly parallel tentacles with an eye at the base of each tentacle. No published report appears to be available of any study of the soft parts or radula of the animal. Joyce Gemmel (personal communication, June, 1970), living in San Felipe, northern Gulf of California, Mexico, commented on the animal of *Seila assimolata*, "We had a good minus tide this week and I went over to Campo Uno to obtain some *Seila assimolata* and a piece of sponge to look at under the microscope. In the aquarium they are shy little creatures and I had to wait for them to emerge from their shells. When disturbed, they attach themselves to the sponge by a string of mucus which appears to be expelled from a point at the anterior notch. As the animal emerges from its shell, the foot and then the head with eye stalks is seen. The animal is white with cream tinges around the head and with black eye spots. I saw no signs of a siphon extended from the anterior notch while they were actively inching up the side of the glass. They move by the front of the foot reaching forward and pulling the mollusk along. The foot looks very small compared to the total length of the shell. The operculum is thin and light yellow. Details of the operculum were difficult to see as it was either folded up on top of the foot and under the shell, or it was contracted too far in the shell to be seen well. While observing the *Seila* I made the

following sketches to show some of the details I have mentioned."

Two authors have reported taking *Seila assimolata* from sponge at low water mark (C. B. ADAMS, 1852: 374; McLEAN, 1961: 466). The senior author has taken live specimens of *Seila* sp. from sponge and clinging to the underside of rocks at low tide. The junior author has taken live specimens of *S. assimolata* from pockets in a grey sponge at Cholla Bay, Sonora, Mexico and has live-taken specimens of both *S. assimolata* and *S. montereyensis* from the washings of *Spondylus princeps* Broderip, 1833 taken by divers, about 24 km southeast of Santa Rosalia, and from the Loreto Channel, both in the Gulf of California, Mexico, in 12 to 18 m.

Living specimens are rarely taken by dredging, probably because of the inaccessibility of the habitat, *i. e.*, red or grey sponge, or among the spines of *Spondylus princeps* shells, or clinging to the underside of rocks.

METHODS AND FORMAT

This review covers the genus *Seila* in the Californian and Panamic-Galapagan fauna from Mendocino County, California to northern Perú. It continues recognition of the 2

currently accepted species and recognizes one species previously considered to be a synonym, and adds the description of one new species. The original description for each species, with the date of publication, is given together with the taxonomy and synonymy. Special care was given to locating sources of published records, geographical and bathymetric ranges, and geochronological limits. Brief diagnoses are given, attempting to show diagnostic characteristics. In the preparation of the diagnoses the following terminology is used: spiral sculpture, the sculpture following the direction of the coils of the whorls; axial sculpture, the small riblets which cross the channels between the spirals, either vertically (in a line from the center of the base toward the apex), protractively (slanting forward from the preceding suture), or retractively (slanting backward from the preceding suture).

When referred to in the paper, the following abbreviations are used:

USNM	United States National Museum
MCZ	Museum of Comparative Zoology, Harvard
CAS [GTC]	California Academy of Sciences
LACM	Los Angeles County Museum of Natural History
LACM AHF	Los Angeles County Museum, Allan Hancock Foundation
USC	University of Southern California
UCLA	University of California at Los Angeles

Seila assimolata (C. B. Adams, 1852)

(Figures 1 - 7, 10)

- Cerithium assimilatam* C. B. Adams, 1852: 374; [reprint: 150]; TURNER, 1956: 32; plt. 9, fig. 1
- Cerithiopsis assimilatam*. H. & A. ADAMS, 1853-1858: 240
- Cerithiopsis assimolata*. CARPENTER, 1857a: 260, 335, 364; 1857b: 445; 1864: 613, 624, 660, 669 [reprint: 99, 110, 146, 155]; COOPER, 1888: 233 [error]; BARTSCH, 1907: 178; ORCUTT, 1915: 21; 194; BURCH, 1945, #54: 13 [as *assumillata*], 20, 21; PALMER, 1951: 62; BRANN, 1966: 74; plt. 49, fig. 563
- Seila assimolata*. ARNOLD, 1903: 290; plt. 4, fig. 8 [error]; BARTSCH, 1907: 177; 1911: 327; STRONG & HANNA, 1930: 21; LOWE, 1935: 31 [as *Seila assimillata*]; BAKER, HANNA & STRONG, 1938: 223; EMERSON & PUFFER, 1957: 13, 39; KEEN, 1958: 304; fig. 305; McLEAN, 1961: 466; DuSHANE, 1962: 46; KEEN, 1964: 187; DuSHANE & POORMAN, 1967: 426; DuSHANE & SPHON, 1968: 241; COAN, 1968: 124; DuSHANE & BRENNAN, 1969: 358; KEEN, 1971: 415; fig. 557; DRAPER, 1972: 2

Original Description: "Shell very long, conic, very dark brownish red, with some [151] irregular linear spots of white on the spiral keels; with three excessively prominent compressed acute nearly equal and equidistant spiral keels, with narrow deep interspaces, which are crossed by microscopic raised lines, with a fourth keel on the periphery of the last whorl, and another anteriorly which is more minute; apex acute; spires with the outlines nearly rectilinear; whorls sixteen to eighteen, planulate, with the suture very indistinct; last whorl very short; aperture ovate; labrum deeply scalloped by the spiral ridges; canal large, very short. Mean divergence about 18°; length .23 inch; breadth .06 inch; length of spire .19 inch." (C. B. ADAMS, 1852: 374).

Diagnosis: Shell small for the genus, elongate conic; color brownish orange to dark chocolate with irregular linear zones of white or lighter color, occasionally having the posterior keel almost entirely white; also purple-brown, uniformly colored with lighter apex; nucleus of 5 glassy bulbous whorls increasing rapidly in size; nuclear sculpture of occasional microscopic protractive threads; transition to postnuclear sculpture occurring in the 6th whorl; postnuclear whorls flat, increasing in diameter less rapidly in the latter whorls, giving a slightly convex shape to the shell; postnuclear sculpture of 3 prominent spiral keels, rather rounded at their tops, separated by deep interspaces $\frac{1}{3}$ to $\frac{2}{3}$ the width of the keels; interspaces crossed by nearly vertical raised threads, spaced closer than the width of the interspaces; a 4th keel showing just below the deeply impressed sutures and extending around the periphery of the base; with the sutural channel slightly wider than the interspaces and crossed by similar, but weaker vertical threads; darker colored base has a weaker spiral keel nearly equally spaced from the peripheral keel, with vertical threads in the channel between these keels; base then dips concavely to the anterior tip of the columella, with only incremental lines, which make a sharp bend near the middle of the concave surface; aperture roundly ovate with a thin outer lip made sinuous by the keels and showing the outer sculpture through the inside; canal rather wide and short, meeting the twisting columella, which has a narrow callus along its inner exposed surface; operculum thin, yellow-brown in color. Length, 2.6mm; width, 1.1mm to 2.2mm.

Discussion: Although it is not the intention of the authors to include here every reference to *Seila assimolata* (C. B. Adams, 1852), the reports in certain important papers should be presented. C. B. ADAMS (1852: 374) [reprint 1852: 150] first described his species as *Cerithium assimilatam* from Panama; "8 specimens, under

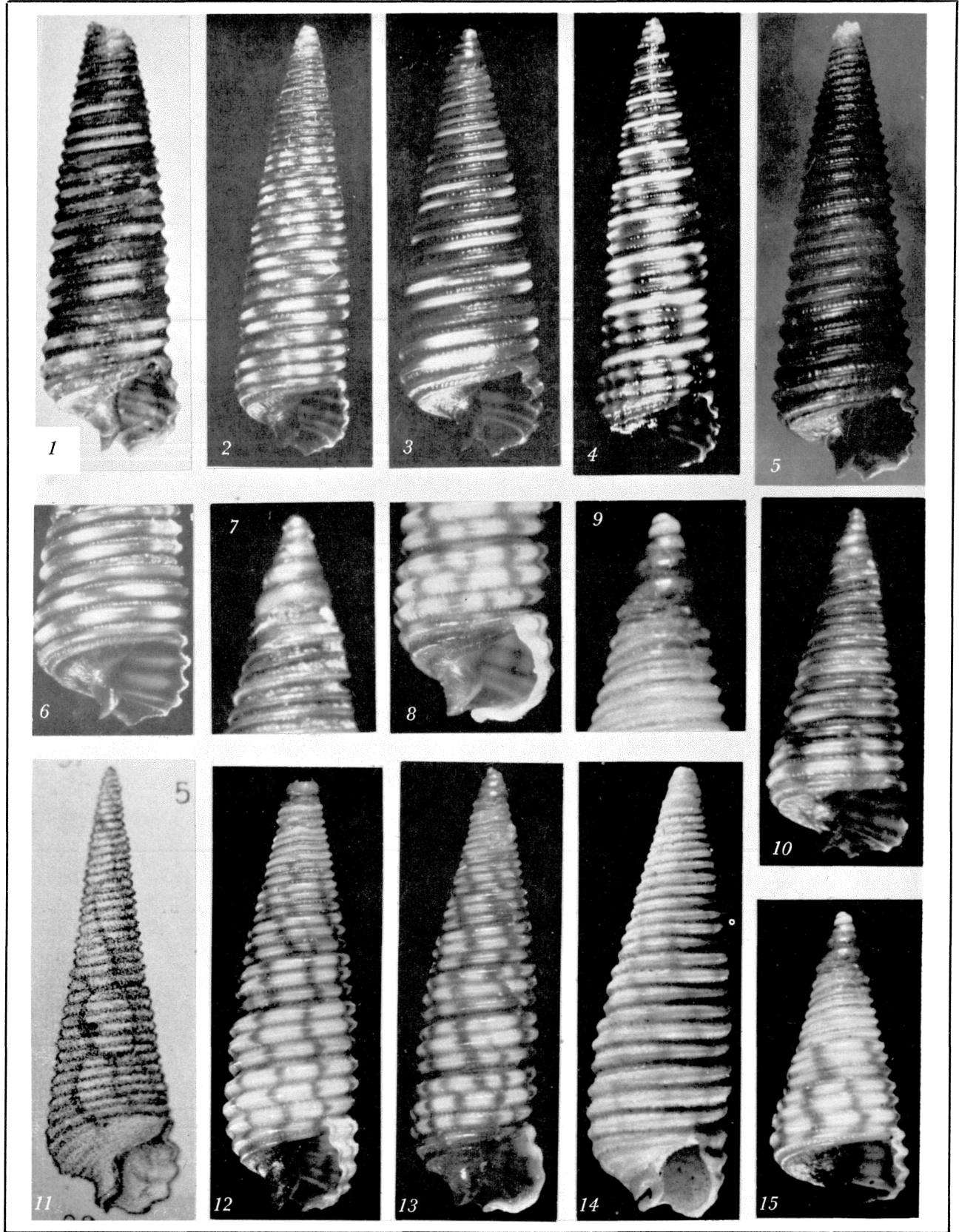
stones, sponges, and marine plants, near low water mark." He did not choose a holotype; therefore, there is only a cotype series from which a lectotype has been selected (TURNER, 1956: 32). CARPENTER (1857: 260, 335) in a geographical and zoological table of shells from the Gulf of California, Mexico and Panama suggests that, although separable, *S. assimilata* from Panama and *S. terebella* from the West Indies have very slight differences. CARPENTER (*op. cit.*, 445) reported 20 specimens of the former species off *Chama* and *Spondylus* shells from Mazatlán, Mexico, and again in 1864 (pp. 613, 624, 660, 669 [reprint: 99, 155]), collected by Cooper on Santa Barbara Island, and the channel islands off Santa Barbara, California [certainly an error], various locations in the Gulf of California, Acapulco, Mexico and Real Llejos, Central America. ORCUTT (1915: 194) reported taking dead shells at San Diego, California and gave the range from Monterey to Panama [the northern point is in error]. STRONG & HERTLEIN (1939: 188), in reporting on the Allan Hancock Expedition to the Galápagos Islands cited specimens of *S. assimilata* dredged from 3 locations off the coast of Panama. STRONG & HANNA (1930: 21), in reporting on the mollusks of the Tres Marias Islands, Mexico, accounted for 100 specimens. GRANT & GALE (1931: 764) questioned COOPER'S (1888: 233) and ARNOLD'S (1903: 290) identifications of *S. assimilata* from the California fossil occurrences; they thought it must be *S. montereyensis* Bartsch. LOWE (1935: 31) took several living specimens from the underside of old *Dosinia ponderosa* valves at Punta Peñasco, Sonora, Mexico. BAKER, HANNA & STRONG (1938: 223) reported Adam's species taken at Coyote and Concepcion Bay, Puerto

Escondido, Amortajada Bay, Carmen, San José, Espíritu Santo Islands, La Paz, Cape San Lucas, Gulf of California, Mexico. To quote them, "We are unable to detect any differences between this species and *S. montereyensis*, except that the specimens are much smaller, a feature noted by Bartsch. Bartsch's description does not seem to separate them positively in any other respect." HERTLEIN & STRONG (1939: 370), reporting on late Pleistocene mollusks from the Galápagos Islands, recorded specimens of *S. assimilata* from a raised beach 5 to 10 m above sea level at James Bay, James Island (Isla San Salvador). BURCH (1945, 54: 21) [from A. M. Strong's notebook] gives the range from the Gulf of California, Mexico to Perú. PALMER (1951: 62), in reporting on the only large collection of authentic Carpenter material in the United States of America, stated that on Tablet 2035 there are 2 specimens, one young and one adult, and TURNER (1956: 33), that C. B. Adams collected 8 specimens. EMERSON & PUFFER (1957: 13, 39), in reporting Recent mollusks from the *E. W. Scripps* cruise to the Gulf of California, apparently took live specimens from Concepcion Bay in 33 m and from off Carmen Island in 31 m, both localities in the Gulf of California, Mexico. DUSHANE (1962: 46), DUSHANE & POORMAN (1967: 426), DUSHANE & SPHON (1968: 241) state that *S. assimilata* was collected at low tide on a sand beach at both Puertecitos and at San Luis Gonzaga Bay, west side of the Gulf of California, and dredged at 31 m at Guaymas, Sonora, Mexico (dead specimens). KEEN (1958: 304; 1963: 103) reported one species of *Seila* from the Panamic province and stated the ecological niche to be from the intertidal zone down to 63 m on rocks, and (1971: 415) with a

Explanation of Figures 1 to 15

Figure 1: *Cerithium assimilatum* C. B. Adams, 1852. Lectotype, MCZ 186405; length 5.8 mm; width 1.5 mm × 13.5
 Figure 2: *Seila assimilata* (C. B. Adams, 1852). LACM 66-28, off Isla Partida, Gulf of California, Mexico; length 6.3 mm × 12
 Figure 3: *Seila assimilata*. LACM 65-21, Isla Otoque, Panama; length 3.9 mm × 18.5
 Figure 4: *Seila assimilata*. Shy Collection, Manzanillo, Mexico; length 6.3 mm × 12.5
 Figure 5: *Seila assimilata*. Draper Collection, Cholla Bay, Sonora, Mexico; (dark form) length 5.9 mm × 13
 Figure 6: *Seila assimilata*. Draper Collection, apertural view × 18
 Figure 7: *Seila assimilata*. Draper Collection, apical view × 40
 Figure 8: *Seila kanoni* (deFolin, 1867). Draper Collection, apertural view × 22
 Figure 9: *Seila kanoni*. Draper Collection, apical view × 42

Figure 10: *Seila assimilata*. Draper Collection, Piedras Blancas, Nayarit, Mexico; Charles Snell, coll., diving at 15 - 18 m; length 2.8 mm × 22
 Figure 11: *Cerithiopsis Kanoni* deFolin, 1867 [after TRYON, 1887: 208]. Panama; length 5 mm × 16
 Figure 12: *Seila kanoni*. LACM 65-25, Taboga Island, Panama Bay; McLean & Bergeron coll., dredged at 9 - 27 m; length 4.1 mm × 17.5
 Figure 13: *Seila kanoni*. Draper Collection, Piedras Blancas, Nayarit, Mexico; Charles Snell coll., diving at 15 - 18 m; length 4.6 mm × 17.5
 Figure 14: *Seila kanoni*. USNM 2429 [no data other than pencilled note by Bartsch identifying the specimen]; length 3.6 mm × 18
 Figure 15: *Seila kanoni*. Draper Collection, Piedras Blancas, Nayarit, Mexico; Charles Snell coll., diving at 15 - 18 m; length 2.0 mm (juvenile specimen) × 26



range from the Gulf of California to Panama. KEEN (1964: 187) obtained 10 specimens from intertidal drift at Candeler Bay, Espíritu Santo Island, Gulf of California. COAN (1968: 124) collected one specimen at 6m off Bahía de los Angeles, Gulf of California. BRANN (1966: 74; pl. 49, fig. 563) reported *S. assimilata* in her figures of Mazatlán shells described by Carpenter. DUSHANE & BRENNAN (1969: 358) stated that *S. assimilata* was common on sand and mud bottom at 12m entangled in aborted egg masses off San Felipe Point, Gulf of California. DRAPER (1972: 2), in a listing of mollusks found in scrapings from *Spondylus princeps*, taken at 13m depth 9km southeast of Santa Rosalia, Gulf of California, reported juvenile to adult specimens (15) of *Seila assimilata* 2.2 to 6.7mm in length.

Differences: *Seila assimilata* differs from other west coast species of *Seila* by its smaller size (except *S. kanoni*, which it exceeds in size); by its usual color pattern of linear white areas on a darker body color; by its glassy nucleus, whose final whorl attains a slightly greater diameter than the first postnuclear whorl; by the flat outline of its post-nuclear whorls, by the sine shaped cross-sectional outline of its spiral keels, by its interspaces being narrower than either *Seila montereyensis* or *S. pulmoensis*, and wider than the smaller *S. kanoni*; and by the shape of the aperture which is narrowed somewhat by the flatness of the final whorl.

Type Material: *Cerithium assimilatam* C. B. Adams, 1852: lectotype, MCZ 186405 (TURNER, 1956: 32), cotype series, MCZ, Harvard.

Type Locality: Panama.

Geographical Distribution: Todos Santos Bay, Baja California, Mexico (outer coast) (LACM, Station 66-5, 1966), throughout the Gulf of California and south to the Galápagos Islands, Ecuador (Mulliner Collection, 1971), and northern Perú (LACM Collection, 1972). Obtained from various sponges, *Chama*, *Dosinia*, and *Spondylus* shells.

Bathymetric Range: Intertidal zone to 33m

Geochronological Range: Late Pleistocene and Recent

Seila montereyensis Bartsch, 1907

(Figures 16 to 23)

Seila montereyensis Bartsch, 1907: 177 [not to be confused with *Cerithiopsis montereyensis* Bartsch, 1911]; DALL, 1921: 144; STRONG, 1923: 42; T. S. OLDROYD, 1925: 15; E. K. JORDAN, 1926: 246; IDA OLDROYD, 1927: 277;

STRONG & HANNA, 1930: 6; GRANT & GALE, 1931: 764; STRONG, 1937: 194; BAKER, HANNA & STRONG, 1938: 223; BURCH, 1945, #54: 13; EMERSON & ADDICOTT, 1953: 440; BERRY, 1956: 153; EMERSON, 1956: 338; CHAGE, 1958: 325; 1966: 171; ADDICOTT & EMERSON, 1959: 16; MCLEAN, 1969: 33; fig. 16; DRAPER, 1972: 2; HUMAN, 1972: 9

Original Description: "Shell large, robust, brown. (Extreme apex lost in all our specimens.) One of the cotypes has two and a half nuclear whorls remaining. These are rather inflated, evenly rounded, marked by many slender obliquely retractive axial riblets. The transition of the nuclear sculpture to the post-nuclear is very abrupt. The sculpture of the post-nuclear turn consists of three very strong, equal, and equally spaced lamellar spiral keels between the sutures. Channels separating the spiral keels well rounded, a little wider than the keels, crossed by many subequal and subequally spaced slender riblets, of which about 40-50 appear on the whorls. Periphery of the last whorl marked by a fourth spiral keel not quite as strong as the keels of the spire and a little more closely placed to the keel posterior to it than it is to its neighbor above it. Base marked by a spiral keel which equals the peripheral keel in strength, separated from it by a channel a little narrower than the supraperipheral groove. Both of these channels are crossed by the axial riblets. The remaining portion of the base slopes somewhat concavely toward the stout columella. Under the microscope the entire surface of the spire and base appears marked by fine lines of growth and spiral striations. Aperture sub-quadrate, decidedly channeled anteriorly; outer lip rendered sinuous by the spiral keels, parietal wall and edge of columella covered by a moderately strong callus. The nuclear structures were described from a young specimen, Cat. No. 195206, U. S. N. M., which has 10 whorls (the first two nuclear whorls probably being lost), and measures: Length 3.6mm.; diameter 1.4mm. The other cotype (Cat. No. 32290, U. S. N. M.) is an adult shell in which the last 11 whorls remain, and measures: Length 12.4mm.; diameter 4.1mm.

This species has been known from the west coast under the name of *Cerithiopsis assimilata* C. B. Adams, a Pan-amic species, which is a pygmy in size compared with the present form." (BARTSCH, 1907: 177)

Diagnosis: Shell large for the genus, color light yellow-brown to chocolate, with faint maculations or zones of lighter shading; nucleus of 4 to 4½ rounded whorls, enlarging irregularly until final whorl nearly equals the first postnuclear whorl in size, with a rapid transition to post-nuclear sculpture occupying the lower half of the transition whorl; nuclear sculpture, as seen on uneroded shells,

of many microscopic pits and occasional protractive incised lines, not visible on most adult shells because of erosion; postnuclear whorls somewhat convex, with 3 sharply raised, flat topped spiral keels, separated by interspaces nearly twice as wide as the keels, crossed at various angles by axial riblets spaced somewhat irregularly about as far apart as the width of the keels; suture deeply impressed at the base of the posterior keel, with a low peripheral thread separating it from the main sutural channel, nearly twice as wide as the interspaces; sutural channel crossed by axial threads similar to those in the interspaces; peripheral keel nearly as strong as the other keels at the base; base of same color as the body of the shell, sloping concavely to the anterior tip of the columella, with a weaker narrow spiral keel near the peripheral keel, and a thin spiral thread in the middle of the concavity of the base; incremental lines extend axially from this central spiral thread; aperture roundly quadrate, made sinuous at the rather thin outer lip by the keels, with the outer sculpture showing through; canal broad, shallow, $\frac{2}{3}$ surrounded by the lip and columella; operculum thin, yellow-brown in color. Length, 5.2 mm to 18.6 mm; width, 1.9 mm to 5.4 mm.

Discussion: BARTSCH (1907: 178) reported the range of *Seila montereyensis* as from Monterey, California to Todos Santos Islands, Mexico. DALL (1921: 143) extended the range northward to Mendocino County; A. M. STRONG (1923: 42) included *S. montereyensis* in a list of a molluscan fauna from off Catalina Island, California; E. K. JORDAN (1926: 246) reported that G Dallas Hanna collected specimens from an upper Pleistocene deposit at San Quintín Bay, Lower California, Mexico. STRONG & HANNA (1930: 6) dredged *S. montereyensis* off Guadalupe Island, Mexico from a sandy substrate. GRANT & GALE (1931: 764) reported Pliocene specimens from Fifth and Hope Streets, Los Angeles; Pleistocene specimens from the lower San Pedro series at Nob Hill cut, San Diego, and Santa Monica, with a range of the Recent animals from Little River, Mendocino County, California to Todos Santos Bay, Baja California, Mexico. They added, "This species is much larger than the true *S. assimidata* of the Panamic region." KEEN (1937: 45) gave 32° - 37° N as the total range of the species with 34° N as the midpoint of the range, *i. e.*, from San Diego to San Francisco, California. STRONG (1937: 194), in reporting on the marine mollusca San Martin Island outer coast of Baja California, a small volcanic island just north of the entrance to San Quintín Bay, stated, "The fauna of San Martin Island is of particular interest, in that it marks the southern known limit of a range of a considerable number of California species." He included *S. mon-*

tereyensis in this statement. WILLETT (1937: 398) listed 100 *S. montereyensis* from the Pleistocene fauna of Baldwin Hills, Los Angeles County, California and referred to them as synonyms of *S. assimidata* using ARNOLD, 1903 as his authority. BURCH (1945, 54: 20, 21) [from A. M. Strong's notebook] gives the range from Monterey, California to the Gulf of California, Mexico. BERRY (1956: 153) in a report on mollusca dredged by the *Orca* off the Santa Barbara Channel Islands, listed one specimen of *S. montereyensis* as taken north of the west end of Anacapa Island. EMERSON (1956: 338) found it on the south side of Punta China, Baja California among Pleistocene invertebrates at about 7½ m above sea level resting on rocks of either middle or upper Cretaceous age. ADDICOTT & EMERSON (1959: 16) reported this species from the upper Cretaceous Rosario formation, from Pleistocene from Punta Cabra, outer coast of Baja California. McLEAN (1969: 33) recorded the range as from Monterey Bay, California to Punta Abreojos, central Baja California, Mexico. HUMAN (1972: 9) reported it from a Pleistocene marine terrace at Corona del Mar, Orange County, California. DRAPER (1972: 2) reported 8 specimens of *S. montereyensis* found in scrapings from *Spondylus princeps* taken by divers 24 km southeast of Santa Rosalia, Gulf of California, Mexico, in 13 m. Three specimens in the LACM Collection (72-7, Bahía Elena, Guanacaste Province, Costa Rica), tentatively identified as *S. montereyensis*, indicate a disjunct range for the species.

Differences: *Seila montereyensis* differs from other west coast species of the genus by attaining the larger size, up to 18.6 mm in length (LACM, Station 60-24); by its overall brown color, with vague maculations or areas of lighter color; by the cross-sectional shape of the spiral keels; by the interspaces between the keels being wider than in *S. assimidata* and *S. kanoni*; by the axial riblets in the interspaces being fewer and more widely spaced.

Type Material: *Seila montereyensis* Bartsch, 1907: cotype 1, USNM 32290 (from Stearns Collection); cotype 2, USNM 195206 (from Berry Collection).

Type Locality: Monterey, California.

Geographical Distribution: Mendocino County, California, to Baja California and throughout the Gulf of California, Mexico and possibly in Costa Rica. Obtained from the intertidal zone and dredged from sandy substrates, under rocks, usually associated with small sponges.

Bathymetric Range: Intertidal zone to 67 m

Geochronological Range: Pliocene, Pleistocene and Recent

Seila kanoni (de Folin, 1867)

(Figures 8, 9, 11 - 15)

Cerithiopsis Kanoni de Folin, 1867: 70; pl. 6, fig. 11; TRYON, 1887: 174 [translation of description], 208; pl. 36, fig. 62
Cerithiopsis kanoni. STRONG [in BURCH, 1945, #54: 21]; KEEN, 1971: 415 [as synonym of *Seila assimilata* (C. B. Adams, 1852)]

Original Description: "Whitish, shining maculated with longitudinal chestnut veins; whorls 11, flat, each widely longitudinally lirate, base smooth, short, concave, defined by a slight ridge. Length 5 mill. Bay of Panama." (DE FOLIN, 1867: 70 [from TRYON, 1887: 174])

Diagnosis: Shell small for the genus, convexly conic, whorls increasing regularly in size during first half of growth, then at a decreasing rate during the latter half of the growth period; color white, with brownish orange or chestnut colored, irregularly shaped longitudinal stripes, fading to nearly white near the apex; sutural channels and peripheral keel chestnut brown, base somewhat darker brown; nucleus of 5 whorls slightly translucent, first 2 white, smooth, well rounded, next 3 whorls less rounded, chestnut brown or purplish, marked by microscopic pits and occasional fine obliquely retractive axial threads; postnuclear sculpture starts abruptly on 6th whorl, consisting of 3 strong, well rounded spiral keels, with much narrower interspaces, crossed on the final whorls by 60 to 70 closely spaced retractive axial riblets, extending only partly onto the spiral keels; sutural channels about twice as wide as the interspaces between the keels, deeply impressed at the anterior edge; periphery of the base with a 4th slightly weaker spiral keel followed by a much weaker 5th keel, outlining the very concave basal area; axial riblets extend between both of these keels and slightly into the concavity of the base; additional low rounded spiral keels divide the concave base into 3 shallow channels; aperture ovate, outer lip rendered wavy by the spiral keels, exterior sculpture clearly visible through the lip; anterior canal well rounded, moderately wide, bordered by a narrow callous pad extending up the inner surface of the twisting columella; operculum unknown. Length, 2.7 mm to 5.0 mm; width, 1.0 mm to 1.6 mm.

Discussion: Although the original description of *Seila kanoni* has not been available to us, TRYON (1887: 174) has provided an English translation and a copy of the original figure. It is not known whether a holotype was chosen, or, if so, where this type is located. The original shell examined by de Folin is known to have been collected in the Bay of Panama. No further reference to this species

has been found in the literature until Strong (in BURCH, 1945: 21) suggested it belonged in synonymy with *S. assimilata*. KEEN (1971: 415) repeated this synonymy. A study of 51 specimens of *S. kanoni*, taken from various locations, shows a marked similarity of these specimens to the description and figure by TRYON (*loc. cit.*) and several distinct differences from *S. assimilata*. We are of the opinion that the placing of *S. kanoni* in synonymy with *S. assimilata* is not justified.

Differences: *Seila kanoni* differs from other eastern Pacific species by its smaller size; by basically white body color with darker markings; by spiral keels being more rounded than in other species, with interspaces much narrower, considerably less than the width of the keels; by axial riblets being more numerous and closely spaced than in *S. assimilata* and *S. montereyensis*, from which 2 species it also differs by having 2 low, broad, revolving ridges in the concavity of the base. Specimens of *S. kanoni* taken intertidally have not been alive; so it seems that the animals have an offshore habitat, occupying a deeper ecological niche than the other species which commonly are taken alive intertidally.

Because this species has not been recognized by collectors, it seems appropriate to include current data here:

Tepoca Bay, Sonora, Mexico (LACM AHF 1078-40), dredging 22m on sand substrate, 2 February 1940	2
Piedras Blancas (20km N of San Blas), Nayarit, Mexico, collected by Charles Snell, diving at 15 - 18m, 9 February 1967 (Draper Collection)	15
Banderas Bay (Los Arcos), Jalisco, Mexico (LACM 65-15), collected by McLean and Miller, diving at 5 - 18m, 1965	2
Banderas Bay, Jalisco, Mexico, collected by Snell and McMillan, diving at 10 - 20m, February 1967	6
Cuastecomate Bay, Jalisco, Mexico, collected by DuShane, dredging at 11 m, sand and broken shell substrate, January 1969 (DuShane Collection)	1
Punta Santa Elena, Costa Rica, collected by LaFollette and Cadien, diving at 12 - 15m, February 1972	13
Taboga Island, Panama Bay, Panama (LACM 65-25), collected by McLean and Bergeron, dredging at 9 - 27m, June 1965	3
Secas Islands, Panama Bay, Panama (LACM AHF 314), bottom sample, 6 February 1945	4
Salinas, Ecuador (LACM 70-9, collected by McLean, intertidally, March 1970	1
Total specimens:	47

Type Material: Unknown

Type Locality: Panama Bay

Geographical Distribution: Tepoca Bay, Sonora, Mexico south to Panama and Ecuador

Bathymetric Range: Sublittoral zone to 28m

Geochronological Range: Recent

Seila moreleti (de Folin, 1867)

(Figure 30)

Cerithiopsis Moreleti de Folin, 1867: 68; plt. 6, fig. 10; TRYON, 1887: 174; plt. 36, fig. 60 [figure error: larger specimen matches description]

Cerithiopsis moreleti. STRONG [in BURCH, 1945, #54: 21]

Cerithiopsis moreleti. KEEN, 1971: 415 [as synonym of *Seila assimilata* (C. B. Adams, 1852)]

Original Description: "Chestnut brown, yellowish white towards apex; whorls 11, flat with three revolving narrow ridges, the somewhat wider interspaces distantly longitudinally lirate, as though beaded, base smooth, defined by a thread. Length 8 mill. Bay of Panama." (DE FOLIN, 1867: 68; transl. from TRYON, 1887: 174)

Discussion: The description and figure in TRYON (1887: 174; plt. 36, fig. 60) is too indeterminate to apply to any particular west coast species. The concavely conic shape as shown in the figure is not characteristic of any species we have seen, and the appearance of being beaded, as mentioned in the description, must be the way the original figure was drawn. The suggestion by A. M. Strong (in BURCH, 1945, 54: 21) that this species be placed in the synonymy of *Seila assimilata* (C. B. Adams, 1852) appears to be an unacceptable solution. The incomplete description is partially applicable to either *S. assimilata* or

S. montereyensis, but fits neither convincingly. The figure of *S. moreleti* shows further discrepancies; therefore we consider this taxon a *nomen dubium*.

Seila pulmoensis DuShane & Draper, spec. nov.

(Figures 24 to 29)

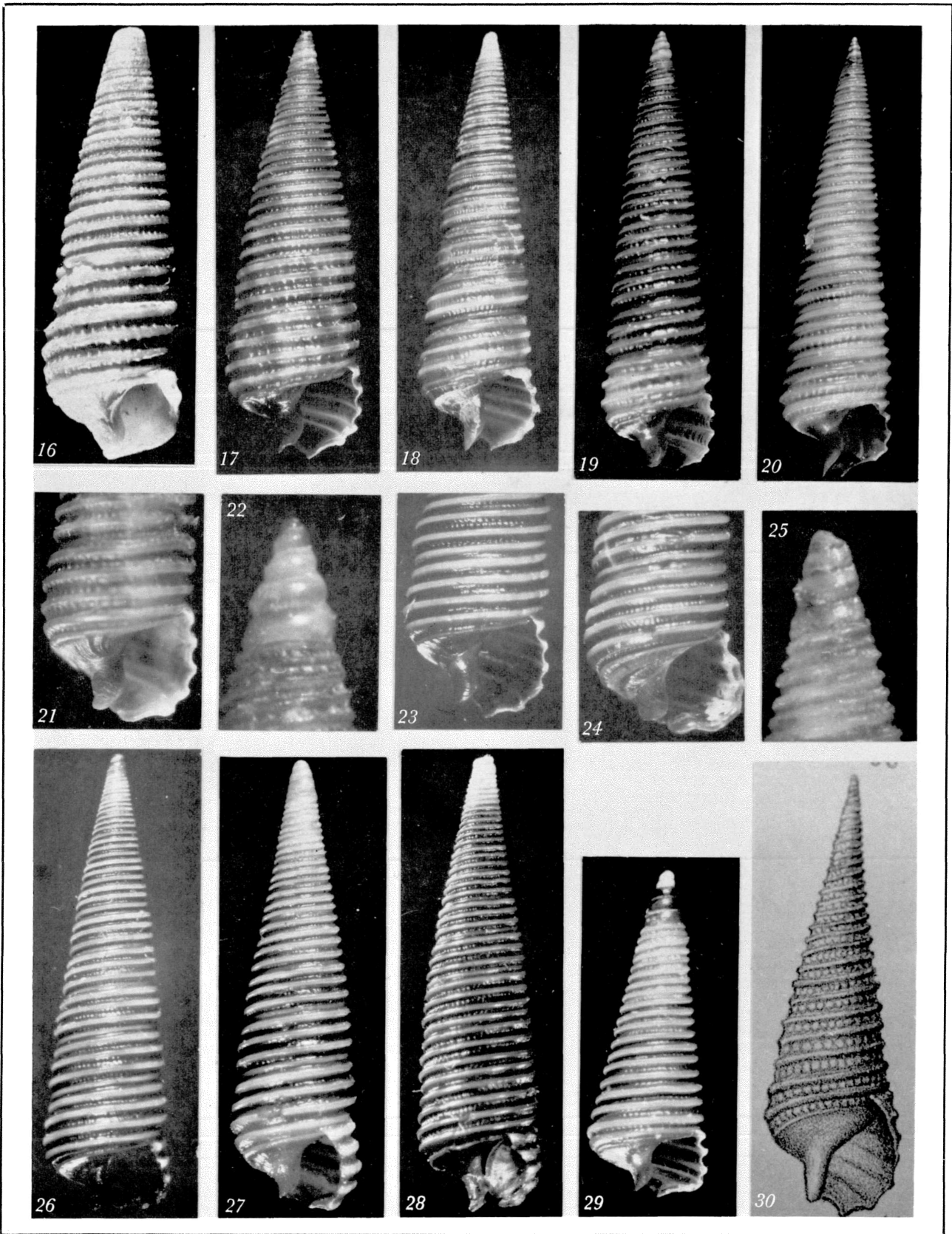
Species of the genus *Seila* are few in number in the eastern Pacific. At Pulmo Reef, Baja California Sur, Mexico a number (25) of a *Seila* new to science was collected.

Description: Shell moderately large, elongate conic, tapering smoothly, slightly convex; color chocolate brown, with lighter color near apex and on outer edges of spiral keels; spaces between keels and basal area very glossy; nuclear whorls 5, first 3 enlarging more rapidly than latter 2, all somewhat bulbous, irregularly pitted, mostly near the sutures; one or more oblique riblets on later whorls; transition to postnuclear sculpture occurring in less than $\frac{1}{2}$ whorl; postnuclear whorls flat with 3 sharply raised spiral keels of equal strength and spacing; made more prominent by the lighter color at the top of each keel, interspaces between keels $1\frac{1}{2}$ to $2\frac{1}{2}$ times as wide as the keels, crossed vertically by many regularly spaced axial riblets, numbering 60 to 80 on the final whorls, extending from keel to keel and anteriorly to the suture, but extending less than halfway onto the keels; sutures deeply impressed in the anterior portion; sutural channel somewhat wider than the interspaces with the peripheral keel showing about midway in the channel, always posterior to the suture; peripheral keel, when strong enough to be easily visible, of lighter color, as on the other keels making the whorls appear to have 4 instead of the usual

Explanation of Figures 16 to 30

Figure 16: *Seila montereyensis* Bartsch, 1907. Cotype 1, USNM 32290; length 12.4mm; width 4.1mm × 6
 Figure 17: *Seila montereyensis*. Draper Collection, San Pedro, California; length 8.7mm × 8.6
 Figure 18: *Seila montereyensis*. Draper Collection, San Felipe, Baja California, Mexico (E. P. Chace, coll.); length 11.1mm × 6.7
 Figure 19: *Seila montereyensis*. LACM-AHF 696-37, Tortuga Island, Gulf of California, Mexico, dredged at 81m, sand substrate; length 7.2mm × 11
 Figure 20: *Seila montereyensis*. Draper Collection, Santa Rosalia, Baja California, Mexico, from washings off *Spondylus princeps*; length 11.1mm × 7
 Figure 21: *Seila montereyensis*. Apertural view × 10.5
 Figure 22: *Seila montereyensis*. Apical view × 38
 Figure 23: *Seila montereyensis*. Apertural view × 9.5

Figure 24: *Seila pulmoensis* DuShane & Draper, spec. nov. Apertural view × 10
 Figure 25: *Seila pulmoensis*. Apical view × 30
 Figure 26: *Seila pulmoensis*. Holotype, LACM 1728; Pulmo Reef, Baja California del Sur, Mexico; length 8.4mm; width 2.4mm × 9.7
 Figure 27: *Seila pulmoensis*. Paratype, DuShane Collection; length 8.8mm; width 2.2mm; Pulmo Reef, Baja California, Mexico × 9
 Figure 28: *Seila pulmoensis*. LACM 65-22, Tortola Island, Panama; length 7.6mm; width 2.0mm × 10.6
 Figure 29: *Seila pulmoensis*. Draper Collection, Piedras Blancas, Nayarit, Mexico; Charles Snell, coll., diving at 15 - 18m (juvenile specimen) × 20
 Figure 30: *Cerithiopsis Moreleti* de Folin, 1867 [after TRYON, 1887: 208]. Panama; length 8mm × 20



3 keels; on the final whorl the peripheral keel attains nearly the same strength as the other keels; a weaker spiral ridge just anterior to the peripheral keel outlines the concave base, with the axial riblets continuing to this ridge; 2 additional, poorly defined, rather broad ridges revolve obliquely in the concavity of the base, dividing it into 3 equal, shallow channels, the final one blending into the columella; on some specimens these latter ridges are hardly apparent; aperture subquadrate, rather large, outer lip flaring and scalloped by extension of the keels, which show interiorly as white lines; axial riblets barely outlined by a narrow, dark callus, extending entirely up the inner columellar wall; operculum thin, light yellow.

Type Locality: Pulmo Reef, Baja California Sur, Mexico (23°25' N; 109°25' W). Eighteen specimens were collected by the senior author, intertidally from undersides of rocks and boulders resting on coarse sand, January 26, 1967. Seven specimens were collected intertidally to 3 m on rocky boulders, ledges and reef by McLean, February 3, 4, 1966.

Additional Localities:

Baja California, Mexico —

Punta San Felipe (LACM 68-33), collected intertidally by Donald Cadien, June 1968 3
 Agua Chale, collected intertidal zone by DuShane, May, 1966 15
 Puertecitos, intertidal zone, and dredging to 12 m, collected by DuShane, October 1970 10

Baja California Sur, Mexico —

Escondido Bay, intertidal zone, collected by DuShane, February 1970 1
 El Tule (LACM 66-15), intertidal zone, collected by McLean, April 1966 5
 El Chileno, intertidal zone, collected by DuShane, February, 1970 4
 Cabo San Lucas (LACM 66-12), diving at 7½ to 30 m, McLean & Oringer, April 1966 1

Other Mexican localities —

Mazatlán, Sinaloa (LACM 59-10 & 63-11), intertidal to 4½ m, collected by McLean, December 1959 & March 1963 11
 Piedras Blancas (9 km N of San Blas), Nayarit, diving at 16½ to 18 m, collected by C. Snell, February 1967 (Draper Collection) 7
 Sayulita, Nayarit (LACM 71-82), intertidal to 2.3 m, collected by McLean & Margetts, May 1971 1
 Banderas Bay, Nayarit, intertidal zone, collected by DuShane, January 1969 6

Panama Bay, Panama —

Tortola Island (LACM 65-22), dredging 18 - 27 m, McLean & Bergeron, June 1965 1

Total specimens: 65

Type Material: *Seila pulmoensis* — holotype, LACM, Invertebrate Zoology Type Collection No. 1728.

paratypes (7): LACM, Invertebrate Zoology Type Collection No. 1729.

paratypes (4): Draper Collection

paratypes (13): DuShane Collection

Measurements: holotype, length 8.4 mm; width 2.4 mm
 largest paratype: length 9.6 mm; width 2.3 mm

Discussion: *Seila pulmoensis* is somewhat smaller in size than *S. montereyensis*, but larger than *S. assimilata* and *S. kanoni*. Shells of this species, with a similar number of whorls, show comparatively little size variation from different localities. The whorls are very flat, with the sutural channels similar to the keel interspaces, so that the whorls appear to blend into a continuity of spiral keels. There is little variation in the width of the spiral keels. The slightly convex tops of the keels are of much lighter color, making them stand out prominently against the much darker body color. The sutural keel is often much stronger in the channels than in the other 3 species, in some specimens nearly equaling the other keels in strength. The interspaces between the keels vary quite extensively in width, from about as wide as the keels to nearly 3 times as wide, with twice the width being more common. The interspaces are glossier than in the other 3 species of *Seila* and have more numerous and closely spaced axial riblets. In general aspect the base resembles that of *S. assimilata*; however, the extreme glossiness and occasional occurrence of 2 additional, low, spiral keels on the concave base set this species apart from both *S. assimilata* and *S. montereyensis*. From *S. kanoni* this species differs by having a much darker shell with no axial flammules.

This species is known to range from Punta San Felipe in the northern Gulf of California, Mexico, south along the eastern coast of Baja California to Cabo San Lucas and along the west Mexican coast from Mazatlán, Sinaloa to Banderas Bay, Nayarit, Mexico. It also occurs in Panama Bay, Panama. The species seems to have a discontinuous distribution, although future collecting may reveal additional specimens from intermediate localities. It has been collected intertidally and by diving, from mid-tide line to 27 m, from the underside of rocks and in sand or gravel over a rocky substrate.

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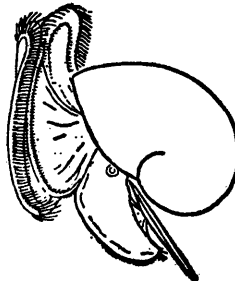
All photographs are by Bertram C. Draper.

The following libraries permitted us to use their reference material: USNM Library (Department of Mollusca); USC Hancock Library; UCLA Library (Department of Geology Library and Biomedical Library); LA CM reference library and Invertebrate Zoology Library.

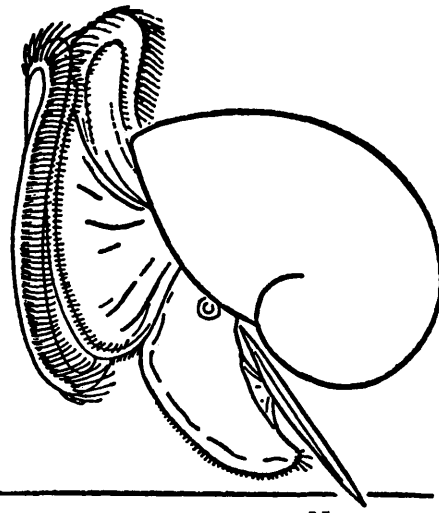
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Note: The various taxa above species are indicated by the use of different type styles
as shown by the following examples, and by increasing indentation.

ORDER, Suborder, DIVISION, Subdivision, SECTION,
SUPERFAMILY, FAMILY, Subfamily, *Genus*, (*Subgenus*)
New Taxa

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