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Bryozoans from Bali, Lombok, and Komodo

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ABSTRACT

Collections from three very shallow-water (3 m or less) Indonesian reef localities yielded 33 species of cheilostome bryozoans. Five species: *Thalamoporella komodoensis, Crepidacantha carsioseta, Fenestrulina harmeri, Celleporaria sibogae,* and *Drepanophora verrucosa* are described as new. Five species: *Exechonella brasiliensis, Watersipora edmondsoni, Parasmittina hastingsae, Rhynchozoon rostratum,* and *Rhynchozoon verruculatum* are reported for the first time from the Indonesian region. Many of the species found have wide distributions: 79 percent are recorded from elsewhere in the Indo-West Pacific, 30 percent from the Red Sea, and 28 percent from the Caribbean. This work provides further documentation of the diversity and broad ecological tolerances of reef-associated cheilostome bryozoans.

INTRODUCTION

From 1899 to 1900, the Dutch, under the direction of Dr. Max Weber, carried out the great collections of the *Siboga* expedition. The bryozoans of this expedition were studied by Sidney F. Harmer in a series of four monographs over the course of his career. The first part, on the Entoprocta, Ctenostomata, and Cyclostomata, was published in 1915. The last part, on the Ascophora, was compiled from his uncompleted drafts and notes by Anna B. Hastings and published posthumously in 1957. In view of this opus on bryozoans of the Indonesian region one might question the need for further studies, but, in fact, very little of the *Siboga* material was taken from reef environments. Thus, the collections described below, though small, do add to our knowledge of the systematics and distribution of reef-associated bryozoans. In addition, many of these species have never been studied and illustrated by SEM. The study of the fine structure of bryozoan skeletons is becoming increasingly important to bryozoan taxonomy, and we expect the present paper to contribute to this cataloging process.

STUDY AREAS

Figure 1 shows the location of the three areas where bryozoans were collected. Locality 1 was at Sanur on the southeast coast of the island of Bali, facing Badung Strait. Bryozoans were collected from coral rubble in 2–3 m depths. A strong current scoured the reef in the area collected, the corals had flattened or encrusting shapes, and the pieces of dead coral that remained in scour holes in the reef rock were large and heavy. It appeared to be a relatively high-energy environment.

Locality 2 was 90 km east of Sanur on the

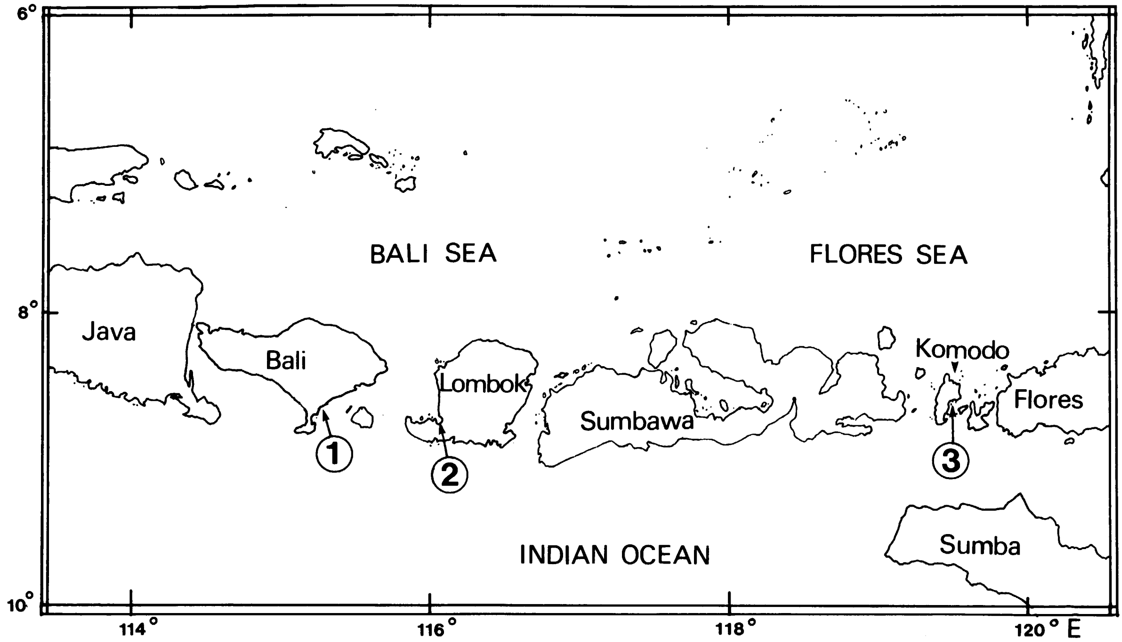


FIG. 1. Map of portion of the Indonesian archipelago showing locations from which bryozoans were collected. (1) Sanur, Bali. (2) Lambuan, Lombok. (3) Komodo.

island of Lombok in the Lesser Sunda Islands. The reef was located just outside the harbor at Lembar, on the southwest coast of Lombok. The bryozoans were collected in a back-reef area, on coral rubble from the compacted platform of rubble that formed the back part of the reef flat (depths 0.5–1.5 m). This mass of rubble bordered a back-reef lagoon, with sand-bottom and scattered seagrass beds. It constituted a sheltered back-reef environment.

The third locality was approximately 380 km east of Lembar on the east coast of the island of Komodo, in the bay adjacent to the Komodo Dragon refuge. Here the reef began directly off the beach with leather corals, nephteids, and other soft corals in the shallowest water, and scleractinians appearing in slightly deeper water. Bryozoans were collected from coral rubble in depths of 1.5–2.0 m. This locality, though open to the water of the bay, was somewhat sheltered by the bay itself.

METHODS AND MATERIALS

Encrusted coral rubble was rinsed in fresh water, trimmed to remove excess substratum, and air-dried in the field. At the AMNH laboratory, the bryozoan specimens were identified and measured with a dissecting microscope. Measurements included standard features: zooid length (Lz), zooid width (Wz), orifice length (Lo), orifice width (Wo), ovicell length (Lov), ovicell width (Wov), avicularium length (Lav), avicularium width (Wav), as well as other measurements necessary for a particular species. Figure 2 shows how each of these measurements was taken.

At least one colony of each species was examined under the scanning electron microscope. Specimens were prepared for the SEM by soaking in bleach to remove chitinous parts and tissue. The specimens were rinsed in water, cleaned ultrasonically, and dried before they were sputter-coated with gold or platinum.

It seemed immediately apparent that the scanning electron microscope offered a better way to illustrate bryozoan specimens. Bryozoan skeletal (and more rarely chitinous) parts had traditionally been illustrated by pen-and-ink drawings or, in the 20th century, by photographs. An argument can be made that well-executed drawings (such as those of Peter Hayward) are still the best way to illustrate species, for they can survive photocopying,

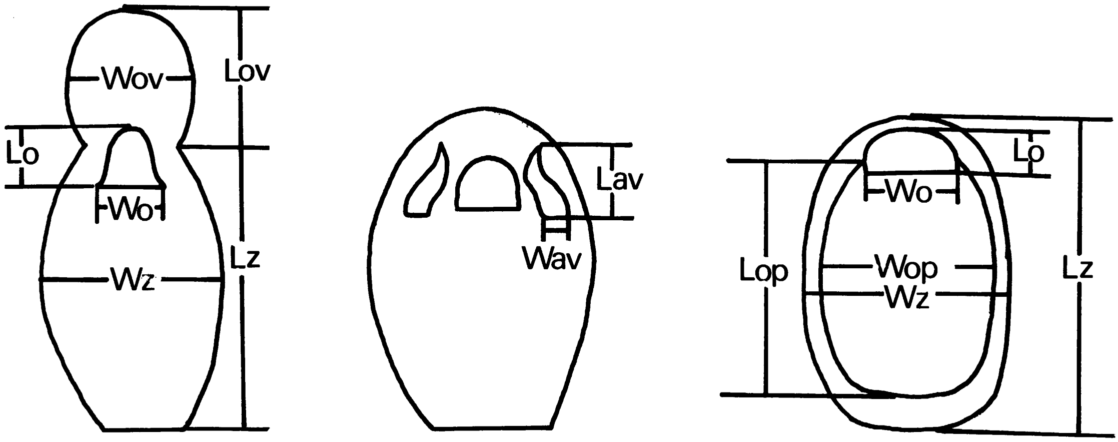
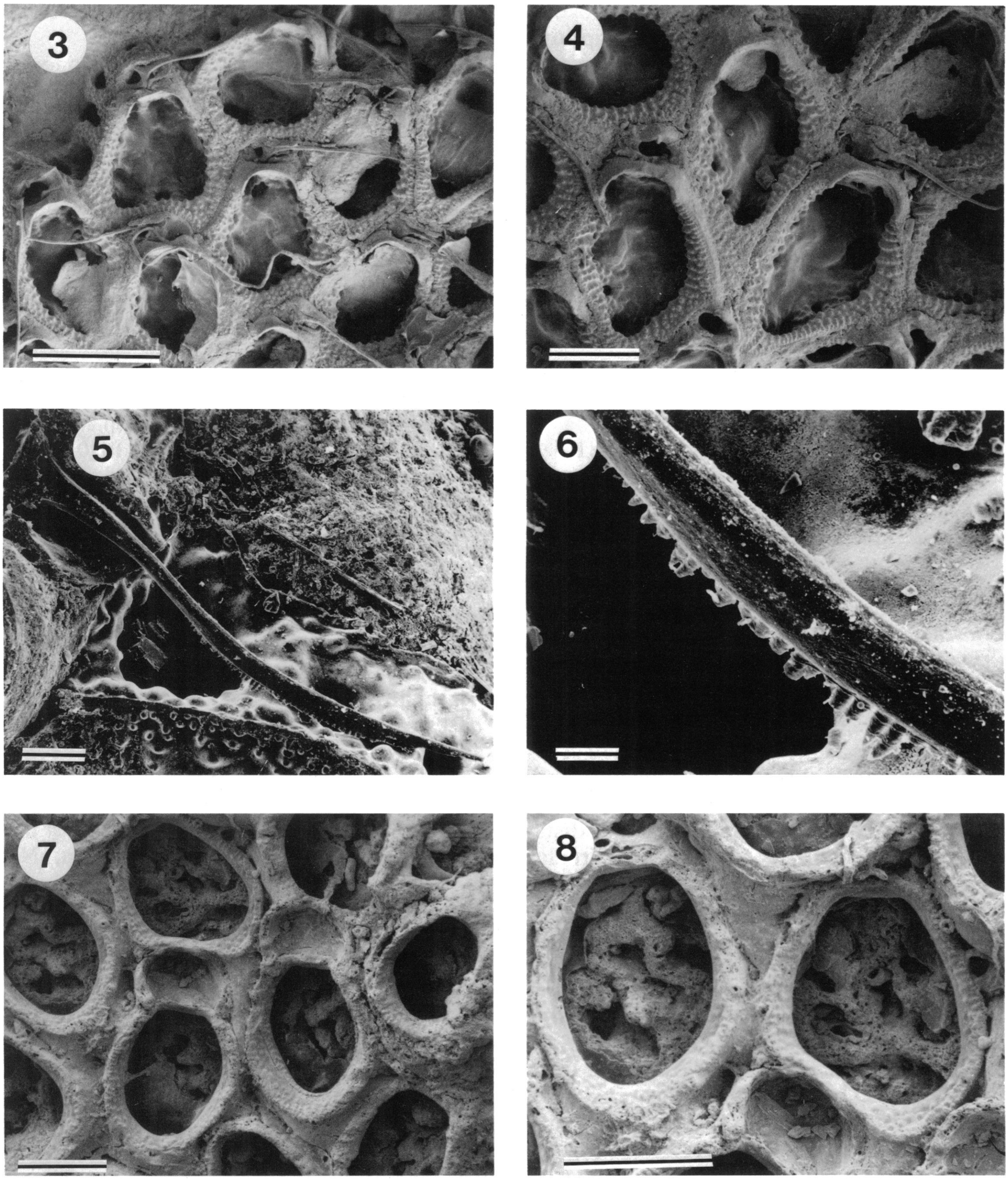


FIG. 2. Diagrams of bryozoan zooids to show way in which each measurement was taken. Lz = zooid length, Wz = zooid width, Lo = orifice length, Wo = orifice width, Lov = ovicell length, Wov = ovicell width, Lav = avicularium length, Wav = avicularium width, Lop = opesia length, Wop = opesia width.

thus extending the useful life of the monograph in which they are included past the expiration of reprints, editions, and even authors! However, those taxonomists not talented enough to do their own illustration and not wealthy enough to pay an illustrator, but who wanted to objectively portray the colonies they studied, turned as soon as possible to photography. Unfortunately, the small size of bryozoan zooids means that pictures taken at the high magnifications (50–60×) necessary for identification come close to the limits of resolution of the dissecting microscope. Even the best photomicrographs are not entirely in focus due to the limited depth of field at those magnifications, and many monographs have been made less useful by the poor quality of their illustration. This is especially true of the early photographs like those in papers by Canu and Bassler (e.g., 1924, 1928a, 1928b, 1929), where the details of orifices and avicularia were blacked in with ink (and where the structure drawn in was sometimes what the authors wished to see rather than what was on the specimen). While SEM also has limits to depth of focus, with SEM "portraits" of groups of zooids taken at 60–100× all details of zooids are in focus, even when the colony surface is (as is generally the case) not perfectly even.

More and more, bryozoologists have come to realize the importance of SEM as a tool in the study of specimens. It permits us to look at skeletal structure (and the structure of chitinous parts as well) at a new level of resolution. In this regard we are at the point reached some years ago by entomologists and protozoologists, for example. With the SEM we are able to see the characters traditionally considered most important in bryozoan systematics—orifice, frontal wall structure, pore patterns, avicularia—in detail never before possible. Multiple views are necessary to illustrate different polymorphs and ontogenetic and astogenetic stages which can also furnish taxonomic characters. In addition, we are finding new characters, both internal (muscle scars, pores, spines, hooks) and external (fine structure of frontal wall texture, pores, joints between zooids, orificial condyles and sinuses, avicularian mandibles, and opercula) which we believe will be important in revealing the still tangled phylogenetic relationships in the group.

In our species descriptions we have attempted to include as much fine structural detail as we could obtain through SEM study. We have also attempted to illustrate as many of these characters as possible. This means that we have included several illustrations per species, but we believe that this is necessary if we are to take advantage of all characters available to us. Once we have achieved a better understanding of bryozoan structure at this level, it may once again be sufficient to illustrate a species less extensively, but it



FIGS. 3–8. **3.** *Cranosina coronata,* Bali (AMNH 583), growing edge of colony showing marginal pore chambers and transverse avicularia. Scale = 400 μm. **4.** *C. coronata,* zooids and avicularia. Scale = 200 μm. **5.** *C. coronata,* avicularian mandible. Scale = 40 μm. **6.** *C. coronata,* scalloped edge of avicularian mandible. Scale = 10 μm. **7.** *Parellisina curvirostris,* Komodo (AMNH 584), zooids and ovicells. Scale = 200 μm. **8.** *P. curvirostris,* close-up of zooids to show marginal spine bases. Scale = 200 μm.

will take much more study before that time comes.

We have included a glossary of bryozoan terminology used in this paper. We hope this will make our use of terms clear to bryozoan workers and that it will make our descriptions more accessible to nonspecialists interested in identifying reef faunas.

SYSTEMATIC ACCOUNTS

ORDER CHEILOSTOMATA BUSK, 1852

SUBORDER ANASCA LEVINSEN, 1909

SUPERFAMILY MEMBRANIPOROIDEA BUSK, 1854

FAMILY CALLOPORIDAE NORMAN, 1903

Genus *Cranosina* Canu and Bassler, 1933

Cranosina coronata (Hincks), 1881

Figures 3–6

Membranipora coronata Hincks, 1881, p. 147; 1882, p. 118. Thornely, 1907, p. 186.
Membranipora hastilis Kirkpatrick, 1890a, p. 18. Thornely, 1905, p. 110.
Biflustra coronata MacGillivray, 1891, p. 79.
Setosellina coronata Harmer, 1926, p. 265.
Cranosina coronata Osburn, 1940, p. 363.

DESCRIPTION: The colony is encrusting on coral rubble. Zooids are irregularly ovoid to subhexagonal; a narrow densely beaded cryptocyst surrounds the oval to triangular opesia, with beads tending to be aligned radially. Deep grooves separate zooids. At the distal end of each zooid, a smooth semicircular gymnocystal hood surrounds the operculum. No ovicells are present in our specimens. Harmer (1926) suggests that they are probably lacking. Located at the distal edge of most zooids are transversely directed avicularia. These have a spoutlike rostrum with two large pointed condyles to support the setiform mandible. The mandible (fig. 3) is long, slightly curved (some of those illustrated have been distorted by the drying process), and edged with finely scalloped serrations (fig. 4).

Measurements

	Range	Mean	N
Lz	0.504–0.558	0.536	5
Wz	0.324–0.414	0.364	5
Lo	0.072–0.090	0.083	5
Wo	0.144–0.180	0.171	5
Lop	0.342–0.432	0.382	5
Wop	0.216–0.270	0.241	5
Lav	0.126–0.180	0.155	5
Wav	0.054–0.090	0.076	5
Lm	0.342–0.486	0.434	10

OCCURRENCE: One colony was collected at Sanur.

DISTRIBUTION: Torres Strait, Indonesia, W. Australia, Ceylon, Indian Ocean, Macclesfield Bank, China Sea, Venezuela.

Genus *Parellisina* Osburn, 1940

Parellisina curvirostris (Hincks), 1862

Figures 7, 8

Membranipora curvirostris Hincks, 1862, p. 29.
Ellisina curvirostris Harmer, 1926, p. 228. Hastings, 1930, p. 711.
Callopora curvirostris Canu and Bassler, 1928b, p. 32.
Parellisina curvirostris Osburn, 1940, p. 361. Cheetham and Sandberg, 1964, p. 1020. Cook, 1968, p. 156. Ryland and Hayward, 1977, p. 102. Winston, 1984, p. 7.

DESCRIPTION: The colony is encrusting on coral. Zooids vary from ovoid to subtriangular in shape and have a beaded cryptocyst and a smooth gymnocyst which is widest proximally and very narrow laterally, with the opesia taking up most of the surface beneath the frontal membrane. Occasional spine bases can be seen on the inner edges of the gymnocyst of zooids. A groove marks the mural rims of adjacent zooids. The ovicell in this species is globular with a beaded texture like that of the cryptocyst. The ovicells of the specimen found (fig. 5) were broken. No avicularia were present in this colony.

Measurements

	Range	Mean	N
Lz	0.360–0.468	0.425	5
Wz	0.324–0.378	0.349	5
Wo	0.090–0.126	0.108	5
Lov	0.144	0.144	2
Wov	0.180–0.198	0.189	2
Lop	0.216–0.324	0.292	5
Wop	0.216–0.270	0.230	5

DISCUSSION: The condition of the colony and the lack of avicularia make positive identification difficult, but zooid morphology, especially the occurrence of distal and lateral spine bases, indicates that it belongs to *Parellisina curvirostris*. Zooid measurements are in the range for the species.

OCCURRENCE: Komodo—one worn dead colony was found.

DISTRIBUTION: Britain, East and West Atlantic, Mediterranean, Caribbean, Indian

Ocean, W. Pacific, Galapagos Islands, Singapore.

SUPERFAMILY BUGULOIDEA GRAY, 1848

FAMILY BUGULIDAE GRAY, 1848

Genus *Caulibugula* Verrill, 1900

Caulibugula mortenseni (Marcus), 1925

Figures 9, 10

Stirpariella mortenseni Marcus, 1925a, p. 153; 1925b, p. 37.
Caulibugula mortenseni, Harmer, 1926, p. 465. Cook, 1968, p. 163.

DESCRIPTION: The colony is erect, with a jointed stalk and biserial branches. Zooids are moderately large, narrowing proximally, with sharply pointed outer distal corners and a membranous frontal surface (fig. 9). About two-thirds of the way down the outer edge of each zooid is a short, stout peduncle bearing a bird's head avicularium. The avicularium is slightly longer than the width of the zooids. It has an elongated head and a strongly curved beak (fig. 10). No ovicells were present on our specimen. In zooids of mature colonies, a pedunculate ovicell occurs attached to the distal corner of the opesia.

	Measurements		
	Range	Mean	N
Lz	0.540–0.630	0.598	5
Wz	0.234–0.306	0.266	5
Lop	0.378–0.450	0.421	5
Wop	0.198	0.198	5
Lav	0.360–0.378	0.369	2
Wav	0.180	0.180	2

DISCUSSION: Our specimen appears to be a very young colony of *Caulibugula mortenseni*, previously described from the Sunda Strait and Java Sea. The colony has only one branch bifurcation (type 5 of Harmer, 1923) and lacks the elongate kenozooid stalk, but zooid and avicularian morphology correspond extremely well with those of the specimen illustrated by Harmer (1926, pl. XXXIII, figs. 19–22). In this species of *Caulibugula*, spines are lacking or vestigial and zooids have a shape very similar to those of *Bugula neritina*.

OCCURRENCE: Komodo—one very small colony was found.

DISTRIBUTION: Indonesia, West Africa.

FAMILY SCRUPOCELLARIIDAE LEVINSEN, 1909

Genus *Scrupocellaria* Van Beneden, 1845

Scrupocellaria spatulata (D'Orbigny), 1851

Figures 11, 12

Cellularia spatulata D'Orbigny, 1851.
Crisia pilosa Audouin, 1826, p. 241; 1828, p. 71.
Scrupocellaria pilosa Waters, 1913, p. 478.
Scrupocellaria cervicornis Marcus, 1922, p. 425.
Scrupocellaria spatulata Harmer, 1926, pp. 382–384.

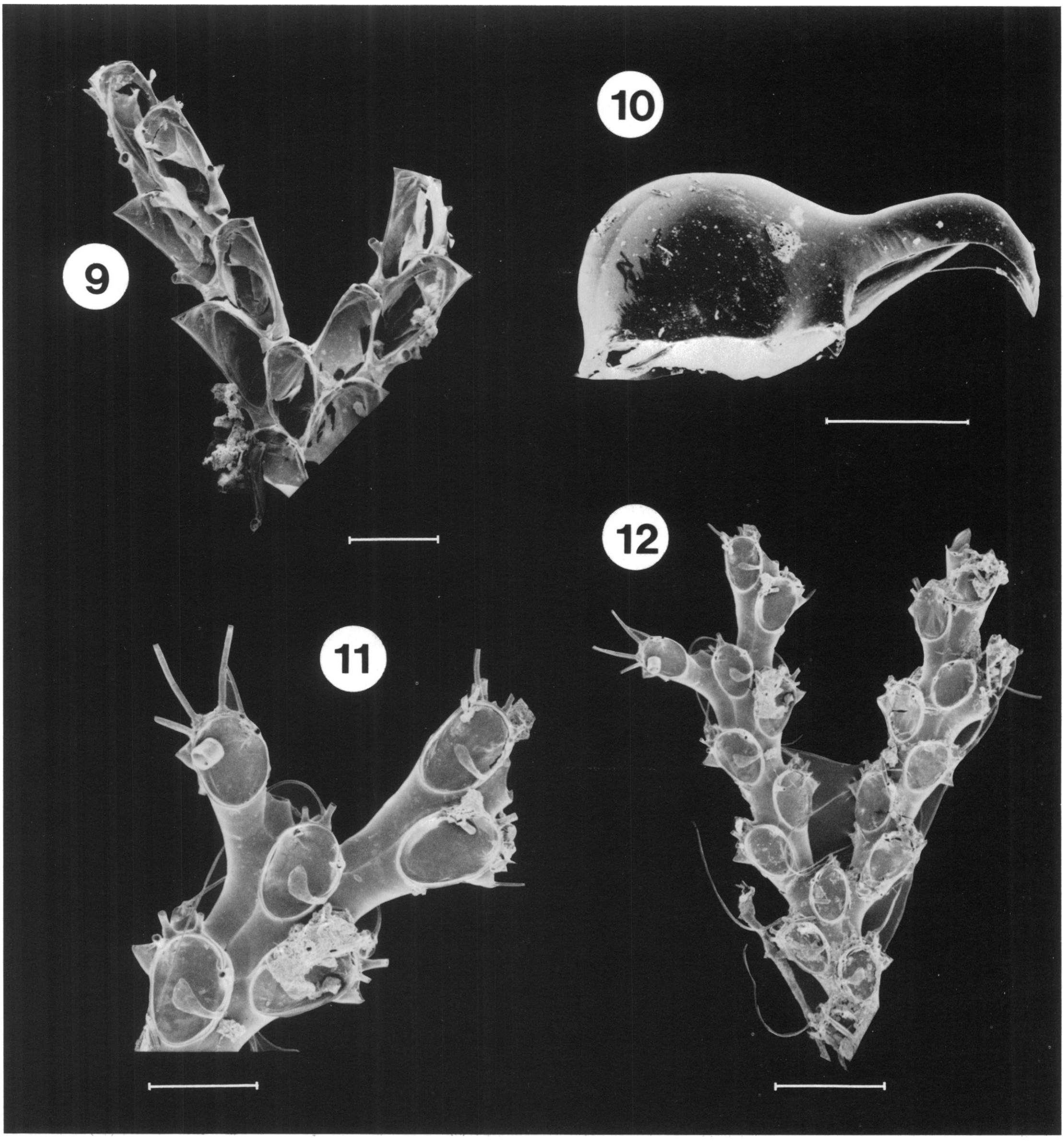
DESCRIPTION: Colonies are erect, biserially branching, and delicate. Zooids are elongate, with the oval opesia occupying only one-half to one-third of the frontal wall; the rest is a smooth proximal gymnocyst. Four to five spines are located at the distal end of each zooid. The scutum, on the proximal inner side of the opesia, is narrow, covering only part of the frontal membranous area. It is slightly flattened and unbranched. Small vibracula with delicate, short, curved setae occur on the basal surface of the colony. Marginal avicularia are located distally on the sides of zooids. They are triangular in shape. Zooids are never more than two across, except at a bifurcation. No ovicells were present on this colony.

	Measurements		
	Range	Mean	N
Lz	0.306–0.360	0.346	5
Wz	0.144–0.180	0.162	5
Lop	0.180–0.234	0.202	5
Wop	0.126–0.144	0.137	5

DISCUSSION: Harmer (1926) placed *Scrupocellaria pusilla* (Smitt, 1872) in the synonymy of this species. However, Osburn (1940) gave reasons, based chiefly on avicularian characteristics, for keeping the two species separate. On the basis of our examination of Caribbean specimens, we agree with Osburn. The specimen of *Scrupocellaria spatulata* in our collection was apparently a young colony. It lacks ovicells and does not possess the giant spatulate marginal avicularia which sometimes occur in this species (e.g., pl. XXVI, fig. 1, in Harmer, 1926).

OCCURRENCE: Komodo.

DISTRIBUTION: Red Sea, Zanzibar, Indonesia.



FIGS. 9–12. **9.** *Caulibugula mortenseni* Komodo (AMNH 585), portion of branch. Scale = 400 μm. **10.** *C. mortenseni,* close-up of avicularium. Scale = 100 μm. **11.** *Scrupocellaria spatulata,* Komodo (AMNH 586), zooids. Scale = 200 μm. **12.** *S. spatulata,* portion of branch. Scale = 400 μm.

SUPERFAMILY MICROPOROIDEA GRAY, 1848

FAMILY THALAMOPORELLIDAE LEVINSEN, 1909

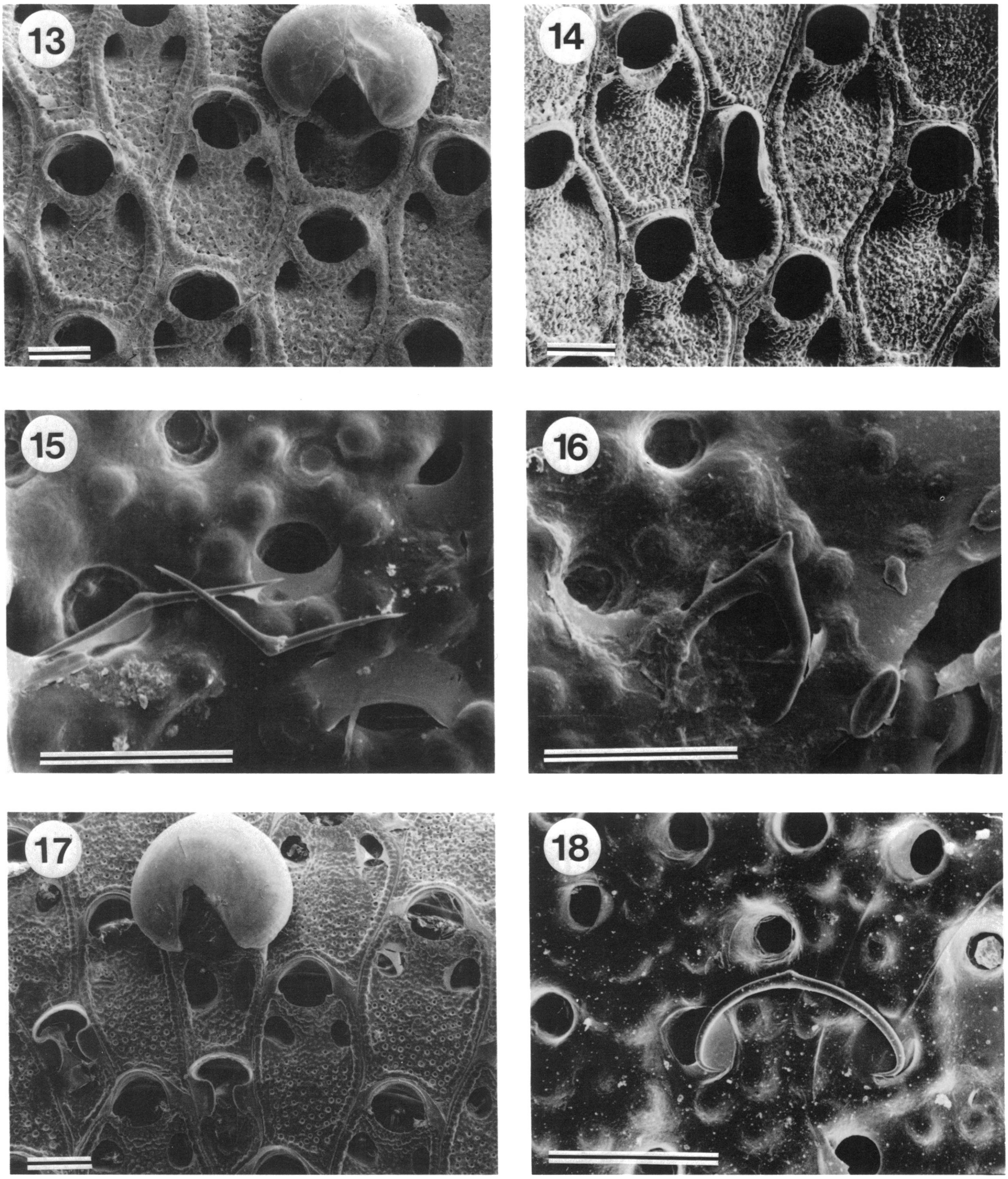
Genus *Thalamoporella* Hincks, 1887

Thalamoporella stapifera Levinsen, 1909
Figures 13–16

Thalamoporella granulata var. *stapifera* Levinsen, 1909, p. 188.

Thalamoporella stapifera Harmer, 1926, p. 297. Soule and Soule, 1970, p. 10.

DESCRIPTION: Colonies are large and encrust on coral. Zooids are rectangular to subhexagonal in shape. From the raised beaded border the granular cryptocyst, perforated by



FIGS. 13–18. **13.** *Thalamoporella stapifera,* Lombok (AMNH 587), zooids and ovicell. Scale = 200 μm. **14.** *T. stapifera,* Bali (AMNH 588), showing vicarious avicularium. Scale = 200 μm. **15.** *T. stapifera,* compass. Scale = 40 μm. **16.** *T. stapifera,* calipers. Scale = 40 μm. **17.** *T. komodoensis,* Komodo (holotype, AMNH 589), zooids and ovicell. Scale = 200 μm. **18.** *T. komodoensis,* calipers. Scale = 40 μm.

evenly spaced small pores, slopes inward toward the two large opesiules and rises as a polypide tube to the orifice. The orifice-opesia is shaped like a semicircle distally and a smaller semicircle proximally. A tiny pair of condyles separates the parts. Calcification of the distal end of the zooid is smooth, and forms a narrow, slightly raised rim around the distal portion of the orifice. There may be an occasional small adoral tubercle (e.g., fig. 13). The ovicell is quite large, smooth, and oval, with a median suture; it opens via a wedge cut out over the orifice. Ovicelled zooids are shorter than autozooids and have larger opesiules and a more sunken polypide tube. The avicularium has a long, narrow rostrum with a pair of stout, triangular condyles at the base of the rostrum (fig. 16). The proximal end of the avicularium is rounded and has a narrow cryptocyst. Avicularia were present but rare in our specimens. Compasses and calipers were found. The compass (fig. 15) has an angle of approximately 128°. The calipers (fig. 16) are wishbone or stirrup-shaped.

	Measurements		
	Range	Mean	N
Lz	0.576–0.846	0.738	15
Wz	0.360–0.504	0.438	15
Lo	0.180–0.306	0.227	15
Wo	0.198–0.234	0.215	15
Lov	0.414–0.432	0.423	4
Wov	0.540–0.594	0.572	4
Lavz	0.540–0.666	0.597	7
Wavz	0.270–0.396	0.319	7
Lav	0.414–0.486	0.460	7
Wav	0.162–0.234	0.206	7

Additional Specimens Examined: (BMNH) 28.3.6.106, 290 B4, *Siboga* Station 279, Roma Island, N.E. of Timor, 36 m. 28.3.6.104, 290 B3 (whole mount from same station). 28.9.13.46, co type, on *Tridacna*, locality unknown, G. M. R. Levinsen.

Occurrence: Lombok, Sanur.

Distribution: Hawaii, Indonesia.

***Thalamoporella komodoensis*, new species**
Figures 17, 18

Diagnosis: Encrusting *Thalamoporella* with medium-size zooids (smaller than those of *T. stapifera*). Zooids with slightly unequal opesiules, a flatter, less depressed cryptocyst than many *Thalamoporella* species, and with no adoral tubercles ornamenting the smooth, flat distal rim. Ovicells round in outline, with a deep V-shaped central opening. Avicularia with mushroom-shaped mandible and rostral foramen. Spicules include calipers in the shape of a very broad wishbone with the ends pointing inward.

Holotype: AMNH 589.

Paratype: AMNH 590.

Etymology: This species was named after the island of Komodo where it was found.

Description: The colony is encrusting. Zooids are subhexagonal in shape, with a beaded border surrounding the granular cryptocyst, which in this species is flatter and less depressed centrally than in many *Thalamoporella* species. Opesiules (slightly unequal in size) are found one on each side of the polypide tube. The orifice-opesia is semicircular distally and has a broad slightly flattened proximal sinus bordering the polypide tube. Calcification of the distal rim is smooth and flat with no trace of adoral tubercles. The proximal rim of the orifice and the polypide tube area show a more strongly granular calcification than the proximal part of the cryptocyst; this region is imperforate, while the cryptocyst underlying the proximal zooid surface is perforated by evenly spaced pores. Ovicelled zooids are equal in size to autozooids; they have larger opesiules, a narrower polypide tube, and a larger orifice. The ovicell is globular, round in outline, with a deep central wedge-shaped opening above the zooidal orifice-opesia. Its calcification is imperforate and smooth except for faint radiating lines and median suture. The vicarious avicularia have a smoothly rounded rostrum. The mandible and the rostral foramen into which it fits are mushroom-shaped, semicircular distally, with a narrow "stem" attaching to the hinge. The opesia is rounded proximally, margined by a granular and imperforate cryptocyst. The proximal end of the avicularium is pointed. Spicules include very broad calipers (fig. 18).

	Measurements		
	Range	Mean	N
Lz	0.360–0.810	0.566	15
Wz	0.270–0.468	0.377	15
Lo	0.144–0.216	0.179	15
Wo	0.144–0.216	0.173	15
Lov	0.414–0.468	0.446	4
Wov	0.468–0.522	0.513	4
Lavz	0.378–0.540	0.457	15
Wavz	0.198–0.288	0.233	15
Lav	0.180–0.324	0.268	15
Wav	0.144–0.216	0.184	15

Occurrence: Komodo.

FAMILY STEGINOPORELLIDAE HINCKS, 1884 emend. BASSLER, 1953

Genus *Steginoporella* Smitt, 1873

Steginoporella buskii (Harmer), 1900
Figures 19–22

Steganoporella buskii Harmer, 1900, p. 272. Thornely, 1905, p. 112. Levinsen, 1909, p. 168. Hastings, 1932, p. 413. Marcus, 1938, p. 22; 1955, p. 285. Cook, 1964a, p. 46; 1968, p. 152.
Steganoporella transversalis Canu and Bassler, 1928a, p. 68. Marcus, 1949, p. 11.
Steginoporella buskii Pouyet and David, 1979, p. 771.

DESCRIPTION: The greenish-colored colonies are encrusting on pieces of coral. The large A zooids are square to rectangular in shape and lined up in neat bricklike rows (fig. 19). The frontal surface of the zooid is underlain by a granular cryptocyst marked by scattered pores and a slightly granular texture. This cryptocyst has a narrow marginal descending portion, a flat central portion, and an ascending polypide tube. The semicircular operculum (fig. 21), its crescentic shelf visible in illustrated specimens, covers the distal third of the zooid. A beaded ridge edges each zooid. B zooids are larger and have opercula with marginal teeth (fig. 22). Embryos are brooded inside A zooids; during this period, the cryptocyst undergoes degeneration (Cook, 1964a).

	Measurements Range	Mean	N
A zooids			
Lz	0.630–0.810	0.714	15
Wz	0.504–0.702	0.602	15
Lo	0.216–0.288	0.256	15
Wo	0.414–0.522	0.466	15
Loperc	0.198–0.288	0.245	10
Woperc	0.396–0.540	0.479	10
B zooids			
Lz	0.810–1.008	0.864	10
Wz	0.576–0.756	0.650	10
Loperc	0.324–0.396	0.351	10
Woperc	0.486–0.594	0.518	10

OCCURRENCE: Found at Sanur.

DISTRIBUTION: Gulf of Guinea (Sierra Leone to Ghana), Guinea, Ceylon, Indonesia, Torres Strait, Arabia, South Africa, Australia, Caribbean, Brazil.

FAMILY ONYCHOCELLIDAE JULLIEN, 1882

Genus *Smittipora* Jullien, 1882

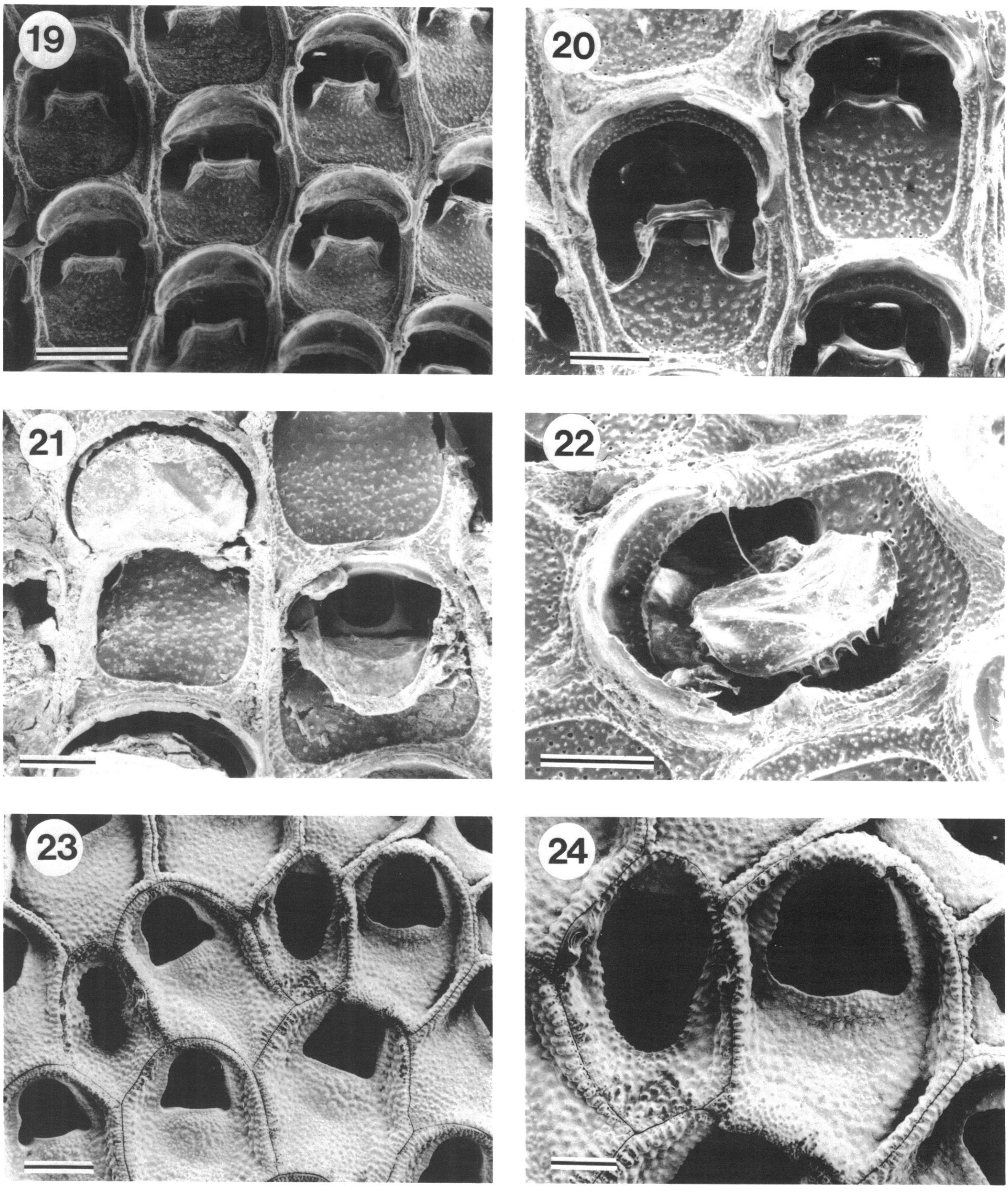
Smittipora harmeriana (Canu and Bassler), 1929
Figures 23, 24

Smittipora abyssicola (Smitt) Harmer, 1926, p. 259 (not *Vincularia abyssicola* Smitt, 1873, p. 6).
Velumella harmeriana Canu and Bassler, 1929, p. 128.

DESCRIPTION: The colony is flat and encrusts on coral and shell. Zooids are hexagonal to subrectangular in shape. The granular cryptocyst surface is sunken slightly in the center and raised at the edge. A thin groove divides the zooids. The orifice-opesia is subtriangular. Nonbrooding zooids have slight opesiular indentations. The avicularia are interzooecial, with a granular cryptocyst relatively narrower than that of autozooids. A pair of small hinge teeth are located on the sides of the avicularium. The ovicells are thickenings of the cryptocyst of the distal zooid. Their surface is also granular. Opesia of fertile zooids are enlarged, perhaps by cryptocystal degeneration as in *Steginoporella buskii*, and lack opesiular indentations.

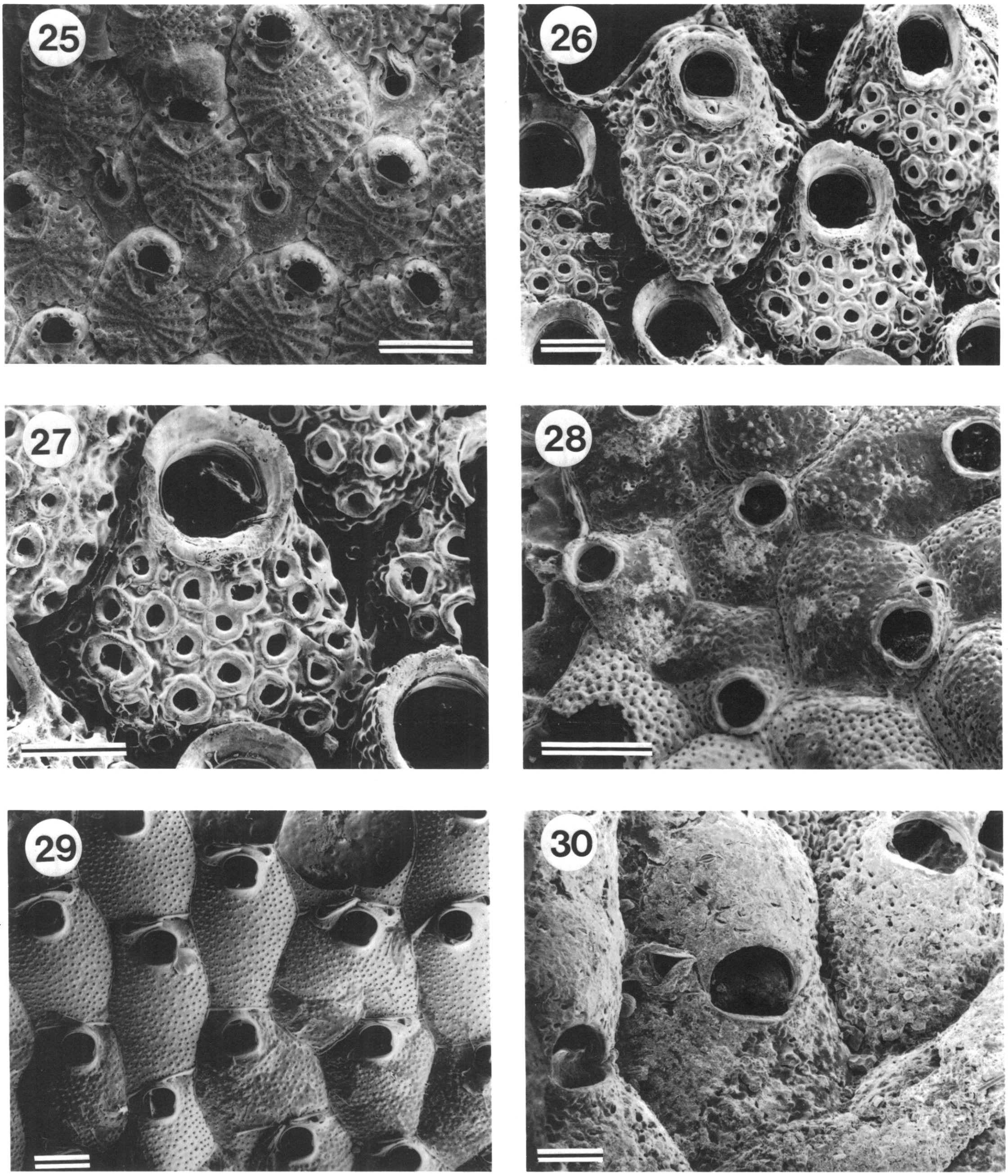
	Measurements Range	Mean	N
Lz	0.486–0.612	0.567	10
Wz	0.360–0.450	0.405	10
Lo	0.162–0.216	0.191	10
Wo	0.162–0.216	0.193	10
Lov	0.054–0.090	0.066	3
Wov	0.108–0.144	0.126	3
Lavz	0.378–0.540	0.457	10
Wavz	0.216–0.360	0.281	10
Lav	0.162–0.252	0.203	10
Wav	0.090–0.126	0.110	10

DISCUSSION: Canu and Bassler (1929) gave a new name to Harmer's *Smittipora abyssicola* from Indonesia, but did not discuss their reasons for doing so. Harmer's species is distinct from the other species he named in the *Siboga* report, *Smittipora cordiformis*, but it is not identical with the species now known as *Smittipora levinseni* which Smitt (1873) described from Florida. Among other differences, *Smittipora levinseni* is considerably larger in zooid size. The Caribbean species *Smittipora acutirostris* is very similar in zooid size. In comparison with *acutirostris*, *S. harmeriana* has slightly smaller avicularia, and



FIGS. 19–24. **19.** *Steginoporella buskii,* Bali (AMNH 591). Scale = 400 μm. **20.** *S. buskii,* showing B (left) and A (right) zooids. Scale = 200 μm. **21.** *S. buskii,* A zooid operculum. Scale = 200 μm. **22.** *S. buskii,* B zooid operculum with marginal teeth. Scale = 200 μm. **23.** *Smittipora harmeriana,* Komodo (AMNH 592), zooids and avicularia. Scale = 200 μm. **24.** *S. harmeriana,* close-up of avicularium and ovicelled zooid. Scale = 100 μm.

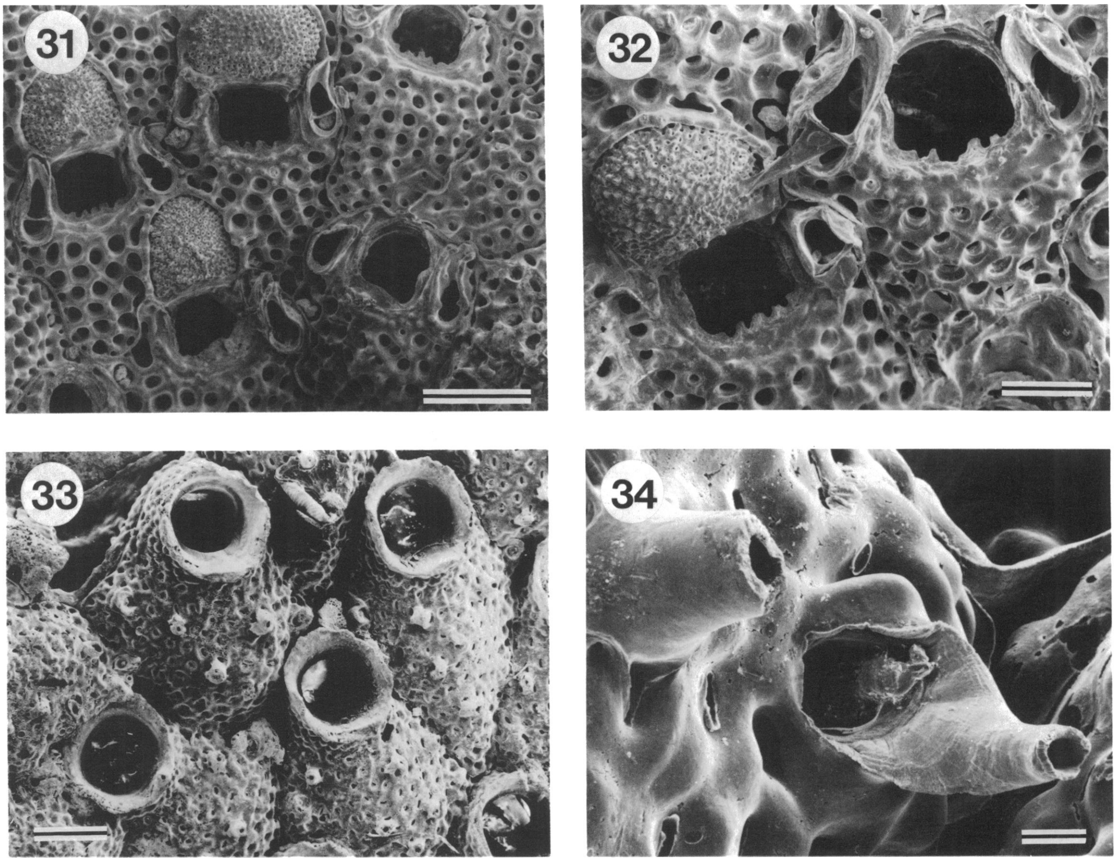
larger orifices, with relatively greater enlargement of the orifices of fertile zooids. The cryptocyst of both avicularia and autozooids appears more sharply depressed from zooid



FIGS. 25–30. **25.** *Cribrilaria flabellifera,* Lombok (AMNH 593), zooids, ovicell, and avicularia. Scale = 200 μm. **26.** *Exechonella brasiliensis,* Komodo (AMNH 594), zooids near growing edge. Scale = 200 μm. **27.** *E. brasiliensis,* close-up of zooid, showing rimmed pores. Scale = 200 μm. **28.** *Hippopodina feegeensis,* Bali (AMNH 595), ancestrular region. Scale = 400 μm. **29.** *H. feegeensis,* Komodo (AMNH 596), zooids near growing edge of colony. Scale = 400 μm. **30.** *H. feegeensis,* Lombok (AMNH 597), ovicelled zooid. Scale = 200 μm.

margins and avicularian condyles may be more pronounced.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) *Smittipora harmeriana*: 28.3.6.71, 323D,



FIGS. 31–34. **31.** *Petraliella chuakensis,* Komodo (AMNH 598). Scale = 400 μm. **32.** *P. chuakensis,* close-up of ovicell and avicularia. Scale = 200 μm. **33.** *Coleopora verrucosa,* Komodo (AMNH 599). Scale = 200 μm. **34.** *C. verrucosa,* close-up showing slitlike pores and hollow papillae. Scale = 20 μm.

Badjo Bay, W. Flores, Station 50. 82.2.23.485–489, Torres Strait, Prince of Wales Channel. 1975.7.16.41, 1½ km E. of Pulau Putri Ketjil. *Smittipora cordiformis*: 28.3.6.74, 364C Makassar, S.W. Celebes, Station 71. Part of type specimen, 85.12.29.3, Mergui, Burma.

OCCURRENCE: Two colonies were collected at Komodo.

DISTRIBUTION: Indonesia.

SUPERFAMILY CRIBRILINOIDEA HINCKS, 1879

FAMILY CRIBRILINIDAE HINCKS, 1880

Genus *Cribrilaria* Canu and Bassler, 1928

Cribrilaria flabellifera (Kirkpatrick), 1888

Figure 25

Cribrilaria radiata var. *flabellifera* Kirkpatrick, 1888, p. 75.
Colletosia radiata Harmer, 1926, p. 475, in part.
Puellina radiata var. *flabellifera* Thornely, 1912, p. 144.
Colletosia radiata flabellifera Soule, 1959, p. 48.
Cribrilaria flabellifera Harmelin, 1970, p. 94; 1978, p. 186. Banta and Carson, 1977, p. 392. Winston, 1984, p. 13.

DESCRIPTION: Colonies are small and encrusting. Zooids are ovoid to rhomboid in shape, with six to nine pairs of costae. Separating the costae is a line of evenly spaced pores. The first pair of costae (or apertural bar) is more extensively fused and tends to be thicker than the other costae and slightly raised. Above the apertural bar, but under the orifice, is a larger pore. The orifice is semicircular and is bordered distally by six spines. The ovicell is shaped like a helmet with a small keel. Avicularia are interzooecial. They are rhomboid in shape with a smooth calcified proximal gymnocyst like that of an autozooid. The palate is rounded proximally and the rostrum is hourglass-shaped, flaring out at the distal end. The avicularium mandible is broad proximally and comes to a point distally, resembling a poplar leaf (not shown in fig. 25, but see Winston, 1984, fig. 25).

	Measurements		
	Range	Mean	N
Lz	0.342–0.414	0.378	5
Wz	0.234–0.324	0.274	5
Lo	0.054–0.072	0.061	5
Wo	0.072–0.090	0.083	5
Lov	0.126	0.126	2
Wov	0.180	0.180	2
Lavz	0.180–0.270	0.230	5
Wavz	0.126–0.180	0.148	5
Lav	0.126–0.144	0.130	5
Wav	0.090–0.108	0.094	5

OCCURRENCE: Lombok—one colony was found.

DISTRIBUTION: Philippines, Indian Ocean, New Guinea, Mediterranean, Baja California, Belize, Costa Rica.

FAMILY EXECHONELLIDAE HARMER, 1957

Genus *Exechonella* Canu and Bassler, 1927

Exechonella brasiliensis Canu and Bassler, 1928

Figures 26, 27

Exechonella brasiliensis Canu and Bassler, 1928a, p. 72.

DESCRIPTION: The colony is small and encrusting on coral. The zooids are rhomboid in shape. The frontal surface is convex and perforated with large pores that have a smooth flat collar surrounding them. The zooids are separated by a deep valley. The orifice is almost square in shape and surrounded by a smooth flared peristome. The inner rim of the primary orifice can be seen within the peristome. A pair of stout, triangular condyles are present about two-thirds of the way down from the top of the orifice. The adventitious avicularia are oval and have a crossbar. They are rare and very small. When present they are located on the side of the zooid and directed transversely. No ovicells were present on our specimen.

	Measurements		
	Range	Mean	N
Lz	0.774–0.936	0.850	5
Wz	0.450–0.738	0.590	5
Lo	0.180–0.216	0.198	5
Wo	0.180–0.234	0.212	5
Lav	0.090	0.090	1
Wav	0.036	0.036	1

DISCUSSION: The Indonesian species of *Exechonella* discussed by Harmer (1957) are *E. magna* and *E. tuberculata.* Unlike *E. brasiliensis,* both species have tubular peristomes. In addition, in *E. tuberculata,* the rims of the large pores form spinelike projections, very different from the flattened pore rims of *E. brasiliensis,* while zooids of *E. magna* are characterized by relatively large frontal avicularia with curved triangular mandibles. Such avicularia are lacking in *E. brasiliensis.*

In its flared peristome, orifice shape, and overall zooid size, *E. brasiliensis* most closely resembles the Caribbean and West African species, *E. antillea.* However, the peristome of *E. brasiliensis* is more flared and lacks the spinous projections found in many Caribbean colonies of *E. antillea,* while the primary orifice has a more shallow proximal portion. The most striking difference, though, is in the number of frontal pores, which is less than 25 in *E. brasiliensis* but approximately 50–60 in *E. antillea* colonies from the Caribbean.

OCCURRENCE: One colony was collected at Komodo.

DISTRIBUTION: Indonesia, Brazil.

Genus *Coleopora* Canu and Bassler, 1927

Coleopora verrucosa Canu and Bassler, 1924

Figures 33, 34

Coleopora verrucosa nom. nud. Canu and Bassler, 1924, p. 67; 1927, p. 6; 1929, p. 267.
Teuchopora verrucosa Harmer, 1957, p. 898.

DESCRIPTION: The colony is small and encrusting on coral. Zooids are rhomboidal in shape. The frontal surface (fig. 34) is perforated with slitlike to triangular pores and is marked with occasional hollow papillae. These papillae are smooth-textured and narrow toward the distal end. The orifice is surrounded by a high peristome which flares out slightly. The orifice is almost square and has a pair of condyles pointing down into the opening. There are no avicularia. No ovicells were found on the one specimen collected.

	Measurements		
	Range	Mean	N
Lz	0.702–1.170	0.868	5
Wz	0.450–0.720	0.601	5
Lo	0.162–0.198	0.184	5
Wo	0.180–0.216	0.198	5

DISCUSSION: Harmer (1957) included Recent and fossil species in *Teuchopora* (Neviani, 1895). However, Poluzzi (1977) has shown that *Teuchopora castrocarensis,* the type of the genus, differs from Recent species in frontal wall structure, type of budding, and other general characters. We have placed *Coleopora verrucosa* in the Exechonellidae on the basis of frontal wall and orificial characters. However, the species presently included in the genus *Coleopora* may not constitute a monothetic group. Further study is needed.

OCCURRENCE: One colony was found at Komodo.

DISTRIBUTION: Indonesia, Philippines, Ceylon.

SUBORDER ASCOPHORA LEVINSEN, 1909

SUPERFAMILY SCHIZOPORELLOIDEA JULLIEN, 1883

FAMILY HIPPOPODINIDAE LEVINSEN, 1909

Genus *Hippopodina* Levinsen, 1909

Hippopodina feegeensis (Busk), 1884
Figures 28–30

Lepralia feegeensis Busk, 1884, p. 144.
Lepralia pulcherrima Canu and Bassler, 1928a, p. 82.
Hippopodina feegeensis Levinsen, 1909, p. 353. Hastings, 1930, p. 729. Marcus, 1939, p. 116. Osburn, 1940, p. 412. Harmer, 1957, p. 974. Powell, 1971, p. 771. Banta and Carson, 1977, p. 413. Winston, 1984, p. 19.
Cosciniopsis fallax Canu and Bassler, 1929, p. 296.

DESCRIPTION: Colonies are encrusting on pieces of shell and coral. Zooids are rectangular to polygonal in shape. The thin line of calcification marking the intercalary cuticle is noticeable in younger zooids (fig. 29) but becomes obscured by secondary calcification in the older regions of the colony (fig. 30). In younger zooids the surface is covered with tiny pores and is smoother than in older zooids though the pores have raised edges. The surfaces of older zooids are also covered with pores but, with increasing secondary calcification, their surfaces become more granular in texture. The orifice has a slightly raised peristome and two condyles pointing down and in. Its distal portion is circular, its proximal portion slightly concave. Most zooids have one or two avicularia located above the orifice and directed more or less transversely inward. The avicularia have slightly curved triangular mandibles. The ovicells are large and helmet-shaped with a perforated, heavily calcified surface. As shown in figure 30, a triangular avicularium, shorter than those of autozooids, may be located on the side of the ovicell.

	Measurements		
	Range	Mean	N
Lz	0.684–1.080	0.860	15
Wz	0.450–0.864	0.652	15
Lo	0.180–0.270	0.247	15
Wo	0.216–0.270	0.247	15
Lov	0.432	0.432	1
Wov	0.522	0.522	1
Lav	0.180–0.270	0.220	13
Wav	0.090–0.108	0.095	13

OCCURRENCE: Komodo, Sanur, and Lombok.

DISTRIBUTION: Circumtropical.

FAMILY PETRALIELLIDAE HARMER, 1957

Genus *Petraliella* Canu and Bassler, 1927

Petraliella chuakensis (Waters), 1913
Figures 31, 32

Petraliella chuakensis Waters, 1913, p. 518. Livingstone, 1926, p. 99. Canu and Bassler, 1929, p. 251. Hastings, 1932, p. 436. Harmer, 1957, p. 698.
Hippopetraliella (*Serripetraliella*) *chuakensis hastingsae,* Stach, 1936, p. 371.

DESCRIPTION: Colonies are encrusting. Zooids are irregular in shape. Their surface is covered with many large pores and is heavily calcified. A raised line of calcification marking the meeting of the frontal edge of lateral walls and intercalary cuticle sharply delimits zooid boundaries. Generally there are two avicularia on a zooid, one on each side of the orifice. When an ovicell is present there may be only one avicularium. The avicularia are curved and directed distally. A complete cross-bar is present on some but not all avicularia. The orifice is curved distally, with parallel sides; its proximal edge is serrated. Below the orifice is a smooth shelf; on the bottom edge of the shelf is a row of 7–9 bumps. Ovicells are round to elliptical in shape. The surface is covered with many small perforations and has a bumpy texture. Older ovicells become calcified over and buried in the secondary calcification of the surrounding zooids.

	Measurements		
	Range	Mean	N
Lz	0.360–0.558	0.475	5
Wz	0.306–0.486	0.367	5
Lo	0.144–0.162	0.151	5
Wo	0.126–0.198	0.154	5
Lov	0.198–0.216	0.205	5
Wov	0.198–0.288	0.227	5
Lav	0.162–0.198	0.169	5
Wav	0.054–0.090	0.068	5

OCCURRENCE: Komodo—one colony was collected.

DISTRIBUTION: Zanzibar, Torres Strait, Philippines, Borneo.

FAMILY WATERSIPORIDAE VIGNEAUX, 1949

Genus *Watersipora* Neviani, 1895

"*Watersipora subovoidea*" fide Harmer, 1957
Figures 35–37

Dakaria subovoidea (D'Orbigny) Harmer, 1957, p. 1022, in part.
"*Watersipora subovoidea*" fide Harmer, Soule and Soule, 1975, p. 308.

DESCRIPTION: Colonies are encrusting on pieces of coral. Dried colonies are an iridescent black. Zooids are ovoid; the surface is covered with evenly spaced, large pores. A thin calcified line separates each zooid. The orifice is semielliptical, opening into a broad sinus. The sinus ledge projects distally into the orifice (fig. 37). A short condyle does not quite reach its edge. There is a slight peristome around the orifice, and the suboral area is granular but imperforate. Two large areolae occur in the oral region of each zooid, one on each side of the sinus. There are no ovicells. Embryos are brooded internally.

	Measurements		
	Range	Mean	N
Lz	0.720–1.116	0.886	15
Wz	0.396–0.684	0.486	15
Lo	0.216–0.252	0.238	15
Wo	0.252–0.306	0.275	15
Ws	0.144–0.198	0.161	15

DISCUSSION: Zooids of "*Watersipora subovoidea*" are longer than those of *Watersipora edmondsoni.* The other main differences are the shape of the orifice and sinus. The orifice of *W. edmondsoni* is not as large and the sinus is not as broad as those of "*W. subovoidea.*" The condyles are more pronounced in *W. edmondsoni,* extending beyond the rim of the sinus and pointing down into it.

We have followed Soule and Soule (1975) in calling this species the "*Watersipora subovoidea* of Harmer." It may turn out, as they suggest, that these specimens will be referable to *Watersipora aterrima* (Ortmann, 1890), but as we do not have any Japanese material for comparison, we have not used that name here. Our specimen fits Harmer's illustration (pl. LXIX, fig. 12) in the shape of the aperture and sinus and the presence of a thin collar. We agree with the Soules that peristomial (presence of collar or oral lappets) and orificial characters (particularly the size and shape of the sinus, the sinus ledge, and the condyles), are important in defining species and species groups in *Watersipora.* The presence or absence of the two distolateral areolae may also be useful.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 367.A.6, *Siboga* Station 181, Ambon, anchorage. 367.A.3, cleaned specimen from same station, specimen illustrated in Harmer (1957), pl. LXIX, fig. 12.

OCCURRENCE: Komodo.

DISTRIBUTION: Indonesia and probably elsewhere. The extent of distribution uncertain until the species of this genus have received revisionary study.

Watersipora edmondsoni Soule and Soule, 1968
Figures 38–40

Watersipora edmondsoni Soule and Soule, 1968, p. 215.

DESCRIPTION: Dried colonies are an iridescent black and encrust on pieces of coral.

Zooids are ovoid to diamond shaped. The zooid surface is covered by many pores except for a small region near the orifice. There are two prominent areolae, one on each side of the orificial sinus, close to the edge of the zooid. A thin calcified line marks the boundary of each zooid. The orifice is oval proximally, with a pair of sharp-pointed condyles marking the beginning of the narrow semicircular sinus. There is a slight peristome around the orifice. There are no avicularia and no ovicells. Embryos are brooded internally.

	Measurements		
	Range	Mean	N
Lz	0.684–0.954	0.812	15
Wz	0.414–0.702	0.559	15
Lo	0.162–0.216	0.202	15
Wo	0.198–0.234	0.216	15
Ws	0.090	0.090	15

DISCUSSION: Our specimens have narrower sinuses than those of the *Watersipora edmondsoni* colonies in our collections from Hawaii. They are similar to the specimens illustrated by Soule and Soule (1975, pl. 3, fig. 5 and pl. 3, fig. 6). It may be true, as suggested by Soule and Soule (1975), that a larger degree of speciation has occurred in Indo-Pacific watersiporids than had been realized. However, until more material is available for study it seems best to identify our specimens with *edmondsoni.*

ADDITIONAL SPECIMENS EXAMINED: *Schizoporella aterrima* (Harmer list, no. 898), Torres Strait, Haddon Collection, no. 122, reg. Feb. 24, 1898; specimen illustrated in Soule and Soule (1975), pl. 3, fig. 6. *Watersipora subovoidea,* 1981.4.1.3 pt. (Harmer list, no. 1252), Ceylon, 1905; specimen illustrated in Soule and Soule (1975), pl. 3, fig. 5.

OCCURRENCE: Sanur.

DISTRIBUTION: Hawaii, Indonesia.

FAMILY SCHIZOPORELLIDAE JULLIEN, 1882

Genus *Calyptotheca* Harmer, 1957

Calyptotheca wasinensis (Waters), 1913

Figures 41, 42

Schizoporella nivea (not *S. nivea* Busk, 1884, p. 163) Thornely, 1905, p. 114; 1907, p. 189.
Schizoporella nivea Waters, 1909, p. 168, var. *millanensis* (name suggested but retracted). Thornely, 1912, p. 148. Waters, 1913, p. 502.
Schizoporella nivea var. *wasinensis* Waters, 1913, pp. 504, 535.
Emballotheca furcata Levinsen, 1909, p. 334.
Calyptotheca wasinensis Harmer, 1957, p. 1017.

DESCRIPTION: Colonies are encrusting. Zooids are rectangular and slightly convex, the frontal surface perforated and heavily calcified, the pores sunken in the calcification. A calcified ridge separates the zooids. A small umbo is present under the orifice. The orifice is wider than long, with large, blunt lateral condyles and opens into a broad, shallow sinus (fig. 42). No ovicells were present in our specimen. According to Harmer, they are globose, often with triradiate sutural lines, and the fertile zooid has a wider orifice than autozooids. Avicularia are located in the distal left and right corners of the zooid. There are usually two avicularia per zooid. The avicularia are small and point proximally.

	Measurements		
	Range	Mean	N
Lz	0.486–0.630	0.554	5
Wz	0.270–0.414	0.320	5
Lo	0.126–0.162	0.140	5
Wo	0.144–0.162	0.148	5
Lav	0.054	0.054	5
Wav	0.036	0.036	5

OCCURRENCE: One colony was found at Sanur.

DISTRIBUTION: Ceylon, Red Sea, Seychelles, Amirante Is., Providence (Indian Ocean), Zanzibar, E. Africa, Indonesia.

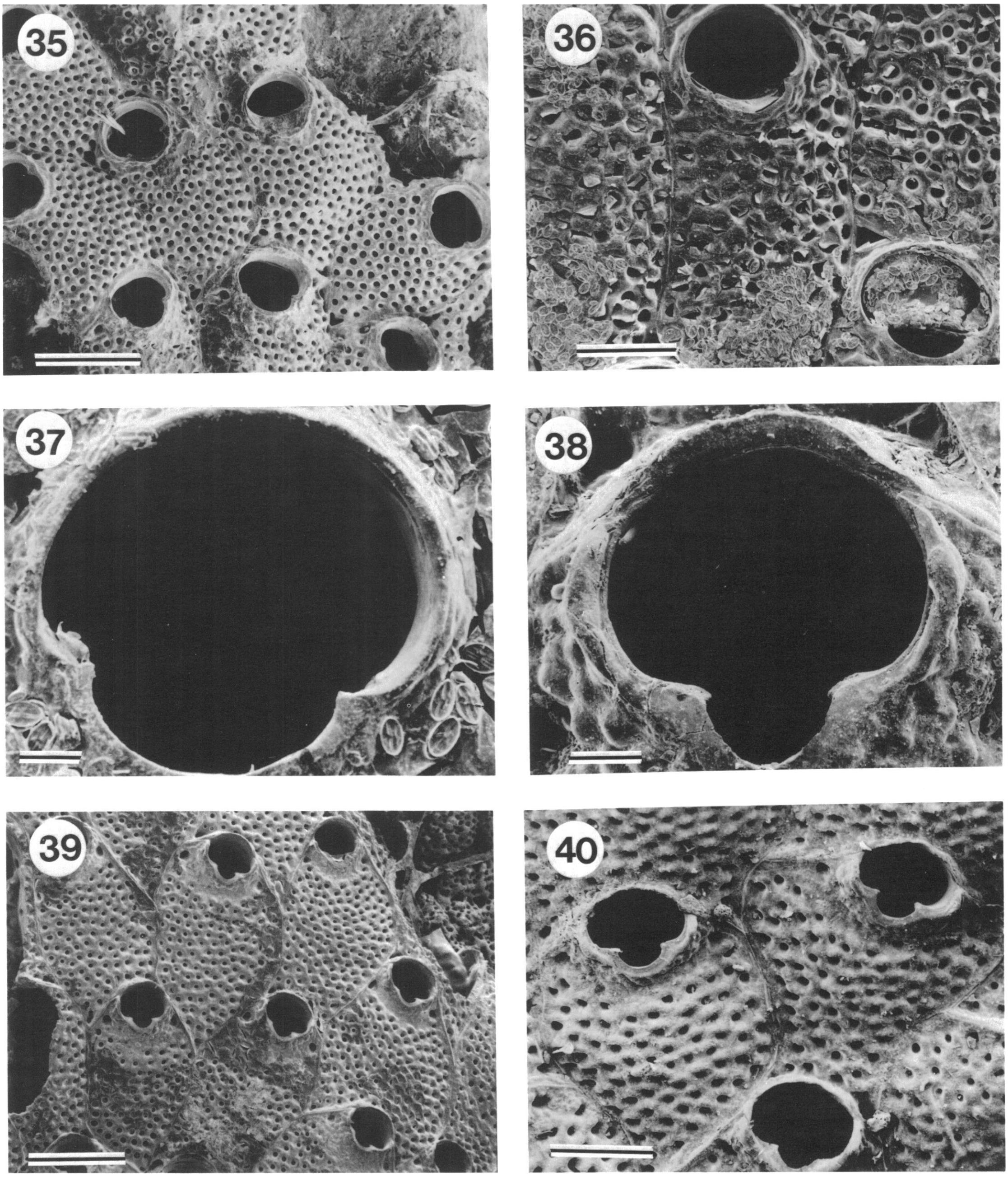
Genus *Schizomavella* Canu and Bassler, 1917

Schizomavella inclusa (Thornely), 1906

Figures 43, 44

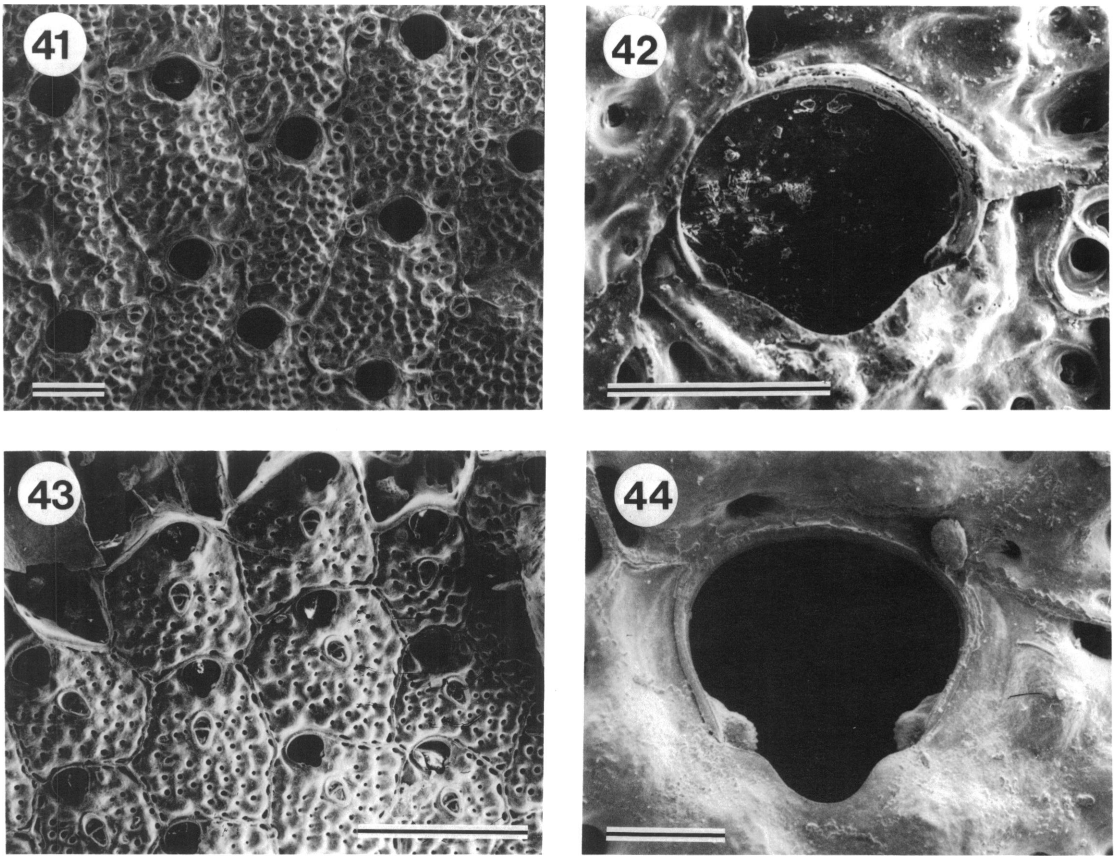
Schizomavella subimmersa var. Waters, 1889, p. 11.
Schizoporella triangula Thornely, 1905, p. 115.
Schizoporella avicularis Thornely, 1905, p. 116.
Schizoporella inclusa Thornely, 1906, p. 450.
Schizomavella (Metroperiella) lepraliodes Canu and Bassler, 1929, p. 307.
Schizomavella inclusa Harmer, 1957, p. 1028.

DESCRIPTION: Colonies are encrusting on coral rubble. Zooids are polygonal and slightly convex. The zooid frontal surface is heavily calcified and covered with pores except for the area around the orifice. There is a row of narrow marginal areolae. A thin line of cal-



FIGS. 35–40. **35.** *Watersipora "subovoidea,"* Komodo (AMNH 600). Scale = 400 μm. **36.** *W. "subovoidea."* Scale = 200 μm. **37.** *W. "subovoidea,"* close-up of orifice. Scale = 40 μm. **38.** *W. edmondsoni* (AMNH 601), close-up of orifice. Scale = 40 μm. **39.** *W. edmondsoni.* Scale = 400 μm. **40.** *W. edmondsoni.* Scale = 200 μm.

cification divides zooids. The orifice is rounded distally, tapering toward the large blunt condyles and small semicircular sinus. An adventitious avicularium is located in the middle of each zooid below the sinus of the orifice. Avicularia have a rounded opesia and



FIGS. 41–44. **41.** *Calyptotheca wasinensis,* Bali (AMNH 602). Scale = 200 μm. **42.** *C. wasinensis,* close-up of orifice. Scale = 100 μm. **43.** *Schizomavella inclusa,* Komodo (AMNH 603). Scale = 400 μm. **44.** *S. inclusa,* close-up of orifice. Scale = 40 μm.

a subtriangular rostrum with a complete crossbar. They are directed proximally. Large, vicarious avicularia occur rarely in this species. The mandible of such an avicularium is illustrated in Harmer, 1957, pl. LXVI, fig. 7. No ovicells were present on our specimens. According to Harmer (1957) they are immersed, porous, and sometimes edged by a semicircular ridge of calcification (Harmer, 1957, pl. LXVI, fig. 4).

Measurements

	Range	Mean	N
Lz	0.414–0.468	0.443	5
Wz	0.216–0.378	0.313	5
Lo	0.090–0.126	0.108	5
Wo	0.090–0.108	0.097	5
Lav	0.054–0.090	0.072	5
Wav	0.036–0.054	0.047	5

DISCUSSION: See Harmer, 1957, pp. 1029–1030 for justification of the synonymy for this species.

OCCURRENCE: One colony was found at Komodo.

DISTRIBUTION: Ceylon, Indonesia, Australia.

Genus *Stylopoma* Levinsen, 1909

Stylopoma duboisii (Audouin), 1826
Figures 45–47

Flustra ?duboisii Audouin, 1826, p. 239; 1828, p. 66. Savigny, pl. VIII, figs. 41, 42.

Lepralia schizostoma MacGillivray, 1869, p. 135; 1879, Dec. 4, p. 33.

Lepralia (*Schizoporella*) *assimilis* Haswell, 1880, p. 39 (not *Lepralia assimilis* Hassall, 1842, p. 412).

Schizoporella spongites (in part) Thornely, 1905,

p. 14 (no descr.); 1907, p. 189 (no descr.); 1912, p. 148 (no descr.).
Stylopoma duboisii Harmer, 1957, p. 1033. Powell, 1967b, p. 168. Cook, 1968, p. 196.

DESCRIPTION: Colonies are encrusting on coral. Zooids are rectangular in shape. The zooid surface is covered with pores, except for the area in the immediate vicinity of the orifice, which has a granular texture. In older sections of the colony the area between pores is thick and granular; the pores are sunken in polygonal pits. In younger sections it is only slightly roughened. A thin irregular line of calcification marks the division between zooids. The orifice is semicircular distally, with serrated condyles (fig. 47) that may come right up to the narrow, slitlike central sinus. There are two types of avicularia: small, triangular, and adventitious or large, spatulate, and vicarious. The small avicularia occur singly or in pairs on each zooid, beside or just below the orifice. They are directed distolaterally or transversely outward. The large vicarious avicularia are spatulate (fig. 46) and less frequent. No ovicells were present in either colony collected. When present they are very large, porous, and cover the fertile zooid orifice (Harmer, 1957).

	Measurements		
	Range	Mean	N
Lz	0.378–0.630	0.478	15
Wz	0.252–0.450	0.331	15
Lo	0.090–0.126	0.101	15
Wo	0.108–0.126	0.118	15
Adventitious avicularia			
Lav	0.036–0.072	0.053	15
Wav	0.018–0.036	0.035	15
Spatulate avicularia			
Lav	0.324–0.378	0.351	2
Wav	0.162–0.180	0.171	2
Lavz	0.486–0.540	0.513	2
Wavz	0.234–0.288	0.261	2

OCCURRENCE: Komodo and Sanur.

DISTRIBUTION: W. Africa, Red Sea, Indian Ocean, Ceylon, Indonesia, Australia.

Stylopoma viride (Thornely), 1905
Figures 48–50

Schizoporella viridis Thornely, 1905, p. 116; 1912, p. 148. Waters, 1909, p. 147. Marcus, 1921b, p. 17. Livingstone, 1926, p. 84.
Stylopoma grandis Canu and Bassler, 1929, p. 316.
Stylopoma viride Hastings, 1932, p. 425. Harmer, 1957, pp. 1036–1038.

DESCRIPTION: Colonies are encrusting and green in color. Zooids are rhomboidal in the initial layer of growth, becoming irregular in frontally budded layers. The zooid surface is thick, granular, and covered with pores. In older sections of the colony the calcification becomes so rough and heavy that it may form spiny ridges between the pores. The orifice is round distally, opening into a broadly V-shaped sinus. The beginning of the sinus is marked by a pair of blunt-pointed, proximally directed condyles. In younger zooids the area around the orifice is smooth except for a few tubercles. In older zooids this area becomes quite granular (fig. 50). There are two kinds of adventitious avicularia. Both have a triangular base which then narrows to a point. They differ in size and location: the larger avicularia are located on one side of the orifice and are directed distolaterally; the small avicularia are located under the orifice and point in the same direction. No vicarious avicularia were present in these colonies. They are illustrated in Harmer, 1957, pl. LXXIV, fig. 12. No ovicells were present on colonies collected, but according to Harmer's (1957) illustration (pl. LXXIV, fig. 8), they are very large, covered with the same granular, porous calcification, and occlude the fertile zooid orifice. They have an independent circular, sometimes tubular, opening.

	Measurements		
	Range	Mean	N
Lz	0.540–0.990	0.718	15
Wz	0.378–0.810	0.541	15
Lo	0.162–0.216	0.191	15
Wo	0.162–0.216	0.180	15
Lav_1	0.072–0.144	0.100	7
Wav_1	0.054–0.090	0.062	7
Lav_2	0.126–0.234	0.168	9
Wav_2	0.072–0.108	0.088	9

OCCURRENCE: Lombok and Sanur.

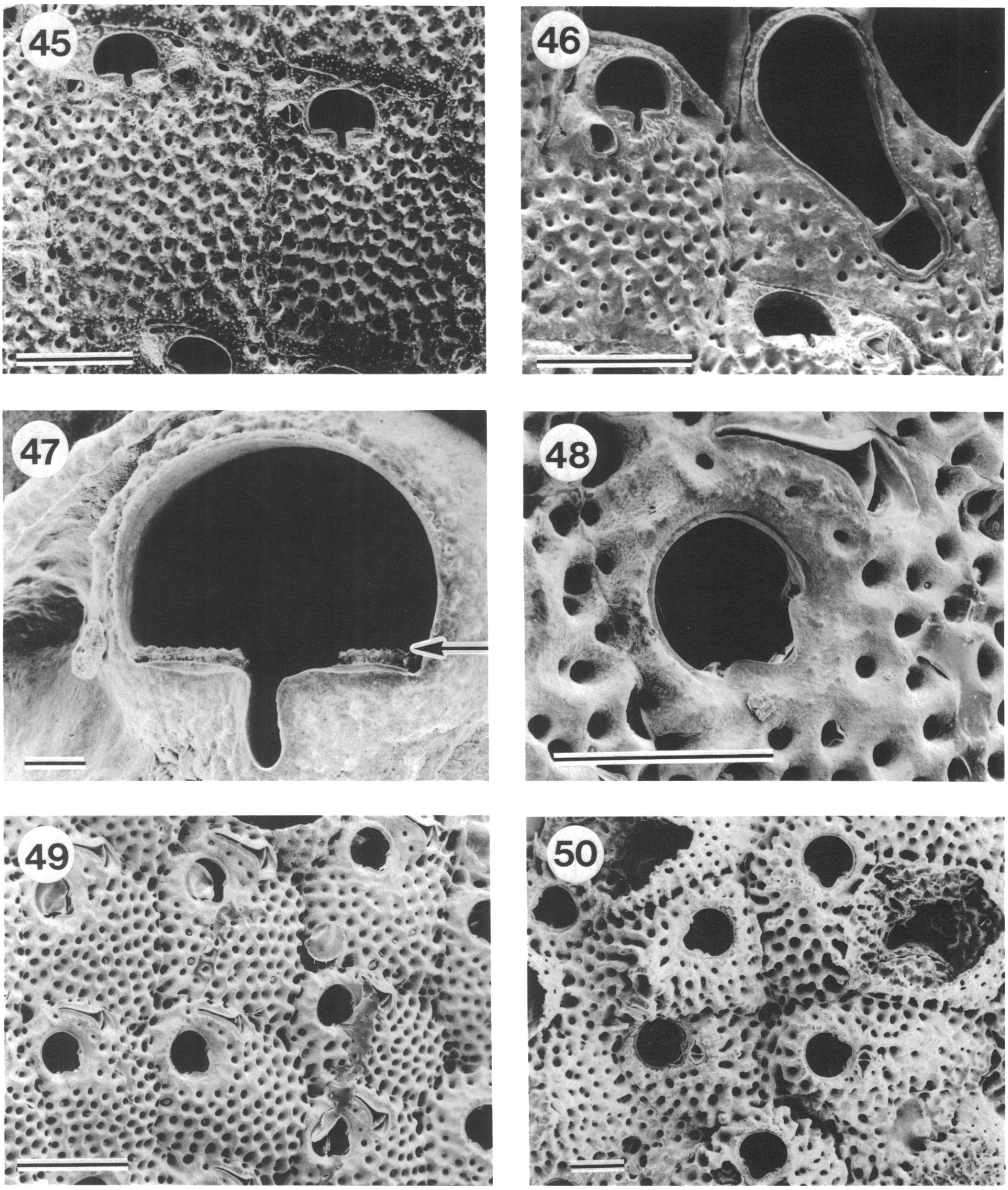
DISTRIBUTION: Philippines, Ceylon, Indian Ocean, Indonesia, Great Barrier Reef, northeast Australia, Red Sea.

FAMILY SMITTINIDAE LEVINSEN, 1909

Genus *Parasmittina* Osburn, 1952

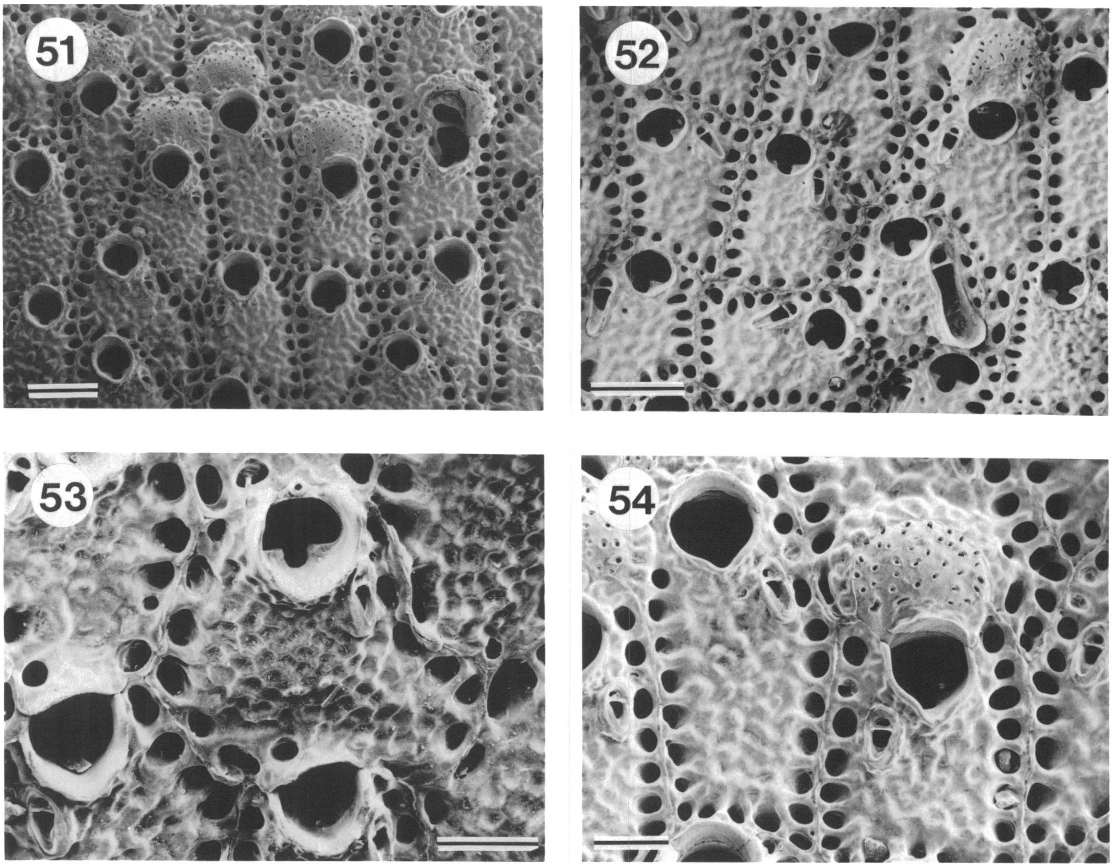
Parasmittina signata (Waters), 1889
Figures 51–54

Smittina signata Waters, 1889, p. 17.
Smittina marmorea Waters, 1909, p. 157.



FIGS. 45–50. **45.** *Stylopoma duboisii,* Bali (AMNH 604). Scale = 200 μm. **46.** *S. duboisii,* large interzooecial avicularium. Scale = 200 μm. **47.** *S. duboisii,* close-up of orifice. Arrow points to serrated condyle. Scale = 20 μm. **48.** *S. viride,* Lombok (AMNH 605), close-up of orifice. Scale = 200 μm. **49.** *S. viride.* Scale = 400 μm. **50.** *S. viride.* Scale = 200 μm.

Smittia signata Thornely, 1912, p. 151 (no descr.).
Schizoporella horsti Osburn, 1927, p. 127.
Lacerna signata Canu and Bassler, 1929, p. 308.
Smittina signata Hastings, 1932, p. 429. Harmer, 1957, p. 928.
Parasmittina signata Lagaaij, 1963, p. 197.



FIGS. 51–54. **51.** *Parasmittina signata,* Bali (AMNH 606), zooids and ovicells. Scale = 200 μm. **52.** *P. signata,* Komodo (AMNH 607), showing giant spatulate avicularium. Scale = 200 μm. **53.** *P. signata,* showing single ephemeral oral spine. Scale = 100 μm. **54.** *P. signata,* close-up of ovicelled zooids. Scale = 100 μm.

Rimulostoma? *signata* Cheetham and Sandberg, 1964, p. 1028.

DESCRIPTION: Colonies are encrusting. Zooids are rectangular to polygonal. The texture of the calcification of the frontal wall is rough, especially in the older portions of the colony, but imperforate except for a row of large areolae around the zooid margin and an occasional small pore, usually near the avicularium. The orifice is round distally. Proximally, a deep narrow sinus occurs between two square-edged condyles. There is no lyrula. Three oral spines are present on young zooids. Two kinds of adventitious avicularia are found. Small avicularia with subtriangular rostra are located below and to one side of the orifice. Large spatulate avicularia may be located in the same position as the smaller ones. Both point proximally. The smaller avicularia are more abundant than the larger type. The ovicell is round, with scattered pores on the surface and a ridge of calcification around the edges.

Measurements

	Range	Mean	N
Lz	0.342–0.576	0.443	15
Wz	0.270–0.414	0.307	15
Lo	0.090–0.144	0.118	15
Wo	0.108–0.144	0.122	15
Lov	0.162–0.216	0.180	8
Wov	0.234–0.288	0.248	8
Lav	0.054–0.108	0.082	12
Wav	0.036–0.054	0.045	12
Spatulate avicularia			
Lav	0.270	0.270	2
Wav	0.090	0.090	2

DISCUSSION: The generic placement of this distinctive species, the only smittinid lacking a lyrula except for members of the genus *Codonellina,* is difficult. Harmer (1957) placed it in *Smittina,* but that genus is now generally reserved for those species with a porous frontal wall (Hayward and Ryland, 1979, p. 98). The imperforate frontal wall and the row of marginal pores, as well as the finely porous ovicell, are characteristics found in *Smittoidea* and *Parasmittina.* But *Smittoidea* is limited to those species with a median adventitious avicularium, whereas the small and large avicularia of *signata* are located to one side of the orifice. Apparently on the basis of the location of avicularia and the structure of the frontal wall and ovicells, Lagaaij (1963) placed the species in *Parasmittina.*

Within the Smittinidae the absence of a lyrula is almost certainly a derived character. For that reason it might seem desirable to place the species in a genus of its own. However, to use the absence of a character to monothetically define a group is usually considered bad taxonomic practice. Based on the presence of derived characters—variety and positioning of avicularia, frontal wall morphology, and ovicell morphology—the species appears to fit within the definition of *Parasmittina* and is probably appropriately left in that genus.

Though this species apparently has a circumtropical distribution, Harmer (1957) noted that zooid size varied considerably in colonies from different locations and depths; in fact, examination of specimens to which he had access shows that some specimens have zooids almost twice as long as others; this amount of variation seems suspiciously large. In addition, it should be noted that Caribbean and West African populations are not only somewhat smaller in size than those from the Indo-Pacific, but also lack the large avicularia (P. L. Cook, personal commun.). Only further study will show whether we are dealing with one extremely variable species or a species complex.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 81A, *Siboga* Station 105, Sulu Archipelago, 275 m. 472D, *Siboga* Station 99, N. Ubian, Sulu Archipelago, 16–23 m. Japan, Owston Collection, 5D, reg. June 23, 1902. Japan, Mitsukuri Collection, C, reg. Sept. 23, 1896. 1961.11.2.17, Mudlump no. SP5, A. H. Cheetham. 1973.3.22.84 pt., Gold Coast, Bassindale Collection. 34.11.12.65, Australia? *Challenger.* 32.4.20.51 pt., Australia, Great Barrier Reef Exp., Station xxii. 32.4.20.119, Australia, Great Barrier Reef Exp., off N.E. Low Island. 99.7.1.2014, Busk Collection.

OCCURRENCE: Sanur and Komodo.

DISTRIBUTION: Australia, Red Sea, Indian Ocean, Philippines, Tahiti, Indonesia, Gulf of Mexico, Curaçao, Mexico.

Parasmittina parsevalii (Audouin), 1826

Figures 55–58

Cellepora parsevalii (Flustra?) Audouin, 1826, p. 238; 1828, p. 64 (as *Persevalii*). Savigny, pl. VII, figs. 91–94.

Smittia trispinosa var. i Hincks, 1884, p. 361.

Smittia obstructa Waters, 1889, p. 18.

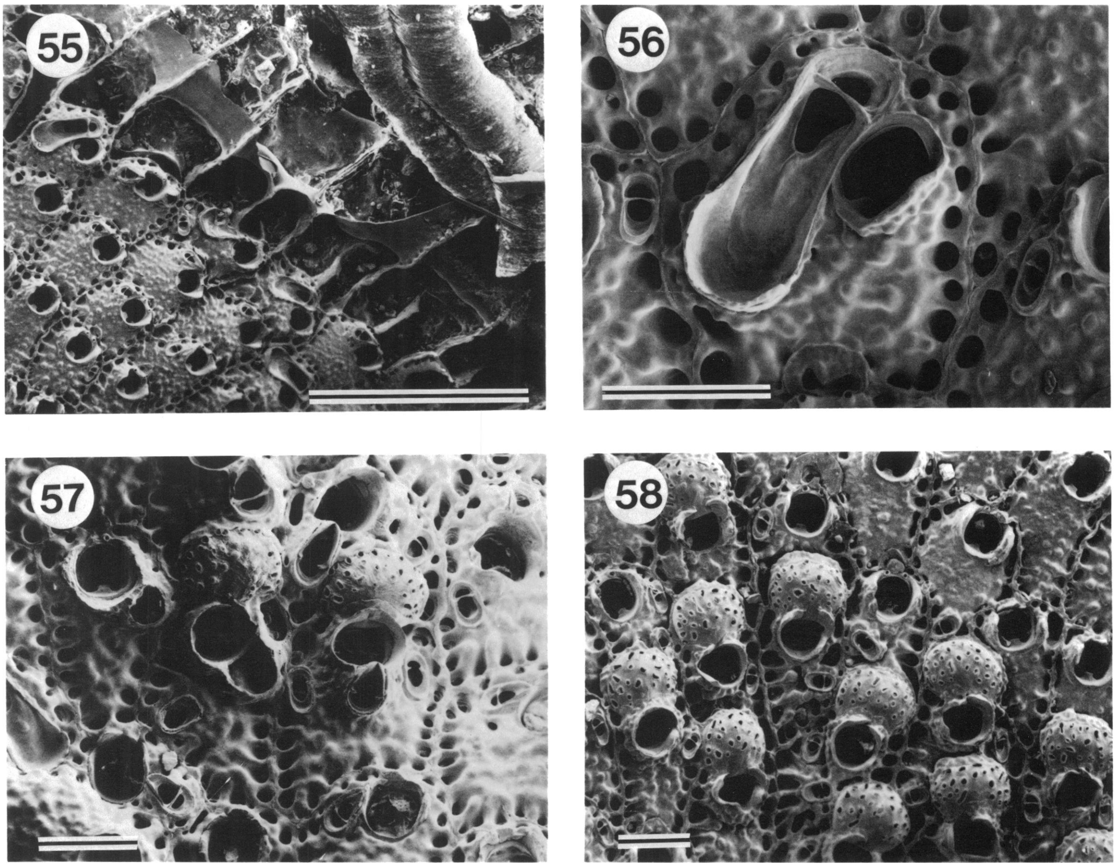
Smittina tripora Canu and Bassler, 1929.

Smittina trispinosa var. *applicata* Canu and Bassler, 1929, p. 345.

Smittina obstructa Hastings, 1932, p. 431.

Parasmittina parsevalii Harmer, 1957, p. 941. Powell, 1967b, p. 172. Cook, 1968, p. 215.

DESCRIPTION: Colonies are large and encrusting on corals. Zooids are rectangular in shape, heavily calcified, and the rough-textured frontal surfaces are imperforate except along the margins where there is a row of areolae. The orifice is roundish to square. At the proximal end is a square lyrula, flanked by condyles. Two spines are located at the distal end of young zooids (fig. 55). The short peristome is raised laterally into two lappets which flare out slightly at the top. On zooids with ovicells, the peristome becomes more circular (fig. 57). There are three kinds of adventitious avicularia, two small and one large. The small avicularia are found oriented in almost every direction. Small oval avicularia near the proximal edge of the orifice are usually directed proximally. Small triangular avicularia occur beside the orifice on either the lateral or proximal margins of the peristome. They point either distally or distolaterally. The small avicularia in the ancestrula area are scattered with no apparent pattern. The large avicularia are spatulate; the spoon-shaped rostra have a scalloped edge. They take up almost half of the zooid bearing them, which is distorted in shape, with orifices displaced laterally and sometimes partially occluded. The large avicularia are directed proximolaterally. Ovicells are round. The frontal surface is covered with small pores



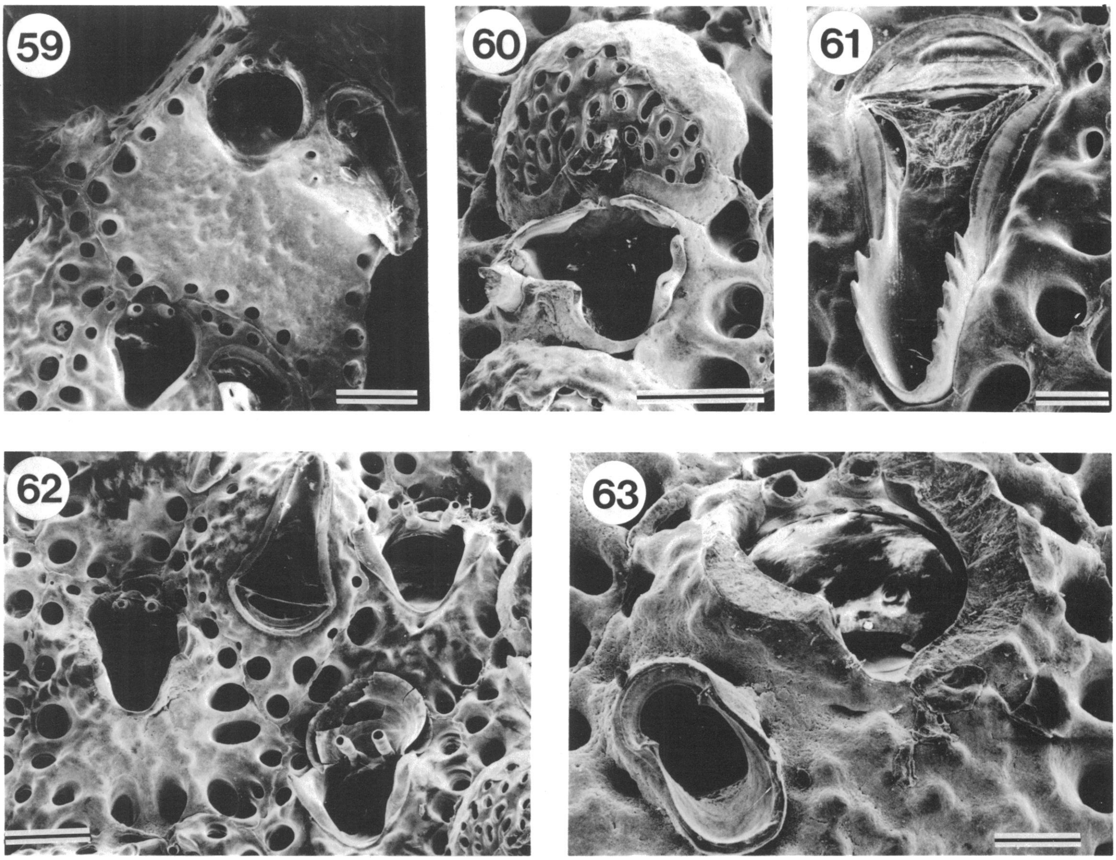
FIGS. 55–58. **55.** *Parasmittina parsevalii,* Bali (AMNH 608), growing edge of colony. Scale = 1 mm. **56.** *P. parsevalii,* Sanur (AMNH 609), close-up of giant spatulate avicularium. Scale = 200 μm. **57.** *P. parsevalii,* Komodo (AMNH 610), ovicelled zooids showing various types and orientations of avicularia. Scale = 200 μm. **58.** *P. parsevalii,* Sanur, ovicelled region of same colony seen in figures 55 and 56. Scale = 200 μm.

and slits, and there is a peripheral layer of secondary calcification.

	Measurements		
	Range	Mean	N
Lz	0.360–0.612	0.444	15
Wz	0.270–0.468	0.362	15
Lo	0.108–0.198	0.138	15
Wo	0.108–0.162	0.131	15
Lov	0.162–0.198	0.183	6
Wov	0.216–0.270	0.237	6
Small avicularia			
Lav	0.054–0.108	0.077	8
Wav	0.054	0.054	8
Avicularia near orifice			
Lav	0.108–0.144	0.117	8
Wav	0.054–0.072	0.065	8
Spatulate avicularia			
Lav	0.288–0.342	0.313	5
Wav	0.090–0.162	0.122	5

DISCUSSION: Most of the specimens examined by Harmer (1957) including the specimen from Ghardaqa, Red Sea, appear to belong to one species. There are two exceptions. The specimen from Torres Strait (Haddon Collection, reg. Feb. 24, 1898) does not belong to that species. In the specimen from Skeat, Malay Peninsula, which Harmer illustrated as a variation because of its reversed avicularia (pl. LXV, fig. 6), the avicularia are not just reversed, but have a very bulbous rostral surface; that specimen probably represents a third species.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 38I, *Siboga* Station 77, Borneo Bank, Strait of Makassar, 59 m; specimen illustrated in Harmer (1957), pl. LXV, fig. 5. 45B, same station. 388C, 388C-1, *Siboga* Station 81,



FIGS. 59–63. **59.** *Parasmittina hastingsae,* Komodo (AMNH 611), close-up of zooid at growing edge to show broad lyrula and two oral spines. Scale = 100 μm. **60.** *P. hastingsae,* close-up of ovicell. Scale = 100 μm. **61.** *P. hastingsae,* close-up of giant triangular avicularium, showing serrated edge of rostrum. Scale = 100 μm. **62.** *P. hastingsae,* showing giant avicularium. Scale = 100 μm. **63.** *P. hastingsae,* showing small oval avicularium. Scale = 40 μm.

Borneo Bank, Strait of Makassar, 0–34 m. 563A, *Siboga* Station 37, Sailus Ketjil, Paternoster Is., 0–27 m. 289A, *Siboga* Station 47b, Sumbawa, N., 296 m. 23J, 325G 2, 325N-1, *Siboga* Station 50, Badjo Bay, W. Flores, 0–40 m. 72C, *Siboga* Station 303, Haingsisi, Samau Island, W. Timor, 0–36 m. 81B, *Siboga* Station 105, Sulu Archipelago, 275 m. 150E, 518A, *Siboga* Station 204, between Wowoni and Buton, S.E. Celebes, 75–94 m. 295G, *Siboga* Station 273, Jedan, Aru Island, 13 m. 376K, *Siboga* Station 213, Saleyer, S. of Celebes, 0–36 m. 412C, *Siboga* Station 310, Sumbawa, E., 73 m. 377E, *Siboga* Station 240, Banda, Banda Sea, 0–45 m. Harmer list, no. 1394, Malay Peninsula, Skeat, reg. Nov. 30, 1899, 1b. Harmer list, no. 1379, Ghardaqa, Red Sea, Crossland, 4d. Harmer list, no. 1409, Torres Strait, Haddon, reg. Feb. 24, 1898, 175.

OCCURRENCE: Sanur and Komodo. One of the more abundant species found. To judge by the number of specimens listed in Harmer (1957), it was also one of the most abundant species in *Siboga* collections.

DISTRIBUTION: Indonesia, W. Africa, Australia, Philippines, India, Red Sea.

Parasmittina hastingsae Soule and Soule, 1973
Figures 59–63

Parasmittina hastingsae Soule and Soule, 1973, p. 417.

DESCRIPTION: The colony is small and encrusting on coral. Zooids are diamond shaped. The surface of the zooid is smooth in younger portions of the colony. There is a row of marginal pores which are small on zooids near the growing edge and become larger in older zooids by incorporation in larger pits. Two spines are located at the distal edge of the orifice, which is almost square. The lyrula is broad and slopes down into the orifice opening. Older zooids develop a broad secondary sinus. The peristome is raised laterally, forming two lappets which flare out on the sides. There are three kinds of avicularia: two are located on the zooid, and the third is interzooecial. One type of avicularium is oval and directed distally. It is located on the side or slightly below the orifice. The second type is triangular, directed outward and distally, located on the side of the orifice, and raised slightly. The interzooecial avicularium has a triangular and serrated rostrum with a rounded proximal end. The two parts are divided by a cross-bar. The ovicell is globose, its surface covered with many pores.

	Measurements		
	Range	Mean	N
Lz	0.288–0.540	0.356	10
Wz	0.252–0.396	0.306	10
Lo	0.090–0.144	0.115	10
Wo	0.108–0.144	0.115	10
Lov	0.144–0.180	0.162	7
Wov	0.216–0.234	0.221	7
Small oval avicularia			
Lav	0.090–0.144	0.111	7
Wav	0.054	0.054	7
Medium triangular avicularia			
Lav	0.144–0.216	0.162	7
Wav	0.054–0.090	0.072	7
Interzooecial avicularia			
Lavz	0.216–0.450	0.354	9
Wavz	0.162–0.270	0.206	9
Lav	0.144–0.396	0.274	9
Wav	0.072–0.162	0.118	9

OCCURRENCE: Two colonies were found at Komodo.

DISTRIBUTION: Hawaii, Indonesia.

FAMILY CREPIDACANTHIDAE LEVINSEN, 1909

Genus *Crepidacantha* Levinsen, 1909

Crepidacantha carsioseta, new species

Figures 64–66

DIAGNOSIS: *Crepidacantha* with 10 marginal spines, a trifoliate proximally arcuate orifice, and a rounded suboral umbo. Paired avicularia located just proximal to the umbo, their mandibles directed crosswise. Ovicell with curved median band of pores.

ETYMOLOGY: The species name is derived from the Greek *karsios* = crosswise, and the Latin *seta* = bristle, in an attempt at paralleling the other descriptive names used in this genus.

HOLOTYPE: AMNH 612.

DESCRIPTION: The colony is encrusting. Zooids have 10 marginal spines and a frontal wall that is imperforate except for marginal areolae. The frontal wall surface is faintly granular and slightly convex with a pronounced suboral umbo. The orifice is trifoliate, rounded distally, and arcuate proximally, its distal edge raised so that it is hooded in side view. A pair of small triangular avicularia face each other across and proximal to the suboral umbo, their mandibles directed proximomedially (crosswise). The ovicell is globular and imperforate except for a curved median row of pores (fig. 65).

	Measurements		
	Range	Mean	N
Lz	0.396–0.540	0.436	5
Wz	0.270–0.324	0.299	5
Lo	0.090–0.108	0.104	5
Wo	0.090	0.090	5
Lov	0.162	0.162	1
Wov	0.180	0.180	1
Lav	0.036–0.054	0.040	5
Wav	0.018	0.018	5

DISCUSSION: Brown (1954) revised the species of the genus *Crepidacantha.* Of the species he discussed, *C. carsioseta* most closely resembles *C. poissonii* and *C. solea,* two species which have avicularian mandibles directed inward and an ovicell with a band-shaped porous area. Harmer (1957) found two species of *Crepidacantha, C. poissonii* and *C. crinispina,* in the *Siboga* collections. Brown did not have access to Harmer's *Siboga* specimens (Harmer's ascophoran manuscript had not yet been published), so did not discuss them. However, examination of Harmer's specimen of *poissonii* showed it to be that species and not *carsioseta.* In *C. poissonii,* the avicularia are located much closer to the orifice and to the lateral edge of the zooid, and there is no pronounced suboral umbo. In avicularian position and in the presence of the suboral umbo, *C. carsioseta* is very similar to *C. solea,* a species described by Canu and Bassler (1929) from Tizard Reef, South China Sea. However, in that species the proximal lip of the orifice is squared rather than rounded.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) *Crepidacantha poissonii,* 249Q, *Siboga* Station 310, Sumbawa, E., 73 m.

OCCURRENCE: Sanur. Only one colony found. It was heavily fouled by diatoms and encrusting algae.

FAMILY MICROPORELLIDAE HINCKS, 1879

Genus *Fenestrulina* Jullien, 1888

Fenestrulina harmeri, new species
Figures 67–69

Fenestrulina malusii Harmer, 1957, p. 966, in part.

DIAGNOSIS: *Fenestrulina* with an evenly porous frontal wall, one or two rows of pores distal to the orifice, a single oral spine, and three or four pore chambers in distal halves of zooids. Ascopore crescentic, denticulate, with a proximally raised rim. Ovicell with radiating ridges and a marginal row of pores.

ETYMOLOGY: The species is named in honor of Sir Sidney F. Harmer, who made the study of bryozoans from the Indonesian area a major part of his life's work.

HOLOTYPE: AMNH 613.

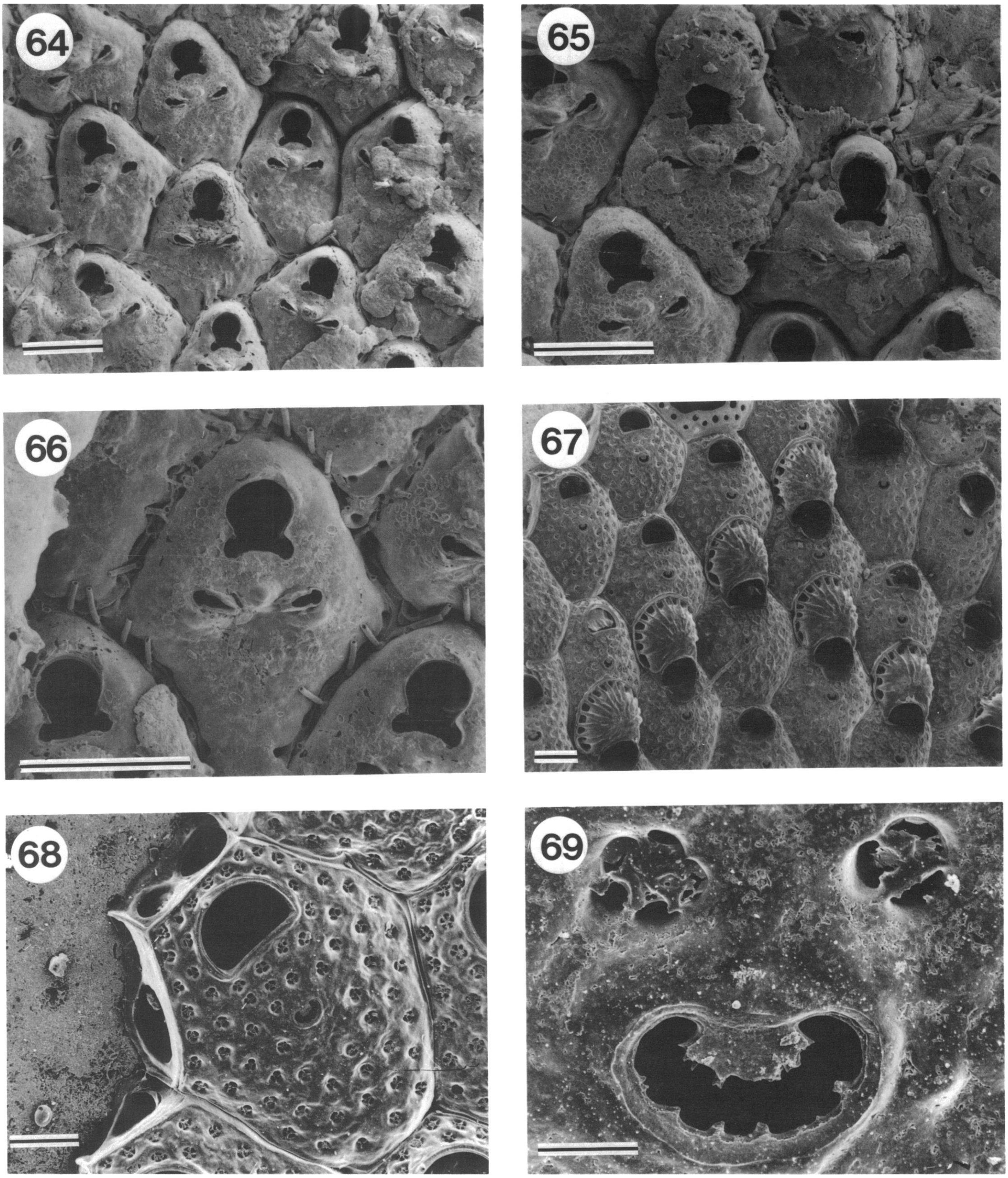
PARATYPES: AMNH 614, 615.

DESCRIPTION: The colonies are encrusting on pieces of shell. Zooids are hexagonal, the frontal wall slightly convex and granular in texture, its surface evenly perforated by large pores. In just budded zooids these pores are round, but in older zooids they are stellate, their centers filled by tissue (fig. 69). Three or four pore chambers can be seen in distal halves of zooids (fig. 68). One or two rows of pores occur distal to the orifice, and there is no imperforate proximal area. The orifice is semicircular, with a smooth rim from which one distal oral spine (fig. 68) emanates. The median ascopore (fig. 69) is crescentic and denticulate, with a proximal raised rim. There are no avicularia. Ovicells are prominent, recumbent, and circular in outline, closed by the zooecial operculum. Ridges of calcification radiate from the center of the ovicell past the row of pores just inside its outer rim.

	Measurements		
	Range	Mean	N
Lz	0.450–0.540	0.508	15
Wz	0.396–0.522	0.441	15
Lo	0.072–0.126	0.099	15
Wo	0.144–0.216	0.167	15
Lov	0.234–0.270	0.257	10
Wov	0.270–0.324	0.306	10
Lasc	0.036	0.036	15
Wasc	0.036–0.054	0.049	15

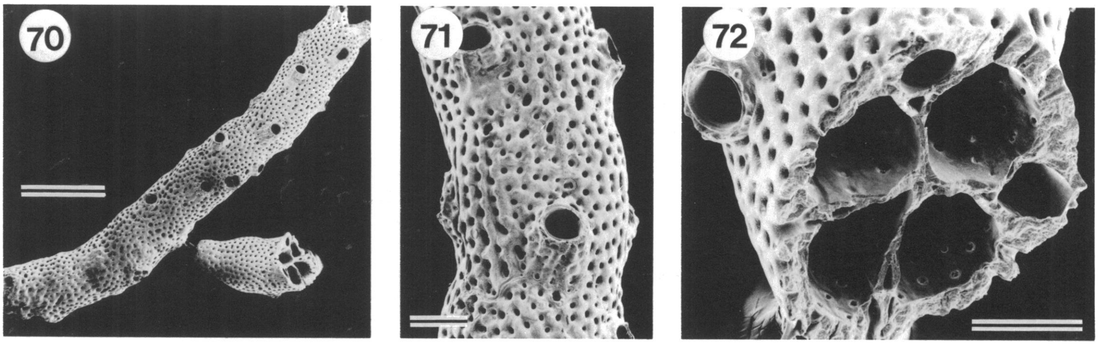
DISCUSSION: A number of species and subspecies of *Fenestrulina* have been described, particularly from the Southern Hemisphere. We feel our specimens differ enough from these to warrant specific designation. Zooids of *Fenestulina malusii* have the central area of the frontal wall proximal to the ascopore imperforate, and the orifice has two or three spines. Two specimens illustrated in the literature are similar to *Fenestrulina harmeri* in having a completely porous frontal wall: the *F. malusii* of Wass and Yoo (1983, figs. 67–69) and *F. catastichos* (described by Gordon, 1984, pl. 40D, E). The specimens from south Australia described by Wass and Yoo have two to three oral spines and the ovicell has a bumpy rather than a ridged texture. In addition, though the frontal wall is porous, there appear to be only narrowed areolae distal to the orifice. According to the description, *F. catastichos* has a row of pores distal to the orifice (though they are not visible in specimens illustrated), but differs from *F. harmeri* in having no orificial spines, having a raised buttonlike disc rimming the ascopore all around, and, at least in the specimen illustrated, having the outer row of pores of the ovicell occluded by calcification. Our specimen most closely resembles the specimen illustrated by Harmer (1957, pl. LXII, fig. 32) from the *Siboga* collection (no. 489C). Of the other *Siboga* material of *F. malusii* in the collection of the British Museum, specimen no. 551A-3 is also *F. harmeri,* but specimen 371G is not. Although Harmer stated that the specimen illustrated in figure 32 is like "the Torres Straits specimen and others," examination of the Torres Strait specimen showed it to belong to a species with a large imperforate frontal area.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) *Fenestrulina malusii,* 489C, *Siboga* Station 136, Ternate, 23 m. 551A-3, *Siboga* Station 310, Sumbawa E., 73 m. 371, *Siboga*



FIGS. 64–69. **64.** *Crepidacantha carsioseta,* Bali (holotype, AMNH 612). Scale = 200 μm. **65.** *C. carsioseta,* including ovicelled zooid. Scale = 200 μm. **66.** *C. carsioseta,* close-up of zooid showing orifice shape and marginal spines. Scale = 200 μm. **67.** *Fenestrulina harmeri,* Komodo (AMNH 613, holotype), zooids and ovicells. Scale = 200 μm. **68.** *F. harmeri,* close-up of growing edge showing pore chambers. Scale = 100 μm. **69.** *F. harmeri,* close-up of ascopore and two pores. Scale = 20 μm.

Station 273, Jedan, Aru Island, 13 m. Harmer list, no. 1669, Torres Strait, Haddon Collection, reg. Feb. 24, 1898, 54. Harmer list, no. 1666, Japan, Uraga Channel, off Tokyo,



FIGS. 70–72. **70.** *Margaretta triplex,* Komodo (AMNH 616), colony branch, showing chitinous joint. Scale = 1 mm. **71.** *M. triplex,* close-up of zooids. Scale = 200 μm. **72.** *M. triplex,* cross-section of branch. Scale = 200 μm.

20–30 fm, Owston Collection, reg. June 23, 1902. Harmer list, no. 1667, Japan, deep water, Prof. Mitsukuri, reg. Sept. 23, 1896.

OCCURRENCE: Komodo.

DISTRIBUTION: Indonesia.

FAMILY MARGARETTIDAE HARMER, 1957

Genus *Margaretta* Gray, 1843

Margaretta triplex Harmer, 1957

Figures 70–72

Tubucellaria cereoides Kirkpatrick, 1890b, pp. 604, 611, in part.
Tubucellaria cereoides var. *chuakensis* Waters, 1907, p. 130. Livingstone, 1926, p. 87.
Margaretta triplex Harmer, 1957, p. 841.

DESCRIPTION: The colony is very young, small, and erect, with chitinous joints. Zooids, almost rectangular in shape, are arranged in four longitudinal rows. The frontal surface is covered by rows of pores except for a small area proximal to the secondary orifice. The peristome is ribbed longitudinally. The secondary orifice is circular and raised. Spine bases can be seen on the edge of the orifice. No avicularia occur. No fertile peristomes were present on the colony collected. According to Harmer (1957) these are truncated cones, transversely directed, with swollen bases.

	Measurements		
	Range	Mean	N
Lz	0.090–1.026	0.965	5
Wz	0.360–0.486	0.410	5
Lo	0.108–0.127	0.112	5
Wo	0.144	0.144	5

OCCURRENCE: One colony was collected at Komodo.

DISTRIBUTION: Torres Straits, Zanzibar, Australia, Indonesia.

SUPERFAMILY CELLEPOROIDEA LAMOUROUX, 1821

FAMILY CELLEPORARIIDAE HARMER, 1957

Genus *Celleporaria* Lamouroux, 1821

Celleporaria sibogae, new species

Figures 73–78

Celleporaria fusca Harmer, 1957, p. 680, in part.

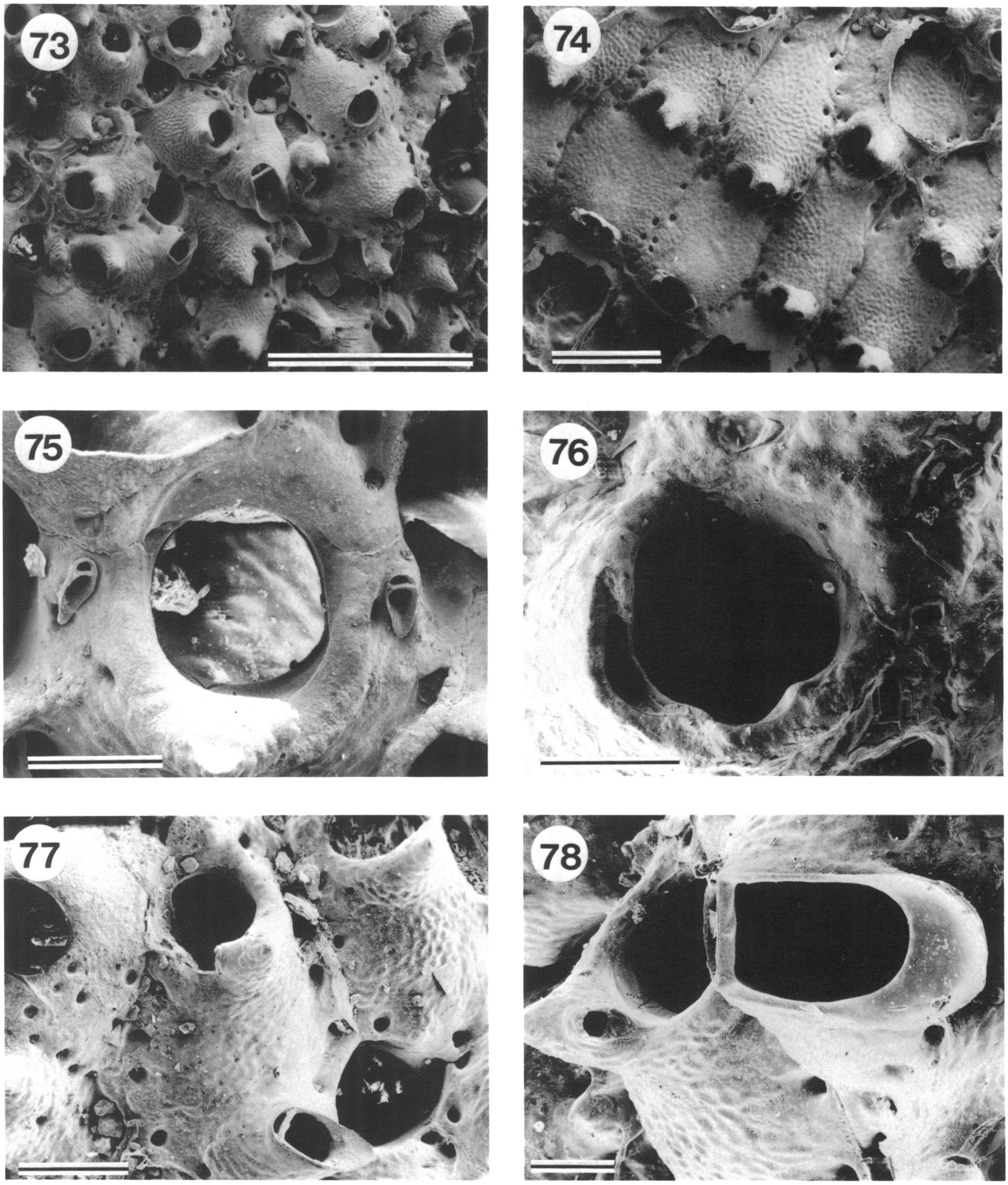
DIAGNOSIS: *Celleporaria* with primary orifice orbicular and without a sinus. Frontal wall granular in texture and imperforate except for marginal and a few distal pores. Peristome blunt, sometimes bifid, with ovoid suboral avicularium on its side. Scattered small triangular avicularia and large interzooecial avicularia with a smooth, spatulate rostrum of variable length.

HOLOTYPE: AMNH 617.

PARATYPES: AMNH 618, 619.

ETYMOLOGY: The species is named in honor of the *Siboga* Expedition which from 1899 to 1900 made collections of marine organisms at over 300 stations throughout the Indonesian region.

DESCRIPTION: Colonies are encrusting in multilaminar patches on coral and are a dull greenish or grayish color when dried. Zooids are rectangular, decumbent, and regularly ar-



FIGS. 73–78. **73.** *Celleporaria sibogae,* Komodo (AMNH 617, holotype). Scale = 1 mm. **74.** *C. sibogae,* zooids at growing edge of colony. Scale = 400 μm. **75.** *C. sibogae,* close-up showing shape of primary orifice and triangular adventitious avicularia. Scale = 100 μm. **76.** *C. sibogae,* Bali (AMNH 618), a more heavily calcified orifice. Scale = 100 μm. **77.** *C. sibogae,* showing raised interzooecial avicularium. Scale = 200 μm. **78.** *C. sibogae,* showing suboral avicularium, and large interzooecial avicularium. Scale = 100 μm.

ranged at the growing edge (fig. 74), but partially or wholly erect in inner regions. The primary orifice is orbicular, without a sinus (fig. 75), although the peristome as it develops includes a sinus. The frontal surface is imperforate except for marginal areolae (occasionally a few additional pores are at the distal edge of the zooid) and has a regularly granular pebbled-glass texture that continues on the peristome. The peristome is raised into a blunt or bifid point on its side. Facing into the peristomial sinus is a vertically positioned ovoid adventitious avicularium with a serrated rostrum. Other adventitious avicularia with blunt triangular mandibles and raised rostra develop from some marginal pores (fig. 75). Large interzooecial avicularia are scattered over the colony. These have a spatulate mandible and a raised, smooth, curved rostrum with a thick cross-bar (fig. 78). No ovicells were found in our specimens.

	Measurements		
	Range	Mean	N
Lz	0.378–0.594	0.488	15
Wz	0.360–0.576	0.418	15
Lo	0.108–0.162	0.140	15
Wo	0.126–0.180	0.168	15
Lov	0.126–0.162	0.144	6
Wov	0.180–0.270	0.228	6
Small avicularium			
Lav	0.054–0.108	0.094	15
Wav	0.036–0.072	0.054	15
Interzooecial avicularium			
Lavz	0.252–0.360	0.318	3
Wavz	0.198–0.270	0.234	3
Lav	0.180–0.324	0.270	3
Wav	0.108	0.108	3

DISCUSSION: Harmer (1957) placed a large group of pigmented *Celleporaria* from the *Siboga* and other collections in Busk's (1854) species, *Celleporaria fusca*, which was described from Bass Strait. There appears to be no type material for this species. However, the illustration (fig. 9.17d) of Bass Strait *Celleporaria fusca* in Bock (1982) shows a species with interzooecial avicularia raised on a conical rostrum and having a rostrum with a striking serrated edge. A British Museum specimen from Bass Strait (99.5.1.1316, Hincks Collection) appears to be the same. In addition to the very different form of the interzooecial avicularia, it also had considerably larger zooids. In view of this evidence we believe that Harmer's specimens cannot belong to Busk's species. Examination of specimens available at the British Museum indicates that several species may be involved, but most of the *Siboga* specimens belong to the species described above. Torres Strait specimens he cites as *C. fusca* appear to belong to another species. Specimens from the Great Barrier Reef and Queensland show some similarities with *C. sibogae,* but because those we examined lacked interzooecial avicularia, positive identification was impossible. Specimens in our collection from Moreton Bay, Queensland, have small zooids, but have interzooecial avicularia more similar to Bass Strait *C. fusca.* Thus, three (or more) species may be involved, all pigmented, all with small triangular avicularia in marginal positions, and all with nonsinuate primary orifices.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 1963.9.8.13 pt. 71C-1, 71C-9, 71C-2, *Siboga* Station 99, N. Ubian, Sulu Archipelago, 16–23 m. 1963.9.8.12, 71C-3, same station, figured specimen, Harmer (1957), pl. XLIII, fig. 2. 1963.9.8.10, 472M, same station. 1963. 9.8.16, 472K-2, same station. 1963.9.8.17, 466A, *Siboga* Station 91, Muaras Reef, E. Borneo, 0–54 m. 1963.9.8.15, 376G, *Siboga* Station 213, Saleyer, S. of Celebes, 0–36 m. 1963.9.8.28, Torres Strait, 15–20 fm, Kirkpatrick, reg. May 26, 1900. 1963.9.8.23, Port Denison, Queensland, Busk, October 23, 1899. 32.4.20.84 pt., Great Barrier Reef Exp. Station XXII, Hastings. 99.5.1.1316, Bass Strait, Hincks Collection.

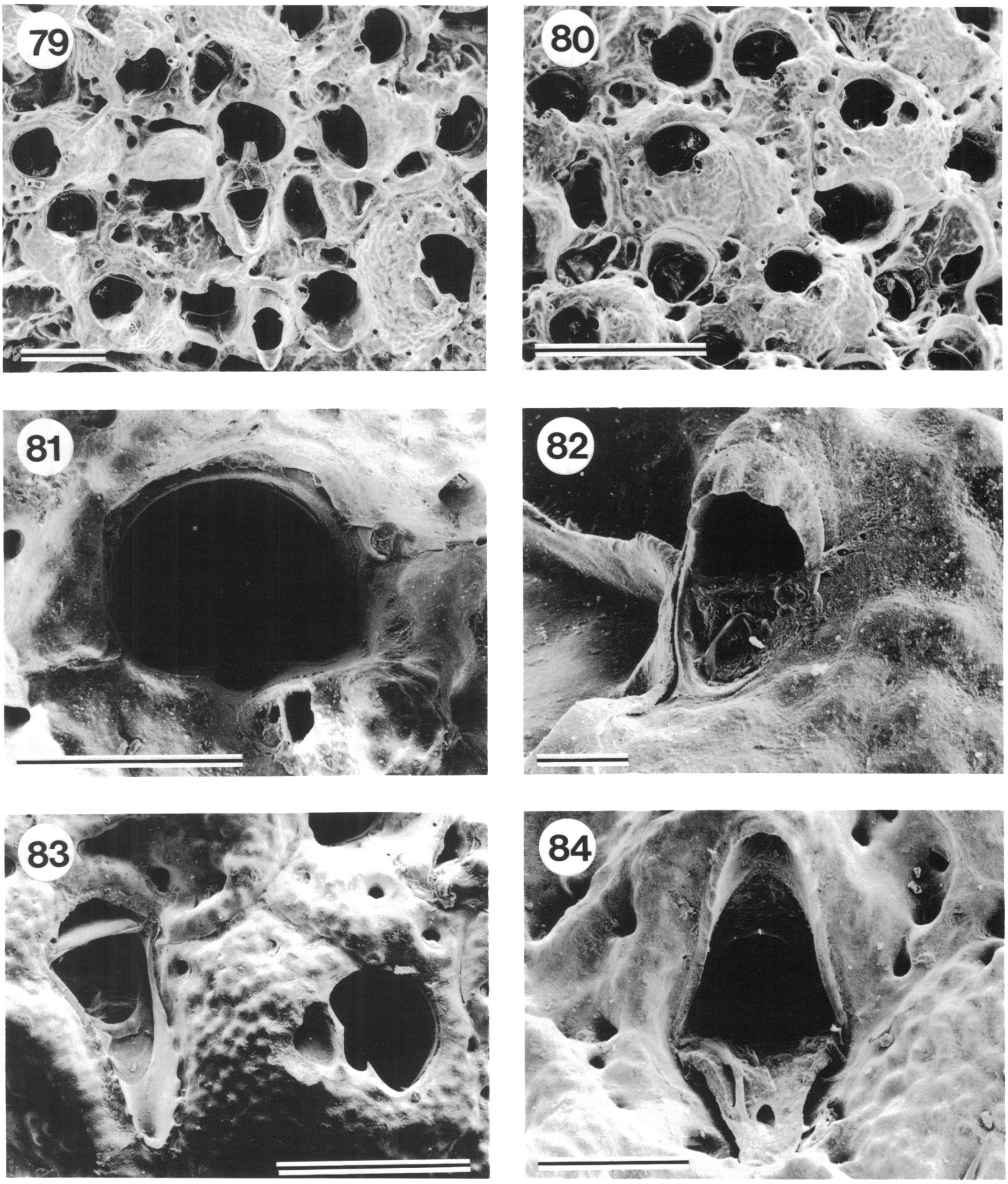
OCCURRENCE: Komodo, Sanur, and Lombok.

DISTRIBUTION: Indonesia.

Celleporaria aperta (Hincks), 1882
Figures 79–84

Schizoporella aperta Hincks, 1882, p. 126.
Mucronella serratimargo Ortmann, 1890, p. 48.
Schismopora cucullata Maplestone, 1905, p. 389.
Holoporella aperta Waters, 1909, p. 161. Livingstone, 1926, p. 97.
?*Holoporella discoidea* Canu and Bassler, 1929, p. 426.
Celleporaria aperta Harmer, 1957, p. 673, in part. Cook, 1968, p. 175.

DESCRIPTION: Colonies are encrusting on coral. Zooids are ovoid, becoming erect in frontally budded regions. The surface is covered with irregularly granular calcification and



FIGS. 79–84. **79.** *Celleporaria aperta,* Komodo (AMNH 620). Scale = 200 μm. **80.** *C. aperta.* Scale = 400 μm. **81.** *C. aperta,* close-up of primary orifice. Scale = 100 μm. **82.** *C. aperta,* close-up of rostral avicularium. Scale = 20 μm. **83.** *C. aperta,* showing triangular interzooecial avicularium. Scale = 200 μm. **84.** *C. aperta,* another triangular avicularium. Scale = 100 μm.

perforated by marginal and occasional frontal pores. There is no high peristome, and the shape of the orifice may be easily seen. The orifice is semicircular with a small, rounded proximal sinus. There are two to four long-jointed oral spines, though these are often broken, and even their bases may be obscured by secondary calcification. Small adventitious avicularia are located on the side of the small conical rostrum, just below the orificial sinus. This avicularium is ovoid and its rostrum has a scalloped edge. Large interzooecial avicularia are common. They have a subtriangular mandible and a serrated rostral margin. Ovicells are caplike and imperforate, with a curved opening above the zooid orifice.

	Measurements		
	Range	Mean	N
Lz	0.270–0.540	0.413	15
Wz	0.216–0.468	0.317	15
Lo	0.090–0.126	0.112	15
Wo	0.108–0.144	0.134	15
Lov	0.180	0.180	1
Wov	0.090	0.090	1
Oral avicularium			
Lav	0.036–0.090	0.065	15
Wav	0.036–0.054	0.038	15
Interzooecial avicularium			
Lavz	0.270–0.540	0.414	15
Wavz	0.144–0.360	0.258	15
Lav	0.180–0.458	0.311	15
Wav	0.090–0.162	0.140	15

DISCUSSION: Our specimens agree best with that illustrated in Harmer's (1957) plate XLII, figure 11. Harmer (1957) noted that the orifice in his specimens sometimes has three denticles. However, upon reexamination of some of the material he cited, it became apparent that he had combined several species under the name *C. aperta,* including colonies of *Celleporaria tridenticulata.* The specimen from Torres Strait belongs to *C. tridenticulata,* as do the *Siboga* specimens from Paternoster Island and Borneo Bank. Some *Siboga* specimens do belong to *C. aperta* (see below); another group appears to belong to a third species which has a tridenticulate orifice and low pointed avicularia. Other specimens Harmer lists under *C. aperta,* e.g., those from Japan and the Suez Canal, appear to belong to entirely different species of *Celleporaria.*

ADDITIONAL SPECIMENS EXAMINED: (BMNH) *Celleporaria aperta*: 97.5.1.720, Singapore or Philippines, type specimen. 1963.3.10.25, 360I, *Siboga* Station 240, Banda, Banda Sea, 0–45 m. 1963.3.10.26, 322J, *Siboga* Station 50, Badjo Bay, W. Flores, 0–40 m. 1963.3.10.15 pt. 298D-2, *Siboga* Station 273, Jedan, Aru Island, 13 m, figured specimen, Harmer (1957) pl. XLII, fig. 11. 1936.12.30.125A, India, Thornely. 1963.3.10.19, Singapore, Hannitsh Collection. 1963.2.12.84, Panama, off Colón, Dundee Collection. 1963.3.10.18, Skeat, Malaya, reg. Nov. 30, 1899. *Celleporaria tridenticulata:* 1963.3.10.17, Torres Strait, figured specimen, Harmer (1957), pl. XLII, fig. 12. 1963.3.10.24, 336B, *Siboga* Station 37, Sailus Ketjil, Paternoster Island, 0–27 m. 1963.3.10.21, 1963.3.10.22, 385C-2, Borneo Bank, Strait of Makassar, 59 m. *Celleporaria* sp. (3): 1963.3.10.16, 295F, *Siboga* Station 273, Jedan, Aru Island, 13 m. 1962.2.20.9, China Sea, 119°35′E, 23°32′N, Professor Ma. Other *Celleporaria* species: 26.9.6.151, 26.9.6.154, Suez Canal, Hastings. 1963.3.10.20, Japan, Uraga Channel, off Tokyo, 150 fm, reg. June 23, 1902.

OCCURRENCE: Komodo.

DISTRIBUTION: Singapore, Philippines, Red Sea, Indonesia, W. Africa, Cape Verde Islands, Caribbean.

FAMILY CLEIDOCHASMATIDAE CHEETHAM AND SANDBERG, 1964

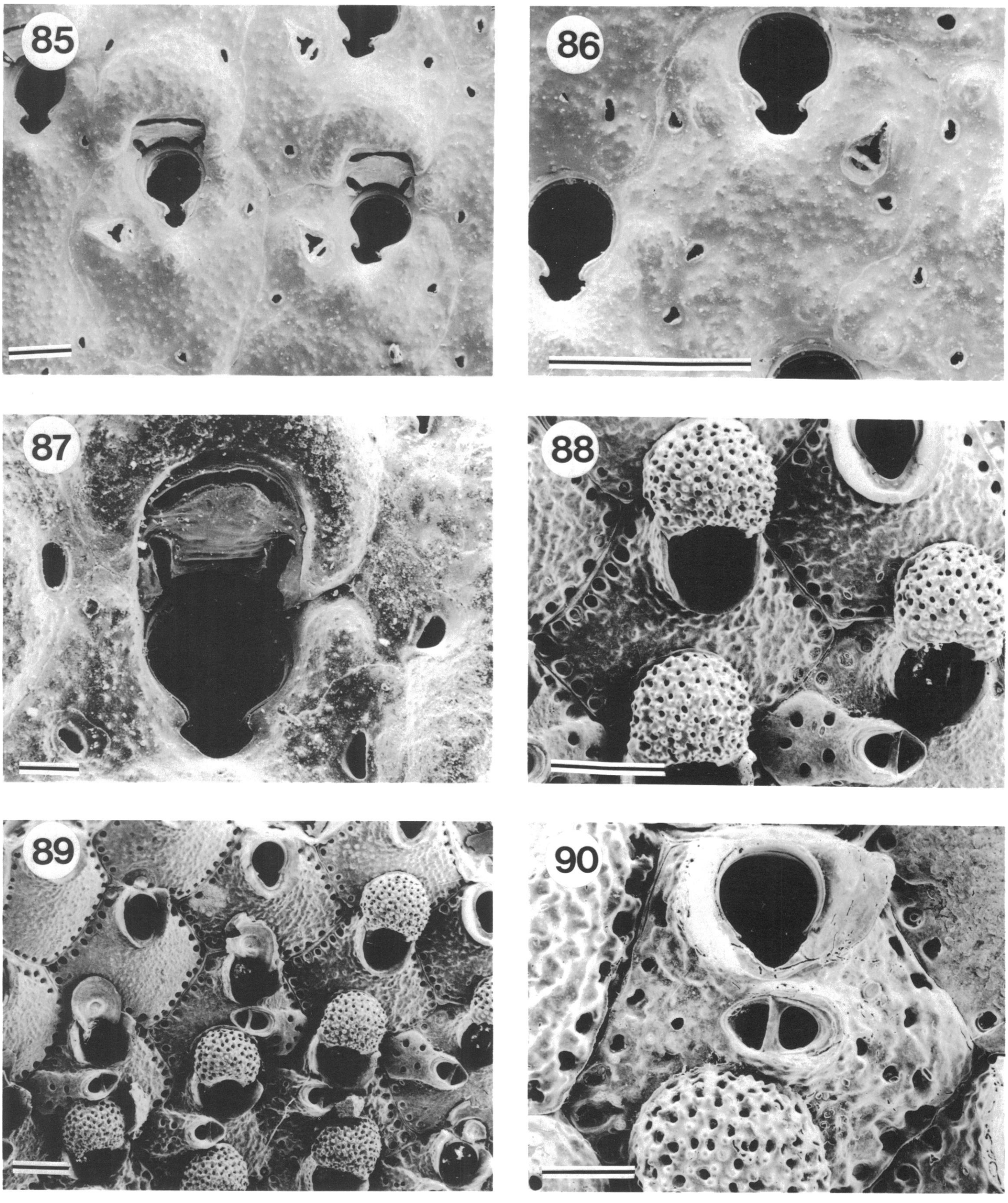
Genus *Cleidochasma* Harmer, 1957

Cleidochasma porcellanum (Busk), 1860

Figures 85–87

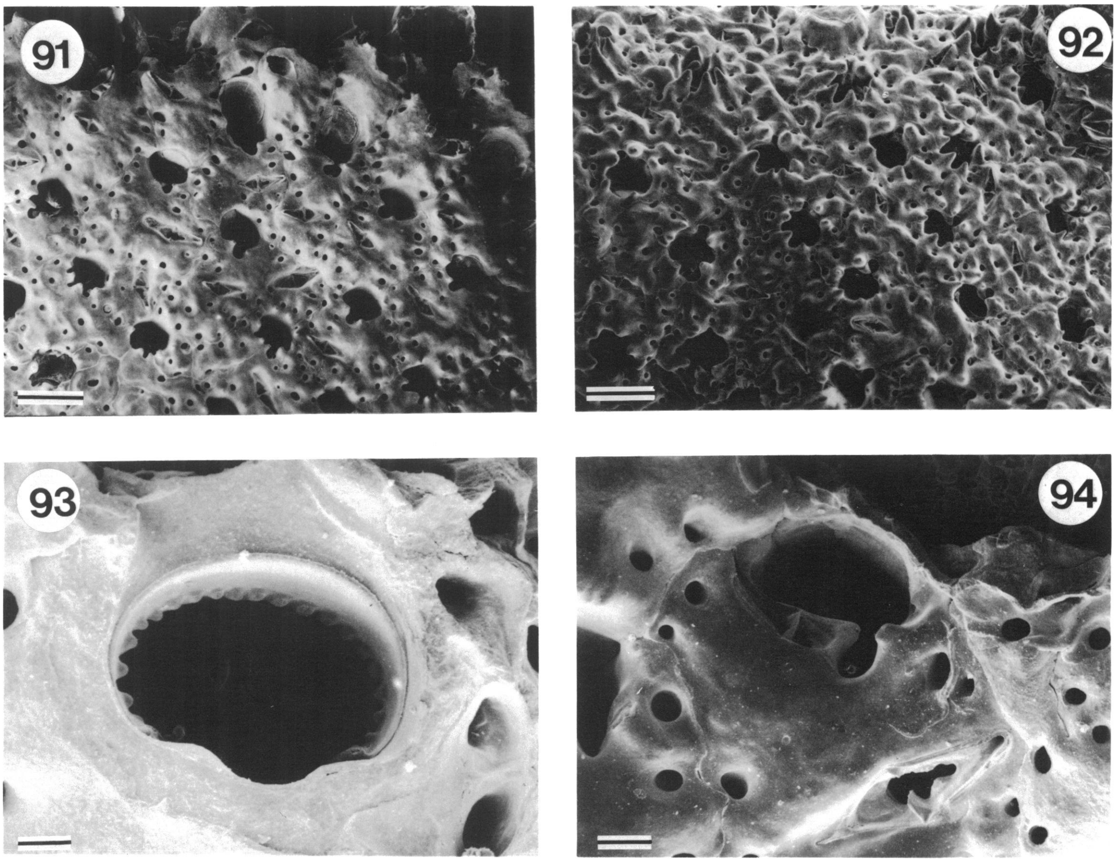
Lepralia porcellanum Busk, 1860, p. 283.
Lepralia cleidostoma Smitt, 1873, p. 62.
Hippoporina cleidostoma Canu and Bassler, 1928a, p. 80; 1928b, p. 104.
Hippoporina porcellana Hastings, 1930, p. 721. Marcus, 1937, p. 96. Osburn, 1940, p. 422; 1952, p. 344. Shier, 1964, p. 633.
Cleidochasma porcellanum Cheetham and Sandberg, 1964, p. 1032. Cook, 1964b, p. 11; 1968, p. 197. Long and Rucker, 1970, p. 19. Powell, 1971, p. 771. Winston, 1982, p. 148; 1984, p. 28.

DESCRIPTION: Colony is encrusting on a piece of coral. Zooids are rectangular in shape. There are three to five marginal pores on a zooid; the otherwise imperforate frontal surface is somewhat granular. A thin line of calcification marks the boundary of each zooid. An umbo is present at the base of the orifice. The orifice is keyhole shaped, with proximally directed condyles. One avicularium is



FIGS. 85–90. **85.** *Cleidochasma porcellanum,* Komodo (AMNH 621), ovicelled zooids. Scale = 100 μm. **86.** *C. porcellanum.* Scale = 200 μm. **87.** *C. porcellanum,* close-up of ovicell plate. Scale = 40 μm. **88.** *C. peristomarium,* Komodo (AMNH 622). Scale = 200 μm. **89.** *C. peristomarium.* Scale = 200 μm. **90.** *C. peristomarium,* close-up of orifice. Scale = 100 μm.

present on each zooid, usually oriented distolaterally. The avicularium is located at the base of or slightly below the orifice. Ovicells are helmet-shaped, deeply immersed, and imperforate. At the opening of the ovicell is a calcified plate, with slitlike openings into



FIGS. 91–94. **91.** *Rhynchozoon verruculatum,* Komodo (AMNH 623), zooids near growing edge. Scale = 200 μm. **92.** *R. verruculatum,* zooids from inner region of colony. Scale = 200 μm. **93.** *R. verruculatum,* close-up of orifice. Scale = 20 μm. **94.** *R. verruculatum,* showing oral avicularium. Scale = 40 μm.

the ovicell at the top and bottom and attached to the ovicell at each side.

Measurements

	Range	Mean	N
Lz	0.234–0.450	0.344	10
Wz	0.252–0.360	0.302	10
Lo	0.108–0.144	0.130	10
Wo	0.090–0.126	0.106	10
Lov	0.162–0.198	0.180	6
Wov	0.216–0.234	0.228	6
Lav	0.072–0.108	0.079	10
Wav	0.036–0.073	0.047	10

OCCURRENCE: One colony was found at Komodo.

DISTRIBUTION: Florida, Gulf of Mexico, Caribbean, Bermuda, Madeira, Brazil, Colombia, Panama, Galapagos Islands, Ceylon, Philippines, West Africa, Indonesia, Red Sea.

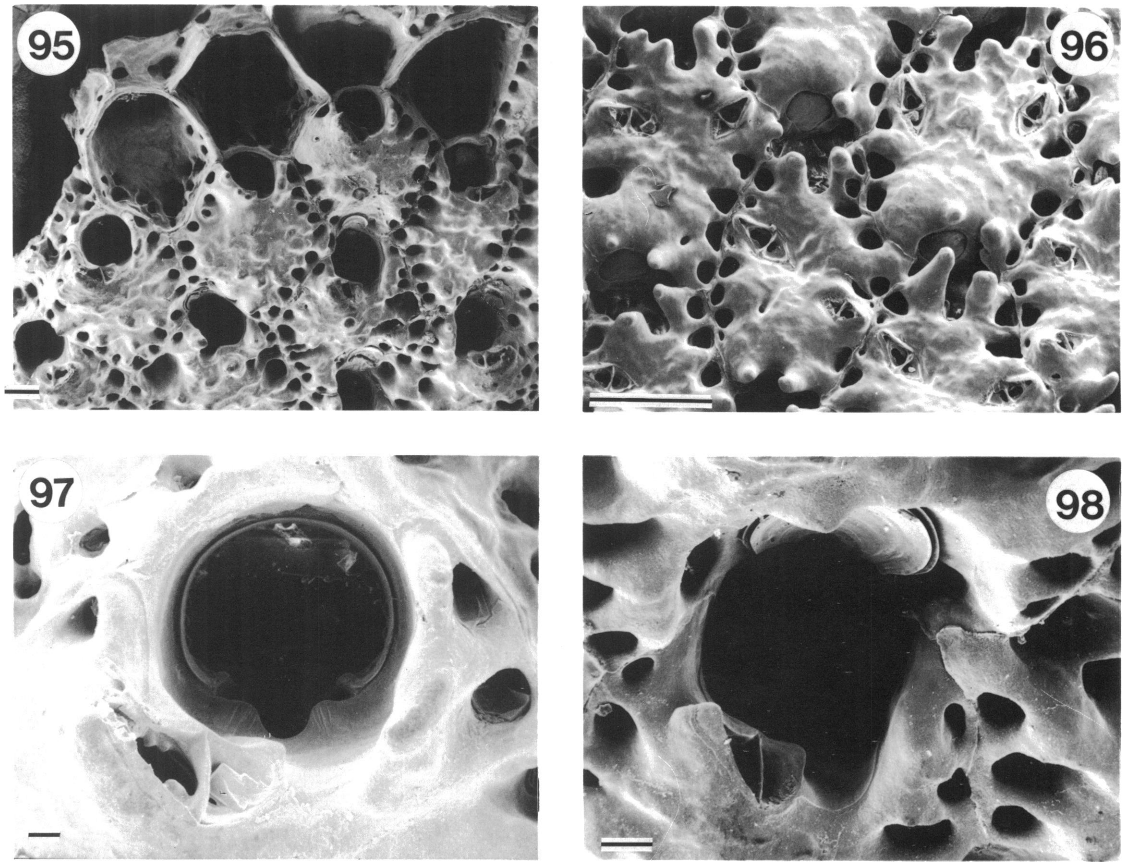
Cleidochasma peristomarium (Canu and Bassler), 1929

Figures 88–90

Gemellipora peristomaria Canu and Bassler, 1929, p. 310.

Cleidochasma peristomarium Harmer, 1957, p. 1047.

DESCRIPTION: The colonies were found encrusting on a piece of shell. The zooids are rhomboidal, their surfaces granular and imperforate except for a row of marginal pores. A thin line of calcification marks each zooid boundary. The orifice is keyhole shaped. A raised peristome flares out on each side of the orifice. The avicularia are located below the orifice and directed transversely inward. They are almost oval in shape with a cross-



FIGS. 95–98. **95.** *Rhynchozoon rostratum,* Bali (AMNH 624), zooids at growing edge of colony. Scale = 100 μm. **96.** *R. rostratum.* Scale = 200 μm. **97.** *R. rostratum,* close-up of orifice. Scale = 20 μm. **98.** *R. rostratum,* close-up of oral avicularium and developing ovicell. Scale = 40 μm.

bar in the middle. Five to six pores perforate the elongated proximal portion of the avicularium. The ovicells are globose and perforated, their surfaces beaded and heavily calcified.

Measurements

	Range	Mean	N
Lz	0.378–0.504	0.439	10
Wz	0.324–0.450	0.376	10
Lo	0.108–0.144	0.128	10
Wo	0.108–0.162	0.119	10
Lov	0.180–0.216	0.196	9
Wov	0.144–0.270	0.236	9
Lav	0.126–0.162	0.135	10
Wav	0.090	0.090	10

OCCURRENCE: Two colonies were found at Komodo.

DISTRIBUTION: Indonesia, Philippines.

Genus *Rhynchozoon* Hincks, 1895

Rhynchozoon verruculatum (Smitt), 1873

Figures 91–94

Cellepora verruculata Smitt, 1873, p. 50. Osburn, 1914, p. 214.

Escharoidea verruculata Busk, 1884, p. 150.

Rhynchozoon verruculatum Canu and Bassler, 1928a, p. 88. Hastings, 1930, p. 728. Marcus, 1939, p. 153. Osburn, 1940, p. 444. Winston, 1984, p. 31.

DESCRIPTION: Colonies encrusting and multilaminar. Zooids at the growing edge are subrectangular in shape; in the older regions of the colony they become irregular. There is a series of marginal pores on each zooid and additional pores in older zooids. The frontal surface of the zooid is smooth. The orifice is semicircular distally, with a beaded margin, and shallowly U-shaped proximally, with a plain margin. There is a peristome around the orifice with a proximolateral avicularium bordering an asymmetrically placed secondary sinus. In older sections of the colony the calcification increases greatly. The tubercles around the orifice are more pronounced and the peristome becomes immersed in the frontal shield. An elongate diamond-shaped avicularium is located on almost every zooid in a median-lateral position. The avicularia point in either a distolateral or lateral direction. Ovicells are semicircular and are embedded in the secondary calcification, so that only the ovicell plate can be seen within the peristome (fig. 91).

	Measurements		
	Range	Mean	N
Lz	0.306–0.450	0.365	15
Wz	0.216–0.342	0.276	15
Lo	0.090–0.126	0.106	15
Wo	0.090–0.144	0.118	15
Lov	0.090–0.144	0.108	5
Wov	0.126–0.216	0.162	5
Suboral avicularium			
Lav	0.072–0.126	0.095	11
Wav	0.036–0.054	0.044	11
Adventitious avicularium			
Lav	0.090–0.216	0.154	13
Wav	0.036–0.072	0.051	13

OCCURRENCE: Komodo.

DISTRIBUTION: Indonesia, Indian Ocean, Caribbean, Florida to Brazil.

Rhynchozoon rostratum (Busk), 1855

Lepralia rostrata Busk, 1855, p. 4; 1856, p. 178.
Rhynchozoon rostratum Hastings, 1930, p. 728. Soule, 1961, p. 43. Soule and Soule, 1964, p. 33. Long and Rucker, 1970, p. 178.

DESCRIPTION: Colonies are encrusting. Zooids are hexagonal. The zooid surface is heavily calcified and divided by a line of calcification. Zooids in older regions of colonies develop prominent peristomial knobs and processes. The primary orifice has a beaded margin distally and a deep, narrow, rounded sinus proximally. A distolaterally suborally directed avicularium is located in the peristome. This avicularium, conspicuous in early ontogeny, has a curved triangular rostrum and a moderately developed uncinate process. Adventitious avicularia are diamond shaped, often paired, and distolaterally directed. The front of the ovicell is covered by a subtriangular to oval plate and is buried in secondary calcification. However, the bumps caused by the ovicells are visible on the frontal surface; thus the ovicells are more prominent than those of many *Rhynchozoon* species.

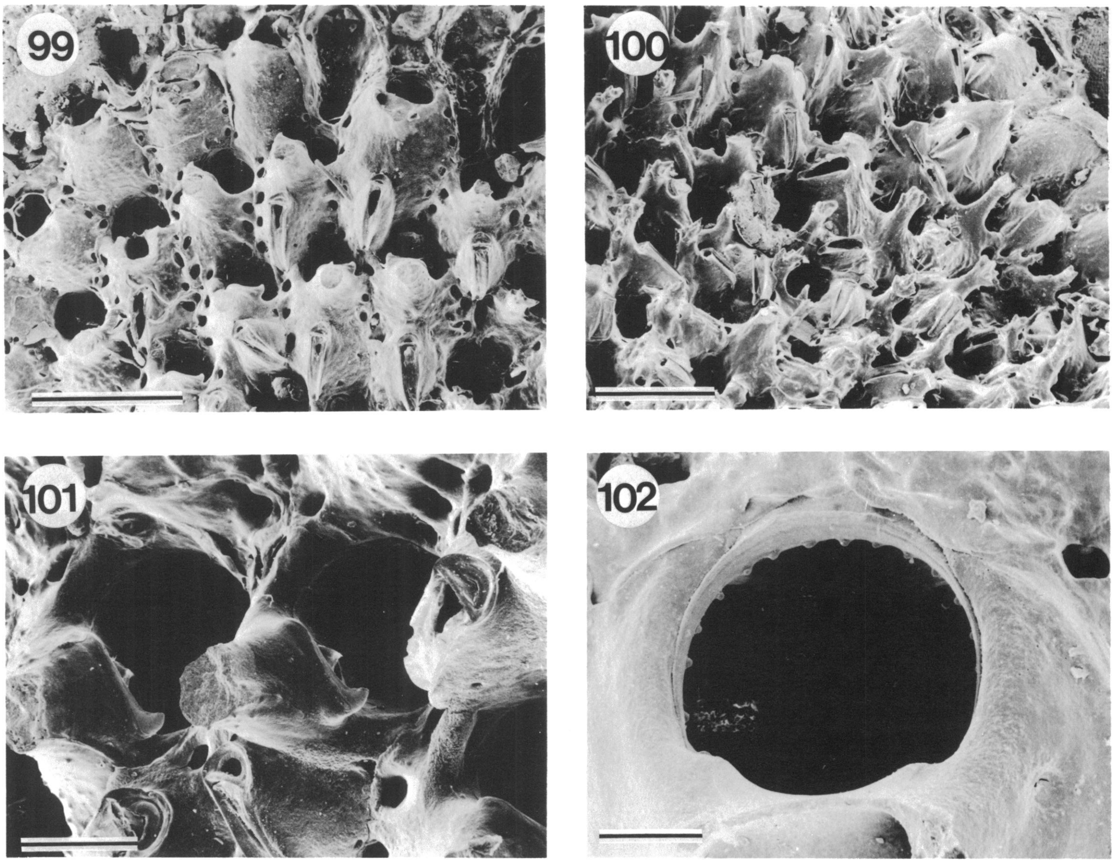
	Measurements		
	Range	Mean	N
Lz	0.342–0.558	0.472	15
Wz	0.270–0.396	0.336	15
Lo	0.108–0.144	0.130	15
Wo	0.108–0.180	0.138	15
Lov	0.108–0.162	0.134	9
Wov	0.171–0.234	0.202	9
Suboral avicularium			
Lav	0.054–0.144	0.110	15
Wav	0.036–0.072	0.047	15
Adventitious avicularium			
Lav	0.072–0.126	0.106	10
Wav	0.036–0.072	0.054	10

DISCUSSION: Osburn (1952) synonymized Smitt's *Cellepora verruculata* (1873) and Busk's *Lepralia rostrata* (1855). Study of Caribbean and Indonesian specimens has shown that, in fact, these are two distinct species, which may co-occur. They are superficially quite similar, and, like most species of *Rhynchozoon,* exhibit marked astogenetic and ontogenetic differences in zooid morphology. Zooids of *R. verruculatum* are somewhat larger than those of *R. rostratum.* In addition to size, the most useful characters for distinguishing the two are the shape of the primary orifice (the sinus is deeper and narrower in *R. rostratum*), the shape of the frontal avicularia (less elongate in *R. rostratum*), and the nature of the ovicell, which is completely immersed in the frontal surface in *R. verruculatum,* but slightly protruding in *R. rostratum.*

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 92.9.6.10, 92.9.6.9, 99.7.1.2237, 99.7.1.1844, 99.7.1.1845, 99.7.1.1846, 99.7.1.1847, all Mazatlan, Busk Collection, paratype material. 29.4.26.169 pt., 29.4.26.229 pt. (two slides), Gorgona 3, St. George Collection, Hastings. 1961.11.2.6, Campeche Bank, Gulf of Mexico, off Alacran Reef, Deep Water #194, Coll. L. Kornicker, det. A. H. Cheetham.

OCCURRENCE: Sanur.

DISTRIBUTION: Indonesia, E. Pacific, Caribbean, Gulf of Mexico.



FIGS. 99–102. **99.** *Rhynchozoon detectum,* Komodo (AMNH 625), zooids at growing edge of colony. Scale = 400 μm. **100.** *R. detectum,* zooids at angle to show length of the rostrum. Scale = 400 μm. **101.** *R. detectum,* orificial avicularia. Scale = 100 μm. **102.** *R. detectum,* close-up of orifice. Scale = 40 μm.

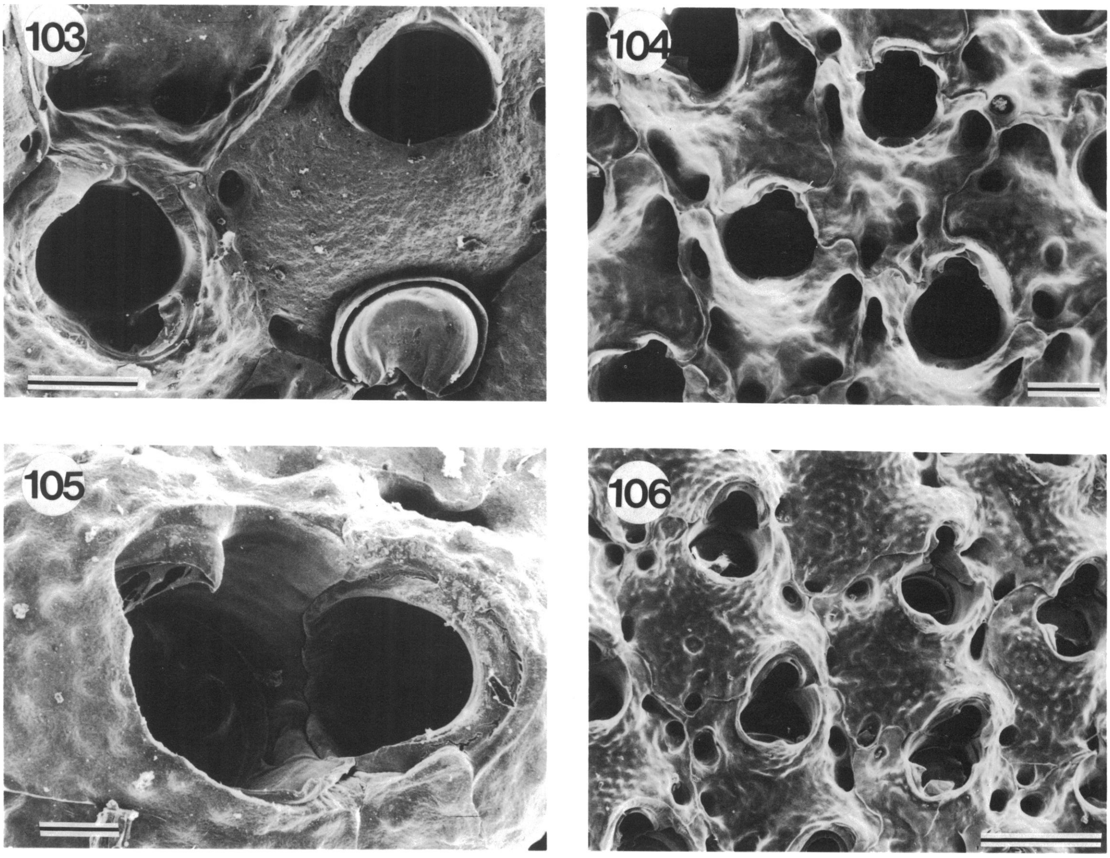
Rhynchozoon detectum Harmer, 1957

Figures 99–102

Rhynchozoon crenulatum Philipps, 1899, pp. 440, 448 (not *Rhynchopora crenulata* Waters, 1887, p. 195).
Rhynchozoon detectum Harmer, 1957, p. 1067.

DESCRIPTION: The colony is encrusting on coral. The zooids' rectangular shape can be seen clearly at the growing edge, while it is obscured in the older portions of the colony. The zooid surface is convex and has a row of marginal pores. The orifice is semicircular and opens into a very broad sinus. The inner distal margin of the orifice is beaded. A long blunt or bifid-ended rostrum is present below the orifice opening. There are two types of avicularia which differ in size and location. Both have a triangular mandible and a rounded base. One is located suborally at the base of the *rostrum.* It has a sharp, pointed uncinate process. The other avicularium is longer and narrower. It is located medially on the frontal wall of the zooid and directed proximally. No ovicells were present on our specimens. According to Harmer, ovicells are large, with a finely tuberculate frontal plate.

	Measurements		
	Range	Mean	N
Lz	0.324–0.486	0.407	15
Wz	0.198–0.342	0.258	15
Lo	0.090–0.144	0.101	15
Wo	0.090–0.198	0.115	15
Suboral avicularia			
Lav	0.072–0.126	0.097	15
Wav	0.054–0.072	0.061	15
Longer avicularia			
Lav	0.162–0.252	0.209	15
Wav	0.054–0.072	0.063	15



FIGS. 103–106. **103.** *Drepanophora verrucosa,* Lombok (AMNH 626, holotype), primary orifice and peristomial avicularium in zooids at growing edge. Scale = 100 μm. **104.** *D. verrucosa,* showing uncinate process in peristome, and developing ovicells. Scale = 100 μm. **105.** *D. verrucosa,* ovicelled zooids. Scale = 200 μm. **106.** *D. verrucosa,* close-up of orifice and avicularium. Scale = 40 μm.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) 483C, 483C-1, 483C-2, 483C-3, *Siboga* Station 117, Kwandang Bay, N. Celebes, 80 m. Harmer's list no. 1871, Torres Strait, Haddon Coll., reg. Feb. 24, 1898, 189. *Rhynchozoon crenulatum,* Lifu, Loyalty Islands, Philipps (Willey Collection), reg. Mar. 1, 1898.

OCCURRENCE: Komodo.

DISTRIBUTION: Lifu, Loyalty Is., Indonesia, Torres Strait.

Genus *Drepanophora* Harmer, 1957

Drepanophora verrucosa, new species
Figures 103–106

DIAGNOSIS: *Drepanophora* with rough pebbled texture to frontal surface, short tubular peristome with a subcircular opening and a hooded, immersed ovicell lacking the typical lateral pores.

HOLOTYPE: AMNH 626.

PARATYPE: AMNH 627.

ETYMOLOGY: The species name is derived from the Latin *verrucosus,* meaning "full of warts," because of the rough, tuberculate zooid surface.

DESCRIPTION: Colonies are encrusting on shell. Zooids are small and ovoid in shape. The frontal wall is convex; it and the tubular peristome become thickened, roughened, and covered by small tubercles. Five or six large areolae are found at zooid margins. The secondary orifice is subcircular. A sharp-beaked triangular avicularium is located inside the peristome on a lateroproximal wall. Hood-shaped ovicells are embedded in the calcification of the distal zooid. Ovicells are covered with the same thick tubercular calcification as zooids; they have a curved rim which shows both calcified layers. In our specimens, which had heavy secondary calcification, the two lateral pores characteristic of *Drepanophora* were not apparent. Ovicell pores seemed to be identical with the proximal areolae of the distal zooid and were often completely occluded.

	Measurements		
	Range	Mean	N
Lz	0.306–0.450	0.387	10
Wz	0.252–0.306	0.279	10
Lo	0.090–0.144	0.117	10
Wo	0.108–0.144	0.151	10
Lov	0.090–0.126	0.108	10
Wov	0.144–0.216	0.180	10
Lav	0.036–0.072	0.054	10
Wav	0.036–0.054	0.040	10

DISCUSSION: Examination of British Museum specimens of the three Indo-Pacific species described by Harmer (1957) showed that the specimen found in our collection did not correspond to any of them. It is somewhat similar to *Drepanophora tuberculatum,* a species described by Osburn (1914), from the Tortugas. However, zooids of *Drepanophora tuberculatum* are slightly larger, with numerous marginal areolae. In addition, the peristomial avicularium is smaller and is oriented frontally, rather than transversely, while the ovicells are initially globose, with distinct lateral pores, although in older regions of colonies they may become increasingly embedded in secondary calcification.

ADDITIONAL SPECIMENS EXAMINED: (BMNH) *Drepanophora incisor*: 06.12.3.13, 1969.1. 10.1, Ceylon, Thornely, 1905, paratypes. 1936.12.30.53, Ceylon, Thornely, 1935, 53, specimen illustrated in Harmer (1957), pl. LXX, figs. 26–28. *Drepanophora corrugata*: 1969.1.10.2, 348M, *Siboga* Station 213, Salayer, S. of Celebes, 0–36 m, specimen figured in Harmer (1957), text fig. 114. 06.12.3.12, Ceylon, Thornely, paratype. 1936.12.30.52D, Ceylon, Thornely. 1938.2.22.2, Maldive Islands (note—this does not appear to be *D. corrugata*). *Drepanophora longiuscula*: 99.7. 1.2012, Bay of Suez, 7 fm, Busk, holotype.

OCCURRENCE: Two colonies were collected at Lombok.

DISCUSSION

Thirty-three species of cheilostome bryozoans were found in these collections: 13 species occurred at Sanur, Bali, 6 species were found at Lombok, and 23 were found at Komodo (table 1). Although Wallace's Line passes between Bali and Lombok, there is no evidence of any influence on the bryozoan distributions. This probably reflects the fact that Lombok Strait, between Bali and the Lesser Sunda chain, is not particularly deep. In view of the various changes in sea level in the region during the last 3 million years (Potts, 1983), Lombok Strait does not represent a barrier to most marine organisms.

The differences between the three sites can be better explained ecologically. The backreef area at Lombok was the shallowest site, ranging from 1 to 1.5 m, and may have received considerable subaerial exposure at times. Only six species were collected there. Four of them were also found in at least one of the other two sites; the other two are known from elsewhere in the region. Although low, this degree of diversity is probably higher than for equivalent depths on Caribbean reefs. For example, at Carrie Bow Cay in Belize, only one species, *Trematooecia aviculifera,* occurred in water less than 1 m in depth, while only three species, *Trematooecia aviculifera, Hippopodina feegeensis,* and *Steginoporella* sp. were found in 1–2 m depths (Winston, 1984). *Hippopodina feegeensis* was also found at Lombok (and at Bali and Komodo); it appears to be one of the most successful reef-dwelling species worldwide (Winston, 1986). The most characteristic Caribbean shallow water species, *Trematooecia aviculifera,* does not occur in the Indo-Pacific. Its ecological replacement may be *Stylopoma viride,* a species which, like *Trematooecia,* has massive well-calcified frontally budding colonies which appear to be less cryptic than those of most reef cheilostomes.

At Sanur, in depths between 2 and 3 m, 13 species were collected. At Komodo, in 1.5 to 2 m depths, 23 species were collected. This diversity is also higher than for equivalent depths in the Caribbean.

Five of the 33 species reported are new. Four species, *Watersipora edmondsoni, Parasmittina hastingsae, Rhynchozoon verrucu-*

TABLE 1
Distributions of Cheilostome Bryozoans Found at the Three Sites Studied

	Bali	Lom-bok	Komo-do	Indo-W. Pac.	Red Sea	E. Atl.	Carib.- W. Atl.	E. Pac.	Austra.
1. *Cranosina coronata*	X			X	X		X		X
2. *Parellisina curvirostris*			X	X		X	X	X	
3. *Caulibugula mortenseni*			X	X		X			
4. *Scrupocellaria spatulata*			X	X	X				
5. *Thalamoporella stapifera*	X	X		X				X	
6. *Thalamoporella komodoensis**			X						
7. *Steginoporella buskii*	X		X	X		X	X		X
8. *Smittipora harmeriana*			X	X					
9. *Cribrilaria flabellifera*		X		X			X	X	
10. *Exechonella brasiliensis*			X	X			X		
11. *Coleopora verrucosa*			X	X					
12. *Hippopodina feegeensis*	X	X	X	X	X	X	X	X	X
13. *Petraliella chuakensis*			X	X					
14. *Watersipora "subovoidea"*			X	X					
15. *Watersipora edmondsoni*	X			X				X	
16. *Calyptotheca wasinensis*	X			X	X				
17. *Schizomavella inclusa*			X	X					X
18. *Stylopoma duboisii*	X		X	X	X	X			X
19. *Stylopoma viride*	X	X		X	X				X
20. *Parasmittina signata*	X		X	X	X		X	X	X
21. *Parasmittina parsevalii*	X		X	X	X	X			X
22. *Parasmittina hastingsae*			X	X				X	
23. *Crepidacantha carsioseta**	X								
24. *Fenestrulina harmeri**			X	X					
25. *Margaretta triplex*			X	X					X
26. *Celleporaria sibogae**	X	X	X	X					
27. *Celleporaria aperta*			X	X	X	X	X		
28. *Cleidochasma porcellanum*			X	X	X	X	X	X	
29. *Cleidochasma peristomarium*			X	X					
30. *Rhynchozoon verruculatum*			X	X			X		
31. *Rhynchozoon rostratum*	X			X			X	X	
32. *Rhynchozoon detectum*			X	X					X
33. *Drepanophora verrucosa**			X						
	13	5	25	30	10	8	11	9	10

* = new species.

latum, and *Rhynchozoon rostratum* are reported for the first time from Indonesia; the first two were previously known only from Hawaii, the latter two from the Caribbean. As table 1 shows, many of the other species have broad distributions: 91 percent occur elsewhere in the Indo-West-Pacific region, 30 percent reach the Red Sea, and 30 percent occur in Australia, primarily on the Great Barrier Reef. Almost a quarter of the species listed have also been reported from the eastern Atlantic (Mediterranean, West Africa), and 28 percent are reported from the eastern Pacific (Hawaii, Galapagos, Baja California), and 33 percent from the Caribbean. These results are in agreement with Jackson et al.'s (1985) finding that about one-third of Caribbean reef-dwelling cheilostome species are also known from the Indo-West-Pacific, and provide further indication that ecological tolerances of reef-dwelling cheilostome species are generally much greater than those of their coral substrata. This finding does not mean that reef-dwelling cheilostomes can never be useful in biogeographic studies. It does mean that we need to be able to determine which species occupy a narrow ecological niche and which species a broad one, something that can only be accomplished through careful ecological and taxonomic studies of additional bryozoan faunas.

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GLOSSARY

adventitious avicularium an avicularium which develops on the lateral, frontal, or basal wall of an autozooid. It is usually smaller than the supporting autozooid (feeding zooid).

areolae marginal pores in the frontal wall of a zooid.

ascopore a median frontal pore, marking the entrance to the ascus, the sac which permits the protrusion of the polypide in some ascophorans.

avicularium a modified cheilostome zooid in which the internal organs are rudimentary and the operculum is enlarged into a blade-, spoon-, or bristle-shaped mandible, opened and closed by hypertrophied muscles.

caliper a calcareous spicule, shaped like the measuring device called an outside caliper, found beneath the frontal membrane of members of the genus *Thalamoporella.*

compass a calcareous spicule in the form of two straight pointed rods joined at one end, resembling a drafting compass. These occur beneath the frontal membrane of members of the genus of *Thalamoporella.* The morphology of compasses and calipers is important in species-level taxonomy.

condyles paired small skeletal projections on which the operculum of autozooids or the mandible of avicularia pivot.

costae the modified spines which curve and meet over the frontal membrane in cribimorph cheilostomes, forming a frontal shield.

cross-bar a bar of calcification on which the mandible is hinged in many avicularia.

cryptocyst frontal skeletal reinforcement formed by calcification of an interior wall which grows out parallel to, but beneath, the frontal membrane of a zooid. In living zooids there is a coelomic fluid-filled space between the cuticle-covered frontal membrane and the underlying cryptocyst. The cryptocyst contains uncalcified spots for passage of muscles and connections to the main body cavity of the zooid.

decumbent lying flat (in reference to the position of zooids at the growing edge of a colony).

distal the direction toward the growing edge of the colony and away from the ancestrula or metamorphosed larva, the origin of colony growth.

erect (1) colonies with bushy or treelike forms or (2) zooids with deep body cavities and relatively short frontal walls, often with the orifice displaced medially. They are characteristic of the secondary layers in many species with frontal budding.

frontal in the direction of the orifice-bearing surface of a zooid or colony.

frontal membrane uncalcified frontal body wall, consisting of an outer noncellular cuticle, produced by underlying epidermis.

frontal wall calcareous frontal covering which may be formed in several different ways and modified during the life of the zooid by secondary calcification. The morphology and texture of the frontal wall is an important component of species descriptions.

gymnocyst frontal wall formed by deposition of calcification between the outer cuticle and the epidermis of the frontal membrane. It may be completely calcified or have gaps (pores) covered only by cuticle.

intercalary cuticle the outermost layers of lateral walls of adjoining zooids. The frontal trace of this cuticle and the rims of calcification on either side of it often form a very noticeable line of demarcation between zooids.

interzooecial avicularium one which is placed in the budding series between zooids, communicates with at least two zooids, but is smaller than a feeding zooid in size.

lappets lateral extensions of the calcification of the peristome.

lyrula a median toothlike projection of calcification at the proximal end of the orifice.

mandible the enlarged and modified operculum of an avicularium, capable of opening and closing by muscular action.

mural rim raised inner edge of the gymnocyst, often carrying marginal spines.

opesia a noncalcified area under the frontal membrane, bordered by cryptocyst.

opesiule groove or hole in cryptocyst through which parietal muscles pass.

oral in the vicinity of the orifice.

orifice opening through which the lophophore protrudes for feeding. In almost all cheilostomes this is closed by a hinged or pivoting operculum. In many ascophorans the orifice is sinuate, the proximally located sinus marking the opening to the ascus, through which water enters as the tentacles are protruded through the larger distal portion.

ovicell brood chamber, usually mostly calcified, located at the distal end of the maternal zooid.

palate the space beneath the avicularian mandible equivalent to the orifice or opesia of an autozooid. In life it is covered by frontal membrane and has a central opening to the polypide rudiment.

peduncle the stalk of a bird's head avicularium, formed by the proximal portion of that modified zooid.

peristome a raised rim or collar of calcification surrounding the primary orifice. Its opening is called the secondary orifice.

polypide tube a square-sided or semicircular section of cryptocyst which covers the retracted tentacle sheath in some families of anascans, e.g., Steginoporellidae, Thalamoporellidae.

pores gaps in calcification of frontal walls of zooids, ovicells, and (rarely) avicularia. Though in the skeletal preparations used in taxonomy these are open holes, in life they are covered by cuticle and may be plugged by tissue as well.

primary orifice the opening in the body wall through which the feeding organs are extruded, located directly beneath the operculum. The shape of the primary orifice is of great importance in cheilostome taxonomy. However, in species with long peristomes, the primary orifice may be impossible to see without breaking away the peristome.

proximal in the direction of the ancestrula, the origin of colony growth.

rostrum (1) a sharp or blunt pointed suboral spike of solid calcification, usually supporting an avicularium (e.g., in *Celleporaria*) or (2) the distal calcified beaklike end of an avicularium on which the closed mandible rests.

scutum a modified (usually enlarged and flattened) marginal spine which overarches the frontal membrane in members of the Scrupocellariidae.

secondary calcification additional deposition of skeletal material occurring as a zooid ages. In some species this can completely transform a zooid's appearance; thus in taxonomic work it is often necessary to examine recently budded zooids as well as those in older regions of the colony in order to determine identity.

setae the long bristlelike mandible of a vibraculum.

sinus (1) an indentation or slit in the proximal end of the peristome or (2) the U- or V-shaped proximal portion of the primary orifice in some ascophorans.

spatulate shaped like a spoon or a broad blunt-ended blade (of avicularian mandibles).

spine a tubular or flattened projection of calcified body wall and coelomic cavity, sometimes jointed.

umbo a suborificial moundlike projection of solid calcification on the frontal wall of a zooid. See also **rostrum** (1).

vibraculum an avicularium with an elongate bristlelike mandible.

vicarious avicularium an avicularium which replaces an autozooid in the budding series and is in the same size range as an autozooid.

zooid the individual of a bryozoan colony. Autozooids are the regular feeding zooids of the colony. Additional specialized polymorphic zooids: avicularia, gonozooids, rhizooids, and kenozooids are found in most cheilostome species.