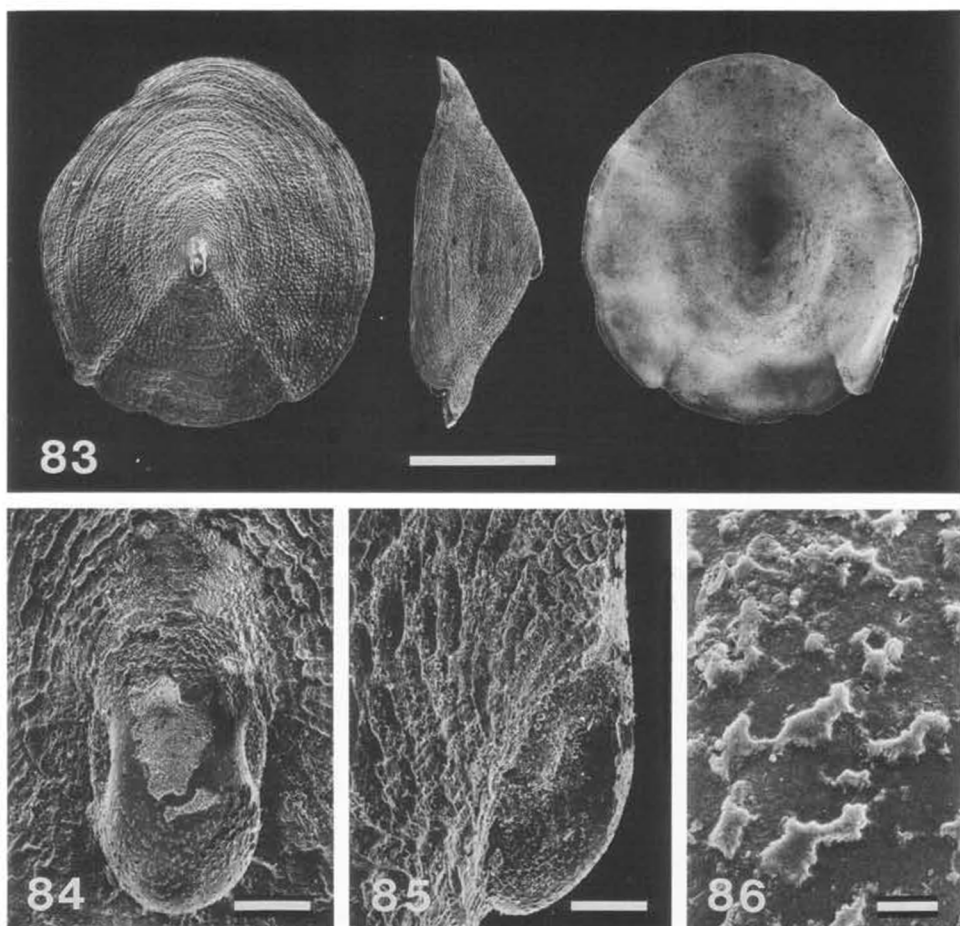




Figures 83–86. *Kaiparapelta askewi*, new species. 83. Dorsal, lateral, and ventral views of holotype. Scale bar = 1.0 mm. 84, 85. Dorsal and lateral views of protoconch of holotype. Scale bars = 50 μ m. 86. Detail of protoconch sculpture. Scale bar = 5 μ m.

ETYMOLOGY. We take pleasure in naming this striking species after our late friend and colleague Richard S. (Joe) Houbbrick of the Division of Mollusks, National Museum of Natural History.

Notocrater youngi, new species

Figures 66–75

DESCRIPTION. Shell (figure 66) small for family (maximum length 3.1 mm), thin, not eroded, white, periostracum thin. Shell height moderate, that of holotype 0.32 times length. Anterior slope convex, posterior slope straight, lateral slopes slightly convex to straight. Outline in dorsal view elongate-oval, anterior end slightly narrower than posterior end; aperture not planar, sides raised relative to ends of shell. Apex posterior to center, at about $\frac{2}{3}$ shell length from anterior margin, protoconch below highest point of shell, extending posteriorly. Protoconch length 190 μ m, protoconch sculpture of clumped crystals, some forming anastomosing

threads (figures 67–69). Tip of protoconch immersed in posterior slope of shell. Early sculpture of raised concentric ribs and fine radial striae. Mature sculpture of elongate pustules on evenly spaced concentric ribs arranged in curving rows. Shell edge thin and sharp. Muscle scar not well marked.

Dimensions. Length 3.1, width 2.2, height 1.0 mm (holotype).

External Anatomy (figures 70–72). Cephalic lapets broad, epipodial tentacles two posterior pairs. Cephalic tentacles with band of cilia and scattered sensory papillae (figure 72). Mouth with cuticular lining (figure 71, cl).

Radula (figures 73–75). Rachidian broad, uncusped; first lateral triangular, with projecting elbow; second, third, and fourth lateral with elbow and single large overhanging cusp and up to four serrations on medial side; pluricuspid with four, similar-sized cusps below the overhang; inner marginals enlarged compared to outer marginals, second marginal the largest.

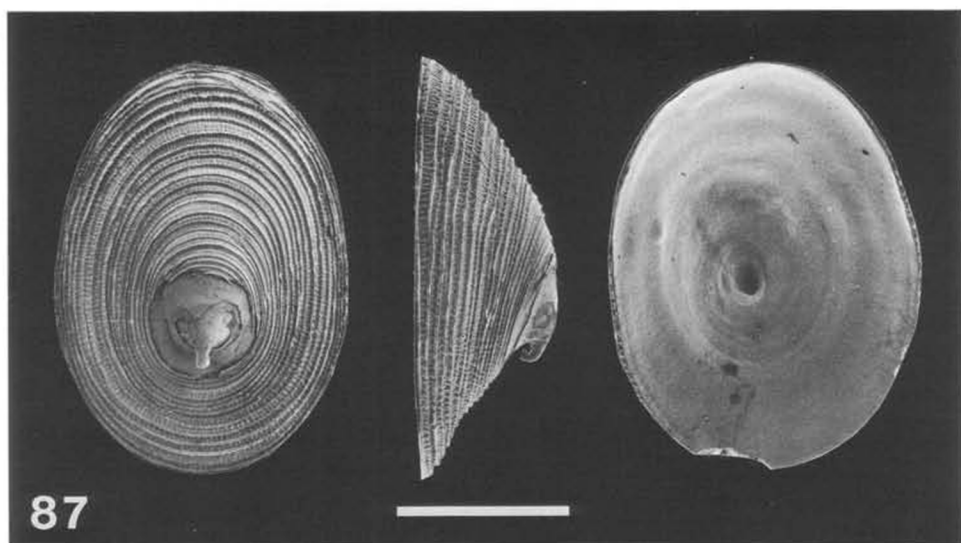


Figure 87. *Copulabyssia leptalea* (Verrill, 1884). Dorsal, lateral, and ventral views of shell (USNM 757345). NE of Norfolk, Virginia, in 3080–3090 m, R/V *Gillis* Cruise 75-08, sta. 36. Scale bar = 1.0 mm.

TYPE LOCALITY. Off Southwest Reef, New Providence Island, Bahamas (24°54'04"N, 77°33'14"W), 518 m on palmetto fronds.

TYPE MATERIAL. 17 specimens retrieved from palm fronds and grass mat collectors placed on bottom for larval settlement experiments by R. Emsen, C.M. Young, and P.A. Tyler. Holotype, USNM 860360, *Johnson-Sea-Link II*, dive 2317, 9 May 1992. 16 paratypes, from same locality and depth retrieved by Mary Rice, *Johnson-Sea-Link I*, dive 3463, 10 May 1993; 8 paratypes USNM 860387; 5 paratypes LACM 2738; 3 paratypes HBOM 065:03885.

REMARKS. On shell characters this species differs from *Notocrater houbricki* in its larger size (length 3.1 compared to 2.6 mm), more anteriorly located apex, larger and more widely spaced pustules on the protoconch, and less projecting nodes on the teleoconch.

ETYMOLOGY. This species is named after Craig M. Young, of Harbor Branch Oceanographic Institution, Fort Pierce, Florida, whose research on larval recruitment brought this species to light.

Genus *Tentaoculus* Moskalev, 1976

Type species by monotypy: *Tentaoculus perlucida* Moskalev, 1976; New Guinea.

DIAGNOSIS. Shell with or without small septum near apex on inner surface. Protoconch sculpture of fine pits and anastomosing ridges; teleoconch sculpture of fine concentric growth lines and radial striae.

REMARKS. Marshall (1986:67) used the genus *Tentaoculus* for three species from New Zealand, noting that the genus is unique in having an interior

shell septum. This character provides a clue to the allocation of an enigmatic northwestern Atlantic species described originally in the family Fissurellidae by Verrill, 1884, as well as that of a previously unfigured species described by Dall in *Cocculina*.

Tentaoculus eritmeta (Verrill, 1884), new combination Figures 76–78

Puncturella (Fissurisepta) eritmeta Verrill, 1884:204, pl. 32, fig. 19; Clarke, 1962:8 [checklist only]; R.I. Johnson, 1989:37 [type specimen].

Puncturella eritmeta; Pilsbry, 1890:238, pl. 27, figs. 60, 61 [copy of Verrill]; Thiele, 1919:156, pl. 17, figs. 14, 15 [copy of Verrill].

REMARKS. The original illustration, which has been copied by Pilsbry (1890) and Thiele (1919), includes a posterior view with two circular scars separated by what was intended to represent a septum. In our interpretation, the upper scar is that left by loss of the protoconch aperture and the lower shows the trace of the protoconch tip where it was engulfed by the posterior slope of the shell. Verrill (1884) described but did not illustrate an interior septum: "in the apex there is a minute transverse lamina, forming a small flattened tube." Shell proportions and sculpture are consistent with those of the *Tentaoculus* species illustrated by Marshall (1986). The flattened tube described by Verrill is shown in an enlarged view with SEM, tilted to show its length (figure 78). This species, which has been ignored by all recent compilers of the Fissurellidae, is now added to the list of western Atlantic pseudococculinids.

Tentaoculus georgiana
(Dall, 1927),
new combination
Figures 79–82

Cocculina georgiana Dall, 1927:121; C.W. Johnson, 1934:66 [listed only]; Abbott, 1976:35 [listed only].

A lectotype (USNM 108281) of this previously unillustrated species is designated and illustrated here (length 2.5, width 1.7, height 1.2 mm). Twenty paralectotypes have been recataloged as USNM 860384; 2 paralectotypes LACM 2739. The original type locality is “off Georgia,” but the printed label reads “U. S. Fish Com. sta 2415, 440 fm. [805 m], off Georgia.” Although not mentioned originally by Dall, it proves to have an interior septum (figure 82) comparable to that of *Tentaoculus eritmeta*. The protoconch sculpture is too worn to show the pits near the terminus, but the anastomosing sculpture illustrated by Marshall (1986:534, fig. 6M) for *T. haptricola* Marshall, 1986, from New Zealand is present. Like the previous species, this species may safely be allocated to *Tentaoculus* in the absence of soft parts. It differs from *T. eritmeta* in having a much higher profile and the apex at $\frac{3}{4}$ the shell length from the anterior, rather than nearly central.

Genus *Caymanabyssia* Moskalev, 1986

Type species by original designation: *Caymanabyssia spina* Moskalev, 1976.

DIAGNOSIS. Protoconch with columnar prisms; teleoconch sculpture of sharp pustules on anastomosing network of surface sculpture; central and lateral teeth degenerate, lacking cusps; right cephalic tentacle enlarged, open seminal groove; gill leaflets on both sides.

REMARKS. Although the type species was poorly figured, the teleoconch sculpture of strong pustules superimposed on an anastomosing network is unmistakable. This genus has been used for the New Zealand species *Caymanabyssia rhina* Marshall, 1986, and for the eastern Pacific species *Caymanabyssia vandoverae* McLean, 1991. Haszprunar's (1988:174) anatomical definition of *Camanabyssia* is based on the species *C. sinespina* Marshall, 1986, which was designated the type species of the subgenus *Dictyabyssia* McLean, 1991.

Caymanabyssia spina Moskalev, 1976

Caymanabyssia spina Moskalev, 1976:65, fig. 4, pl. 2, figs. 7, 8; Marshall, 1986:538.

Moskalev's original description was translated from Russian by G.V. Shkurkin in a privately circulated “reprint” dated December 1978. That translation is repeated here, altered to place it in telegraphic style and with terminology slightly revised to conform to that used throughout this paper:

Shell small, low, thin, apex at $\frac{2}{3}$ shell length from anterior margin, protoconch lacking sculpture. An-

terior slope slightly convex, posterior slope straight; aperture elliptical, margin made denticulate from projecting surface sculpture. Surface yellowish-white, semi-transparent. Sculpture of numerous, similar conelike thorns in regular checker-board pattern, spaced not less than the diameter of the base of each thorn. Shell interior white, surface sculpture visible from inside.

Shell lengths 0.85–2.95 mm, holotype the largest.

Epipodial tentacles clearly visible, a differentiation of the right cephalic tentacle noticeable on 34 specimens and eggs present in 31 specimens.

Rachidian rounded, thickened in the middle by a horizontal ridge. Subcentral teeth diverging wing-like from the rachidian, irregularly triangular, with folds on outer edge. First, second, and third lateral teeth almost identical, cusps lacking, boomerang shaped. Fourth lateral tooth [pluricuspid] slightly smaller than subcentral one, of complex shape with folds. Fifth lateral tooth [lateromarginal plate] smallest, its middle part situated at level of lower margin of fourth lateral tooth.

TYPE LOCALITY. Eastern part of Cayman Trough (19°38'5"N, 76°38'8"W), 6740–6800 m. A total of 204 specimens on wood, 7 on other substrates of vegetal origin, collected with research vessel *Akademic Kurchatov*, cruise 14, sta. 1267, 2.5 m Sigsby dredge, 24–25 March 1967. Further locality: western part of Cayman Trough (19°00'6"N, 80°29'5"W), 6800 m, sta. 1242A, 20 March 1967, 2 specimens on wood. In the type series, shells are broken and bodies deformed in 29 specimens; 11 were used for radular mounts.

REMARKS. Moskalev did not mention the anastomosing background sculpture that occurs between the sharp pustules, although it is recognizable in his illustration.

Genus *Kaiparapelta* Marshall, 1986

Type species by original designation: *Kaiparapelta singularis* Marshall, 1986.

DIAGNOSIS. Protoconch sculpture of anastomosing threads, teleoconch sculpture granulate, profile low.

REMARKS. The new species described here is the second known species of the genus; the type species of *Kaiparapelta* occurs in the New Zealand Miocene. The genus is still based on shell characters. For the generic allocation, we are indebted to A. Warén, who has recognized living material of this genus from the eastern Atlantic and will report on the radula and anatomy in a forthcoming paper.

On shell characters the genus differs from *Notocrater* in its lower profile. It also resembles *Caymanabyssia* (*Dictyabyssia*), which has a more oval and more regular outline. The latter genus has been reported only from abyssal depths.

***Kaiparapelta askewi*, new species**
Figures 83–86

DESCRIPTION. Shell (figure 83) small for family

(maximum length 2.7 mm), thin, not eroded, white, periostracum thin. Shell height moderate, that of holotype 0.38 times length. Anterior, posterior, and lateral slopes nearly straight. Outline in dorsal view broadly oval, margin irregularly undulating; anterior end slightly narrower than posterior end; aperture not planar, ends raised relative to sides of shell. Apex slightly posterior to center, protoconch nearly at highest point of shell, extending posteriorly. Protoconch length 185 μ m, protoconch sculpture of clumped raised threads (figure 86). Tip of protoconch immersed in posterior slope of shell. Sculpture of weak concentric growth lines and irregular anastomosing threads or low pustules, producing a shagreen surface. Posterior slope with two faintly indicated, raised ridges terminating at slight indentations at margin. Anastomosing sculpture more prominent than radial sculpture, not raised at intersections with radial striae. Shell edge thin and sharp. Muscle scar and pallial attachment scar not well marked.

Dimensions. Length 2.65, width 2.55, height 1.0 mm (holotype); length 3.2, width 2.45, height 1.0 mm (paratype).

Radula and External Anatomy. Unknown.

TYPE LOCALITY. 165 km E of Charleston, South Carolina (32°43.68'N, 78°05.72'W), 194 m. This is the locality known as the "Charleston Lumps," which is also the type locality of two recently described pleurotomariid gastropods, *Perothroches charlestonensis* Askew, 1988, and *P. maureri* Harasewych & Askew, 1993.

TYPE MATERIAL. Two dead specimens in sediment sample collected at the type locality by T.M. Askew and M.G. Harasewych with the research submersible *Clelia*, sta. 78, 6 July 1993. Holotype USNM 860362, paratype LACM 2740.

REMARKS. Shell profile, protoconch sculpture and teleoconch sculpture agree with that of the type species. The two posterior ridges and the corresponding indentations at the margin are unique to this species. The indentations are probably indicative of the position of the posterior epipodial tentacles.

ETYMOLOGY. We are pleased to name this species after Timothy M. Askew, Director of Marine Operations, Harbor Branch Oceanographic Institution, Fort Pierce, Florida.

Genus *Copulabyssia* Haszprunar, 1988

Type species by original designation: *Cocculina corrugata* Jeffreys, 1883.

DIAGNOSIS. Protoconch sculpture of prismatic crystals, teleoconch sculpture of raised concentric rings and fine radial striae. Apex below highest point of shell. Right cephalic tentacle exceptionally large.

REMARKS. Haszprunar (1988a) detailed the anatomy of the type species and provided SEM illustrations of the shell, protoconch, and radula of a Mediterranean specimen identified as the type

species. Dantart and Luque (1994:290) also described and illustrated the type species. Warren (1991:80) noted that the northwestern Atlantic *Cocculina leptalea* Verrill, 1884, is also referable to *Copulabyssia* on the basis of shell characters, but he did not illustrate specimens.

Copulabyssia leptalea (Verrill, 1884)

Figures 87–91

Cocculina leptalea Verrill, 1884:202, pl. 32, figs. 20, 20a, 20b; Pilsbry, 1890:133, pl. 25, figs. 7, 8; Thiele, 1909:7, pl. 2, fig. 5; C.W. Johnson, 1934:66 [checklist only]; Abbott, 1974:34 [checklist only]; R.I. Johnson, 1989:46 [citation of type material].

Copulabyssia leptalea; Warén, 1991:80.

REMARKS. As noted by Warén (1991:80), the holotype (USNM 38079, from USFC sta. 2038, 3700 m off Delaware) is now fragmented. We illustrate (figure 87) a specimen (USNM 7577345) dredged off Norfolk, Virginia, 3080–3090 m (length 2.45, width 1.85, height 0.9 mm). As in the holotype, the early sculpture is eroded and the protoconch is replaced by an infilled plug that cannot be compared to that illustrated for the type species by Haszprunar (1988a). Its radula (figures 88–91) differs from that of the type species as illustrated by Haszprunar (1988a:fig. 1D, E) in having the rachidian with a single, weakly projecting cusp, rather than lacking any cusp. The pluricuspid teeth of *Copulabyssia leptalea* have four nearly equal cusps, whereas those of *C. corrugata* have two cusps, as illustrated by Dantart and Luque (1994:fig. 60).

Copulabyssia leptalea differs from *C. corrugata* in radular characters as already noted and in having a more anterior apex.

Genus *Amphiplica* Haszprunar, 1988

Type species by original designation: *Amphiplica venezuelensis* McLean, 1988. Subgenus (or synonym) *Gordabyssia* McLean, 1991; type species by original designation *Amphiplica (Gordabyssia) gordensis* McLean, 1991.

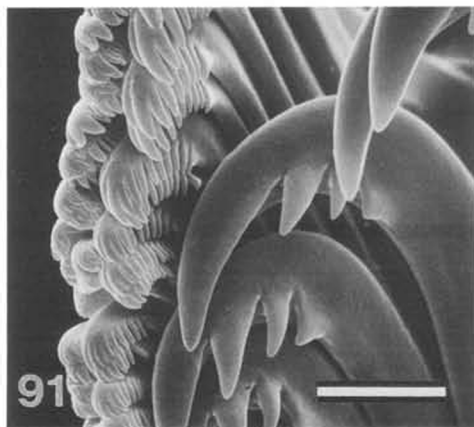
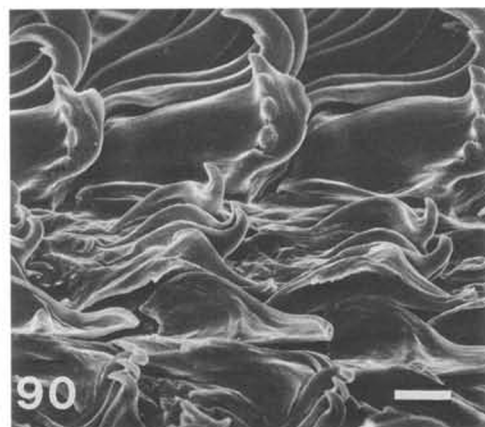
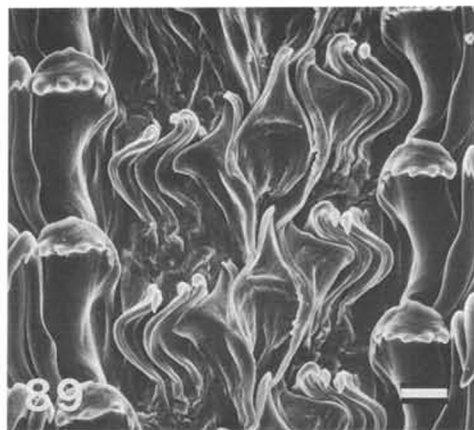
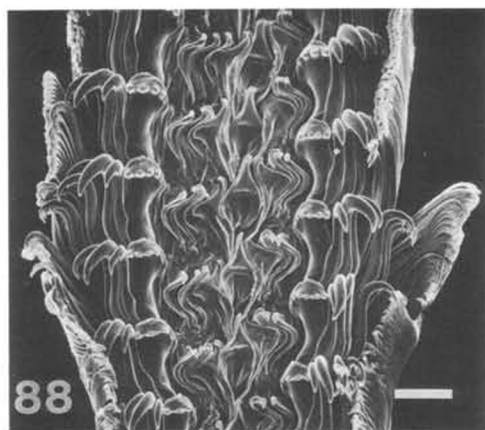
DIAGNOSIS. Shell large, profile low; protoconch sculpture of dense net pattern arranged in longitudinal rows.

REMARKS. Protoconch sculpture was unknown prior to discovery of the eastern Pacific species *Amphiplica (Gordabyssia) gordensis* McLean, 1991. There is a single species in the western Atlantic.

Amphiplica venezuelensis McLean, 1988

Amphiplica venezuelensis McLean, 1988:155, figs. 1–7.

REMARKS. This species, from 5057 m in the Venezuela Basin, attains a maximum length of 14.8



Figures 88–91. *Copulabyssia leptalea* (Verrill, 1884). Radula from specimen in figure 87. 88. Dorsal view of radular ribbon. Scale bar = 25 μ m. 89. Detail of rachidian and lateral teeth. Scale bar = 100 μ m. 90. Lateral view of longitudinally cut radula revealing relative heights of tooth fields. Scale bar = 100 μ m. 91. Detail of distal ends of inner and outer marginal teeth. Scale bar = 5 μ m.

mm and is the largest known pseudococculinid. Its anatomy was treated by Haszprunar (1988a).

REALLOCATED TAXA

The following taxa were initially described in the genus *Cocculina* but are now considered to be members of families other than Cocculinidae or Pseudococculinidae. Although most can be allocated to family and genus, their status as species or synonyms remains to be resolved, pending revision of the genera. These taxa are arranged in their order of description.

"Cocculina" conica Verrill, 1884

Cocculina conica Verrill, 1884:204; Pilsbry, 1890: 134 [copy Verrill description]; Thiele, 1909:7 [German translation]; C.W. Johnson, 1934:66 [listed only]; Abbott, 1974:34 [listed only]; R.I. Johnson, 1989:30.

Pilus conica; Warén, 1993:80, fig. 20A–E.

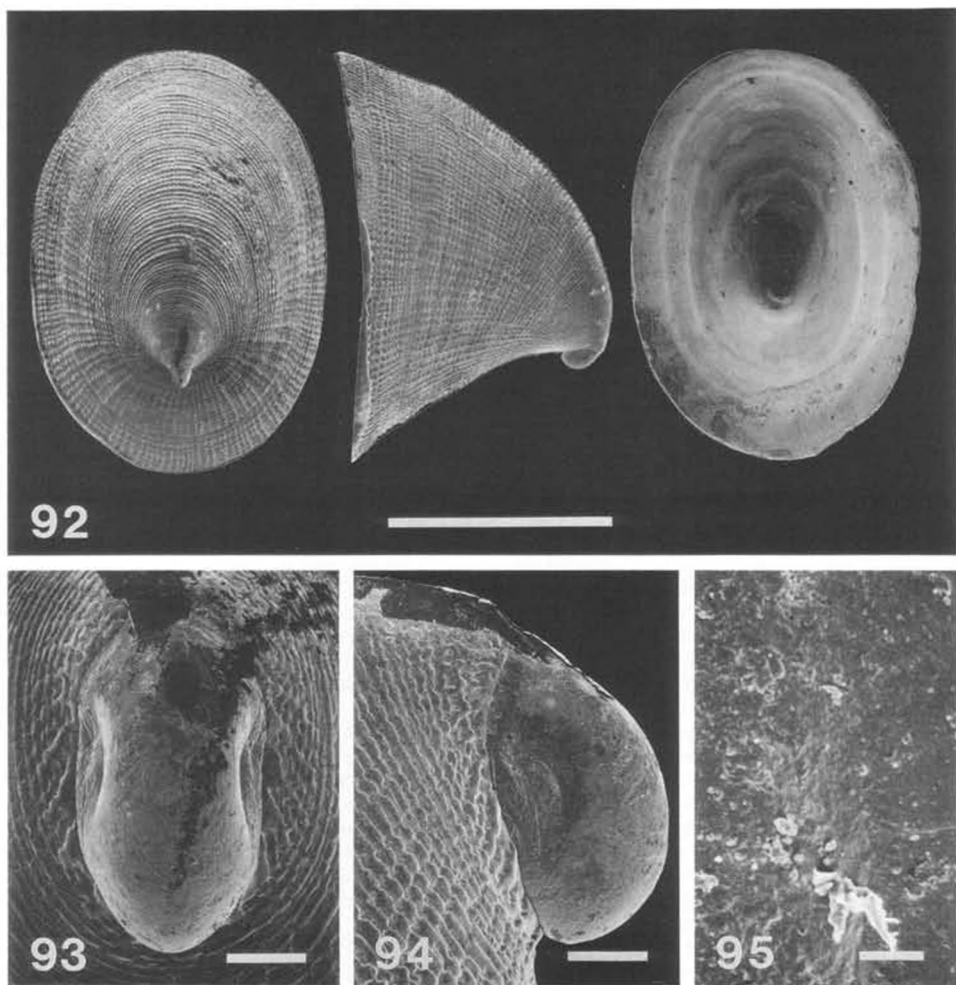
Although the holotype (USNM 38441) of this orig-

inally unfigured species from 499 fathoms off Nova Scotia was reported lost by Johnson (1989), Warén (1993) recognized the species from the detailed original description and illustrated shell specimens from deep water off southwestern Iceland. The shell is less than 1 mm in length and has a posteriorly overhung apex. This species is the type species for Warén's genus *Pilus*. The radula is unknown, and the family allocation is therefore uncertain within the Cocculiniformia.

"Cocculina" dalli Verrill, 1884

Cocculina dalli Verrill, 1884:203; C.W. Johnson, 1934:66 [listed only]; Abbott, 1974:34 [listed only]; R.I. Johnson, 1989:32, pl. 10, fig. 10 [holotype].

The single known specimen (holotype USNM 38081), from 580 m (39°53'N, 69°47'W) was first illustrated by Johnson (1989). It is here considered to be close to the North Atlantic *Iothia rugosa* (Jeffreys, 1883), family Lepetidae.



Figures 92-95. *Propilidium lissocona* (Dall, 1927). 92. Dorsal, lateral, and ventral views of lectotype. Scale bar = 1.0 mm. 93, 94. Dorsal and lateral views of the protoconch of the lectotype. Scale bars = 50 μ m. 95. Detail of protoconch sculpture. Scale bar = 5 μ m.

"Cocculina" reticulata Verrill, 1885

Cocculina reticulata Verrill, 1885:426; Verrill in Bush, 1893:240, pl. 2, fig. 6; C.W. Johnson, 1934: 66 [listed only]; Abbott, 1974:34 [listed only]; R.I. Johnson, 1989:62 [citation of holotype only].

The holotype (USNM 44832) from 128 m off Chesapeake Bay is here referred to the genus *Propilidium*, family Lepetidae.

"Cocculina" lissocona Dall, 1927
Figures 92-95

Cocculina lissocona Dall, 1927:110; C.W. Johnson, 1934:66 [listed only]; Abbott, 1974:35 [listed only].

We designate and illustrate (figures 92-95) a lectotype (USNM 333472, USFC 2668, 538 m off Fer-

nandina, Florida). Fourteen remaining paralectotypes have been recataloged USNM 860385; two paralectotypes LACM 2741. This is also referred to *Propilidium*, family Lepetidae. It is characterized by its high profile, radial and concentric sculpture producing beads at intersections, smooth protoconch, and weak interior septum. The septum (figure 92) is characteristic of *Propilidium*, being shorter than that of *Tentaaculus*.

Marshall (1985:541) illustrated a Tasmanian species of *Propilidium* and gave further notes on the genus. *Propilidium exiguum* (Thompson, 1844), the type species of *Propilidium*, was treated by Dantart and Luque (1994:303). *Propilidium lissocona* and *P. reticulata* are indistinguishable from the type species on shell characters. We suspect that the type species occurs broadly in the North Atlantic and that the two western Atlantic taxa should be added to the synonymy of the type species.

"Cocculina" rotunda Dall, 1927

Cocculina ? *rotunda* Dall, 1927:115, 121; C.W. Johnson, 1934:66 [listed only]; Abbott, 1974:35 [listed only].

Type material (holotype USNM 108156), from off Fernandina, Florida, has a circular outline and a high, centrally positioned apex. It is here tentatively referred to the genus *Bathysciadium* Dautzenberg & Fischer, 1901 (family Bathysciadiidae).

"Cocculina" superba Clarke, 1960

Cocculina superba Clarke, 1960:1, fig. 1.

Clarke illustrated the animal of this abyssal species from Argentina. Although a radular preparation was not made, characters of the shell and external anatomy are suggestive of the family Lepetidae.

ACKNOWLEDGMENTS

We are grateful to our colleagues who have provided the specimens on which this study is based. Drs. Craig Young (Harbor Branch Oceanographic Foundation, Fort Pierce, Florida), Roland Emson (Kings, College, London), Paul A. Tyler (University of Southampton, United Kingdom), and Mary Rice (Smithsonian Marine Station at Link Port, Fort Pierce, Florida) supplied samples of limpets collected from experimental substrates deployed off New Providence Island, Bahamas. Their work was supported by NSF OCE-9116560 to C.M. Young and NATO Collaborative Research Grant CRG-900628 to C.M. Young, P.A. Tyler, and R.H. Emson. Dr. Charles Messing (Nova University, Dania, Florida) provided samples from his study site at Grand Bahama Island, Bahamas (NSF EAR-9004232). Paula Mikkelsen brought to our attention specimens in the collections of the Harbor Branch Oceanographic Museum. We thank Ms. Susann Braden of the National Museum of Natural History for her assistance with the scanning electron microscopy. Alan Kabat of the same institution helped to verify the status of specimens described by W. H. Dall. We much appreciate the reviews and helpful suggestions provided by Bruce Marshall, Winston Ponder, and Anders Warén.

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