

Figures 29–35. *Cocculina emsoni*, new species. 29. Ventral view of critical-point-dried animal of holotype. Scale bar = 200 μm . 30. Right lateral view of head. Scale bar = 50 μm . 31. Right epipodial tentacle. Scale bar = 50 μm . 32. Anterior margin of oral lappet. Scale bar = 100 μm . 33. Dorsal view of radular ribbon. Scale bar = 20 μm . 34. Detail of rachidian and lateral teeth. Scale bar = 10 μm . 35. Detail of pluricuspid and marginal teeth. Scale bar = 10 μm . co = copulatory organ; ct = cephalic tentacle; et = epipodial tentacle.

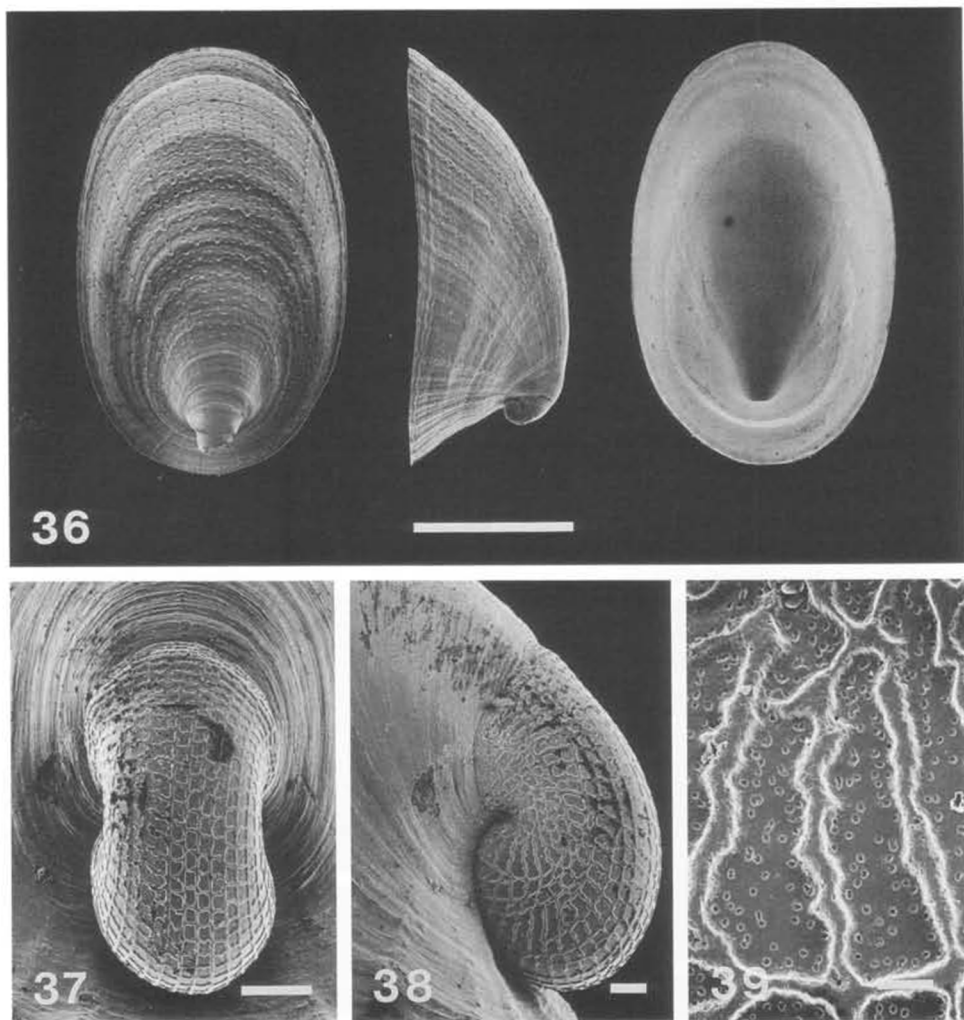
126807) is correctly labelled *C. rathbuni*; it measures 6.7 mm in length and agrees with our figured specimen and that of McLean (1987). We here designate it the lectotype and Martinique the type locality.

Cocculina messingi, new species

Figures 12–24

DESCRIPTION. Shell (figure 12) medium-sized for family (maximum length 5.5 mm), thin, not

eroded, white, periostracum thin. Shell height moderate, that of holotype 0.38 times length. Anterior and posterior slopes faintly convex, lateral slopes more markedly convex. Outline in dorsal view elongate-oval, anterior end slightly narrower than posterior end; aperture not planar, ends raised relative to sides of shell. Apex slightly posterior to center, protoconch at highest point of shell, extending posteriorly. Protoconch length 200 μm , protoconch sculpture of honeycomb pattern, aligned longitudinally in rows. Tip of protoconch immersed in



Figures 36–39. *Coccopigya spinigera* (Jeffreys, 1883). 36. Dorsal, lateral, and ventral views of syntype, USNM 177890. Scale bar = 1.0 mm. 37, 38. Dorsal and lateral views of protoconch of syntype in figure 36. Scale bars = 50 μ m. 39. Detail of protoconch sculpture in figure 38. Scale bar = 5 μ m.

posterior slope of shell. Sculpture of raised concentric growth lines and fine radial striae; concentric sculpture more prominent than radial sculpture, not raised at intersections with radial striae. Shell edge thin and sharp. Muscle scar and anterior pallial attachment scar well marked, inner edge of muscle scar irregular.

Dimensions. Length 5.5, width 3.6, height 2.1 mm (holotype); length 5.3, width 3.8, height 2.1 mm (paratype 1); length 5.4, width 4.0, height 2.4 (paratype 2).

External Anatomy (figures 15–19). Animal translucent white, showing red buccal musculature, with large black eyes. Ventral surface of oral lappet with broad ciliated band (figure 16). Penis bilobed, at tip of right oral lappet, with open seminal groove (fig-

ure 17). Pseuduplicate gill showing long bands of cilia (figure 19). Pair of posterior epipodial tentacles (figure 18).

Radula (figures 20–24). Rachidian broad, tip small, with single cusp; first lateral with broad base and three cusps, second lateral narrow, with three cusps, third with single cusp. Pluricuspid long and broad with large central denticle, one smaller denticle on outer and two on inner side. Marginals similar in size.

TYPE LOCALITY. South of Settlement Point, Grand Bahama Island, Bahama Islands (26°37'31"N, 78°58'56"W), 412 m, on pencil-sized piece of wood along with *Notocrater houbrieki*, new species.

TYPE MATERIAL. Three specimens from type locality, collected by Dr. Charles Messing, using

deep-submersible *Johnson-Sea-Link II*, dive 2335, 18 May 1992. Holotype USNM 860353, paratype 1 USNM 860354, paratype 2 LACM 2735.

REMARKS. This species differs from *C. rathbuni* as treated above in its coarser concentric sculpture, less prominent radial sculpture, and the presence of prominent black eyes. Eyes have not previously been reported in any species of *Cocculina*.

ETYMOLOGY. The name honors the collector, Charles Messing of Nova University, Dania, Florida.

Cocculina emsoni, new species

Figures 25–35

DESCRIPTION. Shell (figure 25) small for family (maximum length 3.3 mm), thin, not eroded, white, periostracum thin. Shell height moderately high, that of holotype 0.48 times length. Anterior slope convex, posterior slope nearly straight, lateral slopes slightly convex. Outline in dorsal view elongate-oval, anterior end with keeled projection producing concave area close to tip on both sides, posterior with two projecting keels, forming single concave embayment in outline. Anterior end slightly narrower than posterior end; aperture not planar, ends raised relative to sides of shell except that the anterior and posterior keeled projections extend downward. Apex posterior to center, situated at $\frac{2}{3}$ shell length from anterior end. Protoconch below highest point of shell, extending posteriorly. Protoconch length 205 μm , protoconch sculpture of honeycomb pattern, with raised ridges forming irregular hexagons (figures 26, 27). Surface within the netted area of protoconch finely pitted (figure 28). Tip of protoconch immersed in posterior slope of shell. Sculpture of irregular concentric growth lines and raised radial ribs; secondary radial ribs arising after shell length of 1.5 mm attained. Midline of anterior slope with sharply raised anterior ridge on which there are secondary ribs; posterior slope with two raised keels, between which there are secondary ribs. Shell edge thin and sharp; interior with grooved areas corresponding to strong anterior ridge and two posterior ridges.

Dimensions. Length 3.3, width 1.8, height 1.6 mm (holotype).

External Anatomy (figures 29–32). Penis simple, derived at base of right oral lappet (figure 30); epipodial tentacles and pseudoplicated gill present.

Radula (figures 33–35). Rachidian broad, basal outline hidden, tip with main cusp and two small lateral cusps; first and second laterals with three cusps on outer edge, third lateral with single cusp; pluricuspid broad, with long main cusp and inner and outer lateral cusps. Marginals similar in size.

TYPE LOCALITY. Off Southwest Reef, New Providence Island, Bahamas (24°54'04"N, 77°33'14"W), 518 m on palmetto fronds. Further details will be provided in a forthcoming paper by R. Emson, C.M. Young, and P.A. Tyler.

TYPE MATERIAL. Three specimens retrieved from palmetto fronds placed on bottom for larval settlement experiments by R. Emson, C.M. Young, and P.A. Tyler, *Johnson-Sea-Link II*, dive 2317, 9 May 1992. Holotype USNM 860355, 1 paratype USNM 860356, 1 paratype LACM 2736.

REMARKS. *Cocculina emsoni* is remarkable for its strong anterior ridge and two posterior ridges. *Cocculina angulata* Watson, 1886, from the Philippines (Watson, 1886:30, pl. 4, fig. 2a–c) has an anterior shell ridge but lacks the two posterior ridges. Direct comparisons of specimens should be made before commenting further about a possible affinity between the two species. For *C. emsoni* it is a reasonable supposition that the two posterior ridges serve to shield the two posterior epipodial tentacles, but the function of the anterior ridge is unknown.

ETYMOLOGY. Named after Roland Emson of King's College London, whose experimental work on larval settling brought this species to light.

Genus *Coccopygia* Marshall, 1986

Replacement name for *Coccopygia* Dall, 1889, not Reichenbach, 1882. Type species by monotypy: *Cocculina spinigera* Jeffreys, 1883.

DIAGNOSIS. Protoconch with reticulate sculpture (as in *Cocculina*); periostracum thick, hirsute; teleoconch sculpture of radial ribs and pit rows; copulatory organ branched from right cephalic tentacle.

REMARKS. The type species is represented in the northeastern and northwestern Atlantic; a second western Atlantic species is described herein. There are no species known in the eastern Pacific. Marshall (1986) treated five living and three fossil species from New Zealand.

Coccopygia spinigera (Jeffreys, 1883)

Figures 36–39

Cocculina spinigera Jeffreys, 1883:393, pl. 44, figs. 1–1c; Verrill, 1884:203; Pilsbry, 1890:125, pl. 25, figs. 9, 10 [copy Jeffreys]; Abbott, 1974:34 [not fig. 198].

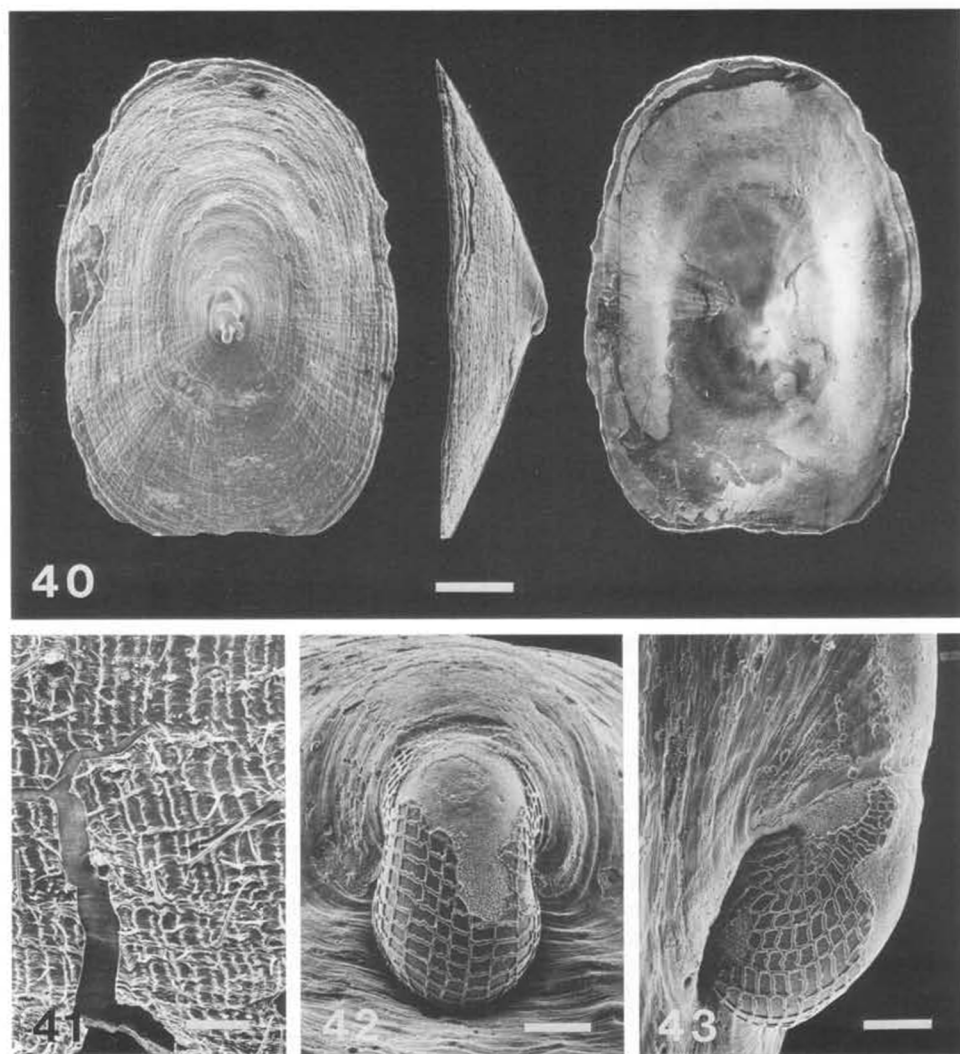
Cocculina (section *Coccopygia*) *spinigera*; Dall, 1889:348, pl. 31, figs. 7–9.

Cocculina (*Coccopygia*) *spinigera*; Thiele, 1909: 15, pl. 3, figs. 9, 10.

Coccopygia spinigera; Marshall, 1986:512, figs. 2B, 3D, E, 12C; Waren, 1991:80, fig. 19A, B, D, F, H; Dantart and Luque, 1994:278, figs. 1–6, 15, 16, 18.

REMARKS. We illustrate the shell and protoconch of a syntype (USNM 177890) from the Outer Hebrides, Scotland, Triton sta. 10 (59°40'N, 7°21'W), 943 m. The fine pits that occur within the net pattern on the protoconch are illustrated here for the first time.

Coccopygia spinigera occurs in the northeastern and northwestern Atlantic south to North Carolina.



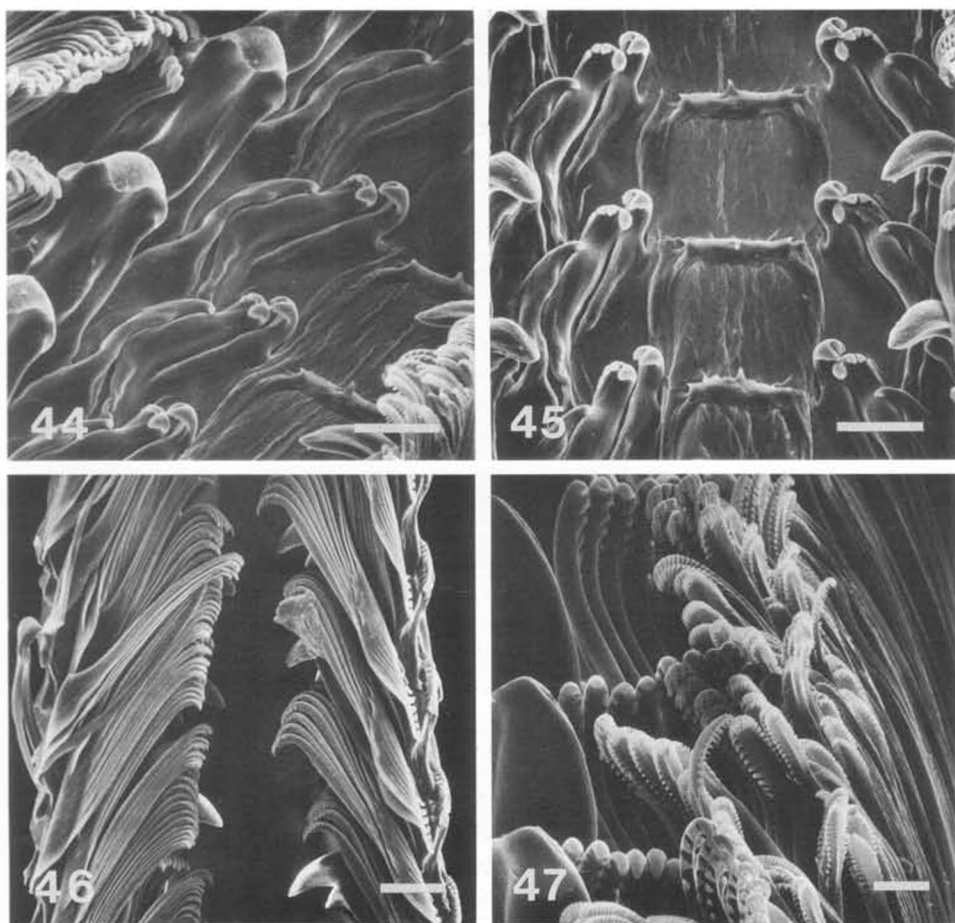
Figures 40–43. *Coccopigya mikkelsenae*, new species. 40. Dorsal, lateral, and ventral views of holotype, periostracum removed. Scale bar = 1.0 mm. 41. Detail of periostracum at shell edge of paratype 1. Scale bar = 100 μ m. 42, 43. Dorsal and lateral views of protoconch of holotype. Scale bars = 50 μ m.

Dall's (1889:pl. 31, fig. 8) original illustrations were based on specimens received from Jeffreys and included a drawing of the copulatory organ. Marshall (1986) included SEM views of the shell and radula and a drawing of the copulatory organ, also based on a syntype specimen. Dall (1889:fig. 9) showed a broad rachidian with three similar-sized cusps, but in Marshall's preparation the rachidian does not show, suggesting that it folded under in drying. Waren (1991) gave SEM views of shells from Iceland. Dantart and Luque (1994) illustrated material from Spain and added a species described by Dautzenberg and Fischer to the synonymy.

Coccopigya mikkelsenae, new species

Figures 40–47

DESCRIPTION. Shell (figure 40) medium-sized for family (maximum length 6.2 mm), thin, not eroded, white under thick periostracum bearing long hairs (figure 41). Shell height low, that of holotype 0.27 times length. All slopes straight to slightly convex. Outline in dorsal view elongate-oval, sides nearly parallel; aperture not planar, sides raised slightly relative to ends. Apex slightly posterior to center, slightly below level of highest point of shell, protoconch extending posteriorly. Protoconch length 210 μ m, protoconch sculpture of honeycomb, nearly rectangular net pattern, aligned longitudinally in rows (figures 42, 43). Tip of protoconch immersed in posterior slope of shell. Sculpture of irregular concentric growth lines and faint radial striae, and scattered, radially aligned pits. Radial and concentric sculpture of equal prominence.



Figures 44–47. *Coccopigya mikkelsenae*, new species. 44. Oblique view of rachidian, lateral, and pluricuspid teeth. Scale bar = 20 μ m. 45. Dorsal view of rachidian, lateral, and pluricuspid teeth. Scale bar = 20 μ m. 46. Dorsal view of radular ribbon. Scale bar = 25 μ m. 47. Detail of marginal teeth. Scale bar = 5 μ m.

Shell edge thin and sharp. Muscle scar and anterior pallial attachment scar well marked.

Dimensions. Length 6.2, width 4.7, height 1.7 mm (holotype, posterior end broken); length 6.9, width 4.8, height 2.0 mm (paratype).

External Anatomy. Animal lacking pigmented eyes, penis branching off base of right tentacle, tip of penis with single, tapering lobe. No gill evident, but specimens poorly preserved (body not examined with SEM).

Radula (figures 44–47). Rachidian broad, upper edge broad, small pointed cusp emerging from upper edge; first lateral with secondary cusp on outer edge, second lateral with four cusps, third lateral with single cusp and long shaft. Pluricuspid broad, with large main cusp and inner and outer secondary cusps. Marginals similar in size.

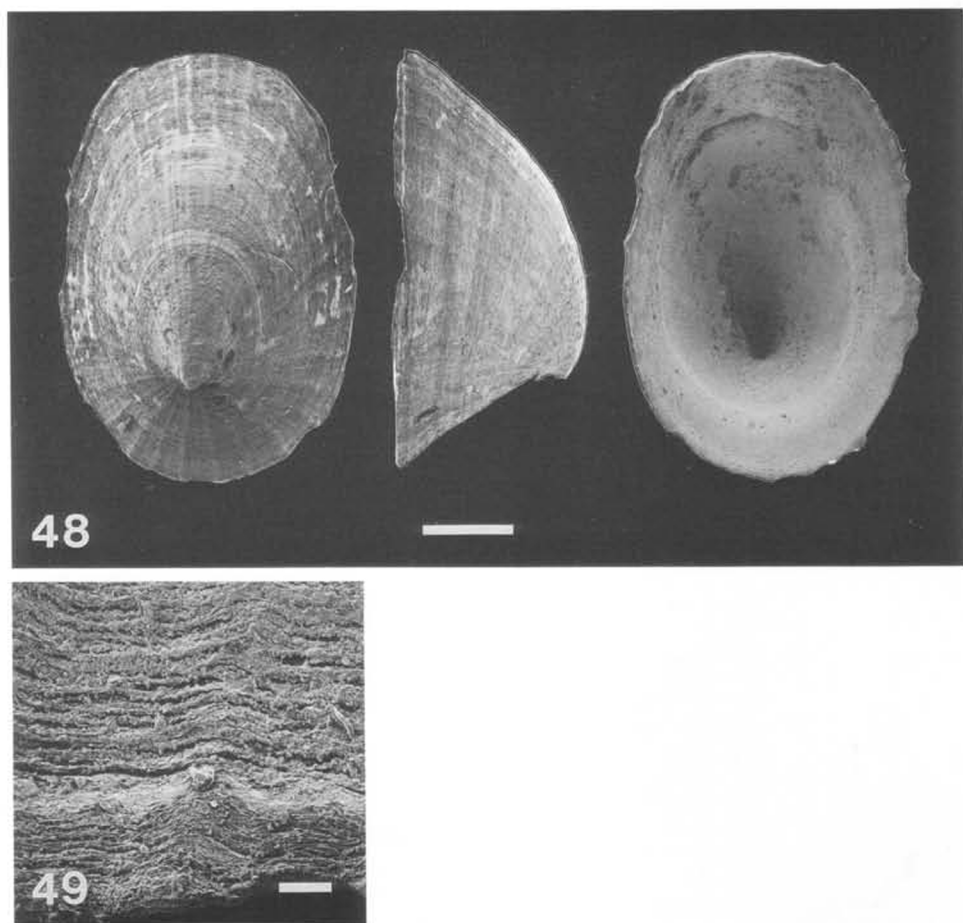
TYPE LOCALITY. Off Chateau Belair Bay, St. Vincent, Lesser Antilles (13°10.5'N, 61°15.5'W), 421 m, on wood, with *Fedikovella beanii*.

TYPE MATERIAL. Two specimens from type locality collected by John E. Miller on deep-submersible *Johnson-Sea-Link II*, dive 1742, 23 April 1989. Holotype, USNM 860357, 1 paratype HBOM 065:03786. Most of the periostracum on the holotype was removed for SEM preparation. The unfigured paratype was also coated for SEM, and the periostracum is in the process of flaking off.

REMARKS. *Coccopigya mikkelsenae* meets the criteria of the genus in having a coarse periostracum with long hairs, corresponding pits along the radial ribs, and the penis branched at the base of right tentacle. The rachidian tooth is broader than that of other members of the family treated here. The single small cusp of the rachidian is also unlike that of other species treated by Marshall (1986).

On shell characters, *Coccopigya mikkelsenae* differs from *C. spinigera* in its lower profile and more central apex.

ETYMOLOGY. We are pleased to name this



Figures 48, 49. *Coccocrater pocillum* (Dall, 1890). 48. Dorsal, lateral, and ventral views of lectotype (USNM 87586). Scale bar = 1.0 mm. 49. Detail of periostracum at shell edge of lectotype. Scale bar = 100 μ m.

species after Paula Mikkelsen of the Harbor Branch Oceanographic Museum, Fort Pierce, Florida, who brought the material to our attention.

Genus *Coccocrater*
Haszprunar, 1987

Type species by original designation: *Cocculina radiata* Thiele, 1903.

DIAGNOSIS. Protoconch with reticulate sculpture, periostracum smooth; teleoconch sculpture of fine radial ribs and growth lines; copulatory organ branched from right cephalic tentacle.

REMARKS. This genus differs from *Coccoligya*, which also has the copulatory organ as a branch from the base of the right cephalic tentacle, in lacking the hirsute periostracum.

Haszprunar's (1987:321) diagnosis states that the copulatory organ is "associated with the right cephalic tentacle." McLean (1987:330) incorrectly stated "the enlarged right cephalic tentacle serving as the penis."

The genus is represented in the eastern Pacific by *Coccocrater agassizii* (Dall, 1908), treated by Haszprunar (1987) and McLean (1987).

Coccocrater pocillum
(Dall, 1890),
new combination
Figures 48, 49

Cocculina (*Coccoligya*) *pocillum* Dall, 1890:340; Thiele, 1909:16.

REMARKS. This previously unfigured species was described from 1600 m off Tobago. The periostracum lacks hairs (figure 49) and each specimen had a "well marked verge extending from the right tentacle," a character combination that agrees with *Coccocrater*. Dall also reported that the species lacks epipodial filaments. A lectotype shell (USNM 87586) is designated and illustrated here (length 4.65, width 3.45, height 2.5 mm). The remaining paralectotype specimen is recataloged as USNM 860386 (length 5.5, width 3.8, height 3.0 mm).



Figure 50. *Coccocrater portoricensis* (Dall & Simpson, 1901). Dorsal, lateral, and ventral views of holotype (USNM 160496). Scale bar = 1.0 mm.

Coccocrater portoricensis
(Dall & Simpson, 1901),
new combination

Figure 50

Cocculina portoricensis Dall and Simpson, 1901:
440, pl. 53, figs. 18, 19; Abbott, 1974:35, fig. 202.
Cocculina (Coccopigya) portoricensis; Thiele, 1909:
16.

REMARKS. This species of 12 mm length from 566 m off San Juan Harbor, Puerto Rico, does not have a hirsute periostracum and was said to have a "large verge projecting from the right tentacle" and the "ctenidium carried over so that it appears to spring from the right side of the animal." Again, this is a character combination in agreement with *Coccocrater*. The species remains known only from the holotype (USNM 160496), reillustrated here (figure 50).

Genus *Fedikovella* Moskalév, 1976

Type species by original designation: *Fedikovella caymanensis* Moskalév, 1976.

DIAGNOSIS. Protoconch with concentric sculpture; periostracum smooth; teleoconch sculpture clathrate, apex overhanging concave posterior slope; cephalic tentacles equal in size.

REMARKS. Moskalév included *Cocculina beanii* Dall, 1882, in *Fedikovella* because of the small rachidian tooth figured by Dall, and the Indo-Pacific *C. capulus* Thiele, 1925, again citing the small rachidian tooth figured by Thiele. We hesitate to accept the inclusion of the latter species. Moskalév's figure of the radula of the type species was based on phase contrast optical microscopy; tooth bases

are not shown and the resolution is sufficient only to place the species in Cocculinidae rather than Pseudococculinidae.

This genus can be accepted on the distinction provided by the peculiar undulating, concentric sculpture of the protoconch shown here (figures 52, 53) for *Fedikovella beanii* (Dall, 1882). However, this sculpture is not radically different from the honeycomb pattern of most cocculinid genera, from which the difference may be only that the longitudinal connections of the net are not formed. Moskalév's (1976:pl. 2, fig. 2) figure of the type species *Fedikovella caymanensis*, which purported to show the protoconch, was instead an enlarged view of the clathrate sculpture of the earliest teleoconch, as also noted by Marshall (1986:508).

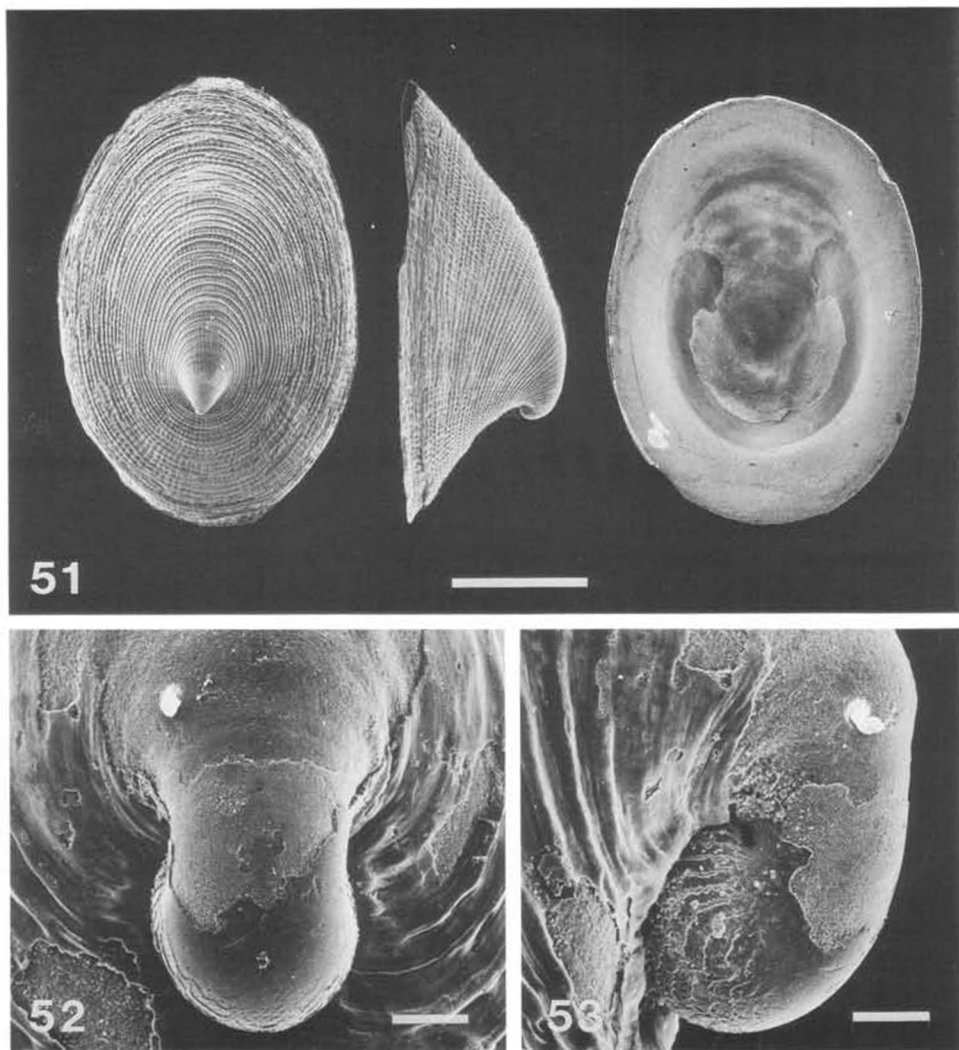
There is still no published information about the internal anatomy or whether there is a copulatory appendage of any kind. Dall (1889:347) believed that all four specimens of "*Cocculina*" *beanii* that he examined were females, as it was then not understood that all cocculinids are simultaneous hermaphrodites. However, B. Marshall (pers. comm.) has examined paratype material of *F. beanii* and noted a copulatory organ on the right behind the base of the right cephalic tentacle.

There are no eastern Pacific species allocated to this genus.

Fedikovella caymanensis Moskalév, 1976

Fedikovella caymanensis Moskalév, 1976:62, fig. 1, pl. 2, figs. 1, 2.

Moskalév's description was translated by G.V. Shkurkin in a privately circulated "reprint" dated December 1978. That translation is repeated here,



Figures 51-53. *Fedikovella beanii* (Dall, 1882). 51. Dorsal, lateral, and ventral views of shell (USNM 860358). Scale bar = 1.0 mm. 52, 53. Dorsal and lateral views of protoconch of specimen in figure 51. Scale bars = 50 μ m.

altered to place it in telegraphic style and with terminology slightly changed in places to conform to that used elsewhere in this paper:

Shell small, high, thin, apex projecting to posterior margin or beyond. Protoconch with concentric sculpture, protoconch pressed against posterior slope of shell. Anterior slope convex, posterior slope short, straight. Aperture elliptical, margin whole. Color opaque cream; periostracum well developed. Sculpture of intersecting radial and concentric ribbing, forming nearly equilateral quadrangles; radial ribs wider than concentric ribs; ribbing worn in places. Shell interior yellowish white, exterior sculpture showing through. Rachidian tooth denticulate, similar to first to third lateral teeth; first and second lateral teeth denticulate, pluricuspid

tooth largest, having three denticles. Cephalic tentacles equal in size; two posterior epipodial tentacles present. Shell length 1.43-4.10 mm.

TYPE LOCALITY. Western end of Cayman Trough (19°00'6"N, 80°29'5"W), 6800 m. 33 specimens on wood, collected with research vessel *Akademik Kurchatov*, cruise 14, sta. 1242A, 2.5 m Sigsbee dredge, 20 March 1967. Additional locality: east end Cayman Trough (19°38'5"N, 76°37'8"W), sta. 1267, 6740-6780 m, 5 specimens on various vegetative remains.

REMARKS. Moskaliev's illustrations do not include a full view of the shell nor is there any indication of actual shell height. Most Cocculinidae occur at continental shelf and slope depths, and this species is unusual in its abyssal occurrence.