

hexamerally arranged in 4 complete cycles: $S_1 > S_2 > S_4 \geq S_3$, the S_1 usually quite thick and "swollen" appearing. Three crowns of thick, ridged pali (P_1 , P_2 , and P_3), arranged in typical trochocyathid fashion. Columella of moderate depth; papillose columella composed of 3-40 tuberculate pillars.

REMARKS. — Two specimens from MUSORSTOM 3 stn 108 show evidence of having been bored by an acrothoracican cirripede crustacean, which is not uncommon in this genus (ZIBROWIUS, 1980; CAIRNS, 1995). *Tethocyathus virgatus* is more fully described and illustrated by CAIRNS (1995).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (Sulu Archipelago); 137-275 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Flores Sea (Sumbawa); 240-315 m. *Elsewhere*: ridges north of New Zealand; 142-530 m.

Genus *BOURNEOTROCHUS* Wells, 1984

Bourneotrochus stellulatus (Cairns, 1984)

Deltocyathus stellulatus Cairns, 1984: 15-16, pl. 3, figs C-D.

Bourneotrochus veroni Wells, 1984: 213-214, pl. 3, figs 7-18.

Bourneotrochus stellulatus - CAIRNS, 1995: 71-72, pl. 18, figs f, i, pl. 19, figs a-c (synonymy).

MATERIAL EXAMINED. — *Indonesia*. DEKI: stn 48, 3 (NNM 22760).

SNELLIUS 2: stn 81.2, 2 (NNM 23075).

KARUBAR: stn 3, 2 (USNM 97118). — Stn 7, 2 (POLIPI). — Stn 18, 6 (MNHN).

TYPE LOCALITY. — 19°48'N, 154°58'W (Hawaiian Islands), 337 m.

DIAGNOSIS/REMARKS. — This species was redescribed and illustrated by CAIRNS (1995) based on specimens from ridges north of New Zealand. Six additional specimens from 3 stations are reported above. The anthocyathus is relatively small (usually less than 6 mm GCD), discoidal to cylindrical corallum with a basal scar resulting from transverse division. Each C_1 bears a prominent costal spine. Septa are hexamerally arranged in 4 cycles, the 4th incomplete, usually resulting in 36 septa. Pali occur before all but the last cycle of septa and the columella is papillose.

As previously discussed in this paper, at least 4 Recent species of *Trochocyathus* reproduce by transverse division, and 5 species bear costal spines, which are present as edge spines in 3 species and as 5-11 C_{1-2} spines in another 2 [*i.e.*, *Trochocyathus (Aplocyathus)*]. One species, *T. cooperi* (Gardiner, 1905), has both edge spines and transverse division, but no species of *Trochocyathus* has the character combination of transverse division and 6 C_1 spines, as does *Bourneotrochus stellulatus*. Nevertheless, a strong relationship to *Trochocyathus* is suggested, perhaps even at the subgeneric level.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai and Tanimbar Islands); 263-340 m. *Elsewhere*: Queensland; ridges north of New Zealand; Chesterfield Islands; Funafuti and Tuvalu; Cook Islands; Hawaiian Islands; 274-476 m. Pleistocene of Vanuatu (WELLS, 1984).

Genus *PARACYATHUS* H. Milne Edwards & Haime, 1848

Paracyathus rotundatus Semper, 1872

Figs 13 d-e

Paracyathus rotundatus Semper, 1872: 253-254, pl. 20, figs 15a-b. — FAUSTINO, 1927: 72-73, pl. 5, figs 13-14.

MATERIAL EXAMINED. — *Philippines*. "Albatross": stn 5164, 5 (USNM 97120). Holotype (NMW 8177).

MUSORSTOM 2: stn 9, 3 (MNHN).

Indonesia. DEKI: stn 68, 5 (NNM 22630). — Stn 71, 4 (NNM 22629). — Stn 82, 1 (NNM 22631).
South China Sea. Pulau Redang, Malaysia, 1 (BMNH).
Papua New Guinea. "*Alpha Helix*": stn 79-M-21, 3 (USNM 80015).

TYPE LOCALITY. — Lapinig Canal, Philippines, 11-18 m.

DESCRIPTION. — Corallum elongate-conical to trochoid, straight, and attached by a robust pedicel up to 0.5 GCD. SEMPER's type is slenderer than indicated in the original description: height 16 mm (vs 15 mm), calice 10.5 x 12.2 mm (vs 12 x 15.5 mm). Specimen illustrated herein 11.6 x 13.8 mm in calicular diameter, 20.2 mm in height, and 5.7 mm in pedicel diameter. GCD:LCD = 1.14-1.63. Costae flat and equal in width (about 0.4 mm), covered with low, rounded granules — approximately 3 granules occurring across width of a costa. Septa, paliform lobes, and columella pigmented a dark brown, purple-grey, blue, or blackish-brown. Theca usually white, but occasionally also darkly pigmented at calicular edge.

Septa hexamerally arranged in 5 cycles, the last cycle never complete. Largest specimen with 84 septa (5th cycle lacking 6 pairs of septa); a specimen 7.5 mm GCD with 66 septa. S₁₋₂ about 1 mm exsert, having vertical, straight inner edges that bear 1-3 paliform lobes, the uppermost lobe occurring about 1/2 distance to columella. S₃ only slightly less exsert than S₁₋₂, each bearing 3-5 narrow paliform lobes, the uppermost lobe reaching slightly higher than the P₁₋₂. S₄ less exsert and less wide than S₃, their narrow paliform lobes mingling with those of S₃ low in fossa. S₅ smallest septa, their paliform lobes fusing with those of S₄ in a complex tuberculate region. Fossa relatively deep. Columella trabecular to papillose, concave, and indistinguishable from lowermost paliform lobes of all septa (nondiscrete).

REMARKS. — This is believed to be the first report of additional specimens of *P. rotundatus* since its original description, which was based on one specimen.

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol; Sulu Sea (Sulu Archipelago); 18-66 m. *Indonesia*: Sunda Strait, Java Sea; 35-54 m. *Elsewhere*: Gulf of Papua, Papua New Guinea; South China Sea (Malaysia); 55 m.

Paracyathus sp.

Figs 13 g-i

Paracyathus defilippi - MOSELEY, 1881: 144 (in part: "*Challenger*" stn 190). [Not *Paracyathus defilippi* Duchassaing & Michelotti, 1860].

Paracyathus agassizi - ALCOCK, 1902c: 18. [Not *Paracyathus agassizi* Duncan, 1873].

MATERIAL EXAMINED. — **Indonesia.** "*Challenger*": stn 190, 1 (BMNH).

"*Siboga*": stn 256, 1 (ZMA Coel. 1306).

DEKI: unnumbered station, Ambon, unknown depth, 2 (NNM).

DIAGNOSIS. — Only 4 specimens of this species are known, the largest ("*Siboga*" stn 256) 8.8 x 9.3 in calicular diameter and 9.4 mm in height, and the "*Challenger*" specimen 3.9 x 4.5 mm in calicular diameter and 5.6 mm in height. Corallum elongate-conical and solidly attached through a broad, polycyclic pedicel and base. Costae poorly developed, covered with low, rounded granules. Theca, septa, and pali all mottled with a brown pigmentation, the columella being uniformly brown. Septa hexamerally arranged in 4 complete cycles according to formula: S₁₋₂>S₄>S₃. S₁₋₂ highly exsert (up to 2.5 mm) and, along with their adjacent pairs of S₄, form 12 rectangular lancets. Inner edges of S₁₋₂ bear 1 or 2 narrow paliform lobes. S₃ about 3/4 width of S₁₋₂, each bearing 1-3 slender paliform lobes. S₄ usually slightly wider than S₃, also bearing paliform lobes. Septal faces bear prominent granules and all paliform lobes are highly sinuous and carinate. Columella papillose, consisting of a field of numerous irregularly-shaped rods.

REMARKS. — The 4 specimens available for study of this species are not considered to be enough material to properly characterise the species, but figures are provided to document this form.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai and Ambon Islands); Arafura Sea; 90-397 m.

Genus *STEPHANOCYATHUS* Seguenza, 1864

Subgenus *STEPHANOCYATHUS* (*STEPHANOCYATHUS*) Seguenza, 1864

Stephanocyathus (*S.*) *regius* sp. nov.

Figs 14 a-c

Stephanocyathus nobilis - ZOU, 1988: 74-75 (in part: pl. 1, figs 4-7). [Not *Ceratotrochus nobilis* Moseley, 1873].

MATERIAL EXAMINED/TYPES. — **Philippines**. "*Albatross*": stn 5444, 2 paratypes (USNM 97123). — Stn 5445, 16 paratypes (USNM 97124). — Stn 5447, 2 paratypes (USNM 97125).

MUSORSTOM 1: stn 49, 7 paratypes (USNM 97129). — Stn 54, 2 paratypes (MNHN).

Indonesia. "*Albatross*": stn 5585, 1 paratype (USNM 97126). — Stn 5650, 3 paratypes (USNM 97127). — Stn 5670, 1 paratype (USNM 97128).

"*Hakuho Maru*": stn KH72-1-26, holotype (USNM 97122) and 1 paratype (USNM 97130).

CORINDON 2: stn 241, 2 paratypes (MNHN).

New Zealand Region. "*Tangaroa*": stn T243, 1 paratype (USNM 94362).

TYPE LOCALITY. — "*Hakuho Maru*" stn KH72-1-26: 9°27'S, 127°58.6'E (Timor Sea, south of Leti Islands), 610-690 m.

ETYMOLOGY. — The shape of the corallum in this genus occasionally has been compared to a crown. This theme is reiterated here (Latin *regius*, royal).

DESCRIPTION. — Corallum bowl-shaped, with a flat to slightly convex base. Holotype 29.0 mm in calicular diameter and 12.5 mm in height; largest specimen ("*Hakuho Maru*" stn KH72-1-26) 32 mm in calicular diameter and 11.5 mm in height. Centre of base often displays an irregularly-shaped imprint of detachment from substratum; otherwise, base covered with low, convex, coarsely granular ridges, the C₁₋₂ sometimes slightly more prominent than others. Corallum uniformly white.

Septa hexamerally arranged in 5 full cycles (S₁≥S₂>S₃>S₄>S₅), some specimens as small as 18 mm GCD having a full 5th cycle, whereas other larger specimens (*e.g.*, 25-32 mm GCD) may lack several pairs of S₅, resulting in 86-94 septa. S₁ highly exsert (3.9-4.2 mm), having straight inner edges, each S₁ internally bordered by a broad (up to 2.2 mm) notch and 2 or 3 paliform lobes, each lobe decreasing in size toward columella. S₂ virtually the same as S₁, but sometimes slightly less exsert. S₃ less exsert (about 3.3 mm), only about 4/5 width of an S₁ or S₂, each S₃ bordered by a narrow notch and 1-4 paliform lobes, the outermost lobe sometimes quite wide (2.0 mm). Outermost lobes of P₃ crown always stand higher in fossa than those of P₁₋₂ and are more recessed from the columella. S₄ less exsert (about 2.5 mm), about 4/5 width of an S₃, with slightly sinuous edges, and bordered by 3 or 4 paliform lobes, the outermost lobe being the largest and occurring higher in the fossa and farther from the columella than P₃. Innermost P₄ often fuse with their common P₃ near columella. S₅ least exsert septa (about 1.5 mm), with slightly sinuous inner edges, becoming rudimentary lower in fossa, bearing no paliform lobes. Thus, only the S₁ and S₅ are independent septa, the inner edges of the P₁ reaching the columella and those of the S₅ diminishing in size, whereas the inner P₃ merge with their common P₂ and the inner P₄ with their common P₃. Fossa shallow, containing an elliptical field of 20-30 small densely fused papillae, the innermost P₁₋₄ being indistinguishable in size and shape from the columellar elements.

REMARKS. — Among the 7 species in the nominate subgenus, *S. regius* most closely resembles *S. paliferus* Cairns, 1977 (known only from the western Atlantic at 229-715 m), both species having a similarly-shaped corallum and well-developed paliform lobes. *S. regius* differs in having multiple paliform lobes and in lacking small costal spines on the C₁₋₂. *S. regius* also resembles *Vaughanella multipalifera* Cairns, 1995 in most characters but differs in having an unattached corallum.

ALCOCK (1902a) described 2 additional species of *Stephanocyathus*, each based on a small, worn corallum: ? *Sabinotrochus flatiliseptis* ("Siboga" stn 211, ZMA Coel. 1315, CD = 11.6 mm, Fig. 14 i) and ? *Sabinotrochus bipatella* ("Siboga" stn 52, ZMA Coel. 1314, CD = 8.1 mm, Fig. 14 f). Given their small size and poor state of preservation, they cannot be confidently identified as one of the better known species of *Stephanocyathus*. Although they are illustrated herein, their names are not included in Table 1.

DISTRIBUTION. — *Philippines*: Lubang Island; Lagonoy Gulf; 563-975 m. *Indonesia/Malaysia*: Celebes Sea (Sulu Archipelago); Makassar Strait; Timor Sea (south of Leti Islands); 690-2160 m. *Elsewhere*: South China Sea; Malaysia (Celebes Sea off Sabah); Kermadec Islands (Macauley Island); 1035-1896 m.

Subgenus *STEPHANOCYATHUS* (*ACINOCYATHUS*) Wells, 1984

Stephanocyathus (*A.*) *spiniger* (Marenzeller, 1888)

Figs 13 f, 14 d

Stephanotrochus spiniger Marenzeller, 1888: 20-21.

Odontocyathus sexradiis Alcock, 1902a: 100-101.

Odontocyathus stella Alcock, 1902b: 119-120.

?*Odontocyathus coloradus* Smith, 1913: 288, pl. 18, fig. 8.

Stephanocyathus (*A.*) *spiniger* - WELLS, 1984: 209, pl. 2, figs 10-13. — CAIRNS & PARKER, 1992: 26-27, pl. 7, figs g-i (synonymy). — CAIRNS, 1994: 57, pl. 25, figs a-c (synonymy); 1995: 67-68, pl. 17, figs d-f, pl. 18, fig. c.

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5273, 1 (USNM 97131). — Stn 5369, 15 (USNM 97132). — Stn 5371, 9 (USNM 97133). — Stn 5372, 1 (USNM 97134). — Stn 5440, 1 (USNM 97135). — Stn 5541, 2 (USNM 97136). — Stn 5545, 2 (USNM 97137).

MUSORSTOM 1: stn 2, 1 (MNHN). — Stn 25, 1 (USNM 97139). — Stn 61, 1 (MNHN). — Stn 63, 1 (MNHN). — Stn 65, 1 (USNM 97140).

SIPHILEXP: stn 78-SP40, 2 (USNM 80005).

MUSORSTOM 2: stn 12, 1 (USNM 97141). — Stn 18, 2 (MNHN). — Stn 21, 1 (USNM 97142). — Stn 26, 1 (USNM 97143). — Stn 62, 2: 1 (MNHN), 1 (POLIPI).

MUSORSTOM 3: stn 88, 1 (USNM 97144). — Stn 96, 1 (MNHN). — Stn 97, 1 (USNM 97145). — Stn 98, 1 (USNM 97146). — Stn 99, 1 (USNM 97147). — Stn 102, 1 (MNHN). — Stn 103, 1 (MNHN). — Stn 109, 1 (MNHN). — Stn 120, 1 (MNHN). — Stn 143, 4 (MNHN).

Indonesia. DEKI: stn 2, 12 (NNM 22514). — Stn 3, 1 (NNM 22519). — Stn 4, 1 (NNM 22520). — Stn 5, 3 (NNM 22515). — Stn 6, 3 (NNM 22516). — Stn 22, 3 (NNM 22522). — Stn 41, 1 (NNM 22523). — Stn 42, 1 (NNM 22517). — Stn 49, 1 (NNM). — Stn 50, 3 (NNM 22525). — Stn 52, 1 (NNM 22526). — Stn 63, 2 (NNM 22518).

KARUBAR: stn 61, 1 (MNHN). — Stn 86, 1 (MNHN).

South China Sea. "Hakuho Maru": stn KH72-1-50, 1 (USNM 97150).

TYPE LOCALITY. — Sagami Bay, Honshu, Japan (depth not given).

DIAGNOSIS/REMARKS. — This common, relatively shallow-water Indo-West Pacific species was redescribed by CAIRNS & PARKER (1992) and CAIRNS (1994). It is characterised by having an unattached, bowl-shaped corallum with 6 long (up to 25 mm), slender costal spines (C_1) that project horizontally from the edge of the base. Septa hexamerally arranged in 5 cycles ($S_1 \gg S_2 > S_3 > S_4 > S_5$); however 1 large specimen (KARUBAR stn 86) of 40.6 mm GCD has 6 additional pairs of S_6 , 1 S_6 on each side of an S_1 , resulting in 110 septa. Largest Philippine specimen ("Albatross" stn 5541) 42 mm in calicular diameter, as measured from outer edge to outer edge of opposing exsert S_1 . S_1 and S_2 extremely exsert, each forming a rectangular calicular lancet with its adjacent S_5 (or S_6). S_1 , and occasionally S_2 , pigmented a dark brown or black. Three crowns of broad paliform lobes (P_{1-2} , P_3 , and P_4) present, the P_{1-2} often integrated into the columella.

DISTRIBUTION. — *Philippines*: Lingayen Gulf, Luzon; Lubang Island; Verde Island Passage; Sibuyan, Visayan, and Bohol Seas; Sulu Sea (Semirara Islands and Sulu Archipelago); 152-401 m. ? Neogene of Masbate, Philippines (Smith, 1913). *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands);

210-352 m. *Elsewhere*: widespread throughout Indo-West Pacific from southwestern Indian Ocean to Japan, including South Australia and ridges north of New Zealand, and Charlotte Bank (South China Sea); 120-695 m.

Stephanocyathus (A.) explanans (Marenzeller, 1904)

Fig. 14 e

Stephanotrochus explanans Marenzeller, 1904a: 304-307, pl. 18, figs 19a-b.

Stephanocyathus nobilis - BOSHOFF, 1981: 39. [Not *Ceratotrochus nobilis* Moseley, 1873].

Stephanocyathus (A.) explanans - CAIRNS & KELLER, 1993: 243-244.

MATERIAL EXAMINED. — **Indonesia**. "Albatross": stn 5589, 4 (USNM 97151).

KARUBAR: stn 35, 1 (USNM 97152). — Stn 39, 10 (MNHN). — Stn 40, 9 (POLIPI). — Stn 58, 5 (USNM 97154). — Stn 59, 14 (MNHN). — Stn 70, 2 (MNHN). — Stn 71, 11 (POLIPI). — Stn 75, 7 (POLIPI). — Stn 87, 1 (USNM 97156).

TYPE LOCALITY. — "Valdivia" stns 194, 243, and 245: off Sumatra, Zanzibar Island, and Pemba, 245-614 m.

DESCRIPTION. — Corallum bowl-shaped, with a slightly rounded base, the thecal edges diverging at a 40°-45° angle. Most coralla 21-27 mm in calicular diameter, the largest known corallum (KARUBAR stn 35) 27 mm in calicular diameter and 20.1 mm in height. All specimens bear 6 relatively short, slender, tapered, straight costal spines (basal diameter 1.5-1.7 mm) that project horizontally from the C₁ at point of upward thecal inflection. Spines best known from juveniles, where they are up to 9 mm long; in larger (older) coralla, C₁ spines are either broken or reduced to small nubs. In about 1/4 of specimens examined, 1-5 additional costal spines present on C₂. All costal spines circular in cross section. Lower corallum, to a level just above costal spines, usually eroded, as though submerged in a soft substratum. Theca above this region costate, the costae slightly convex and granular. Corallum white.

Septa hexamerally arranged in 5 cycles, the 5th cycle never complete: the most common septal complement is 72, achieved by having a pair of S₅ in each of the 12 quarter systems adjacent to the 6 S₁. S₁₋₂ about 3.3 mm exsert, having straight, vertical inner edges, each bordered internally by a deep, broad (up to 1.6 mm) notch and a rather narrow, lamellar paliform lobe only about 1 mm wide, which is often merged into the columella. S₃ about 2 mm exsert, 3/4 width of an S₁₋₂, and bordered by a narrow (about 0.5 mm) notch and a prominent, broad (2.0-3.5 mm) paliform lobe. S₄ that are flanked by S₅ almost as wide and exsert as an S₃, but bear a narrow paliform lobe (about 0.9 mm), which is often fused into or subsumed by the P₃. Unflanked S₄ only 1.5 mm exsert, about half width of an S₃, becoming rudimentary lower in fossa. Because P₁₋₂ are directly adjacent to the columella, and P₄ are often fused into the P₃ or poorly developed, many coralla appear to have only 1 crown of 12 massive P₃. S₅ resemble unflanked S₄. Inner edges of all septa and paliform lobes straight. Calicular margin serrate, but not produced into lancets. Fossa relatively shallow. Columella composed of 8-10 granular papillae that are circular in cross section, which distinguish them from the closely adjacent lamellar P₁₋₂.

REMARKS. — *Stephanocyathus explanans* differs from the only other Recent species in this subgenus, *S. spiniger*, in having a serrate (not lanceted) calicular edge; 48-72 (not 96) septa; 6-11 relatively short costal spines that are circular in cross section (vs 6 elongate, basally compressed C₁); a completely white corallum; equal-sized S₁ and S₂; and wider and more developed P₃.

DISTRIBUTION. — **Indonesia**: Arafura Sea (southeast of Tanimbar Islands); 405-1016 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South Africa, Madagascar, and Tanzania; west of Sumatra; 183-614 m.

Subgenus *STEPHANOCYATHUS (ODONTOCYATHUS)* Moseley, 1881

Stephanocyathus (O.) weberianus (Alcock, 1902)

Figs 14 g-h

Stephanotrochus weberianus Alcock, 1902a: 101-102; 1902c: 25, pl. 3, figs 22, 22a.

Stephanotrochus sibogae Alcock, 1902a: 102-103; 1902c: 25-26, pl. 3, figs 23, 23a.

Stephanotrochus sp. - ALCOCK, 1902c: 26.

Stephanocyathus (*O.*) *ixine* Squires, 1958: 54 (in part: "Albatross" stn 5545, pl. 8, figs 3-4).

Stephanocyathus nobilis - ZOU, 1988: 74-75 (in part: pl. 1, figs 1-3). [Not *Ceratotrochus nobilis* Moseley, 1873].

Stephanocyathus (*O.*) *weberianus* - CAIRNS, 1994: 57-58, pl. 25, figs d-f (synonymy); 1995: 68-69, pl. 17, figs g-i (synonymy).

MATERIAL EXAMINED. — **Philippines.** "Albatross": stn 5348, 1 (USNM 97157). — Stn 5349, 1 (USNM 97158). — Stn 5444, 2 (USNM 97159). — Stn 5445, 54 (USNM 46819).

MUSORSTOM 1: stn 49, 4 (MNHN). — Stn 54, 1 (USNM 97166).

Indonesia. "Albatross": stn 5586, 4 (USNM 97160). — Stn 5587, 1 (USNM 97161). — Stn 5601, 1 (USNM 97162). — Stn 5648, 1 (USNM 97163). — Stn 5650, 1 (USNM 97164). — Stn 5671, 1 (USNM 97165).

"Hakuho Maru": stn KH72-1-26, 6: 4 (USNM 97168), 2 (ORI).

KARUBAR: stn 20, 2 (POLIPI). — Stn 89, 1 (MNHN). — Stn 91, 33: 26 (USNM 97167), 7 (MNHN).

TYPE LOCALITY. — "Siboga" stn 284: 8°43.1'S, 127°16.7'E (Timor Sea), 828 m.

DIAGNOSIS. — Corallum bowl-shaped, often with an eroded lower surface. Largest known specimen (KARUBAR stn 91) 54 mm in calicular diameter and 30 mm in height. 12 to 18 costal tubercles correspond to the 12 C₁₋₂ and the C₃ of those half systems that possess 4 C₅. In some specimens, tubercles are replaced by a thickened rim that encircles the base of the corallum. Corallum white. Septa hexamerally arranged in 5 cycles (S₁₋₂>S₃>S₄>>S₅) — the 5th cycle never complete, 72 being a common number of septa. Paliform lobes present before all but last cycle of septa. Columella papillose to lamellar (Fig. 14h), the latter aspect a result of the intermingling of lamellar P₁₋₂.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1994).

DISTRIBUTION. — *Philippines*: Lubang Island; north of Samar; Sulu Sea (Zamboanga Peninsula); South China Sea (Palawan); 563-1388 m. *Indonesia*: Makassar Strait; Molucca Sea; Ceram Sea; Banda Sea (Kai Islands; Teluk Bone, Sulawesi); Timor Sea (southwest of Tanimbar Islands and south of Leti and Timor Islands); 567-1756 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea; Japan (Honshu, Kyushu, northern Ryukyu Islands); Lord Howe Seamount Chain; Chesterfield Islands; 206-1302 m, although most records deeper than 700 m.

Genus *ERICIOCYATHUS* nov.

TYPE SPECIES. — *Eriocyathus echinatus*, here designated.

DIAGNOSIS. — Corallum solitary, bowl-shaped, and free. Septotheca costate, each C₁₋₂ bearing a series of elongate spines. Pali in a crown before penultimate septal cycle (P₃). Columella papillose.

REMARKS. — Among the caryophylliid genera, *Eriocyathus* is most similar to *Stephanocyathus* (*Odontocyathus*), both taxa having similarly shaped coralla of approximately the same size, and costal tubercles or spines on their C₁₋₂. *Eriocyathus* differs in having pali associated only with the S₃, whereas *S. (Odontocyathus)* has 3 (or 4) cycles of paliform lobes. Also, *S. (Odontocyathus)* has only 12-18 costal tubercles (C_{1-2, 3}) relegated to the lower, outer edges of the corallum, whereas *Eriocyathus* has a series of elongate spines along each C₁₋₂. *Stephanocyathus* (*Acinocyathus*) and *Trochocyathus* (*Aploocyathus*) are also similar to *Eriocyathus* in having elongate costal spines, but differ in having a total of only 5 or 6 spines (one per C₁), and in having P₁₋₂ in addition to P₃.

ETYMOLOGY. — The genus name *Eriocyathus* (Latin *ericius*, hedgehog + *cyathus*, cup) refers to the spiny corallum. Gender: masculine.

Ericocyathus echinatus sp. nov.

Figs 15 a-b

MATERIAL EXAMINED/TYPES. — **Philippines.** "Albatross": stn 5423, 1 paratype (USNM M238415). — Stn 5425, holotype (USNM 97168). — Stn 5429, 1 paratype (USNM 97668). — Stn 5487, 8 paratypes (USNM 97170). — Stn 5512, 1 paratype (USNM 97171). — Stn 5513, 3 paratypes (USNM 97172).

TYPE LOCALITY. — "Albatross" stn 5425: 9°38'N, 121°11'E (Cagayan Island, Sulu Sea), 907 m.

ETYMOLOGY. — The species name (Latin *echinatus*, covered with spines) refers to the many costal spines.

DESCRIPTION. — Corallum bowl-shaped and unattached, the base being evenly rounded and the thecal edge angle 43°-53°. Small coralla bowl-shaped, but older coralla have high thecal edges, the largest specimen (the holotype) 18.6 mm in calicular diameter and 16.8 mm in height. Each C₁₋₂ bears a row of long, tapered costal spines that project perpendicularly to the theca. These spines are short (eroded) near the base, but on the sides of the corallum costal spines up to 6.0 mm long with a basal diameter of 1.2 mm. Spines occur approximately every 2 mm, up to 6 aligned on each C₁₋₂; the holotype has at least 60 spines, whereas smaller specimens have fewer. Costae developed as low, convex, granulated ridges only near calicular edge. Corallum white.

Septa hexamerally arranged in 4 complete cycles (S₁₋₂>S₃>S₄), septa of the 4th cycle beginning to be present at a GCD of 5 mm. S₁₋₂ about 3 mm exsert, having straight, vertical inner edges that extend about 2/3 distance to columella. S₁₋₂ do not have paliform lobes or pali. S₃ about half as exsert as and 3/4 width of S₁₋₂, with straight to only slightly sinuous inner edges. S₄ lowest septa, 2/3 width of an S₃, having straight inner edges, becoming rudimentary lower in fossa. A crown of 12 thin, lamellar, planar P₃, each 1.5-2.5 mm wide, encircles a columella composed of 3-6 papillae or short lamellae. Fossa relatively shallow, the pali rising high in the fossa contrasting with the columella, which is deeply seated.

DISTRIBUTION. — *Philippines*: Bohol Sea (Sogod Bay and Iligan Bay); Sulu Sea (Cagayan Island and Honda Bay, Palawan); 814-1401 m.

Genus *DELTOCYATHUS* H. Milne Edwards & Haime, 1848

Key to the 7 species of *Deltocyathus* known from the Philippine-Indonesian region

1. Adult corallum with 5 full cycles of septa (96) 2
- Adult corallum with 4 cycles of septa or an incomplete 5th cycle (48-80 septa) 4
2. P₄ much larger than all other pali *D. rotulus*
- P₄ of similar size to other pali 3
3. Base flat, no scar; all septa project an equal distance beyond calicular margin; S₅ well developed *D. magnificus*
- Base convex (bowl-shaped), usually with a central scar or eroded region; S₅ project much less than S₁₋₄ beyond calicular margin; S₅ rudimentary, often absent near calicular edge ...
..... *D. suluensis*
4. All septa project beyond calicular edge an equal distance; costae coarsely dentate
..... *D. vughani*
- Septa of higher cycle less prominent than others; costae finely dentate or granular 5
5. CS₃ thick, projecting beyond calicular margin as 12 triangular lancet *D. stella*
- CS₃ of normal thickness, although they may project as lancets 6

6. Corallum often having several pairs of S₅ (up to 80 septa); S₄ fuse to P₃ relatively high in fossa; CS₃ often hyperextended in a lobate structure *D. andamanicus*
 — Corallum always having only 4 cycles of septa (48 septa); S₄ much smaller, fusing to S₃ very low in fossa near columella; CS₃ never hyperextended *D. philippinensis*

Deltocyathus vaughani Yabe & Eguchi, 1932

Levipalifer orientalis Vaughan, 1900: 201-202, pl. 16, figs 3-7 (junior secondary homonym of *Deltocyathus orientalis* Duncan, 1876).

Deltocyathus vaughani Yabe & Eguchi, 1932b: 388-389. — ZIBROWIUS & GRYGIER, 1985: 121, fig. 12. — CAIRNS, 1994: 54-55, pl. 23, figs i-j, pl. 24, figs a-c, f (synonymy).

MATERIAL EXAMINED. — **Philippines.** "Albatross": stn 5110, 10 (USNM 40051). — Stn 5198, 8 (USNM 97173). — Stn 5529, 1 (USNM 97174). — Stn 5536, 2 (USNM 97175).

Indonesia. DEKI: stn 62, 1 (NNM 22458).

KARUBAR: stn 28, 5 (MNHN). — Stn 39, 13 (USNM 97176). — Stn 40, 4 (POLIPI). — Stn 56, 1 (POLIPI). — Stn 59, 1 (MNHN). — Stn 71, 6 (MNHN). — Stn 76, 1 (MNHN).

TYPE LOCALITY. — Bosyu (= Awa), Japan (depth not given).

DIAGNOSIS. — Corallum discoidal, having a convex base with a basal angle of 130°-170°. Largest known specimen (KARUBAR stn 40) 26.8 mm in calicular diameter and 9.4 mm in height. Costae prominently ridged and coarsely dentate. Corallum white. Septa hexamerally arranged in 4 complete cycles: S₁>S₂>S₄>S₃. One palus or paliform lobe occurs on each septum (P₁₋₄). Fossa shallow; columella papillose.

REMARKS. — *Deltocyathus vaughani* is more fully described and illustrated by CAIRNS (1994). These are the first records other than from Japan. It is distinguished from other species in the region by having coarsely dentate costae, a patellate corallum, and costoseptae that project an equal distance beyond the calicular edge (see key).

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol Strait; 247-807 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); 290-549 m. *Elsewhere*: Japan (Honshu and Kyushu); 88-1097 m.

Deltocyathus philippinensis sp. nov.

Figs 15 d-e

Deltocyathus italicus - ALCOCK, 1902c: 19 (in part: "Siboga" stn 95, 100). [Not *Turbinolia italica* Michelotti, 1838].

MATERIAL EXAMINED/TYPES. — **Philippines.** "Siboga": stn 95, 1 paratype (ZMA Coel. 5441). — Stn 100, 2 paratypes (ZMA Coel. 5443).

"Albatross": stn 5505, 4 paratypes (USNM 97179). — Stn 5506, holotype (USNM 97178). — Stn 5538, 1 paratype (USNM 97180).

South China Sea. "Penguin": stn 32, Macclesfield Bank (ca. 16°N, 114°E), 342 m, 1 (BMNH 1892.10.17.123).

TYPE LOCALITY. — "Albatross" stn 5506: 8°40'00"N, 124°31'45"E (Macajalar Bay, Bohol Sea, Mindanao), 479 m.

ETYMOLOGY. — Named for the region from which it was first collected.

DESCRIPTION. — Corallum bowl-shaped, the largest specimen (holotype) 15.0 mm in calicular diameter and 6.0 mm in height. Centre of base (up to 5-7 mm) usually eroded and discoloured to a chalky white. Beyond central worn region radiate 24 ridged costae (C₁₋₃), which become prominent near calicular edge. C₁₋₃ covered with very

fine spines, both laterally and apically. C₄ ridges present only near calicular edge, also bearing fine, elongate spines. Intercostal spaces broad and smooth. Calicular margin adjacent to every CS₁₋₃ produced into a short, triangular apex, resulting in a moderately serrate calicular margin. Upper, outer edges of all septa light brown.

Septa hexamerally arranged in 4 complete cycles. S₁ extend up to 1.6 mm beyond calicular edge and reach 1/2 distance to columella, where each is bordered by a lamellar paliform lobe about 1.5 mm wide. S₁ are the only independent septa. S₂ as exsert as S₁, about 4/5 width of an S₁, bearing a palus of equal size, the P₂ rising slightly higher in the fossa and recessed slightly more from the columella than P₁. S₃ as exsert as S₁₋₂ but only about 2/3 width of an S₂. Each S₃ bears a highly spinose palus (P₃) 1.5-1.7 mm in width, each pair of S₃ within a system fusing to its common P₂ through several robust processes, the uppermost process at the level of S₂-P₂ notch. P₃ rise higher in fossa and are more recessed from the columella than are P₂. S₄ extend about 1.1 mm beyond calicular edge and are about 2/3 width of an S₃ in upper fossa. Deeper in the fossa, far below S₃-P₃ notch and near columella, S₄ are rudimentary, each pair of S₄ joining its common S₃ through 1-3 slender processes. S₄ do not bear paliform lobes. Fossa shallow to moderate in depth. Columella papillose, consisting of 15-20 fused granular elements, each about 0.25 mm in diameter.

REMARKS. — The rudimentary nature of the S₄ and the tenuous connection to their adjacent S₃ distinguish this species from other western Pacific *Deltocyathus*. *D. philippinensis* resembles *D. eccentricus* Cairns, 1979 (amphi-Atlantic, 183-1000 m) in its S₄ morphology, but differs in having only 48 septa (*D. eccentricus* often has pairs of S₅), an eroded central basal region, and ridged costae.

DISTRIBUTION. — *Philippines*: Bohol Sea (south of Siquijor and Macajalar Bay); Sulu Sea (Sulu Archipelago); 402-522 m. *Elsewhere*: South China Sea (Macclesfield Bank); 342 m.

Deltocyathus stella sp. nov.

Figs 15 f-h

MATERIAL EXAMINED/TYPES. — **Philippines**. MUSORSTOM 2: stn 33, 1 paratype (MNHN).

Indonesia. SNELLIUS 2: stn 4.034, 1 paratype (NNM 22777).

KARUBAR: stn 1, 35: holotype and 10 paratypes (MNHN), 10 paratypes (POLIPI), and 14 paratypes (USNM 97181). — Stn 2, 9 paratypes (USNM 97182). — Stn 18, 15 paratypes (MNHN). — Stn 32, 1 paratype (POLIPI).

TYPE LOCALITY. — KARUBAR stn 35: 5°46'45"S, 132°11'10"E (Banda Sea: Kai Islands), 156-305 m.

ETYMOLOGY. — The species name (Latin *stella*, star) refers to the general shape of the corallum. It is treated as a noun in apposition.

DESCRIPTION. — Corallum shaped as a shallow bowl, with a slightly convex base. Largest specimen examined (KARUBAR stn 1) 12.3 mm in calicular diameter; holotype 10.6 mm in diameter and 3.9 mm in height. Centre of base displays a flat to slightly concave attachment scar 1.3-1.5 mm in diameter. Costae well defined and rounded, separated by shallow, narrow intercostal striae. Costae covered with small, rounded granules. Most coralla uniformly white, but several small fresh specimens from KARUBAR stn 18 are reddish-brown in colour.

Septa hexamerally arranged in 4 cycles, the 4th cycle complete at a GCD of about 6 mm; no specimens examined have more than 48 septa. S₁ independent, extending about 0.5 mm beyond calicular edge, and reaching about 1/2 distance to columella. Central most part of each S₁ bears a small P₁ about 0.8 mm wide. S₂ similar to S₁ but slightly narrower, having pali (P₂) that rise higher in the fossa and are more recessed from columella than P₁. S₃ highly exsert (1.5 mm beyond calicular edge) and quite thick (up to 0.45 mm), but only about 2/3 width of S₂. P₃ about 1.2 mm wide, bearing large, coarse granules up to 0.12 mm tall and fusing to their common P₂ near the columella. S₄ about 0.75 mm exsert, each pair fusing to its common S₃ in a short triangular lancet, producing a highly serrate calicular margin. Inner edges of S₄ fuse to adjacent P₃ through 2 or 3 narrow processes below S₃-P₃ notch. Inner edges of S₁₋₃ slightly sinuous; edges of S₄ dentate to lacinate. Fossa shallow. Columella consists of 15-30 small (0.20 mm diameter) papillae, all fused at base level.

REMARKS. — *Deltocyathus stella* is distinctive in having quite exsert and thickened S₃. The 12 S₃ are not spinose as in *D. ornatus* Gardiner, 1899 or lobate as in *D. andamanicus*, but simply prominent and thickened. Another spinose *Deltocyathus*, *D. heteroclitus* Wells, 1984 (Pleistocene of Vanuatu), differs in having spinose (not thickened) CS₃, an irregular number of costal spines, and an incomplete 4th cycle.

DISTRIBUTION. — *Philippines*: Verde Island Passage; 130-137 m. *Indonesia*: Banda Sea (Kai Islands); Timor Sea (southwestern Timor); 206-280 m.

Deltocyathus andamanicus Alcock, 1898

Fig. 15 c

Deltocyathus andamanicus Alcock, 1898: 16-17, pl. 1, figs 5, 5a. — VAUGHAN, 1907: 71-72, pl. 6, figs 4, 4a. — GARDINER & WAUGH, 1938: 196. — PILLAI & SCHEER, 1976: 16. — CAIRNS & KELLER, 1993: 244-245, pl. 5, fig. F. *Deltocyathus* sp. cf. *D. andamanicus* - CAIRNS, 1984: pl. 3, figs A-B.

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5273, 1 (USNM 97183). — Stn 5403, 11 (USNM 82156). — Stn 5412, 3 (USNM 97184). — Stn 5417, 6 (USNM 97185).

MUSORSTOM 2: stn 63, 17: 10 (MNHN), 7 (USNM 97187).

MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 92, 16 (USNM 97188). — Stn 126, 6 (MNHN). — Stn 130, 16 (USNM 97189). — Stn 138, 2 (MNHN). — Stn 139, 32 (MNHN).

Indonesia. DEKI: stn 59, 2 (NNM 22460).

SNELLIUS 2: stn 4.173, 2 (NNM 22461).

TYPE LOCALITY. — "Investigator" stn 236a: Andaman Sea, 315-555 m.

DESCRIPTION. — Corallum shaped as a shallow bowl, with a slightly convex base. Largest known specimen ("Albatross" stn 5417) 21.1 mm in calicular diameter and 5.5 mm in height. Centre of base often bears a circular scar 1.1-1.5 mm in diameter, which is usually surrounded by a larger irregularly-shaped region up to 10 mm in diameter characterised by reduced costal development, increased erosion, and often a lighter colouration. Costae consist of thin, finely dentate ridges. Corallum usually uniformly light brown, exceptionally white or even light yellow, the latter characteristic of specimens dead when collected.

Septa hexamerally arranged in 5 cycles, but the last never complete, most coralla having 4-16 pairs of S₅, which results in a total of 56-80 septa. S₁ extend about 1.8 mm beyond calicular edge and have slightly sinuous inner edges, each S₁ internally bordered by a lamellar P₁ 1.7-1.9 mm in width. S₁, not being joined to any other septa, are the only independent septa. S₂ similar to S₁ but less wide, their P₂ rising higher in the fossa and being more recessed from the columella than P₁. S₃ highly exsert, extending up to 3.8 mm beyond the calicular edge. In large, well-preserved coralla, the lower outer edge of the S₃ is hyperextended as a small (about 1 mm) lobe, this lobe being compressed in the septal plane. Each S₃ bordered by a large palus 1.5-2.4 mm wide that rises higher in the fossa and is more recessed from the columella than P₂. Inner edges of P₃ fused to their common P₂. S₄ small and low, extending only about 1.5 mm beyond calicular edge, each pair fused to their common S₃ to form rectangular lancets, resulting in a highly serrate calicular margin. Inner edges of S₄ fuse to their adjacent P₃ through a series of 3-5 slender processes. In half-systems having pairs of S₅, S₅ are equivalent to previously described S₄, and S₄ are same size as previously described S₃. Upper, outer edges of CS₁₋₃ entire, whereas those of the S₄₋₅ are lacinate. Fossa shallow; columella composed of 10-20 small (about 0.3 mm diameter) granular pillars that are fused basally.

REMARKS. — Although the holotype was not directly examined (deposited at the Indian Museum and not available for loan), photographs of it were obtained and, along with ALCOCK's (1898) figure and description, the holotype of 18 mm GCD and 62 septa appears consistent with the specimens identified above.

DISTRIBUTION. — *Philippines*: Lubang Island; Sibuyan and Visayan Seas; Bohol Strait; Sulu Sea (Semirara Islands); 187-333 m. *Indonesia*: Banda Sea (Kai Islands); Flores Sea (Selayar Island, Sulawesi); 340-385 m. *Elsewhere*: southwestern Indian Ocean; Andaman Sea; Hawaiian Islands; 238-397 m.

Deltocyathus suluensis Alcock, 1902

Fig. 16 d

Deltocyathus italicus - ALCOCK, 1902c: 19 (in part: "*Siboga*" stn 251). [Not *Turbinolia italica* Michelotti, 1838].
Deltocyathus magnificus var. *suluensis* Alcock, 1902c: 20-21. — FAUSTINO, 1927: 76-77.
Deltocyathus formosus Cairns, 1995: 73-74, pl. 19, figs f-g (new synonym).

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3: stn 93, 11 (MNHN).

Indonesia. "*Siboga*": stn 251, 1 (ZMA Coel. 1109).

DEKI: stn 44, 1 (NNM 22462). — Stn 51, 4 (NNM 22463). — Stn 52, 5 (NNM 22464). — Stn 57, 1 (NNM 22465). — Stn 58, 3 (NNM 22466). — Stn 62, 4 (NNM 22467).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 1 (ZMUC).

"*Galathea*": stn 500, 6 (ZMUC).

KARUBAR: stn 2, 80 (USNM 97191). — Stn 3, 3 (USNM 97192). — Stn 7, 3 (MNHN). — Stn 18, 2 (MNHN). — Stn 31, 5 (USNM 97193). — Stn 35, 4 (POLIPI). — Stn 36, 2 (POLIPI). — Stn 67, 4 (USNM 97196). — Stn 77, 1 (MNHN).

TYPE LOCALITY. — "*Siboga*" stns 95 and 100: Sulu Archipelago, 450-522 m.

DIAGNOSIS. — Corallum with a flat to slightly convex base and a small central basal scar; peripherally the theca is thickened and abruptly upturned, resulting in a marked thecal edge. Largest known specimen (KARUBAR stn 77) 21.8 mm in diameter. Costae low, wide rounded ridges covered with granules. Well-preserved specimens show concentric bands of light brown pigmentation on the base and a light brown pigmentation on lower, outer septal edges. Septa hexamerally arranged in 5 cycles, the 5th cycle complete (a total of 96 septa) at a GCD of about 18 mm; however, pairs of S₅ begin to appear in coralla as small as 4 mm GCD. In fact, S₅ are usually more visible in small, flat-based coralla than in larger coralla where they are often rudimentary or even absent on the peripheral, upturned calicular edge, even though their corresponding C₅ are well developed. S₁₋₄ extend equally beyond calicular edge (1.4-1.6 mm), the S₅ being only 1/2 as exsert. Calicular margin serrate but not lanceted. S₁₋₄ and P₁₋₄ arranged in typical deltoyathid fashion, but, as mentioned before, S₅ rudimentary to absent, especially near calicular edge of large coralla. S₅ join their adjacent S₄ very low in fossa near columella by a series of 2-5 thin processes. Columella papillose.

REMARKS. — *Deltocyathus suluensis* differs from *D. magnificus* Moseley, 1876, in having granular costae; a central basal scar or eroded region; less exsert and less developed S₅; and a smaller corallum. It differs from *D. rotulus* (Alcock, 1898), another species with 5 cycles of septa, in having granular, convex (not serrate ridged) costae; a serrate (not lanceted) calicular margin; smaller S₅; and a papillose columella; and is usually found in shallower water (142-565 m vs 210-1986 m for *D. rotulus*).

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (Sulu Archipelago); 450-540 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Bali Sea; 204-390 m. *Elsewhere*: southern Norfolk Ridge; Kermadec Islands; 142-565 m.

Deltocyathus rotulus (Alcock, 1898)

Figs 16 a-c

Trochocyathus rotulus Alcock, 1898: 16, pl. 2, figs 1, 1a.

Deltocyathus fragilis Alcock, 1902a: 99-100; 1902c: 21, pl. 2, figs 15, 15a.

Deltocyathus rotulus - CAIRNS & KELLER, 1992: 245, pl. 5, fig. 1 (synonymy). — CAIRNS, 1994: 55-56, pl. 24, figs j-k.

MATERIAL EXAMINED. — **Philippines.** "*Albatross*": stn 5423, 3 (USNM). — Stn 5425, 2 (USNM 97200). — Stn 5429, 2 (USNM 97201). — Stn 5438, 1 (USNM 97202). — Stn 5439, 1 (USNM 97203). — Stn 5445, 11 (USNM 97204). — Stn 5447, 1 (USNM 97205). — Stn 5527, 2 (USNM 97206).

MUSORSTOM 1: stn 54, 1 (MNHN).

MUSORSTOM 3: stn 94, 1 (MNHN).

Indonesia. "*Albatross*": stn 5582, 6 (USNM 92727). — Stn 5585, 1 (USNM 97207). — Stn 5586, 2 (USNM 97208). — Stn 5591, 1 (USNM 97209). — Stn 5601, 1 (USNM). — Stn 5648, 1 (USNM 97210). — Stn 5668, 1 (USNM 97211).

DEKI: stn 6, 2 (NNM 22437). — Stn 58, 4 (NNM 22439).

"*Galathea*": stn 476, 1 (ZMUC).

CORINDON 2: stn 241, 2 (MNHN). — Stn 286, 2 (POLIPI).

SNELLIUS 2: stn 4.130, 1 (NNM 22440).

KARUBAR: stn 2, 1 (USNM 97213). — Stn 21, 6: 5 (MNHN), 1 (USNM 97214). — Stn 56, 3: 1 (MNHN), 2 (USNM 97215). — Stn 87, 7: 6 (MNHN), 6 (USNM 97216). — Stn 89, 9 (POLIPI). — Stn 91, 18 (POLIPI).

TYPE LOCALITY. — North Maldive Atoll, 1408-1756 m.

DIAGNOSIS. — Corallum discoidal, with a flat to slightly bowl-shaped base. Largest known specimen ("*Albatross*" stn 5582) 36 mm in calicular diameter. Centre of base always eroded and without costae; otherwise C₁₋₅ thin, finely serrate ridges. Septa hexamerally arranged in 5 cycles (S₁₋₂>S₃>S₄>S₅), the 5th cycle complete at a GCD of 30-32 mm. Each S₁₋₂ and the adjacent pair S₅ project as short rectangular lancets, producing a highly serrate calicular margin. P₁₋₃ small, sometimes even absent (Fig. 16 b); however, P₄ prominent (up to 4 mm wide), forming a distinctive crown of 24 lobes. S₅ rudimentary, each pair of S₅ fused to their common S₄ by 5-8 slender processes beginning near the S₄-P₄ notch and continuing to the columella. Fossa shallow, containing a columella in the shape of a circular, undercut platform that supports numerous irregularly-shaped papillae.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1994). It is one of the few species in the genus to attain 5 full cycles of septa and is unique in having such a well-developed P₄ crown.

DISTRIBUTION. — *Philippines*: Dasol, Luzon; Lubang Island; Lagonoy Gulf; north of Samar; Bohol Strait; Sulu Sea (Cagayan Islands and Honda Bay, Palawan); 543-1719 m. *Indonesia*: Makassar Strait; Molucca Sea; Banda Sea (Kai Islands and Gulf of Bone, Sulawesi); Timor Sea (south of Tanimbar Islands); Flores Sea (Sumbawa); Bali Strait; 210-1710 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); Indian Ocean from Durban to Maldive Islands; Japan (Honshu); 510-1986 m.

Deltocyathus magnificus Moseley, 1876

Deltocyathus magnificus Moseley, 1876: 552-553; 1881: 147-148, pl. 4, fig. 10, pl. 13, figs 1-2. — ALCOCK, 1902c: 20. — FAUSTINO, 1927: 76. — CAIRNS & PARKER, 1992: 27-28, pl. 7, figs j-l, pl. 8, fig. a. — CAIRNS, 1994: 56, pl. 24, figs d-e, g-h (synonymy).

MATERIAL EXAMINED. — **Philippines.** "*Albatross*": stn 5135, 1 (USNM 97219). — Stn 5198, 4 (USNM 97220). — Stn 5314, 3 (USNM 97221). — Stn 5374, 2 (USNM 97222). — Stn 5444, 1 (USNM 62712). — Stn 5506, 1 (USNM 97223). — Stn 5508, 1 (USNM 97224). — Stn 5527, 1 (USNM 97225). — Stn 5536, 1 (USNM 97226).

"*Galathea*": stn 436, 2 (ZMUC).

"*Hakuho Maru*": stn KH72-1-20, 1 (USNM 97235).

MUSORSTOM 2: stn 83, 2 (MNHN).

MUSORSTOM 3: stn 120, 3 (USNM 97228).

Indonesia. "*Albatross*": stn 5567, 1 (USNM 97227).

"*Hakuho Maru*": stn KH72-1-28, 2: 1 (USNM 97236), 1 (ORI).

DEKI: stn 3, 2 (NNM 22450). — Stn 6, 1 (NNM 22451). — Stn 12, 2 (NNM 22452). — Stn 41, 28 (NNM 22453). — Stn 44, 1 (NNM 22454). — Stn 46, 2 (NNM 22455). — Stn 51, 1 (NNM 22456).

KARUBAR: stn 3, 5 (POLIPI). — Stn 7, 3 (MNHN). — Stn 31, 1 (MNHN). — Stn 59, 24 (USNM 97231). — Stn 69, 6 (MNHN). — Stn 70, 1 (USNM 97233). — Stn 71, 1 (POLIPI). — Stn 76, 1 (POLIPI).

TYPE LOCALITY. — "*Challenger*" stn 192: 5°49'S, 132°14'E (Kai Islands, Banda Sea), 236 m.

DIAGNOSIS. — Corallum discoidal, with a flat to slightly concave base covered with straight, thin, finely dentate costae. Largest known specimen (KARUBAR stn 69) a damaged corallum 47 mm in calicular diameter and 9 mm in height. All costoseptae project an equal distance (about 1.5 mm) beyond calicular margin. Septa hexamerally arranged in 5 full cycles (S₁>S₂>S₃>S₄>S₅), the 5th cycle usually complete at a GCD of about

8 mm. Pairs of S₅ join their common S₄ by an elongate, porous lamella. All septa bear prominent pali or paliform lobes, even S₅ of larger coralla. Columella an elongate fusion of numerous papillae that rises as high as the septa and thus there is no fossa.

REMARKS. — *Deltocyathus magnificus*, the largest species in the genus, is easily distinguished from *D. rotulus* (Alcock, 1898) by its flat base, equally exsert septa, differently constructed columella, and smaller P₄.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Bohol Sea; Tanon Strait; north of Samar; Comotes Sea; Sulu Sea (Semirara Islands and Sulu Archipelago); 220-717 m. *Indonesia*: Ceram Sea; Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Timor Sea (south of Leti Islands); 118-477 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea (north of Pratas Island); southern Australia; Japan (Honshu, Kyushu, and northern Ryukyu Islands); 88-1500 m.

Genus *CONOTROCHUS* Seguenza, 1864

Conotrochus funiculumna (Alcock, 1902)

Ceratotrochus (*Conotrochus*) *funiculumna* Alcock, 1902a: 93; 1902c: 11-12, pl. 1, figs 6, 6a. — FAUSTINO, 1927: 66, pl. 9, figs 7-8. — ZOU, 1988: 77, pl. 5, figs 1, 1a.

Conotrochus funiculumna - CAIRNS, 1984: 14, pl. 2, figs I-J; 1994: 58-59, pl. 24, fig. i, pl. 25, figs g-l (synonymy).

MATERIAL EXAMINED. — **Philippines**. "*Albatross*": stn 5551, 1 (USNM 97238). — Stn 5567, 19 (USNM 97240).

"*Hakuho Maru*": stn KH72-1-20, 6 (USNM 97242).

Indonesia. "*Albatross*": stn 5586, 19 (USNM 97241).

DEKI: stn 44, 1 (NNM 22551). — Stn 52, 4 (NNM 22552).

"*Galathea*": stn 500, 8 (ZMUC).

"*Hakuho Maru*": stn KH72-1-28, 2 (USNM 97243).

KARUBAR: stn 59, 1 (MNHN).

South China Sea. "*Albatross*": stn 5312, 1 (USNM 97237). — Stn 5318, 1 (USNM 97238).

TYPE LOCALITY. — "*Siboga*" stns 95 and 100: Sulu Archipelago, 450-522 m.

DIAGNOSIS. — Corallum elongate-conical to trochoid, and usually free (often having a small-diameter, blunt pedicel), but some coralla attached by a slender pedicel. Largest Indonesian specimen (KARUBAR stn 59) 14 mm in calicular diameter and 24.0 mm in height. Theca thick, covered with coarse granules and a thin epitheca, the theca projecting 0.5-0.7 mm above outer, upper septal edges as a continuous rim. Septa hexamerally arranged in 4 complete cycles: S₁>S₂>S₃>S₄, the S₁ only slightly wider than S₂. Fossa shallow, containing a prominent columella composed of several short, twisted lamellae that are swirled in the typical clockwise direction.

REMARKS. — *Conotrochus funiculumna* is more fully described and illustrated by CAIRNS (1994). It is compared to *C. brunneus* (Moseley, 1881) in the following account.

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 353-522 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (east of Tanimbar Islands); Timor Sea (south of Leti Islands); 268-616 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea (Pratas Island); Victoria, Australia; Japan (Honshu and Ryukyu Islands); Hawaiian Islands; 88-600 m.

Conotrochus brunneus (Moseley, 1881)

Fig. 16 e

Pleurocyathus brunneus Moseley, 1881: 159-160, pl. 2, figs 1a-c.

Phloeocyathus hospes Alcock, 1902b: 116-117.

Ceratotrochus (*Phloeocyathus*) *hospes* - ALCOCK, 1902c: 12, pl. 2, figs 8, 8a.

Conotrochus brunneus - CAIRNS & PARKER, 1992: 22. — CAIRNS & KELLER, 1993: 246, pl. 4, figs F-G (synonymy). — CAIRNS, 1995: 74-75, pl. 20, figs a-b.
Ceratotrochus (Conotrochus) brunneus - ZOU, 1988: 76-77, pl. 5, figs 2, 2a.

MATERIAL EXAMINED. — **Philippines**. "*Albatross*": stn 5171, 1 (USNM M236517). — Stn 5217, 2 (USNM 97245). — Stn 5277, 1 (USNM 97246).

"*Hakuho Maru*": stn KH72-1-20, 1 (USNM 97260).

MUSORSTOM 2: stn 32, 1 (USNM 97248). — Stn 33, 69 (MNHN). — Stn 63, 5 (USNM 97250).

MUSORSTOM 3: stn 92, 22: 21 (USNM 97251), 1 (BMNH 1992.8.11.4). — Stn 102, 2 (MNHN). — Stn 109, 1 (USNM 97252). — Stn 117, 1 (MNHN). — Stn 126, 2 (MNHN). — Stn 139, 2 (MNHN).

Indonesia. DEKI: stn 3, 6 (NNM 22556). — Stn 4, 1 (ZMUC). — Stn 5, 1 (NNM). — Stn 6, 12 (NNM 22557). — Stn 42, 1 (NNM 22559). — Stn 46, 1 (NNM 22560). — Stn 48, 18 (NNM 22561). — Stn 58, 3 (NNM 22628). — Stn 63, 8 (NNM 22563).

"*Hakuho Maru*": stn KH85-1-A2, 1 (USNM 97247).

KARUBAR: stn 1, 1 (USNM 97253). — Stn 2, 31 (USNM 97254). — Stn 3, 7 (POLIPI). — Stn 7, 11 (MNHN). — Stn 15, 6 (MNHN). — Stn 18, 1 (MNHN). — Stn 31, 1 (POLIPI). — Stn 32, 1 (POLIPI). — Stn 36, 2 (POLIPI). — Stn 69, 1 (USNM 97257). — Stn 71, 1 (MNHN). — Stn 77, 5 (MNHN).

South China Sea. "*Albatross*": stn 5301, 1 (USNM 97247).

"*Hakuho Maru*": stn KH72-1-52, 10: 7 (USNM 97161), 3 (ORI).

TYPE LOCALITY. — "*Challenger*" stn 194: 4°34'S, 129°57'30"E (Banda Island, Banda Sea), 366 m (see CAIRNS, 1995).

DIAGNOSIS. — Corallum elongate-conical, originally attached by a slender pedicel that is usually augmented by a broad lateral thecal adhesion near the pedicel, which together form a broad, solid attachment. Largest known specimen (KARUBAR stn 71) 12.1 mm in calicular diameter and 16.0 mm in height, but most coralla are much smaller, having a GCD of 6-8 mm. Theca coarsely granular and glisteny, the theca of well-preserved coralla commonly pigmented a reddish-brown arranged in longitudinal stripes or circumferential bands. Some specimens, however, have a smooth, usually longitudinally pigmented, theca. Theca quite thick, reinforced internally with deposits of stereome; upper thecal edge forms a smooth circular rim about 0.4 mm around the upper, outer edges of the septa. Septa hexamerally arranged in 4 cycles ($S_1 > S_2 > S_3 > S_4$), the 4th cycle rarely complete, most coralla having 36-44 septa. Fossa deep. Columella consists of short, twisted lamellae swirled in the typical clockwise direction.

REMARKS. — *Conotrochus brunneus* is similar to *C. funiculumna* (Alcock, 1902) but differs in having a smaller corallum, less septa (usually 36-44 vs 48 for *C. funiculumna*), a secondarily attached pedicel, a pigmented corallum, and internal stereome. Also, in general, *C. brunneus* is found in deeper water than *C. funiculumna*.

DISTRIBUTION. — **Philippines**: Lubang Island; Verde Island Passage; Sibuyan Sea; Mindoro Strait; Sulu Sea (Sulu Archipelago); 97-460 m. **Indonesia**: Halmahera Sea; Banda Sea (Banda and Kai Islands); Arafura Sea (south of Tanimbar Islands); Flores Sea (Sulawesi); 206-477 m, with 1 outlying doubtful record at 1089 m (ALCOCK, 1902c). **Elsewhere**: Indo-West Pacific from Madagascar to South China Sea (Vanguard Bank and Pratas Island), including western Australia and ridges north of New Zealand; 237-1051 m.

Genus *LOCHMAEOTROCHUS* Alcock, 1902

Lochmaeotrochus oculus Alcock, 1902

Figs 16 f-i

Lochmaeotrochus oculus Alcock, 1902b: 117-118; 1902c: 13, pl. 2, figs 9, 9a.

MATERIAL EXAMINED. — **Indonesia**. "*Siboga*": stn 159, 5 coralla (syntypes, ZMA Coel. 814). — Stn 259, 2 clusters and 18 individual coralla (syntypes, ZMA Coel. 700).

"*Albatross*": stn 5586, 1 cluster consisting of 3 coralla (USNM 97263). — Stn 5592, 2 clusters consisting of 6 coralla (USNM 97264).

DEKI: stn 52, 1 cluster (NNM 22554). — Stn 56, 2 clusters (NNM 22553).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 3 clusters consisting of 22 coralla (ZMUC).

KARUBAR: stn 13, 15 clusters consisting of 89 coralla: 9 clusters (MNHN), 6 clusters (USNM 97265).

South China Sea. "Hakuho Maru": stn KH73-2-44-2, 19 clusters and 12 coralla: 4 clusters (ORI), remainder (USNM 97266).

TYPE LOCALITY. — "*Siboga*" stns 159 and 259: (Kai Islands and Halmahera Sea), 411-487 m.

DESCRIPTION (emended). — Corallum conical to subcylindrical, having a circular calice up to 11 mm in diameter and a corallum height up to 24 mm. Clusters of up to 30 coralla form pseudocolonies, each corallum providing the substratum for the settlement of up to 6 additional coralla from its theca, resulting in a low, dense, bushy agglomeration. The close proximity of multiple coralla often leads to fusion of their theca. Corallum pedicel robust: PD:GCD up to 0.5. Theca covered with small, hollow granules and epithelial bands. Each corallum internally reinforced with thick stereome. Base polycyclic. Transverse dissepiments sometimes present. Corallum white. Theca extends up to 0.8 mm above upper, outer septal edges as a continuous rim, which is characteristic of the genus.

Septa hexamerally arranged in 4 cycles, most coralla from KARUBAR stn 13 having 48 septa, although 36 septa is also common in other specimens. S₁ 1.0-1.2 mm exsert, having straight, vertical inner edges that border the columella. S₂ slightly less exsert and 3/4 to 4/5 width of an S₁ also having straight inner edges and occasionally bordered by a narrow, lamellar to papillose paliform lobe. These P₂ almost indistinguishable from columellar elements and not always present. S₃ slightly less exsert and 3/4 to 4/5 width of an S₂, having slightly sinuous inner edges, and sometimes bordered by a papillose or short lamellar paliform lobe, 2 of which sometimes unite within a system forming a V-shaped structure before their common S₂. In some coralla P₃ are absent, rudimentary, or irregular in development. S₄ about 1/2 width of an S₃ and have straight inner edges. Fossa of moderate depth, containing a columella of granular papillae or short lamellae, but never swirled as in *C. brunneus* or *C. funiculumna*.

REMARKS. — ALCOCK (1902c: 13) stated that in this species "budding takes place near the calicular margin, is fairly regular, and is a true gemmation." Based on re-examination of the syntypes and additional topotypic coralla, it is clear that new corals occur over the entire theca in a very irregular manner (Fig. 16i) (not just the calicular margin), and seem to prefer attachment to dead coralla or living corals not covered with an edge zone. This results in corallum clusters of very irregular structure. Furthermore the bases of some coralla show a discrete margin at the interface with the corallum on which it settled. Therefore, the clusters of coralla reported above are interpreted as independent settlement of planulae, possibly clonemates, that form a pseudocolony much in the same way that *Desmophyllum dianthus* (Esper, 1794), is known to form (CAIRNS, 1982).

ALCOCK (1902: 13) described *L. oculus* as a colonial *Conotrochus*, very similar to *C. hospes* (= *C. brunneus*). Even though *L. oculus* is now interpreted as a solitary coral, it can be distinguished from *C. brunneus* by having a tendency to form clusters or pseudocolonies, always having a white corallum, usually having 48 septa, having a papillose columella (rarely sublamellar and never swirled), and often having either P₂ and/or P₃. This is believed to be the first report of this species and genus subsequent to their original descriptions.

DISTRIBUTION. — *Indonesia*: Halmahera Sea; Banda Sea (Kai Islands); Bali Sea; 240-616 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea (southern Formosa Strait); 412-430 m.

Genus *AULOCYATHUS* Marenzeller, 1904

Aulocyathus recidivus (Dennant, 1906)

Ceratotrochus recidivus Dennant, 1906: 159-160, pl. 6, figs 1-2.

Aulocyathus recidivus - CAIRNS, 1982: 25-26, pl. 7, figs 7-9, pl. 8, fig. 1 (synonymy); 1994: 59-60, pl. 26, figs a-b; 1995: 75, pl. 20, figs c-f. — CAIRNS & PARKER, 1992: 22-24, pl. 6, figs d-e, g-h (synonymy). — CAIRNS & KELLER, 1993: 247, pl. 5, fig. C.

MATERIAL EXAMINED. — **Indonesia.** "Albatross": stn 5585, 1 (USNM 97268). — Stn 5586, 1 (USNM 97269).

TYPE LOCALITY. — Off Cape Jaffa and Neptune Island, South Australia, 165-190 m.

DIAGNOSIS. — Corallum elongate-conical, straight, and usually budded from fragment of the parent corallum. The only well-preserved Celebes Sea specimen ("Albatross" stn 5585) is 9.5 mm in calicular diameter, 5.0 mm in basal diameter, and 12.4 mm in height. Calicular margin circular and evenly serrate. Theca thin, with hollow, conical spines. Corallum white. Septa hexamerally arranged in 4 to 5 cycles ($S_1 > S_2 > S_3 > S_4 > S_5$); however, development of S_4 and S_5 quite irregular. Specimen from "Albatross" stn 5585 has 44 septa and includes systems with 1 pair of S_4 , 2 pairs of S_4 , and even 1 system with 2 pairs of S_4 and 1 pair of S_5 . Slender paliform lobes (P_3) usually present. Columella papillose.

REMARKS. — *Aulocyathus recidivus* is more fully described and illustrated by CAIRNS (1982, 1994) and CAIRNS & PARKER (1992).

A small *Aulocyathus* specimen measuring only 2.5 mm in calicular diameter and 3.8 mm in height was collected at MUSORSTOM 3 stn 87 (Lubang Island, 191-197 m, USNM 97653). It has a smooth, glistening theca and 24 septa, and may represent a small specimen of *A. juvenescens* Marenzeller, 1904, heretofore known only from Tanzania at 302-463 m (CAIRNS & KELLER, 1993).

DISTRIBUTION. — *Malaysia*: Celebes Sea off Sabah; 616-871 m. *Elsewhere*: Indo-West Pacific from southwestern Indian Ocean to Japan, including South Australia and New Zealand region to Macquarie Island; 128-1137 m.

Genus *PARACONOTROCHUS* Cairns & Parker, 1992

Paraconotrochus zeidleri Cairns & Parker, 1992

Caryophyllia clavus var. *epithecata* - MOSELEY, 1881: 135. [Not *Caryophyllia clavus* var. *epithecata* Duncan, 1873].
Paraconotrochus zeidleri Cairns & Parker, 1992: 21-22, pl. 5, fig. i, pl. 6, figs a-b.

MATERIAL EXAMINED. — **Indonesia.** "Albatross": stn 5589, 2 (USNM 97270). — Stn 5590, 1 (USNM 97271). — Stn 5592, 1 (USNM 97272).

DEKI: stn 52, 8 (NNM 22751).

"Galathea": stn 500, 1 (ZMUC).

KARUBAR: stn 59, 1 (POLIPI). — Stn 69, 7: 6 (MNHN), 1 (USNM 97273). — Stn 77, 4: 3 (USNM 97274), 1 (MNHN).

Admiralty Islands. "Challenger": stn 219, 1 (BMNH).

TYPE LOCALITY. — "Soela" stn 51: 41°15'S, 144°08'E (Tasmania), 520 m.

DIAGNOSIS. — Corallum turbinate, free or attached by a narrow pedicel. Calice elliptical: GCD:LCD = 1.15-1.28; margin of calice finely serrate. Largest known specimen ("Albatross" stn 5592) 30.7 x 24.7 mm in calicular diameter and 27.4 mm in height. Costae not well defined; white theca covered with low, coarse granules. Septa hexamerally arranged in 5 cycles ($S_{1-2} > S_3 > S_4 > S_5$), the lower, inner edges of S_{1-3} fusing to the columella deep within fossa. In some specimens narrow paliform lobes (P_3) are present, but in most specimens reported herein they are absent. Columella very distinctive, composed of numerous short, swirled lamellae, the entire structure well separated from inner septal edges.

REMARKS. — This species is more fully described and illustrated by CAIRNS & PARKER (1992).

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 351-558 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); New South Wales, western Tasmania, and Admiralty Islands; 274-520 m.

Genus *DESMOPHYLLUM* Ehrenberg, 1834

Desmophyllum dianthus (Esper, 1794)

Fig 17 g-h

Madrepora dianthus Esper, 1794: pl. 69, figs 1-3.

Desmophyllum dianthus - CAIRNS, 1994: 26-27, pl. 9, figs a-d (synonymy).

Desmophyllum cristagalli H. Milne Edwards & Haime, 1848a: 253. — ALCOCK, 1902c: 28. — ZIBROWIUS, 1980: 117-121, pl. 61, figs A-O, pl. 62, figs A-M (synonymy).

Not *Desmophyllum* sp. - ALCOCK, 1902c: 28 (= *Madrepora oculata* Linnaeus, 1758).

MATERIAL EXAMINED. — **Indonesia**. "Siboga": stn 259, 2 (ZMA Coel. 1242, see ALCOCK, 1902c).

"Captain Christiansen": 1°31'N, 124°47'E, 457 m, 12 March 1913, 6 (NNM 22800).

South China Sea. "Hakuho Maru": stn KH73-2-44-2, 9: 6 (USNM 97275), 3 (ORI).

TYPE LOCALITY. — Sagami Bay (depth not given).

REMARKS. — *Desmophyllum dianthus* is perhaps the most commonly collected deep-water coral and has a virtually cosmopolitan distribution (see below), but, for unknown reasons, is rare in the Indonesian region. It is known from only 2 localities: one reported by ALCOCK (1902c) and another reported herein. Many descriptions of this species are available in the literature (e.g., ZIBROWIUS, 1974b, 1980; CAIRNS, 1979, 1982, 1994, 1995), most under the name *D. cristagalli*.

DISTRIBUTION. — **Indonesia**: Celebes Sea (Manado, Sulawesi); Banda Sea (Kai Islands); 457-487 m. **Elsewhere**: South China Sea (north of Pratas Islands); cosmopolitan, except for continental Antarctica and northern boreal Pacific (see CAIRNS, 1994); 35-2460 m.

Genus *DACTYLOTROCHUS* Wells, 1954

Dactylotrochus cervicornis (Moseley, 1881)

Tridacophyllia cervicornis Moseley, 1881: 183-184, pl. 10, figs 2a-2d, 3a. — BASSETT-SMITH, 1890: 368.

Tridacophyllia primordialis Gardiner, 1899: 168, pl. 19, figs 7a-e.

Dactylotrochus cervicornis - WELLS, 1954: 470-471, pl. 178, figs 1-3.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 18, 4 (MNHN).

TYPE LOCALITY. — Unknown.

REMARKS. — This species is best described and illustrated by WELLS (1954). The specimen he reported from the Philippines ("Albatross" stn 5336) cannot be located at the USNM.

DISTRIBUTION. — **Philippines**: north of Palawan; 84 m (WELLS, 1954). **Indonesia**: Banda Sea (Kai Islands); 205-212 m. **Elsewhere**: South China Sea (Tizard Bank, Spratly Islands); Bikini, Marshall Islands; New Caledonia; Loyalty Islands; 73-137 m, however yet unreported specimens from New Caledonia occur as deep as 400 m.

Genus *ASTEROSMILIA* Duncan, 1867

Asterosmilium marchadi (Chevalier, 1966)

Figs 17 a-b

Dasmosmilium marchadi Chevalier, 1966: 944-949, pl. 5, figs 3-4.

Asterosmilia marchadi - CAIRNS, 1979: 140-142, pl. 26, figs 7, 9-10. — ZIBROWIUS, 1980: 141-142, pl. 74, figs A-K (synonymy). — CAIRNS & KELLER, 1993: 249, pl. 6, figs A-B.

MATERIAL EXAMINED. — **Philippines.** "Albatross": stn 5133, 10 (USNM 97278). — Stn 5152, 2 (USNM 97279). — Stn 5156, 1 (USNM 97280). — Stn 5164, 55 (USNM 97282). — Stn 5178, 4 (USNM 97283). — Stn 5277, 1 (USNM 97284). — Stn 5357, 4 (USNM 97286).

MUSORSTOM 1: stn 32, 1 (USNM 97289). — Stn 57, 1 (USNM 97290). — Stn 73, 1 (USNM 97291).

SIPHILEXP: stn 78-T10, 1 (USNM 97287).

MUSORSTOM 2: stn 8, 1 (MNHN). — Stn 47, 1 (MNHN).

MUSORSTOM 3: stn 102, 2 (MNHN). — Stn 107, 3 (USNM 97293). — Stn 131, 7 (MNHN). — Stn 140, 10 (MNHN).

Indonesia. DEKI: stn 6, 1 (NNM 22537). — Stn 10, 2 (NNM 22538). — Stn 35, 2 (ZMUC), 3 (NNM 22539).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 42 (ZMUC). — Stn 6, 1 (ZMUC). — Stn 8, 6 (ZMUC). — Stn 9, 2 (ZMUC).

CORINDON 2: stn 216, 3 (MNHN). — Stn 251, 4 (MNHN). — Stn 261, 4 (MNHN). — Stn 263, 1 (MNHN). — Stn 266, 3 (USNM 97295).

SNELLIUS 2: stn 4.235, 9 (NNM 22536).

South China Sea. "Albatross": stn 5311, 19 (USNM 97285).

TYPE LOCALITY. — Senegal, 97-85 m.

DESCRIPTION. — Corallum ceratoid, usually curved about 45°. Approximately half of the coralla examined originated by extratentacular budding from the edge zone of a parent corallum, their pedicels narrowing to a slender, open base only 0.6-0.7 mm in diameter. Other coralla firmly attached to a substratum through a robust pedicel up to 4.5 mm in diameter (PD:GCD = 0.18-0.30), these coralla assumed to have originated from planular settlement. Largest known specimen (MUSORSTOM 3 stn 140) 14.9 x 18.0 mm in calicular diameter, 15.8 mm in height, and 4.5 mm in pedicel diameter; however, most coralla are less than 13 mm in GCD. All costae (C₁₋₄) consist of low, rounded ridges, separated by equally wide, shallow furrows. Costae covered with tiny granules, 4 or 5 occurring across the width of a costa. Theca quite thin. Many coralla display small scars of bud detachment on their theca, some bearing as many as 25 shallow, circular (0.6-0.7 mm in diameter) concavities. Although some coralla are completely white, most coralla are reddish-brown, especially intense near calicular edge and fading to white at base.

Septa hexamerally arranged in 4 cycles, only larger coralla having pairs of S₅, up to 66 septa. S₁ highly exsert (about 2.9 mm), having straight, vertical inner edges that attain the columella. S₂ slightly less exsert (about 2.5 mm), about 4/5 width of an S₁. Both S₁ and S₂ occasionally bear an irregularly-shaped paliform lobe that mingles with the columella. S₃ about 1.2 mm exsert and only 1/2 width of an S₂. Each S₃ bears a lamellar paliform lobe about 1.2 mm wide, together forming a palar crown. S₄ as exsert as S₃ but only about 2/3 the width, with finely dentate inner edges, and attenuating in size low in fossa. If a pair of S₅ flanks an S₄, that S₄ also bears a paliform lobe, the P₄ being larger than the P₃ and occurring higher in the fossa and more peripherally. Pairs of S₄ flanking S₁ and S₂ form low calicular lancets resulting in a serrate calicular margin. Fossa of moderate depth, containing a crispate, twisted columella. Endothecal dissepiments often present.

REMARKS. — Previous records of *A. marchadi* from the Atlantic and southwest Indian Ocean have been of unattached specimens, presumably resulting from asexual budding. However, among the 28 lots reported above, 11 lots (mainly from MUSORSTOM 1-3 and CORINDON 2) contained exclusively attached specimens; 11 lots (mostly "Albatross" and ZMUC specimens) contained only free forms; and 6 lots (from all sources) contained a mixture of both forms. Buds detach at a very early stage, probably because their attachment to the parent is so small and tenuous. Examples of buds still attached to the parent corallum are uncommon, rarely exceeding 2 mm in length; likewise, many already detached buds as small as 4 mm length were found in the study material. We therefore conclude that the buds probably detach at a corallum length of 2-4 mm.

DISTRIBUTION. — *Philippines*: Lubang Island; Sibuyan and Visayan Seas; Sulu Sea (Panay; Zamboanga Peninsula; Balabac Island, Palawan; Sulu Archipelago); 33-184 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Flores Sea (Selayar Island, Sulawesi); Bali Strait; 32-210 m. *Elsewhere*: tropical amphi-Atlantic; southwestern Indian Ocean; Maldive Islands; South China Sea (Pratas Island); 32-229 m.

Genus *THALAMOPHYLLIA* Duchassaing, 1870*Thalamophyllia tenuescens* (Gardiner, 1899)

Figs 17 d-e

Desmophyllum tenuescens Gardiner, 1899: 161-162, pl. 19, figs 1a-b.*Thalamophyllia tenuescens* - CAIRNS, 1995: 78, pl. 21, figs g-i.MATERIAL EXAMINED. — **Philippines.** "Albatross": stn 5255, 2 corallites (USNM 97296).

Marigondon cave entrance, Mactan Island, Cebu, 22 m, coll. H. SCHUHMACHER, 28 May 1981, 1 colony (USNM 94142).

MUSORSTOM 3: stn 131, 3 colonies (MNHN).

Indonesia. DEKI: stn 54, 1 (NNM).

CORINDON 2: stn 248, 1 colony (MNHN).

SNELLIUS 2: stn 4.226, 2 (NNM).

KARUBAR: stn 22, 1 colony (USNM 97298). — Stn 30, 1 (POLIPI).

Queensland. Steven's Reef, 12 m, 10 corallites (USNM 78584). — Reef D, Queensland, depth unknown, 3 corallites (USNM 78585).

TYPE LOCALITY. — Sandal Bay, Lifu, Loyalty Islands, 73 m.

DIAGNOSIS. — Corallum composed of a cluster of elongate-conical corallites, each originating from a common basal coenosteum or the lower pedicel of a larger corallite. Largest known corallite (CORINDON 2 stn 248) 14.9 mm in GCD and 28.7 mm in height, but calices of most other corallites examined less than 5 mm in diameter. C₁ and often C₂ highly ridged, producing a calice hexagonal in outline. Corallum white. Septa of most corallites hexamerally arranged in 3 cycles (S₁>S₂>>S₃), only the larger corallites having a 4th cycle (48 septa). Highest cycle septa (S₃ or S₄, depending on size) rudimentary, often absent from upper corallum. Fossa quite deep; no columella.

REMARKS. — Previously reported specimens of *T. tenuescens* were small (GCD < 4.5 mm) and thus had only 3 cycles of septa. A colony from CORINDON 2 stn 248, having a much larger calice (*i.e.*, 14.9 mm GCD) and 4 cycles of septa, is included without hesitation because from its base bud two smaller corallites (GCD = 4.1 and 4.9 mm), each having only 24 septa and being similar to previously known specimens.

The colony from KARUBAR stn 22 has the C₁₋₂ on the lower pedicel prominently ridged and extending outward onto the common coenosteum. Exothecal dissepiments bridge adjacent C₁₋₂, forming chambers of tissue radiating outward from the base of each corallite, each a potential bud.

This species is more fully described and illustrated by CAIRNS (1995).

DISTRIBUTION. — *Philippines*: Sulu Sea (west of Panay); Bohol Strait; Davao Gulf; 22-183 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Flores Sea (Selayar Island); 85-288 m. *Elsewhere*: Queensland; Lord Howe Seamount Chain; Kermadec Islands; Loyalty Islands; 8-315 m.

Genus *RHIZOSMILIA* Cairns, 1978*Rhizosmilia robusta* Cairns, 1993*Rhizosmilia robusta* Cairns in CAIRNS & KELLER, 1993: 250-253, pl. 6, figs F-I.MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 1: stn 65, 1 colony of 4 corallites (MNHN).

TYPE LOCALITY. — "Anton Bruun" stn 373B: 26°00'S, 33°05'E (off southern Mozambique), 135 m.

DIAGNOSIS. — Phaceloid colonies composed of a few robust, trochoid corallites, the largest known corallite 29.8 x 36.7 mm in calicular diameter, 41.6 mm in height, and 18.1 mm in pedicel diameter. Base and lower pedicel thickened with concentric rings of hollow chambers formed by layers of exothecal dissepiments that bridge raised costae. Corallum white. Septa hexamerally arranged in 5 cycles ($S_1 > S_2 > S_3 > S_4 > S_5$), the largest corallite also having 8 pairs of S_6 and even 1 pair of S_7 in its end systems (*i.e.*, 116 septa). Small, lamellar paliform lobes occur before S_4 , seemingly paired within each half system. Fossa deep; columella composed of granular rods that are strongly fused into a massive structure.

REMARKS. — This species is more fully described and illustrated in its original description.

DISTRIBUTION. — *Philippines*: north of Lubang Island; 194-202 m. *Elsewhere*: southwestern Indian Ocean; 66-150 m.

Rhizosmilia sagamiensis (Eguchi, 1968)

Coenocyathus sagamiensis Eguchi, 1968: C34, pl. C10, figs 6-7.

Rhizosmilia sagamiensis - CAIRNS, 1994: 62-63, pl. 27, figs c-e.

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5255, 1 (USNM 97300).

MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 117, 4 (USNM 97301). — Stn 131, 3 (MNHN). — Stn 134, 1 (MNHN).

Indonesia. CORINDON 2: stn 248, 10 (MNHN).

TYPE LOCALITY. — Sagami Bay, 60-80 m.

DIAGNOSIS. — Corallum composed of a relatively small phaceloid clump of elongate-conical corallites, the largest Philippine corallites (MUSORSTOM 3 stn 131) 8.8 x 10.1 mm in calicular diameter, 13.5 mm in height, and 4.5 mm in pedicel diameter. Corallite bases reinforced with concentric rings of hollow chambers (best seen in a cross section of the pedicel), which is characteristic of the genus. Corallum primarily white; however, faces of S_{1-2} usually bear reddish-brown crescent-shaped bands that parallel the curved septal edge. Septa hexamerally arranged in 4 cycles ($S_1 > S_2 > S_3 > S_4$), the S_1 being highly exsert. A crown of 12 P_3 encircles the trabecular columella.

REMARKS. — *Rhizosmilia sagamiensis* is more fully described and illustrated by CAIRNS (1995).

DISTRIBUTION. — *Philippines*: Lubang Island; Mindoro Strait; Sibuyan Sea (north of Panay); Sulu Sea (west of Panay); Davao Gulf; 97-183 m. *Indonesia*: Makassar Strait; 170 m. *Elsewhere*: Japan (Sagami Bay to northern Ryukyu Islands); 60-98 m.

Rhizosmilia elata sp. nov.

Figs 18 a-b

? *Anomocora fecunda* - EGUCHI, 1968: C42 (in part: pl. C10, figs 1-5). [Not *Coelosmilia fecunda* Pourtalès, 1871].

MATERIAL EXAMINED/TYPES. — **Philippines**. "Albatross": stn 5244, holotype (USNM 97304) and 15 paratype colonies (USNM 97305).

Indonesia. DEKI: stn 27, 3 corallites, paratypes (NNM 22497).

KARUBAR: stn 86, 1 paratype colony (MNHN).

TYPE LOCALITY. — "Albatross" stn 5244: 6°52'N, 126°14'E (Pujada Bay, southeast coast of Mindanao), 313 m.

ETYMOLOGY. — The species name (Latin *elatus*, high) refers to the elongate growth form of this species.

DESCRIPTION. — Corallum consists of a phaceloid colony composed of elongate-ceratoid to cylindrical corallites, the corallites often undergoing multiple rejuvenescence — one attaining the length of 12 cm, but only

7.6 mm in distal calicular diameter. Main corallite of holotype colony 8.3 cm long and 11.8 mm in calicular diameter, bearing 14 smaller corallites, most of which are assumed to be the result of independent settlement of planulae. Corallites budded from edge zone of parent corallite as well as from common basal coenosteum. On elongate corallites the edge zone covers only a small distal region of the corallum, whereas the remaining theca is often encrusted with epifauna (serpulids, bivalves, etc.), including juvenile corallites of *R. elata*. Thus, an elongate corallite may bear numerous, irregularly spaced smaller corallites, the secondary corallites resulting either from true budding or larval settlement. Well-preserved pedicels of this species indicate that the C₁₋₂ form prominent ridges that radiate from the corallite base onto the adjacent coenosteum where exothecal dissepiments form over these raised costae, characteristic of the genus *Rhizosmilia*. In the more distal parts, costae (C₁₋₄) are broad and convex, covered with very fine granules, and separated from one another by narrow intercostal striae. C₁₋₂ usually slightly more prominent than C₃₋₄ and frequently pigmented a light reddish-brown, the remainder of the corallum being white.

Septa hexamerally arranged in 4 complete cycles: S₁>S₂>S₃>S₄. S₁ highly exsert (up to 3.5 mm), having straight, vertical inner edges that reach the columella. S₂ slightly less exsert (up to 3.0 mm), about 2/3 width of an S₁. S₃ about 1/2 width of an S₂, and only about 2.3 mm exsert. Each S₃ bordered by a thin lamellar paliform lobe 1.3-1.5 mm in width, the 12 P₃ forming a distinct palmar crown. S₄ only about 1.8 mm exsert, about 1/2 width of an S₃. Fossa of moderate depth, containing a crispate columella. Endothecal dissepiments common in elongate coralla, usually visible only in longitudinal section.

REMARKS. — Five other species are known in *Rhizosmilia*: *R. maculata* (Pourtalès, 1874); *R. gigas* (van der Horst, 1931); *R. sagamiensis* (Eguchi, 1968); *R. gerdae* Cairns, 1978; and *R. robusta* Cairns, 1993. *R. elata* is distinguished in having elongate, subcylindrical corallites and pigmented C₁₋₂.

Rhizosmilia elata is similar to *Anomocora* in having elongate coralla with endothecal dissepiments and irregular budding, but can be distinguished by its well-developed P₃, the fact that its buds do not detach, and by its characteristic basal structure of raised costae overlain with exothecal dissepiments.

DISTRIBUTION. — *Philippines*: Pujada Bay, Mindanao; 313 m. *Indonesia*: Banda Sea (Kai Islands); Timor Sea (south of Tanimbar Islands); 70-226 m. *Elsewhere*: ? Sagami Bay (EGUCHI, 1968); 100-380 m.

Genus *PHYLLANGIA* H. Milne Edwards & Haime, 1848

Phyllangia papuensis Studer, 1878

Figs 17 c, f, i

Phyllangia papuensis Studer, 1878: 642-643. — RIDLEY, 1884: 396-397, pl. 16, figs 5-10.

Blastomussa lawtoni Nemenzo, 1988: 216, fig. 1 (new synonym).

Phyllangia sp. - KROPP & MANNING, 1995: 535, fig. 3 a-d.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 47, 9 colony fragments: 5 (MNHN), 4 (USNM 97307). Ambon, coll. H. O. FORBES, 10 colony fragments (BMNH 1884.2.16.9-18; Ridley's, 1884 specimens).

Indonesia. DEKI: stn 24, 1 colony (NNM 22496).

Solomon Islands. "Gazelle": stn 37, 10 colonies (syntypes), (ZMB 1849).

Indian Ocean. Madagascar. NW coast Nosy Be: 13°23.5'S, 47°58.5'E, 100 m, coll. R. PLANTE, 29 October 1969, 1 large colony (MNHN).

Maldives Islands. Nilandu, 20 June 1900, depth unknown, 1 colony (NNM 22495).

TYPE LOCALITY. — "Gazelle" stn 37: Solomon Islands, 88 m.

DESCRIPTION. — Colonies consist of many corallites that are budded from a thick dense basal coenosteum (up to 1.5 mm) that envelopes a cylindrical substratum (*i.e.*, gorgonian or antipatharian axis), such that corallites point outward in all directions from the axis. Colony from Madagascar 17 cm long and 15 mm in diameter (including the gorgonian axis), consisting of approximately 200 corallites. Philippine colony originally of similar

size but encrusting a thinner antipatharian axis. Corallites elongate-conical to cylindrical and up to 7.9 mm in diameter, although most are less than 5 mm in GCD. Corallites rise up to 7 mm above coenosteum, but most are considerably lower. Coenosteum between corallites striate and white. Costae low and convex, bearing 3 or 4 small rounded granules across the width of each costa. Upper theca and outer septal elements light reddish brown.

Septa hexamerally arranged in 3 to 4 cycles, a corallite less than 5 mm GCD usually having only 3 cycles ($S_1 \gg S_2 > S_3$), and larger corallites of 6.5 mm GCD having up to 44 septa ($S_{1-2} > S_3 > S_4$), but none having a full 4th cycle of 48 septa. S_1 highly exsert (up to 1.1 mm) and thick (0.2 mm), but not very wide, their inner edges extending only about 1/2 distance to centre of calice. Lower, inner edges of S_1 sometimes bear a small (0.25 mm wide), irregularly shaped paliform lobe. S_2 much less exsert (0.6-0.7 mm) and only about 1/2 width of an S_1 : S_2 may also bear a larger paliform lobe up to 0.33 mm in width. S_3 rudimentary, having lacinate inner edges. In septal systems of corallites bearing pairs of S_4 , the S_2 are accelerated to the same size of an S_1 , the S_3 takes the size of a normal S_2 and has a paliform lobe, and the S_4 are rudimentary, as previously described for the unaccelerated S_3 . Fossa of moderate depth, containing a papillose columella, the rods often fused into a solid, central structure.

REMARKS. — The 2 colonies from the Philippines and northwest Madagascar were the host to the same species of hapalocarinid crab (see KROPP & MANNING, 1995).

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Balicasag Island, Bohol; 81-84 m. *Indonesia*: Banda Sea (Ambon and Kai Islands); 100 m. *Elsewhere*: Bougainville Island (west of Solomon Islands); northwestern Madagascar; Maldive Islands; 88-100 m.

Genus *SYMPODANGIA* nov.

TYPE SPECIES. — *Sympodangia albatrossi*, here designated.

ETYMOLOGY. — The genus name *Sympodangia* (Latin *sympodium*, structure resulting from alternate branching + *angia*, a common coral generic suffix) refers to the growth mode of this coral. Gender: feminine.

DIAGNOSIS. — Colonial, small corallites closely packed in short sympodial branches. No individualized columella; no endotheca. Axial edge of septa dentate.

REMARKS. — This genus is of uncertain affinities. The dentate septal edge is unlike typical rhizangiids. Sympodial growth suggests affinities with *Madrepora*, but branches are stouter and less zigzag-shaped. Also, there are more septa than in a *Madrepora*. Individual calices resemble those of *Hoplania*, a monospecific genus, but which has stronger S_1 .

Sympodangia albatrossi sp. nov.

Figs 18 c-g

MATERIAL EXAMINED. — Types: **Philippines**. "*Albatross*": stn 5398, holotype (USNM 97308); 400+ small branch fragments, paratypes (USNM 97308), 28 branch fragments (MNHN).

Indonesia. "*Albatross*": stn 5586, 2 branch fragments, paratypes (USNM 97310).

KARUBAR: stn 18, 24 branch fragments, paratypes (USNM 97311).

TYPE LOCALITY. — "*Albatross*" stn 5398: 11°35'N, 124°14'E (Biliran Island, Samar Sea, Philippines), 208 m.

ETYMOLOGY. — This species is named for the *R/V Albatross*.

DESCRIPTION. — Small (rarely more than 4 cm in diameter), bushy colonies formed by closely spaced sympodial budding, such that corallites from adjacent branches often fuse to one another. Adjacent corallites may also be linked by slender (1 mm diameter), solid, coenosteal bridges, although this is far less common. Holotype a branch fragment 35 mm long consisting of 20 corallites. Calices circular to slightly elliptical, ranging from 2.5 to 4.2 mm in diameter. No marked costae, the theca homogeneously covered with low, closely spaced, rounded granules 90-120 μm in diameter, the larger-sized granules occurring only on coenosteum that encrusts a barnacle valve substratum. Corallum light yellow-brown in colour.

Septa hexamerally arranged in 4 cycles, the 4th never complete. A full 3rd cycle of septa (a total of 24 septa) present in calices of 2.4 mm GCD, and a maximum number of 36 septa (a pair of S₄ in each system) is achieved at GCD of about 3.4 mm. S₁ exsert (0.3-0.6 mm), having straight, vertical inner edges that bear 3-5 small (85-100 μm diameter), cylindrical papillae on their lowermost edges adjacent to the columella. Accelerated S₂ (those in systems having a pair of S₄) about 0.2 mm exsert and 3/4 width of an S₁; lower, inner edges of S₂ coarsely dentate, the teeth about 0.2 mm in width, beginning slightly higher in fossa than S₁ papillae. S₃ slightly less exsert than S₂ but about equal in width, their inner edges bearing even larger teeth (up to 0.3 mm width) that extend slightly higher in fossa than those of the S₂. S₄ less exsert and about 3/4 width of an S₃, their inner edges finely dentate for most of their length. Septal faces covered with tall (up to 90 μm), blunt granules. Fossa deep and narrow. Columella papillose, but quite small, composed of 1-4 papillae of equal size to those on the lower edges of the S₁.

DISTRIBUTION. — *Philippines*: Samar Sea; 208 m. *Indonesia*: Banda Sea (Kai Islands); 212-616 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah).

Genus *COLANGIA* Pourtalès, 1871

Colangia moseleyi (Faustino, 1927) comb. nov.

Cladocora conferta Moseley, 1881: 185, pl. 10, fig. 5, 5a (junior secondary homonym of *Caryophyllia conferta* Dana, 1846: 380, pl. 27, fig. 6).

Cladocora moseleyi Faustino, 1927: 112-113, pl. 15, fig. 2-3 (*nom. nov.*).

MATERIAL EXAMINED. — **Philippines**. "*Challenger*", 1874, unnumbered stations off Zamboanga (Mindanao): 2 syntypes of *Cladocora moseleyi*: 30 fathoms (= 55 m), 1 colony, larger syntype (= lectotype) (BMNH, no register number); 10 fathoms (=18 m), single corallite, smaller syntype (paralectotype), ? *Polycyathus* (BMNH no register number).

TYPE LOCALITY. — Zamboanga, Mindanao, Philippines, 55 m.

DESCRIPTION. — Lectotype collected alive, a compact colony of ca. 27 clustered corallites of various sizes, some incomplete (damaged). Colony comprises some elongate parallel incomplete corallites, 10-20 mm high, lower end broken. Endotheca can be seen inside the fractured corallites (parasmiliid character). In upper part colony spreads laterally and short corallites overgrow the elongate ones, budding from a basal sheet as in *Phyllangia*. Larger corallites up to 5 x 6 mm in calicular diameter. Septa little exsert (S₁ most exsert of all). Outer surface quite smooth, locally with very attenuate costae covered by fine granules. Smaller calices with only 3 cycles of septa; larger calices with incomplete 4th cycle (for example 14 S₄). Septa decreasing in width from S₁ to S₄. Large S₁ with straight vertical axial edge. One distinct large paliform lobe, with vertical axial edge, separated by notch from corresponding septum, associated with S₂ in smaller calices, or with S₃ in larger calices (when S₄ present in same half system). Narrower septa of subsequent cycles with more sloping (less vertical) axial edge frequently bearing 2 or 3 narrow lobes, subhorizontally or obliquely upward directed. These narrow lobes very different from the main paliform lobes (but unlike septal dentation as in true *Astrangia*). Central area of fossa (up to ca. 1/3 calice diameter) occupied by columella composed of lobes similar to paliform lobes, but smaller.

REMARKS. — MOSELEY (1881) described material said to originate from 2 unnumbered shallow stations (10 and 30 fathoms) off Zamboanga (Philippines), as a new species, *Cladocora conferta*. *Cladocora moseleyi* was introduced by FAUSTINO (1927), who reproduced MOSELEY's description and illustration but with no new data as a *nomen novum* in replacement for MOSELEY's *Cladocora conferta*, the latter then considered as a junior homonym of *Cladocora conferta* (Dana, 1846). In fact, DANA's (1846: 380-381, pl. 27, fig. 6) poorly described and illustrated *Caryophyllia conferta*, of uncertain origin (possibly the West Indies), had been placed by later authors (starting with H. MILNE EDWARDS & HAIME, 1849: 308) in the genus *Cladocora*, or even been assimilated (VAUGHAN, 1901: 298) as the West Indian *Cladocora arbuscula* (Lesueur, 1821), apparently without reexamining DANA's type. Remaining of doubtful generic attribution, DANA's species may not be congeneric with MOSELEY's species. MOSELEY's (1881) description of *Cladocora conferta* from the 30 fathoms station is based on a colony with many clustered corallites (poorly illustrated). This syntype is here selected as the lectotype (BMNH, no register number). It is not a *Cladocora*, but a *Colangia*, and closely resembles the West Indian *Colangia immersa* Pourtalès, 1871, type species of the genus. *Colangia immersa* should be restudied in detail. First described from Florida on the basis of dead material from deep water, it more likely is a species of shelf depths. MOSELEY's second Philippine syntype of *Cladocora conferta*, from the 10 fathoms station, (BMNH, no register number), is a different species, not a *Colangia*: the elongate narrow corallite with only 3 cycles of septa and a lateral bud may be a *Polycyathus*. No other specimen of *Colangia* has yet been recognized in the western Pacific. Elsewhere, the genus is known only from the West Indies. This and the resemblance of MOSELEY's lectotype with the West Indian species is troubling. Perhaps the origin is confused, the material not being from the Philippines. Confused origins of "Challenger" material have been pointed out elsewhere.

DISTRIBUTION. — If indicated origin authentic (see Remarks), *Colangia moseleyi* is known only from Mindanao (Philippines), 55 m (type locality).

Genus *COENOSMILIA* Pourtalès, 1874

Coenosmilia arbuscula Pourtalès, 1874

Figs 19 a-c

Coenosmilia arbuscula Pourtalès, 1874: 39-40, pl. 7, fig. 1. — CAIRNS, 1979: 130-131, pl. 24, figs 9-11 (synonymy).
Coenosmilia fecunda - ZIBROWIUS, 1980: 131-133 (in part: pl. 68, figs A-F). [Not *Coelosmilia fecunda* Pourtalès, 1871].
Coenosmilia sp. cf. *C. arbuscula* - CAIRNS, 1994: 61, pl. 27, figs a-b.
 Not *Parasmilia fecunda* - MARENZELLER, 1904a: 311. — GARDINER & WAUGH, 1939: 229.

MATERIAL EXAMINED. — **Philippines.** "Albatross": stn 5543, 1 colony and 6 detached corallites (USNM 97312).

TYPE LOCALITY. — "Hassler" stn unknown: off Barbados, 183 m.

DESCRIPTION (Specimen from "Albatross" stn 5543). — Corallum a bushy, irregularly branched colony of about 30 corallites showing 5 generations of budding. Colony 9 cm in width, composed of elongate-conical corallites, the largest measuring 12.1 x 12.5 mm in calicular diameter and 37 mm in length. Each corallite bears up to 7 buds that originate from the edge zone just below calicular edge. C₁₋₃ usually slightly ridged near calicular edge, flat and granular, like the C₄, on lower 2/3 of corallum. Corallum uniformly white.

Septa hexamerally arranged in 3 cycles (S₁>S₂>S₃), S₄ represented only as small exsert costosepta at calicular margin. S₁ about 1.8 mm exsert, quite narrow (only about 2/5 calicular radius in upper corallite), having straight, entire inner edges that thicken deep in fossa near columella. S₂ about 1.1 mm exsert, 2/3 width of an S₁, having coarsely dentate inner edges near columella. S₃ about 0.9 mm exsert, 2/3 width of an S₂, having highly lacinate inner edges. S₄ about 0.4 mm exsert, occurring only at calicular edge. Fossa very deep and wide. Columella variable, but most often composed of crispate lamellae that are attached to lower, inner edges of S₁₋₂. Endothecal dissepiments present.

REMARKS. — The Philippine specimen differs from most Atlantic specimens in having larger corallites, a more robust colony, and a much deeper fossa. But, *C. arbuscula* is a variable species, and Atlantic specimens are known to have even larger corallites, colonies of 4 corallite generations, and equally deep fossae. Since all other characters are remarkably similar, this specimen, as well as one reported from Japan (CAIRNS, 1994), are identified as *C. arbuscula*. The second author is dubious about the identification of the Philippine specimens with a species known from the Atlantic, believing that there are probably some characters as yet not fully understood that differentiate the two taxa.

DISTRIBUTION. — *Philippines*: Bohol Sea; 296 m. *Elsewhere*: tropical and warm temperate Amphi-Atlantic (109-622 m); northern Ryukyu Islands (238-240 m).

Genus *GONIOCORELLA* Yabe & Eguchi, 1932

Goniocorella dumosa (Alcock, 1902)

Pourtalosmilia dumosa Alcock, 1902c: 36-37, pl. 5, fig. 33.

Goniocorella dumosa - CAIRNS, 1982: 31-34, pl. 9, figs 7-9, pl. 10, figs 1-2 (synonymy); 1994: 63-64, pl. 27, fig. j (synonymy); 1995: 80-81, pl. 22, figs e-h (synonymy).

Goniocorella glanulosa (sic) Hu, 1987: 41, pl. 3, figs 3, 13-15, 17-20 (new synonym).

MATERIAL EXAMINED. — **Indonesia**. "Albatross": stn 5586, 9 dead fragments (USNM 97313).

South China Sea. "Hakuho Maru": stn KH73-2-44-2, 2 dead fragments (USNM 97314).

TYPE LOCALITY. — "Siboga" stns 156 and 259: Banda Sea, 469-487 m.

DIAGNOSIS. — Bushy colonies formed by extratentacular, right-angled budding, the cylindrical corallites 3-4 mm in diameter. Adjacent corallites often linked by slender, solid, tubular coenosteal bridges. Costae inconspicuous. Septa hexamerally arranged in 3 cycles ($S_1 > S_2 > S_3$). All septa little exsert and narrow, resulting in a vacuous fossa. No columella. Tabular endothelial dissepiments common.

REMARKS. — *Goniocorella dumosa* is more fully described and figured by CAIRNS (1982, 1994).

DISTRIBUTION. — *Indonesia*: Halmahera Sea; Banda Sea (Kai Islands); 469-616 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); throughout Indo-West Pacific from southwestern Indian Ocean to Japan, including South China Sea (southern Formosa Strait) and New Zealand region; 88-1488 m. Plio-Pleistocene of Taiwan (HU, 1987).

Genus *CONFLUPHYLLIA* nov.

TYPE SPECIES. — *Confluphyllia juncta*, here designated.

DIAGNOSIS. — Colonial, extratentacular budding forming bushy colonies. Branch anastomosis common, adjacent corallites also united by solid, cylindrical to sheet-like coenosteal bridges. No pali. Columella fascicular. Tabular endothelial dissepiments present.

REMARKS. — *Confluphyllia* is similar to *Goniocorella*, both genera having the same type of colony formation as well as solid coenosteal bridges, but differs in having a robust, fascicular columella, *Goniocorella* having none. *Confluphyllia* is further differentiated from *Goniocorella* by having more septa (up to 42 vs 24), which are more exsert and wider; ridged C_{1-2} ; and larger-diameter corallites. *Confluphyllia* differs from *Coenosmilia* in having a more robust colony that is reinforced with coenosteal bridges, and a fascicular columella (*Coenosmilia* has a crispate columella).

ETYMOLOGY. — The genus name *Confluphyllia* (Latin *confluus*, which flows together + *phyllia*, a common coral suffix) refers to the confluent nature of the branches as linked by coenosteal bridges. Gender: feminine.

Confluphyllia juncta sp. nov.

Figs 19 d-g

MATERIAL EXAMINED/TYPES. — **Philippines.** MUSORSTOM 3: stn 126, 2 dead colonies, paratypes (USNM 97315).

Indonesia. DEKI: stn 59, 5 paratype colonies (NNM 22442).

KARUBAR: stn 25, holotype (MNHN) and 1 paratype colony (USNM 97316).

TYPE LOCALITY. — KARUBAR stn 25: 5°25'S, 132°51'E (Banda Sea, Kai Islands), 318-352 m.

ETYMOLOGY. — The species name (Latin *jungere*, to join, unite) refers to the connecting coenosteal bridges.

DESCRIPTION. — Corallum bushy, produced by closely-spaced extratentacular budding from the edge zone of parent corallites, resulting in frequent branch anastomosis. Colonial structure reinforced by solid coenosteal bridges that link adjacent corallites, as in *Goniocorella*. Coenosteal bridges circular in cross section (about 1 mm in diameter), elliptical in cross section, or lamellar, the latter shape joining two adjacent corallites by a thin coenosteal sheet several mm long. Holotype colony 7 cm wide, consisting of about 85 corallites, one (perhaps the founder corallite) 6.5 cm in length. C₁ slightly ridged, especially near calice, and usually white. C₂ may also be ridged, but only near calice. Otherwise, theca covered with low, rounded (0.2 mm diameter) granules and light yellow-brown in colour. Edge zone on corallites extends about 7 mm from calice.

Septa hexamerally arranged in 4 cycles, the last cycle not complete. Corallites less than 4 mm in GCD have 24 or less septa, but larger corallites (up to 7.2 mm in GCD) have several pairs of S₄, the most common complements being 36 or 38 septa, although some corallites have as many as 42 septa. S₁ exsert (1.3-1.5 mm), having straight, vertical inner edges that extend to the columella. S₂ less exsert (about 0.8 mm) and only 0.8 width of an S₁, also having straight inner edges that fuse with the columella deep in fossa. S₃ about 3/4 exsertness and width of an S₃. S₄ 2/3 width of an S₃. Fossa deep, containing a narrow fascicular columella consisting of 1-5 thick, granular elements.

DISTRIBUTION. — *Philippines*: Sulu Sea (Semirara Islands); 266 m. *Indonesia*: Banda Sea (Kai Islands); 318-385 m.

Family TURBINOLIIDAE H. Milne Edwards & Haime, 1848

Genus *CONOCYATHUS* d'Orbigny, 1849

Conocyathus zelandiae Duncan, 1876

Conocyathus zelandiae Duncan, 1876: 431, pl. 38, figs 1-3. — WELLS, 1964: 113-114. — FILKORN, 1994: 16. — CAIRNS, 1995: 83-84, pl. 23, figs f-i (synonymy).

Conocyathus sulcatus - TENISON WOODS, 1878: 301-302. [Not *Conocyathus sulcatus* d'Orbigny in H. Milne Edwards & Haime, 1851].

Trematetrochus zelandiae - FOLKESON, 1919: 14.

Turbinolia australiensis Gardiner, 1939: 332-333, pl. 21, fig. 2.

Conocyathus - WELLS, 1967: 355.

MATERIAL EXAMINED. — **Indonesia.** SNELLIUS 2: stn 4.056, 11 (NNM 22637).

KARUBAR: stn 44, 4 (USNM 97320). — Stn 86, 1 (MNHN).

TYPE LOCALITY. — Cook Strait, New Zealand (depth not given), but see CAIRNS (1995).

DIAGNOSIS. — Corallum conical, free, and quite small, the largest known corallum 3.4 mm in calicular diameter and 6.1 mm in height. C_{1-4} highly ridged, but C_4 do not correspond to a septal cycle. Intercostal furrows deep, each containing regularly spaced, circular pits 55-65 μ m in diameter. Corallum white. Septa hexamerally arranged in 3 cycles: $S_1 > S_2 > S_3$. Six large P_2 form a palmar ring that encircles a low, smooth, flat columella.

REMARKS. — 16 additional specimens of this tiny, rarely collected species are reported herein, the largest KARUBAR specimen measuring 2.6 mm in calicular diameter and 4.5 mm in height. This species is more fully described and figured by CAIRNS (1995) and GARDINER (1939, as *Turbinolia australiensis*).

DISTRIBUTION. — *Indonesia*: Arafura Sea (south of Tanimbar Islands); Savu Sea (Sumba); 125-222 m. *Elsewhere*: Persian Gulf; Western Australia; New South Wales; Arafura Sea (Arnhem Land, Australia); ? New Zealand; 6-130 m.

Genus *ENDOCYATHOPORA* Cairns, 1989

Endocyathopora laticostata Cairns, 1989

Endocyathopora laticostata Cairns, 1989a: 39-40, pl. 21, figs a-e.

MATERIAL EXAMINED. — *Indonesia*. DEKI: unnumbered station in Bay of Ambon, 91 m, 5: 3 (ZMUC), 2 (USNM 97322). — Unnumbered station in Bay of Ambon, 100 m, 9 (NNM 22692). — Unnumbered station off Gelala, Ambon, depth unknown, 73 (NNM 22691). — Unnumbered station between Neira and Lontor, Banda Islands, 75-90 m, 1 (NNM 22693).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 9, 1 (ZMUC).

TYPE LOCALITY. — "Albatross" stn 5136: 6°44'45"N, 121°48'E (Sulu Sea, Philippines), 46 m.

DIAGNOSIS. — Corallum a narrow, regular cone with a blunt rounded base. Largest known specimen (DEKI, Ambon) 4.0 mm in calicular diameter and 8.6 mm in height. Costae broad and flat, covered with small (about 20 μ m in diameter) granules arranged 5 or 6 across width of each costa. Intercostal furrows deep and narrow but wider towards theca, undercutting adjacent costae. Inside corallum, aligned with each intercostal region, is a row of small (110-120 μ m) shallow depressions, which, by erosion following the death of the coral tend to become pores. Corallum white. Septa hexamerally arranged in 3 complete cycles: $S_1 > S_{2-3}$. Six P_2 form a palmar crown that encircles a columella composed of 1 or 2 papillae.

REMARKS. — This constitutes the second report of this turbinoliid, which is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Sulu Sea (Mindanao and Basilan); 46-70 m. *Indonesia*: Banda Sea (Bay of Ambon and Banda Islands); Bali Strait; 70-100 m.

Genus *ALATOTROCHUS* Cairns, 1994

Alatotrochus rubescens (Moseley, 1876)

Fig. 18 h

Platyrochus rubescens Moseley, 1876: 553.

Sphenotrochus rubescens - MOSELEY, 1881: 157-159, pl. 6, figs 8, 8a.

Alatotrochus rubescens - CAIRNS, 1994: 68-69, pl. 29, figs g-l (synonymy); 1995: 84, pl. 24, figs a-b (synonymy).

MATERIAL EXAMINED. — **Philippines.** "*Hakuho Maru*": stn KH72-1-20, 43 (USNM 97325), 10 (ORI).
 MUSORSTOM 2: stn 2, 1 (MNHN).
 MUSORSTOM 3: stn 86, 1 (MNHN). — Stn 88, 1 (MNHN). — Stn 91, 1 (MNHN). — Stn 96, 2 (MNHN). — Stn 102, 1 (MNHN).

Indonesia. DEKI: stn 44, 1 (NNM 22638). — Stn 49, 1 (NNM 22639).
 KARUBAR: stn 2, 9 (USNM 97324). — Stn 3, 1 (POLIPI).

TYPE LOCALITY. — "*Challenger*" stn 192: 5°49'15"S, 132°14'15"E (Kai Islands, Banda Sea), 136 m.

DIAGNOSIS. — Corallum compressed, the calice elliptical (GCD:LCD = 1.15-1.25) and the thecal faces meeting in sharp edges that, on the lower corallum, project as much as 4 mm as thick, solid edge crests. Largest Philippine specimen (MUSORSTOM 3 stn 88) 11.8 x 18.3 mm in calicular diameter, which is close to the largest recorded size. Four cycles of ridged costae (C_{1-4}) corresponding to S_{1-4} , but C_5 not corresponding to a septal cycle (no S_5). Edge crests also ridged, as though by costae, but these ridges oriented perpendicularly to thecal costae. Septa hexamerally arranged in 4 complete cycles: $S_1 > S_2 > S_3 > S_4$, the S_{1-2} being highly exsert and extending to the columella. Columella papillose, consisting of 5-12 robust pillars; depending on the individual the columellar pillars may be circular or lamellar in cross section.

REMARKS. — Three relatively large specimens (MUSORSTOM 3 stns 88, 91, 102) differ in having their 4 lateral C_1 swollen and protuberant in the upper 8-10 mm of the theca (Fig. 18h). This variation was previously reported for a Japanese Pleistocene specimen (CAIRNS, 1994). *Alatotrochus rubescens* is more fully described and illustrated by CAIRNS (1994).

DISTRIBUTION. — Philippines: Lubang Island; Sulu Archipelago; 187-460 m. Indonesia: Banda Sea (Kai Islands); 136-278 m. Elsewhere: Japan (Kyushu and Ryukyu Islands); southern Norfolk Ridge; 193-751 m.

Genus *CRYPTOTROCHUS* Cairns, 1988

"*Cryptotrochus*" *venustus* (Alcock, 1902)

Ceratotrochus venustus Alcock, 1902a: 92; 1902c: 10, pl. 1, figs 5, 5a.

Not *Cryptotrochus venustus* - CAIRNS, 1995: 88-89, pl. 26, figs g-i, pl. 27, figs a-b (= gen. nov., sp. nov., CAIRNS, in press).

MATERIAL EXAMINED. — **Indonesia.** DEKI: stn 57, 1 (NNM 22649). — Stn 58, 1 (NNM 22650).
 KARUBAR: stn 2, 2 (POLIPI). — Stn 3, 44: 5 (MNHN), 36 (USNM 96906); Stn 7, 15 (MNHN).

TYPE LOCALITY. — "*Siboga*" stn 256: 5°26.6'S, 132°32.5'E (Kai Islands, Banda Sea), 397 m.

DIAGNOSIS. — Corallum conical but slightly compressed, resulting in an elliptical calice with a GCD:LCD of 1.1-1.2. Largest Indonesian specimen (KARUBAR stn 7) 10.1 x 11.2 mm in calicular diameter and 10.4 mm in height. Costae ridged, often discontinuous, and separated by broad intercostal furrows. Five cycles of costae usually present on coralla having only 4 cycles of septa, the C_5 terminating at the calicular margin as exsert spurs without septal continuation within calice. Thecal edges rounded in upper corallum but on lower corallum faces meet in an acute, non-carinate, angle. Corallum white. Septa hexamerally arranged in 4 cycles (44-48 septa): $S_1 > S_2 > S_3 > S_4$, the S_1 being highly exsert. Six thin lamellar P_2 encircle a papillose columella.

REMARKS. — "*Cryptotrochus*" *venustus* differs from the type-species *C. javanus* Cairns, 1988, in having one more cycle of costae; much wider and shallower intercostal regions; costae of independent origin; and a slightly compressed corallum (that of *C. javanus* is conical). Because of these significant differences, *C. venustus* is not confidently assigned to *Cryptotrochus*; its systematic position is elaborated on in greater detail by CAIRNS (in press).

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 200-397 m.

Genus *NOTOCYATHUS* Tenison Woods, 1880

Notocyathus venustus (Alcock, 1902)

Citharocyathus venustus Alcock, 1902b: 119; 1902c: 22, pl. 3, figs 19, 19a.

Notocyathus venustus - CAIRNS, 1989a: 27-28, pl. 12, figs c-h (synonymy); 1994: 64, pl. 27, figs k-l.

MATERIAL EXAMINED. — *Indonesia*. DEKI: stn 24, 10 (NNM 22682). — Stn 44, 1 (NNM 22683). — Stn 50, 17: 1 (USNM 97336), 16 (NNM 22685). — Stn 62, 1 (USNM 97338).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 18, 1 (USNM 97339).

SNELLIUS 2: stn D2, 1 (NNM 23090). — Stn 81.2, 6 (NNM 22690).

KARUBAR: stn 2, 157 (MNHN). — Stn 3, 200+ (USNM 97327). — Stn 7, 118 (MNHN). — Stn 15, 1 (MNHN). — Stn 22, 1 (USNM 97330). — Stn 31, 5 (POLIPI). — Stn 49, 3 (POLIPI). — Stn 50, 1 (USNM 97333).

TYPE LOCALITY. — "Siboga" stn 59: 10°22.7'S, 123°16.5'E (Savu Sea), 390 m.

DIAGNOSIS. — Corallum conical, the largest Indonesian specimen (a syntype) 6.5 x 6.7 mm in calicular diameter and 9.2 mm in height. Calice almost perfectly circular: GCD:LCD = 1.02-1.05. All costae bear a row of outward projecting granules, as well as 2 rows of laterally oriented granules that project across the deep intercostal furrow. Corallum white. Septa hexamerally arranged in 4 complete cycles: S₁>S₂>S₃>>S₄. S₁ highly exsert, their upper edges being coarsely dentate and inclined inward toward fossa. S₄ considerably less exsert and less wide, but as thick as an S₃, their septal faces often lacking granules. Within each septal system a pair of lamellar P₃ fuse in V-shaped structures before their common P₂. Fossa shallow if any; columella papillose.

REMARKS. — As previously discussed (CAIRNS, 1989a, 1994), *Notocyathus venustus* is very similar to *N. conicus* (Alcock, 1902), the coralla of small specimens being difficult or impossible to distinguish. To reiterate, *N. venustus* differs in having a nearly circular calice and thus a lower GCD:LCD (1.02-1.05 vs 1.01-1.22 for *N. conicus*), and more exsert S₁₋₂ and proportionally less exsert S₄. In large specimens of *N. venustus*, S₃ become almost as wide and exsert as the S₂, but the S₄ remain quite small and thin. In large specimens of *N. conicus*, the S₄ are only slightly less exsert and less wide than the S₃. This species is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Sulu Sea (Mindanao and Sulu Archipelago); 70-555 m. *Indonesia*: Banda Sea (Kai and Tanimbar Islands); Savu Sea; Java Sea; 100-390 m. *Elsewhere*: Malaysia (Darvel Bay, off Sabah, Celebes Sea); Japan (Kyushu and Ryukyu Islands); 193-422 m.

Notocyathus conicus (Alcock, 1902)

Citharocyathus conicus Alcock, 1902b: 118-119; 1902c: 22, pl. 3, figs 18, 18a.

Notocyathus conicus - CAIRNS, 1989a: 28, pl. 13, figs a-i (not "Albatross" stn 5586, a worn unidentified specimen) (synonymy); 1994: 64-65, pl. 28, figs a-b; 1995: 91-92, pl. 27, figs c, g.

MATERIAL EXAMINED. — *Philippines*. "Hakuho Maru": stn KH72-1-20, 1 (USNM 97343).

MUSORSTOM 2: stn 11, 1 (MNHN). — Stn 33, 10 (USNM 81801).

MUSORSTOM 3: stn 102, 6 (MNHN). — Stn 106, 1 (MNHN).

Indonesia. DEKI: stn 6, 20 (NNM 22761).

CORINDON 2: stn 235, 3 (MNHN).

KARUBAR: stn 2, 2 (USNM 97341). — Stn 15, 4 (POLIPI). — Stn 18, 18 (MNHN). — Stn 32, 1 (USNM 97342).

TYPE LOCALITY. — "Siboga" stn 95: 5°43.5'N, 119°40'E (Sulu Sea, Philippines), 522 m.

DIAGNOSIS. — Corallum conical, largest Indonesian specimen (a syntype) 6.9 x 7.0 mm in calicular diameter and 8.1 mm in height. Calice usually slightly elliptical: GCD:LCD = 1.01-1.22. Costae and costal granulation as in *C. venustus*. Corallum white. Septa hexamerally arranged in 4 complete cycles: $S_1 > S_2 > S_3 > S_4$. Difference between exsertness and width of 4 septal cycles gradual, the S_4 of large specimens sometimes almost as wide as the S_3 . Pairs of lamellar P_3 fuse in a V-shaped structure before their common P_2 . Fossa shallow; columella papillose.

REMARKS. — This species is compared to *N. venustus* in the account of that species and is more fully described and figured by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Lubang Island; Sibuyan Sea; Visayan Sea; Bohol Sea; Sulu Archipelago; 34-923 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 206-210 m (depth of 1110 m of CORINDON 2 stn 235 considered erroneous). *Elsewhere*: Japan (Kyushu, Bungo Strait, and Honshu); Norfolk and Kermadec Ridges north of New Zealand; 70-710 m.

Genus *DELTOCYATHOIDES* Yabe & Eguchi, 1932

Deltocyathoides orientalis (Duncan, 1876) comb. nov.

Deltocyathus orientalis Duncan, 1876: 431, pl. 38, figs 4-7.

Peponocyathus australiensis - CAIRNS, 1989a: 29, 30-32, pl. 14, figs d-j, pl. 15, figs a-d (synonymy); 1994: 64-65, pl. 28, figs c-f, pl. 41, fig. i (synonymy). — CAIRNS & PARKER, 1992: 39-40, pl. 13, figs c-d.

Deltocyathus lens Alcock, 1902a: 99; 1902c: 19-20, pl. 2, figs 16, 16a. — ZOU, 1988: 77-78, pl. 5, figs 6, 6a. Not *Peponocyathus orientalis* - YABE & EGUCHI, 1932a: 444-445 [= ? *P. folliculus* (Pourtalès, 1868)].

MATERIAL EXAMINED. — **Philippines**. "*Albatross*": stn 5137 (confused origin, probably 5135), 1 (USNM 97344).

"*Hakuho Maru*": stn KH72-1-20, 1 (USNM 97353).

MUSORSTOM 2: stn 33, 142 (MNHN).

MUSORSTOM 3: stn 102, 1 (USNM 97345). — Stn 117, 1 (MNHN). — Stn 139, 1 (USNM 97346).

Indonesia. DEKI: stn 6, 11 (NNM 22640). — Stn 7, 8 (ZMUC). — Stn 24, 9 (NNM 22641). — Stn 26, 1 (ZMUC). — Stn 44, 1 (NNM 22642). — Stn 46, 2 (ZMUC). — Stn 49, 18 (NNM 22643). — Stn 53, 19 (ZMUC).

"*Galathea*": stn 500, 1 (ZMUC).

CORINDON 2: stn 248, 3 (MNHN).

SNELLIUS 2: stn D2, 6 (NNM 23093). — Stn 81.2, 14 (NNM 22094).

KARUBAR: stn 2, 49 (MNHN). — Stn 3, 26 (POLIPI). — Stn 7, 40 (USNM 97349). — Stn 13, 2 (MNHN). — Stn 15, 35 (POLIPI). — Stn 18, 19 (USNM 97350). — Stn 22, 9 (MNHN). — Stn 28, 4 (USNM 97351). — Stn 29, 1 (MNHN). — Stn 44, 22 (MNHN). — Stn 49, 18 (MNHN). — Stn 61, 35 (POLIPI).

TYPE LOCALITY. — 34°12'N, 136°20'E (southeastern Honshu, Japan), 95 m.

DIAGNOSIS. — Corallum bowl-shaped, with a gently rounded base. Asexual reproduction through transverse division not observed in this species. Coralla usually less than 7.5 mm in calicular diameter. Costae equal in width, separated by deep intercostal furrows of about the same width. Each costa bears a row of outward-projecting, blunt spines as well as smaller spines that project into intercostal furrows. Corallum white. Septa hexamerally arranged in 4 complete cycles above a GCD of about 3.5 mm; 24 septa are present in smaller specimens, rarely with any intermediate number. Septal formula: $S_1 > S_2 > S_4 > S_3$, all septa being equally exsert. S_1 independent; pairs of S_3 join S_2 and pairs of S_4 to S_3 within each septal system. P_2 -3, and occasionally P_1 , present. Columella papillose.

REMARKS. — As implied by CAIRNS (1995), the genus *Deltocyathoides* should be employed for those "peponocyathid" species that do not reproduce by transverse division, and the name *Peponocyathus* for those

species that do. This distinction is discussed in greater detail by CAIRNS (in press), and this species is more fully described and illustrated by CAIRNS (1989a, 1994) as *Peponocyathus australiensis*.

Petrarcid ascothoracidan galls were found in the coralla of specimens from "Albatross" stations 5178, 5313, 5314, 5315, 5317, and 5403 (see CAIRNS, 1989a), the record from "Albatross" stn 5403 previously reported as such by ZIBROWIUS and GRYGIER (1985).

DISTRIBUTION. — *Philippines*: throughout region from Luzon to Sulu Archipelago; 44-635 m. *Indonesia*: Makassar Strait; Banda Sea (Kai, Tanimbar, and Tukangbesi Islands); Arafura Sea (east of Tanimbar Islands); Savu Sea (Timor Sea); 85-393 m. *Elsewhere*: southwest Indian Ocean to Japan; 44-635 m.

Genus *PEPONOCYATHUS* Gravier, 1915

Peponocyathus minimus (Yabe & Eguchi, 1937)

Fig. 18 i

Discotrochus (*Cylindrophyllia*) *minimus* Yabe & Eguchi, 1937: 146-147, pl. 20, figs 16-22; 1942b: 118.

Cylindrophyllia minimus - SQUIRES, 1958: 58. — EGUCHI, 1965: 289, 2 figs. — KIKUCHI, 1968: 8, figs 3a, b. — HU, 1988: 151, pl. 1, figs 9-12, 14-15.

Peponocyathus folliculus - CAIRNS, 1989a: 32-33 (in part: pl. 15, e-h, "Albatross": stns 5172, 5217, 5311). [Not *Stephanophyllia folliculus* Pourtalès, 1868].

Cylindrophyllia orientalis - MORI & MINOURA, 1983: 185-191, figs 1-6. [Not *Peponocyathus orientalis* Yabe & Eguchi, 1932].

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5172, 1 (USNM 81838). — Stn 5217, 1 (USNM 81839). — Stn 5236, 36 (USNM 97354). — Stn 5311, 6 (USNM 81841). — Stn 5312, 8 (USNM 97355). — Stn 5313, 13 (USNM 97356). — Stn 5315, 3 (USNM 97357). — Stn 5424, 1 (USNM 97358). — Stn 5579, 1 (USNM 97359). — Stn 5586, 8 (USNM 97360).

"Galathea": stn 477, 3 (ZMUC).

Indonesia. CORINDON 2: stn 210, 1 (MNHN). — Stn 235, 1 (MNHN).

SNELLIUS 2: stn 81.2, 4 (NNM 22762, 23099).

KARUBAR: stn 2, 4 (POLIPI). — Stn 3, 195 (POLIPI). — Stn 7, 500+ (USNM 97362). — Stn 15, 16 (MNHN). — Stn 18, 13 (MNHN). — Stn 22, 1 (MNHN). — Stn 44, 4 (MNHN). — Stn 49, 33 (MNHN). — Stn 61, 4 (MNHN).

TYPE LOCALITY. — Neogene of Taiwan, Kyushu, and Honshu, and Recent of Toyama Bay, Japan.

DIAGNOSIS. — Anthocaulus not yet known for this species. Anthocyathus cylindrical (usually wider than high), often with a flat base, the result of asexual transverse division. Anthocyathi in process of division rare (but see Fig. 18i), the corallum base appearing "unfinished" or open (thickened closing deposit not yet developed), characteristic of a recent fission from a parent corallum. Corallum rarely over 4.0 mm in calicular diameter. Costae equal in width and covered with fine granules; costae separated by relatively wide intercostal furrows, often as wide as the costae. If C₄ are present, they originate on the horizontal flat base, not the vertical thecal walls. Corallum white. Septa hexamerally arranged in 3 to 4 cycles, the 4th cycle never complete, most coralla having 24 or 36 septa: S₁>S₂-3. Small pali present before all but last septal cycle.

REMARKS. — *Peponocyathus minimus* is similar to *P. folliculus*, both species being known from the Philippine region. CAIRNS (1989a) mistakenly included 3 lots of *P. minimus* in a previous account of *P. folliculus* (see synonymy). *P. minimus* differs in having a short, squat corallum (that of *P. folliculus* is usually higher than wide); a flat base, not rounded; and intercostal furrows almost as wide as the costae (those of *P. folliculus* being very narrow and the costae quite wide). Furthermore, in *P. minimus* pairs of C₄ originate on the anthocyathus base, in *P. folliculus* on the thecal edges.

Peponocyathus minimus is described in greater detail by MORI & MINOURA (1983) as *Cylindrophyllia orientalis*.

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Sulu Sea (Cagayan Islands); eastern Mindanao; Sulu Archipelago; 161-903 m. *Indonesia*: Celebes Sea (Borneo); Makassar Strait; Banda Sea (Tanimbar and Kai Islands); Bali Strait; 124-616 m (depth of 1110 m from CORINDON 2 stn 235 considered erroneous). *Elsewhere*: South China Sea (Pratas Island); Japan (Honshu, Kyushu, and the Ryukyu Islands); 30-402 m. Pleistocene of Ryukyu Islands.

Peponocyathus folliculus (Pourtalès, 1868)

Stephanophyllia folliculus Pourtalès, 1868: 139.

Peponocyathus orientalis Yabe & Eguchi, 1932b: 444-445, unnumb. figs.

Peponocyathus folliculus - ZIBROWIUS, 1980: 113-115, pl. 58, figs A-L, pl. 59, figs A-K (synonymy). — CAIRNS, 1989a: 32-33 (in part: pl. 16, figs a-c, "Albatross" stns 5277, 5577, 5584); 1994: 66-67, pl. 28, figs g-k.

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 10, 3 (NNM 23097).
SNELLIUS 2: stn 4.065 (station data possibly confused), 1 (NNM 23098).
KARUBAR: stn 15, 14: 8 (MNHN), 6 (USNM 97363).

TYPE LOCALITY. — "Bibb" stn 51: 24°12'40"N, 81°19'25"W (Straits of Florida), 433 m.

DIAGNOSIS. — From Indonesia, known only from the anthocyathus stage. Corallum cylindrical, with a flat to slightly rounded base that is the result of transverse division; small, rarely exceeding 4 mm in calicular diameter; adult corallum usually higher than wide (*i.e.*, H:D>1). Costae broad, convex, and finely granular. Corallum white. Septa hexamerally arranged in 3 to 4 cycles, the 4th cycle never complete, 24-36 being the range of septal number. Septa arranged: $S_1 > S_2 \geq S_3$, each of the 6 S_2 bearing a prominent paliform lobe. Fossa shallow; columella papillose.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1994), and is compared to *P. minimus* in the previous account.

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (Sulu Archipelago); 146-534 m. *Indonesia*: Banda Sea (Kai Islands); Savu Sea (Sumba); 50-212 m. *Elsewhere*: Japan (Honshu, Kyushu, and northern Ryukyu Islands); Atlantic; ? 30-582 m.

Genus *TROPIDOCYATHUS* H. Milne Edwards & Haime, 1848

Tropidocyathus lessonii (Michelin, 1842)

Flabellum lessonii Michelin, 1842: 119.

Trochocyathus (Tropidocyathus) lessonii - ALCOCK, 1902c: 17, pl. 2, figs 14, 14a.

Tropidocyathus lessonii - ZOU *et al.*, 1988: 195.

Tropidocyathus lessonii - CAIRNS, 1989a: 33-34, pl. 16, figs d-l (synonymy); 1994: 67, pl. 29, figs a-b (synonymy). — CAIRNS & KELLER, 1993: 253, pl. 7, fig. C.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 64, 1 (MNHN).
MUSORSTOM 2: stn 29, 1 (USNM 97364). — Stn 33, 1 (MNHN).
MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 108, 1 (USNM 97365). — Stn 131, 9 (MNHN).
Indonesia. DEKI: stn 49, 53 (NNM 22670). — Stn 53, 2 (NNM 22671).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 3 (ZMUC). — Stn 8, 1 (ZMUC).
KARUBAR: stn 1, 1 (MNHN). — Stn 2, 8 (POLIPI).

TYPE LOCALITY. — Unknown.

DIAGNOSIS. — Corallum cuneiform, with a rounded base and pronounced (up to 4 mm in height), thin, thecal edge crests. Calice elliptical to rhombus-shaped, with a GCD:LCD = 1.1-1.5. Largest Indonesian specimen (KARUBAR stn 2) 13.2 x 15.7 mm in calicular diameter and 14.2 mm in height. Costae low and flat, covered with

low, blunt granules, 3 or 4 occurring across the width of each C₁₋₃. Costae do not extend to thecal edge crests; however, crests are covered with low aligned granules and ridges. Theca pale orange; calicular elements white. Septa hexamerally arranged in 4 cycles: S₁>S₂>S₃>S₄. Lamellar pali present before S₁₋₃. Columella papillose.

REMARKS. — Some MUSORSTOM specimens were previously reported by CAIRNS (1989a). A more detailed description and illustrations of this species are provided by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Tablas Strait; Sulu Sea (Panay); Sulu Archipelago; 68-421 m. *Indonesia*: Banda Sea (Kai Islands); Timor Sea; Savu Sea (Timor); Flores Sea; Bali Strait; 50-390 m. *Elsewhere*: South China Sea off Hong Kong; Japan (Kyushu and Ryukyu Islands); western Indian Ocean (Natal, Somalia, and Kenya); 62-155 m.

"Tropidocyathus" pileus (Alcock, 1902)

Figs 19 h-i

Trochocyathus pileus Alcock, 1902a: 96-97; 1902c: 15-16, pl. 2, figs 11, 11a. — FAUSTINO, 1927: 81, pl. 7, figs 7-8. — ZOU *et al.*, 1988: 195.

Tropidocyathus pileus - CAIRNS, 1989a: 34-35, pl. 17, figs a-h (synonymy); 1994: 68, pl. 29, figs d-e; 1995: 91, pl. 28, figs a-c.

MATERIAL EXAMINED. — *Philippines*. "*Hakuho Maru*": stn KH72-1-20, 47: 37 (USNM 97382), 10 (ORI).

MUSORSTOM 1: stn 13, 1 (MNHN). — Stn 40, 7 (USNM 97367). — Stn 42, 2 (MNHN). — Stn 55, 1 (USNM 97369). — Stn 58, 9 (USNM 97370). — Stn 62, 1 (MNHN).

MUSORSTOM 2: stn 6, 3 (MNHN). — Stn 10, 1 (MNHN). — Stn 63, 30 (USNM 97372). — Stn 83, 19: 16 (MNHN), 3 (BMNH 1992.8.11.15).

MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 92, 322: 313 (USNM 97374), 9 (BMNH 1992.8.11.16). — Stn 96, 1 (USNM 97375). — Stn 99, 1 (MNHN). — Stn 108, 3 (USNM 97376). — Stn 109, 1 (MNHN). — Stn 124, 3 (MNHN).

Indonesia. DEKI: stn 49, 3 (NNM 22491).

KARUBAR: stn 2, 32 (POLIPI). — Stn 3, 3 (POLIPI). — Stn 7, 12 (MNHN). — Stn 35, 1 (USNM 97380). — Stn 36, 1 (MNHN). — Stn 62, 8 (USNM 97381). — Stn 67, 1 (MNHN). — Stn 85, 2 (POLIPI).

TYPE LOCALITY. — "*Siboga*" stn 95: 5°43'N, 119°40'E (Sulu Archipelago, Philippines), 522 m.

DIAGNOSIS. — Corallum variable in shape: viewed from the side, most coralla are trapezoidal, the basal (shortest) edge often being straight or slightly curved. Other coralla triangular in profile or bowl-shaped. All coralla laterally compressed, resulting in an elliptical calice with a GCD:LCD = 1.50-1.65. Largest specimen (KARUBAR stn 2) 17.9 x 24.8 mm in calicular diameter and 20.8 mm in height. Thecal edges rounded and occasionally slightly protuberant near corallum base. Highly ridged, vertically oriented costae continuous from calice to base, extending onto edge protuberances. Costae bear 1 apical row of coarse teeth and smaller, laterally oriented granules. Intercostal furrows deep. Corallum white. Septa hexamerally arranged in 4 to 5 cycles (see Remarks): S₁>S₂>S₄>S₃ or S₁>S₂>S₃>S₅>S₄. Lamellar pali occur before all but last septal cycle (P₁₋₃ or P₁₋₄), the P₂ and 2 P₃ within each system in a chevron-shaped arrangement. Columella linear-papillose.

REMARKS. — Although "*T. pileus*" is similar to the type species *T. lessonii* (Michelin, 1842) in paler configuration, it differs in costal origin and ornamentation; depth of intercostal regions; columellar structure; and in lacking thecal edge crests. Discussed in greater detail by CAIRNS (in press), it is doubtful that *T. pileus* should remain in the genus *Tropidocyathus*.

All specimens obtained from the Indonesian region differ from typical "*T. pileus*" in having more than 4 cycles of septa, often a full 5th cycle (96 septa) or pairs of S₅ in the 4 systems adjacent to the principal septa, resulting in 80 septa, some coralla even having a few pairs of S₆. This higher number of septa does not seem to be related to a larger corallum size, since specimens as small as 9.8 mm in GCD (*e.g.*, KARUBAR stns 3, 7) have a full 5th cycle. Coralla having 5 cycles of septa are often triangular (not trapezoidal) in profile and have finer (thinner) costae, their C₅ originating on the thecal faces 2-7 mm above the base.

This common Indo-West Pacific species is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Verde Island Passage and Tablas Strait adjacent to Mindoro; Bohol Sea; Sulu Archipelago; 143-522 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 240-390 m. *Elsewhere*: widespread from southwest Indian Ocean to Japan, including Queensland, the Norfolk Ridge, and the South China Sea off Hong Kong; 123-422 m.

"*Tropidocyathus*" *labidus* sp. nov.

Figs 20 a-g

MATERIAL EXAMINED/TYPES. — **Indonesia**. DEKI: stn 52, 1 paratype (NNM 22775).

"*Galathea*": stn 500, 1 (ZMUC).

KARUBAR: stn 2, holotype (MNHN) and 5 paratypes (MNHN). — Stn 3, 38 paratypes (MNHN). — Stn 7, 40 paratypes (USNM 97384). — Stn 15, 1 paratype (MNHN). — Stn 32, 1 paratype (POLIPI).

Japan. "*Tansei Maru*": stn KT93-09-AM8, 3 paratypes (USNM 97385).

TYPE LOCALITY. — KARUBAR stn 2: 5°47'00"S, 132°11'35"E (Kai Islands, Banda Sea), 209-240 m.

ETYMOLOGY. — The species name (Latin *labidus*, slippery) is an allusion to the smooth thecal surface.

DESCRIPTION. — Corallum compressed-conical, resulting in a GCD:LCD of 1.06-1.23. Holotype 6.4 x 7.9 mm in calicular diameter and 10.5 mm in height; largest specimen (DEKI stn 52) 9.8 x 11.4 mm in calicular diameter and 13.2 mm in height. Tip of base pointed, covered by the slender lower distal edges of the 12 C₃; C₁₋₂ originate about 0.5 mm above basal tip; C₄ originate 1.5-3.0 mm above tip. C₄ on centre of thecal faces originate highest on face, whereas C₄ near thecal edges originate lowest, such that the points of origin of the 6 pairs of C₄ on either thecal face form a crescent (Fig. 20d), the arc of which encircles the basal tip. Each costa bears a row of low, large (200-250 µm in diameter), smooth, rounded granules, producing a slippery texture. Intercostal furrows deep and narrow (50 µm). Corallum theca pale orange, as in *T. lessonii*, but basal tip and all calicular elements white. Dead specimens also uniformly white.

Septa hexamerally arranged in 4 complete cycles: S₁>S₂>S₄>S₃ (48 septa). S₁ highly exsert (up to 1.6 mm), having highly sinuous inner edges. S₂ slightly less exsert, about 4/5 width of an S₁, also having sinuous inner edges. S₃ much less exsert (about 0.8 mm), about 2/3 width of an S₂, having sinuous inner edges. S₄ as exsert as S₃, but wider than the S₃ (almost as wide as the S₂), having straight, thin inner edges. A crown of 12 sinuous-lamellar P₁₋₂ encircles the columella, the P₁ about 0.5 mm in width, the P₂ about twice that width. A 2nd crown of 12 P₃, each P₃ about the same width of a P₂, stands higher in the fossa. Inner edges of P₃ slightly recessed from columella, each pair of P₃ within a system forming a chevron arrangement with its common P₂. All septa and pali bear tall (up to 0.11 mm), slender, pointed spines. Fossa shallow. Columella consists of a line of 3-6 robust papillae, fused at their bases to inner edges of P₁₋₂.

REMARKS. — "*Tropidocyathus*" *labidus* differs from the other two Recent species of *Tropidocyathus* by having a smaller adult corallum; a corallum that is only slightly compressed and bears no edge crests or protuberances; a distinctive costal insertion pattern; and a smooth, coarse costal granulation, quite unlike that of the other species. Like "*T.*" *pileus*, it probably should form the basis of a separate genus.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 206-390 m. *Elsewhere*: Amami o Shima, Ryukyu Islands; 422-425 m.

Genus **IDIOTROCHUS** Wells, 1935

Idiotrochus kikutii (Yabe & Eguchi, 1941)

Placotrochides kikutii Yabe & Eguchi, 1941a: 104; 1942b: 149, pl. 9, fig. 16a-c.

Idiotrochus kikutii - CAIRNS, 1989a: 36-37, pl. 18, figs a-b, d-h (synonymy); 1994: 69, pl. 30, figs a-d.

MATERIAL EXAMINED. — **Philippines:** MUSORSTOM 2: stn 32, 2 (MNHN). — Stn 33, 409: 33 (USNM 81911), 376 (MNHN).

MUSORSTOM 3: stn 102, 1 (MNHN). — Stn 117, 2 (MNHN).

Indonesia. DEKI: stn 46, 1 (ZMUC).

SNELLIUS 2: stn D2, 1 (NNM 23088).

KARUBAR: stn 2, 17 (MNHN). — Stn 3, 30 (MNHN). — Stn 7, 32 (USNM 97387). — Stn 15, 111 (USNM 97388). — Stn 18, 13 (MNHN). — Stn 22, 39 (POLIPI). — Stn 49, 23 (MNHN).

TYPE LOCALITY. — Toyama Bay, Japan (depth not given).

DIAGNOSIS. — Corallum (anthocyathus) with an elliptical calice (GCD:LCD = 1.15-1.95) and a wedge-shaped base, the lower edge often blade-like. Largest specimen examined (MUSORSTOM 2 stn 32) 3.6 x 4.6 mm in calicular diameter and 7.9 mm in height. Theca porcellaneous; costae low, wide, and smooth, corresponding to the interseptal regions. Intercostal striae narrow and shallow, corresponding in position to the septa. Septa hexamerally arranged in 3 cycles: $S_1 > S_2 \geq S_3$. A crown of 10-12 P_{1-2} encircle a papillose columella. P_1 aligned with principal S_1 often reduced in size or absent.

REMARKS. — Most of the MUSORSTOM specimens were previously reported by CAIRNS (1989a), who also provided a more detailed description and illustrations of this species.

DISTRIBUTION. — *Philippines:* Verde Island Passage; Sibuyan Sea; Sulu Archipelago; 97-581 m. *Indonesia:* Banda Sea (Kai and Tanimbar Islands); 300-645 m. *Elsewhere:* Malaysia (Celebes Sea off Sabah); South China Sea off Hong Kong (161 m); Honshu, Japan (depth unknown).

Genus *THRYPTICOTROCHUS* Cairns, 1989

Thrypticotrochus multilobatus Cairns, 1989

Thrypticotrochus multilobatus Cairns, 1989a: 37, pl. 19, figs b-g; 1995: 92, pl. 28, figs d-h. — CAIRNS & KELLER, 1993: 254, pl. 7, figs F, I.

MATERIAL EXAMINED. — **Philippines.** "Siboga": stn 102, 2 (ZMA Coel. 710b).

MUSORSTOM 2: stn 33, 1 (MNHN).

MUSORSTOM 3: stn 100, 1 (MNHN).

Indonesia. DEKI: stn 46, 1 (ZMUC).

KARUBAR: stn 2, 1 (MNHN). — Stn 3, 10 (POLIPI). — Stn 7, 24 (USNM 97391). — Stn 18, 1 (MNHN).

TYPE LOCALITY. — "Albatross" stn 5576: 5°25'56"N, 120°03'39"E (Sulu Sea, Philippines), 507 m.

DIAGNOSIS. — Corallum small and conical, rarely exceeding 4 mm in calicular diameter or 7 mm in height. Base of corallum irregularly shaped as the result of regeneration from a parent fragment. Costae broad and serrate, separated by thin, deep intercostal furrows. Corallum white. Septa hexamerally arranged in 4 cycles: $S_1 > S_2 > S_3 >> S_4$. Inner edges of each S_{1-3} bear 1-3 narrow paliform lobes, the lowermost merging with the papillose columella.

REMARKS. — Since its original description, which was based on material from the Philippines, this species has been reported from the southwestern Indian Ocean and north of New Zealand, and is probably widespread throughout the Indo-West Pacific. It is more fully described by CAIRNS (1989a).

DISTRIBUTION. — *Philippines:* Verde Island Passage; Ragay Gulf; Sulu Archipelago; 192-535 m. *Indonesia:* Banda Sea (Kai Islands); 278-300 m. *Elsewhere:* South China Sea (Pratas Islands); southwest Indian Ocean (Mozambique, Tanzania); Queensland; Norfolk and Kermadec Ridges; 95-925 m.

Superfamily FLABELLOIDEA Bourne, 1905

Family GUYNIIDAE Hickson, 1910

Genus *GUYNIA* Duncan, 1872*Guynia annulata* Duncan, 1872

Guynia annulata Duncan, 1872: 32, pl. 1, figs 1-8. — ZIBROWIUS, 1980: 161-162, pl. 83, figs A-Q (synonymy). — CAIRNS, 1984: 23, pl. 5, figs A-B; 1989a: 42-43, pl. 21, fig. f, pl. 22, figs a-e. — CAIRNS & WELLS, 1987: 42-43, pl. 11, figs 8-9, 12-13. — CAIRNS & PARKER, 1992: 42-43, pl. 14, figs g-h. — CAIRNS & KELLER, 1993: 273, pl. 12, figs H-I.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 2: stn 33, 10: 2 (MNHN), 8 (USNM 81892). MUSORSTOM 3: stn 87, 1 (USNM 97382). — Stn 101, 1 (MNHN). — Stn 102, 7 (MNHN). — Stn 117, 1 (MNHN). — Stn 131, 1 (MNHN). — Stn 140, 1 (USNM 97394).

Indonesia. KARUBAR: stn 2, 4 (1 octameral, 1 nonameral, 2 decameral) (POLIPI). — Stn 3, 6 (3 octameral and 3 decameral) (MNHN). — Stn 7, 2 (1 octameral, 1 decameral) (MNHN). — Stn 15, 24 (16 octameral, 8 decameral) (USNM 97396). — Stn 22, 2 (hexameral)(MNHN). — Stn 28, 2 (decameral) (POLIPI). — Stn 29, 1 (decameral) (USNM 97398).

Japan. "Tansei Maru": stn KT93-09-AM7, 3 (USNM 93159).

TYPE LOCALITY. — Adventure Bank, Mediterranean, 168 m.

DIAGNOSIS. — Corallum cylindrical and quite small, rarely over 7 mm in length and 1.0-1.3 mm in diameter, straight to serpentine. Some coralla firmly attached along one side of the corallum, others attached at random points of their theca to sand grains, pebbles, or foraminifera. One specimen (MUSORSTOM 3 stn 140) was laterally attached to a dead specimen of *Heteropsammia*. Epitheca bears 2 sets of ridges: transverse, circumferential ridges, and 16, 18, or 20 longitudinal costal ridges, which form a grid-like pattern of rectangles. Within each rectangle is a chalky white thecal spot. Septa usually octamerally arranged in 2 cycles, the S₁ much thicker than the S₂; among the KARUBAR specimens there was an almost equal division between the typical octameral form (having 16 septa) and decameral specimens (having 20 septa), and one specimen having 18 septa. These septal symmetries are indicated in the Material Examined section. Furthermore, some small specimens have a hexameral symmetry. All septa have highly sinuous inner edges. Columella a single twisted or trefoil ribbon.

REMARKS. — This minute, cryptic species has one of the smallest calicular diameters of all scleractinian corals. It is more fully described and illustrated by ZIBROWIUS (1980), CAIRNS (1989a), and CAIRNS & PARKER (1992).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Sulu Sea (Mindoro and Panay); Sibuyan Sea; 97-194 m. *Indonesia*: Halmahera Sea; Banda Sea (Kai Islands); 141-282 m. *Elsewhere*: nearly cosmopolitan in tropical and warm temperate regions, including Amami o Shima, Ryukyu Islands (reported herein); not yet known from eastern Pacific; 28-653 m.

Family FLABELLIDAE Bourne, 1905

Genus *FLABELLUM* Lesson, 1831Subgenus *FLABELLUM (FLABELLUM)* Lesson, 1831*Flabellum (F.) pavoninum* Lesson, 1831

Fig. 20 h

Flabellum pavoninum Lesson, 1831: 2. — CAIRNS, 1989a: 46-50, pl. 23, figs g-l, pl. 24, figs a-d, g-h (synonymy); 1989b: 67; 1994: 70-71, pl. 30, figs g-i, pl. 31, figs a-e. — CAIRNS & KELLER, 1993: 263.

Flabellum coalitum Marenzeller, 1888: 48-49. — CAIRNS, 1989a: 46, 50, pl. 24, figs e-f, i-l.
Flabellum sp. - CAIRNS, 1989a: pl. 24, figs e-f.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3: stn 131, 19: 8 (MNHN), 11 (USNM 97455).
Indonesia. CORINDON 2: stn 216, 18: 17 (MNHN), 1 (USNM 97456).
 KARUBAR: stn 1, 9 (MNHN). — Stn 30, 5 (POLIPI).

TYPE LOCALITY. — Hawaiian Islands (depth not given).

DIAGNOSIS. — The specimens reported herein are all relatively small coralla of the *coalitum* form, the largest (CORINDON 2 stn 216) only 16.4 x 29.9 mm in calicular diameter and 29.2 mm in height. Angle of thecal edges ranges from 71°-113°; angle of thecal faces, 33°-43°. Thecal faces slightly convex and coarse in texture, meeting in acute thecal edges that often bear low, discontinuous crests. Calicular edge smooth. Theca of well-preserved specimens reddish-brown, often more intensely striped along the C₁₋₃, as in *F. politum* Cairns, 1989. Pedicel elongate and slender (1.1-1.5 mm in diameter), having 6 protosepta in the basal disc. Septa hexamerally arranged in 6 cycles: S₁₋₃>S₄>S₅>S₆. Lower, inner edges of S₁₋₃ moderately sinuous, whereas their upper, outer margins (adjacent to theca) are notched, rising above calicular edge as exsert lobes. Columella rudimentary.

REMARKS. — Small specimens of *F. pavoninum* forma *coalitum* are similar to adult *F. politum* in many characters, but can be distinguished by having coarse, slightly convex thecal faces; less acute thecal edges; and less sinuous inner edges of the S₁₋₃. *F. pavoninum* is more fully described by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Sulu Sea (Panay); 120-122 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 96-156 m. *Elsewhere*: widespread throughout Indo-West Pacific from southwest Indian Ocean to Hawaiian Islands (CAIRNS & KELLER, 1993); 98-665 m. Forma *coalitum* is common off Japan (Honshu, Kyushu); 73-658 m.

Flabellum (F.) magnificentum Marenzeller, 1904

Flabellum magnificentum Marenzeller, 1904a: 276-277, pl. 17, fig. 13. — CAIRNS, 1989a: 50-51, pl. 25, figs a-j (synonymy); 1994: 72, pl. 31, figs j-l.
Flabellum pavoninum - FAUSTINO, 1927: 46 (in part). [Not *Flabellum pavoninum* Lesson, 1831].
Flabellum pavoninum magnificentum - YABE & EGUCHI, 1942a: 89-90, pl. 5, figs 1a-c.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 2: stn 15, 1 (USNM 97476). — Stn 75, 4 (MNHN). — Stn 78, 4 (MNHN).

MUSORSTOM 3: stn 135, 1 (USNM 97477).

Indonesia. DEKI: stn 3, 4 (NNM 22585). — Stn 12, 1 (NNM 22585). — Stn 41, 8 (NNM 22586). — Stn 42, 1 (NNM 22584).

KARUBAR: stn 12, 1 (MNHN). — Stn 36, 2 (MNHN). — Stn 59, 9 (MNHN). — Stn 67, 1 (USNM 97479). — Stn 69, 13 (USNM 97480). — Stn 70, 9: 7 (POLIPI), 2 (USNM 97481). — Stn 77, 11 (POLIPI). — Stn 85, 1 (POLIPI).

TYPE LOCALITY. — "Valdivia" stn 199: 0°15.5'N, 98°04.8'E (western Sumatra), 470 m.

DIAGNOSIS. — Angle of thecal edges 140°-172°; angle of planar, slightly concave thecal faces, 44°-58°. GCD:H = 1.29-1.48-1.71, all coralla being significantly wider than tall and having long thecal edges. Largest specimen (KARUBAR stn 12) 57 x 90 mm in calicular diameter and 61 mm in height. Thecal faces meet in straight, acute edges but only rarely are edge crests present. Calicular edge smooth. Coralla homogeneously reddish-brown or white. Pedicel relatively short, 1.5-2.3 mm in diameter, containing 6 protosepta at the basal disc. Septa hexamerally arranged in 7 cycles: S₁₋₄>S₅>S₆>S₇, only the larger coralla having a complete 7th cycle of 384 septa, and one (the largest specimen examined) also having one pair of S₈. S₁₋₄ quite narrow near calicular edge but abruptly widening 10-12 mm lower in fossa, resulting in a very high septal concavity index. Lower, inner edges of S₁₋₄ highly sinuous. Columella as in *F. lamellulosum*.

REMARKS. — *Flabellum magnificum* is one of the larger deep-water solitary scleractinians, second in size only to *F. impensum* Squires, 1962 and perhaps certain gigantic *Desmophyllum dianthus* (Esper, 1794) and *Rhizotrochus typus* H. Milne Edwards & Haime, 1848. It is easily confused with another large species, *F. lamellulosum* Alcock, 1902, but can be distinguished by: its broad corallum (GCD:H = 1.48 average vs 1.05 average for *F. lamellulosum*); its long, uncrested thecal edges (LEL:H = 0.70 average vs 0.48 average for *F. lamellulosum*); its sinuous S₁₋₄ (SSI = 4.8 average vs 1.13 average for *F. lamellulosum*); and its wide S₁₋₄ (SCI = 14.7 average vs 9.4 average for *F. lamellulosum*).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Sibuyan Sea; Bohol Strait; Sulu Archipelago; 291-486 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south and southeast of Tanimbar Islands); 225-567 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); west of Sumatra; Japan (Honshu and Shikoku); 307-700 m.

Flabellum (F.) patens Moseley, 1881

Fig. 20 i

Flabellum patens Moseley, 1881: 172 (in part: pl. 6, fig. 15). — CAIRNS, 1989a: 51-52, pl. 26, figs a-i (synonymy); 1989b: 67; 1994: 71-72, pl. 31, figs g-i.

Flabellum australe - ALCOCK, 1902c: 30-31. [Not *Flabellum australe* Moseley, 1881].

MATERIAL EXAMINED. — *Philippines*. MUSORSTOM 3: stn 126, 1 (MNHN).

Indonesia: "Siboga": stn 251, 1 (ZMA).

"Hakuho Maru": stn KH72-1-28, 2: 1 (USNM 97469), 1 (ORI).

KARUBAR: stn 5, 2 (MNHN). — Stn 31, 1 (MNHN).

TYPE LOCALITY. — "Challenger" stn 192: 5°49'S, 132°14'E (Kai Islands, Banda Sea), 256 m.

DIAGNOSIS. — Corallum highly compressed, resulting in a very low angle of thecal faces (20°-24°), a very high GCD:LCD (2.0-2.5), and a very narrow fossa. Angle of thecal edges 76°-155°; GCD:H rather low (average = 1.04), indicating corallum to be approximately as tall as wide. Largest specimen known ("Albatross" stn 5313) 28.9 x 67.5 mm in calicular diameter and 54.7 in height, but most specimens examined less than 45 mm in GCD. Calicular edge smooth. Thecal edges prominently crested, usually as one continuous ridge, but occasionally forming spurs as in *F. lamellulosum*. Corallum white to grey, the theca near calicular edge usually discoloured and slightly corroded as a band 3-5 mm in width that parallels the calicular edge, an indication of an association with a commensal *Lumbrineris* polychaete (ZIBROWIUS, SOUTHWARD, & DAY, 1975). Pedicel elongate and slender (1.5-2.0 mm in diameter), containing 6 protosepta at the basal disc. Septa hexamerally arranged in 6 cycles: S₁₋₄>S₅>S₆, only the largest specimens (GCD > 40 mm) having some S₇. S₁₋₄ relatively narrow, their inner edges almost in contact with those from opposite side across a narrow fossa; columella rudimentary.

REMARKS. — *Flabellum patens* is compared to *F. lamellulosum* in the account of the latter species and is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Mindoro Strait; Sulu Sea (Sulu Archipelago); 266-439 m. *Indonesia*: Banda Sea (Kai Islands); Timor Sea (south of Sermata Islands); 204-295 m. *Elsewhere*: Japan (Honshu, Shikoku, and Kyushu); Formosa Strait; South China Sea north of Pratas Island; 223-402 m.

Flabellum (F.) lamellulosum Alcock, 1902

Fig. 21 a

Flabellum lamellulosum Alcock, 1902a: 105-106; 1902c: 30, pl. 4, figs 28, 28a-b. — CAIRNS, 1989a: 52-53, pl. 27, figs a-1 (synonymy); 1989b: 67.

Flabellum distinctum - ALCOCK, 1902c: 30 (in part: "Siboga" stn 12). [Not *Flabellum distinctum* H. Milne Edwards & Haime, 1848].

Flabellum pavoninum - FAUSTINO, 1927: 45-46 (in part). [Not *Flabellum pavoninum* Lesson, 1831].

MATERIAL EXAMINED. — **Philippines.** "Hakuho Maru": stn KH72-1-52, 3 (USNM 97454).

MUSORSTOM 1: stn 9, 1 (MNHN). — Stn 11, 2 (MNHN). — Stn 12, 5 (MNHN). — Stn 13, 1 (USNM 97419). — Stn 24, 6 (USNM 97420). — Stn 25, 1 (MNHN). — Stn 27, 1 (USNM 97422). — Stn 31, 2 (MNHN). — Stn 40, 1 (MNHN). — Stn 55, 1 (MNHN). — Stn 61, 3 (MNHN). — Stn 68, 2: 1 (MNHN), 1 (BMNH 1992.8.11.10). — Stn 71, 1 (MNHN).

MUSORSTOM 2: stn 1, 1 (USNM 97426). — Stn 10, 3 (USNM 97427). — Stn 12, 3: 1 (MNHN), 2 (USNM 97428). — Stn 18, 1 (USNM 97429). — Stn 19, 1 (USNM 97430). — Stn 21, 5: 4 (MNHN), 1 (USNM 97431). — Stn 26, 1 (USNM 97432). — Stn 63, 7: 2 (MNHN), 5 (USNM 97433). — Stn 64, 2: 1 (MNHN), 1 (USNM 97434). — Stn 66, 2 (MNHN). — Stn 68, 2: 2 (MNHN). — Stn 75, 1 (USNM 97437). — Stn 83, 1 (MNHN).

MUSORSTOM 3: stn 86, 2 (USNM 97433). — Stn 87, 4 (MNHN). — Stn 88, 10 (MNHN). — Stn 91, 2 (MNHN). — Stn 92, 7 (MNHN). — Stn 96, 19: 17 (MNHN), 2 (BMNH 1992.8.11.9). — Stn 97, 2: 1 (MNHN), 1 (USNM 97440). — Stn 98, 4 (MNHN). — Stn 99, 4 (MNHN). — Stn 100, 2: 1 (MNHN), 1 (USNM 97441). — Stn 101, 2 (MNHN). — Stn 102, 1 (USNM 97442). — Stn 108, 7 (USNM 97443). — Stn 109, 6 (USNM 97444). — Stn 111, 2 (USNM 97445). — Stn 112, 2 (USNM 97446). — Stn 130, 1 (MNHN). — Stn 135, 2 (USNM 97447). — Stn 143, 10.

Indonesia. DEKI: stn 3, 7 (NNM 22574). — Stn 41, 1 (NNM 22575). — Stn 50, 1 (NNM 22576). — Stn 52, 7 (NNM 22577). — Stn 63, 2 (NNM 22578).

"Hakuho Maru": stn KH72-1-28, 2 (ORI).

KARUBAR: stn 12, 1 (MNHN). — Stn 36, 1 (MNHN). — Stn 59, 1 (USNM 97449). — Stn 67, 4 (POLIPI). — Stn 69, 4 (POLIPI). — Stn 70, 3 (MNHN). — Stn 77, 2: 1 (MNHN), 1 (USNM 97453).

TYPE LOCALITY. — "Siboga" stn 251: 5°28.4'S, 132°02'E (Kai Islands, Banda Sea), 204 m.

DIAGNOSIS. — Angle of thecal edges 130°-240°; angle of planar thecal faces 32°-51°. GCD:H = 0.79-1.05-1.29, most coralla being higher than wide and having relatively short thecal edges. Largest specimen known (KARUBAR stn 70) 49 x 68 mm in calicular diameter and 67 mm in height. Calicular edges smooth. Thecal edges prominently crested, the crests beginning almost immediately adjacent to pedicel, formed by successive eversions (spurs) of the calice associated with the 2 principal septa and costae and subsequent retrenchment of the calice edge. Thecal edges of large specimens may bear 6 or 7 such spurs, some up to 8 mm in height. Well-preserved coralla homogeneously reddish-brown or white with reddish-brown stripes corresponding to C₁₋₄. Pedicel short and 1.5-2.1 mm in diameter, containing 6 protosepta in the basal disc. Septa hexamerally arranged in 7 cycles, the last cycle usually incomplete: S₁₋₄>S₅>S₆>S₇. Septa relatively narrow, having thickened, straight, lower inner edges. Columella a well-developed crescent of trabeculae 1.0-1.5 mm in width.

REMARKS. — A comparison of *F. lamellulosum* to *F. magnificum* Marenzeller, 1904, is given in the account of the latter species. *F. lamellulosum* is also similar to *F. patens* Moseley, 1881, especially in having a high corallum (GCD:H = 1.04-1.05 average for both species) and in having prominently crested thecal edges. *F. lamellulosum* differs in having a much more open calice with a face angle of 32°-51° and a GCD:LCD of 1.43 (average), compared to 20°-24° and 2.25 (average) for *F. patens*. The more open fossa also accommodates a more robust columella in *F. lamellulosum*. Furthermore, the corallum of *F. lamellulosum* is less dense and more fragile than that of *F. patens*, and does not appear to have the lumbrinerid polychaete symbiont that is so common on the theca of *F. patens*.

Petrarcid ascothoracidan galls are present in 2 coralla (MUSORSTOM 1 stn 71 and "Albatross" stn 5273), evidenced as a characteristic columellar deformation (Fig. 21a).

This species is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Lubang Island and Verde Island Passage; Sulu Sea (Panay); Samar Sea; Bohol Sea; 187-486 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Timor Sea (south of Leti Islands); Java Sea; 204-412 m. *Elsewhere*: South China Sea (Vanguard Bank, Spratly Islands); 265-286 m.

Flabellum (F.) politum Cairns, 1989

Flabellum politum Cairns, 1989a: 53-54, pl. 28, figs a-f (synonymy); 1989b: 67 ("species 1"); 1994: 73, pl. 32, figs a-c.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 2, 3 (MNHN). — Stn 6, 4 (USNM 97459). — Stn 10, 3 (USNM 97460). — Stn 68, 2 (MNHN).

MUSORSTOM 3: stn 86, 1 (MNHN). — Stn 88, 6 (USNM 97461). — Stn 96, 10 (MNHN). — Stn 98, 1 (USNM 97463). — Stn 100, 2: 1 (MNHN), 1 (USNM 97464). — Stn 102, 34 (USNM 97465). — Stn 107, 2 (MNHN). — Stn 108, 10 (MNHN). — Stn 109, 1 (MNHN). — Stn 110, 1 (MNHN). — Stn 143, 6 (MNHN).

Indonesia. "Siboga": stn 204, 7 (ZMA Coel. 1233). — Stn 260, 50+ (ZMA Coel. 5435).

DEKI: stn 3, 4 (NNM 22579). — Stn 53, 3 (NNM 22580). — Stn 54, 4 (NNM 22581). — Stn 63, 1 (NNM 22582).

KARUBAR: stn 2, 2 (USNM 97466). — Stn 15, 2 (MNHN). — Stn 31, 1 (POLIPI). — Stn 65, 2 (MNHN).

TYPE LOCALITY. — "Albatross" stn 5391: 12°13'15"N, 124°05'03"E (Samar Sea, Philippines), 216 m.

DIAGNOSIS. — Angle of thecal edges 90°-136°; angle of thecal faces 30°-45°. GCD:H = 0.98-1.30, indicating that most specimens are slightly wider than high. Largest known specimen ("Albatross" stn 5392) 22.0 x 36.1 mm in calicular diameter and 29.7 mm in height. Calicular edges smooth. Thecal faces planar, smooth, and porcellaneous, meeting in sharp, acute edges, which may bear a low thecal crest. Theca of well-preserved coralla reddish-brown, with stripes of more intense pigmentation associated with C₁₋₃. Pedicel elongate, 1.0-1.4 mm in cross section, and broken in all specimens examined, revealing the 6 protosepta. Septa hexamerally arranged in 6 complete cycles: S₁₋₃>S₄>S₅>S₆ (192 septa). Lower, inner edges of S₁₋₃ highly sinuous. Columella rudimentary.

REMARKS. — *Flabellum politum* is distinguished from other West Pacific species of *Flabellum* by having a relatively small corallum; a smooth, lustrous theca; and S₁₋₃ with highly sinuous inner edges. The species is more fully described by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Lubang Island; Tablas Strait; Samar Sea; Ragay Gulf; Bohol Sea; Sulu Sea (Sulu Archipelago); 40-280 m. *Indonesia*: Banda Sea (Kai Islands and southeastern Sulawesi); Arafura Sea (southeast of Tanimbar Islands); 90-288 m. *Elsewhere*: South China Sea off Hong Kong; Japan (Korea Strait, East China Sea, northern Ryukyu Islands); 70-402 m.

Subgenus *FLABELLUM (ULOCYATHUS)* Sars, 1851

Flabellum (U.) deludens Marenzeller, 1904

Flabellum deludens Marenzeller, 1904a: 269-272, pl. 17, figs 10, 10a. — ZIBROWIUS & GRYGIER, 1985: 122, figs 16-17. — CAIRNS, 1989a: 55-56, pl. 29, figs a-f (synonymy); 1994: 73, pl. 32, figs d-e.

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5412, 1 (USNM 96653).

"Hakuho Maru": stn KH72-1-52, 7 (USNM 96666), 3 (ORI).

MUSORSTOM 1: stn 5, 13 (MNHN). — Stn 9, 1 (MNHN). — Stn 10, 1 (USNM 96648). — Stn 11, 35 (USNM 96657). — Stn 12, 2 (USNM 96924). — Stn 13, 2 (MNHN). — Stn 15, 1 (USNM 96646). — Stn 20, 5 (MNHN). — Stn 24, 12 (MNHN). — Stn 25, 14 (MNHN). — Stn 40, 4: 2 (MNHN), 2 (USNM 96925). — Stn 61, 3: 2 (MNHN), 1 (USNM 96922). — Stn 68, 3 (MNHN).

MUSORSTOM 2: stn 1, 1 (MNHN). — Stn 10, 4 (USNM 96654). — Stn 11, 5: 1 (MNHN), 4 (USNM 96649). — Stn 12, 10 (MNHN). — Stn 13, 8 (MNHN). — Stn 15, 1 (USNM 96667). — Stn 20, 2 (USNM 96642). — Stn 21, 1 (MNHN). — Stn 40, 7 (USNM 96647). — Stn 46, 2 (MNHN). — Stn 63, 7 (MNHN). — Stn 64, 19 (MNHN). — Stn 66, 83: 78 (MNHN), 5 (USNM 81925). — Stn 68, 6 (USNM 96640). — Stn 83, 1 (MNHN).

MUSORSTOM 3: stn 87, 21: 20 (USNM 96662), 1 (MNHN). — Stn 88, 1 (MNHN). — Stn 91, 3 (MNHN). — Stn 92, 8 (USNM 96644). — Stn 96, 2 (MNHN). — Stn 97, 11 (USNM 97651). — Stn 98, 23 (MNHN). — Stn 99, 58 (USNM 96645). — Stn 100, 4 (USNM 96663). — Stn 101, 17 (MNHN). — Stn 102, 2 (MNHN). — Stn 103, 2: 1 (MNHN), 1 (USNM 96670). — Stn 108, 8 (USNM 96656). — Stn 109, 4: 1 (MNHN), 3 (USNM 96638). — Stn 111, 15 (MNHN). — Stn 112, 6 (USNM 96659). — Stn 120, 55: 18 (MNHN), 37 (MNHN). — Stn 139, 2 (USNM 96926). — Stn 145, 2: 1 (MNHN), 1 (USNM 96923).

Indonesia. DEKI: stn 46, 2 (NNM 22530). — Stn 49, 100 (NNM 22531).

KARUBAR: stn 59, 1 (USNM 96669). — Stn 62, 8: 6 (MNHN), 2 (POLIPI). — Stn 63, 198: 33 (MNHN), 165 (USNM 96637). — Stn 65, 6 (USNM 96641). — Stn 76, 2 (USNM 96929). — Stn 79, 4 (POLIPI).

TYPE LOCALITY. — "Valdivia" stns 185 and 203: west of Sumatra, 614-660 m.

DIAGNOSIS. — Corallum fragile. Angle of thecal edges 115° - 150° ; angle of thecal faces 64° - 80° , resulting in a very open corallum. Largest known specimen (KARUBAR stn 63) 39.9 x 53.7 mm in calicular diameter and 28.0 mm in height. Thecal edge crests low (rarely over 2 mm), thin, and continuous, extending from pedicel to calice. Calicular edge deeply lacerate — a high (up to 6 mm) lancet corresponding to each S_{1-2} and adjacent pair of S_4 (or the 16 primary septa and adjacent tertiaries). Colour of corallum base white, but theca streaked with broad reddish-brown stripes corresponding to each C_{1-2} , and narrower stripes corresponding to each C_3 . Upper, outer S_{1-2} also pigmented. Septa usually hexamerally arranged in 5 cycles: $S_{1-2}>S_3>S_4>>S_5$, the 5th cycle usually incomplete (but see Remarks). Even in larger coralla the S_5 are typically rudimentary, occurring in pairs flanking the S_3 , not the S_{1-2} , resulting in 72 septa. Columella elongate and rudimentary, formed by the fusion of lower, inner edges of S_{1-2} .

REMARKS. — CAIRNS (1989a) divided the subgenus *Flabellum* (*Ulocyathus*) into 3 groups based on corallum shape: laterally compressed, bowl-shaped, and constricted. Four similar species belonging to the laterally compressed group are reported herein: *F. deludens*, *F. marenzelleri*, *F. japonicum*, and *F. hoffmeisteri*. In addition to being laterally compressed, these 4 species also have reddish-brown striped theca; pigmented upper outer margins of the major septa; small edge crests; and small pedicels. Their differences are summarized in Table 2, the most useful discriminating characters being the nature of the calicular edge, septal symmetry, and the general shape of the corallum. Among the 4 species, *F. deludens* has the largest edge angle and the most exsert septal lancets.

TABLE 2. — Comparison of the four laterally compressed *Flabellum* (*Ulocyathus*) known from the Philippine/Indonesian region.

	<i>F. deludens</i>	<i>F. marenzelleri</i>	<i>F. japonicum</i>	<i>F. hoffmeisteri</i>
Calicular Margin	Deeply lacerate rectangular lancets to 6 mm height	Lacerate rectangular lancets to 4 mm height	Serrate triangular apices (S_{1-2}) to 3.5 mm height	Serrate triangular apices (primary septa) to 2.0 mm height
Septal Symmetry and Number	$S_{1-2}>S_3>S_4>>S_5$ or $16:16:32:32$; 72 septa	$16:16:32:0-32$; 64-96 septa	$S_{1-2}>S_3>S_4>>S_5$; 96 septa	$16:16:32:0-64$; 64-128 septa
Thecal Face Concavity	Slightly convex	Little (almost planar)	Highly convex	Highly convex
Edge Crests	Pedicel to calice	Pedicel to calice	Pedicel to half way to calice	Rudimentary
Edge Angle	115° - 150°	84° - 112°	90° - 108°	63° - 112°
Face Angle	64° - 80°	39° - 52°	65° - 88°	50° - 67°
Robustness	Fragile	Robust	Fragile	Robust

The Philippine and Indonesian specimens identified as *F. deludens* differ from a syntype of that species (ZMB) and several other Indian Ocean specimens (i.e., "Marion Dufresne" cruise 27, station 4, CP6, west of Ceylon, 1035 m, USNM 82013) in having a smaller pedicel that is elongate, not circular, in cross section. The pedicel dimensions of the Indian Ocean specimens average 2.34 x 2.46 mm (almost circular), whereas the pedicels of coralla from the western Pacific are smaller and more elongate in cross section, averaging 1.28 x 2.14 mm (although the pedicel of at least one specimen from KARUBAR stn 76 measures 2.15 x 2.40 mm, consistent with

the Indian Ocean specimens). In both cases there are 12 protosepta at the basal disc. The pedicel size and shape appears to be the only obvious morphological difference between specimens from the 2 regions, and, although this character may distinguish 2 different species or subspecies, it is interpreted herein by the first author to reflect a difference in substrate size availability. The second author disagrees with this interpretation, maintaining that the western Pacific specimens are a separate species different from *F. deludens*. Support for that hypothesis is strengthened by the fact that the western Pacific specimens also differ from the Indian Ocean specimens in having a shallower depth range: mostly less than 350 m vs mostly deeper than 500 m for those from the Indian Ocean.

CAIRNS (1989a) reported one lot of *F. deludens* with octamer symmetry, but most of the specimens from the KARUBAR stations reported herein have octamer (actually decahexamer) symmetry, consisting of 16 primary, 16 secondary, 32 tertiary, and 32 quaternary septa. The quaternaries occur in pairs flanking the secondary septa, not the primary, resulting in 96 septa in large coralla. In these specimens the 4 calicular lancets adjacent to the principal septa are smaller than the others. These decahexamer specimens are otherwise identical to typical *F. deludens*.

Flabellum deludens sensu CAIRNS is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: common throughout Philippines from Lubang Island to Moro Gulf; 187-480 m, although most records are from less than 350 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); 176-400 m. *Elsewhere*: Japan (Honshu, Shikoku, Kyushu); South China Sea (Spratly Islands); west of Sumatra; northern Indian Ocean; 106-1035 m (but see Remarks).

Flabellum (U.) marenzelleri Cairns, 1989

Flabellum (U.) marenzelleri Cairns, 1989a: 57-58, pl. 30, figs a-e (synonymy).

MATERIAL EXAMINED. — **Philippines**. "Albatross": stn 5523, 1 (USNM 97410).

MUSORSTOM 1: stn 40, 1 (MNHN).

Indonesia. DEKI: stn 52, 1 (NNM 22757).

"Hakuho Maru": stn KH72-1-28, 3 (USNM 97407). — Stn KH85-1-A1, 3: 1 (USNM 97409), 2 (ORI). — Stn KH85-1-A2, 1 (USNM 97408).

KARUBAR: stn 2, 4 (MNHN). — Stn 35, 2 (USNM 97406). — Stn 36, 2 (MNHN).

TYPE LOCALITY. — "Albatross" stn 5289: 13°41'50"N, 120°58'30"E (Verde Island Passage, Philippines), 315 m.

DIAGNOSIS. — Angle of thecal edges 84°-112°; angle of planar thecal faces 39°-52°. Largest known specimen (KARUBAR stn 35) 26.5 x 46.0 mm in calicular diameter and 28.1 mm in height. Thecal edge crests low (rarely over 2 mm), thin, and continuous, extending from pedicel to calice. Calicular edge lacerate, a moderately high (up to 4 mm) lancet corresponding to the 16 primary septa and their adjacent pairs of tertiary septa. Theca coarsely granular. Theca purple-brown, with more intensely pigmented stripes corresponding to the 16 primary costae. Pedicel elliptical to elongate in cross section (2.1-2.4 in greater diameter), short, containing 12 protosepta at the basal disc. Septa arranged in 4 size classes, larger coralla having 96 septa arranged accordingly: 16:16:32:32, as in octamerally symmetrical *F. deludens*. Columella elongate and rudimentary.

REMARKS. — *Flabellum marenzelleri* is similar to *F. deludens*, but can be distinguished (Table 2) by having a denser and more compressed corallum, which is characterised by a lower edge angle and a lower face angle, resulting in a higher GCD:LCD (1.65-1.75 vs 1.30-1.40 for *F. deludens*). *F. marenzelleri* also consistently has a decahexamer symmetry, whereas only some specimens of *F. deludens* share this symmetry. *F. marenzelleri* also has equal-sized, less exsert calicular lancets, those of *F. deludens* being dimorphic in size (alternately smaller and larger) in octamer specimens and much more exsert.

Flabellum marenzelleri is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Bohol Sea; 247-315 m. *Indonesia*: Banda Sea (Kai Islands); Timor Sea (south of Leti Islands); Flores Sea (Sulawesi); 240-390 m.

Flabellum (U.) japonicum Moseley, 1881

Flabellum japonicum Moseley, 1881: 168-169, pl. 7, figs 4, 4a, pl. 16, fig. 12. — ALCOCK, 1902c: 32-33 (in part: "Siboga" stn 17). — FAUSTINO, 1927: 47-48, pl. 2, figs 5-6. — CAIRNS, 1989a: 56-57, pl. 29, figs g-i (synonymy); 1994: 73-74, pl. 32, figs g-h (synonymy).

MATERIAL EXAMINED. — **Philippines.** "Siboga": stn 95, 1 (ZMA).

"Galathea": stn 436, 22 (ZMUC).

MUSORSTOM 2: stn 36, 2 (USNM 97402). — Stn 40, 1 (MNHN). — Stn 44, 2 (MNHN). — Stn 49, 10 (MNHN).

MUSORSTOM 3: stn 95, 1 (MNHN). — Stn 122, 15 (USNM 97403). — Stn 123, 10: 5 (MNHN), 5 (USNM 97404). — Stn 128, 2: 1 (MNHN), 1 (USNM 97405).

TYPE LOCALITY. — "Challenger" stn 232: 35°11'N, 139°28'E (Sagami Bay, Japan), 631 m.

DIAGNOSIS. — Angle of thecal edges 90°-108°; angle of thecal faces 65°-88°. Largest known specimen (MUSORSTOM 3 stn 123) 47 x 62 mm in calicular diameter and 33 mm in height. Corallum very fragile, campanulate, and laterally compressed, having convex thecal faces that meet in sharp, crested thecal edges. Edge crests low, usually not extending to calice. Calicular edge serrate, a small (up to 3.5 mm) equilaterally triangular apex corresponding to each S₁₋₂. Upper part of corallum with reddish-brown stripes corresponding to C₁₋₂; lower part often discoloured (superficially eroded). Pedicel circular to slightly elliptical in cross section (occasionally elongate), 2.1-2.7 mm in greater diameter, short, containing 12 protosepta at the basal disc. Septa hexamerally arranged in 5 cycles: S₁₋₂>S₃>S₄>>S₅, a full 5th cycle present only in large coralla.

REMARKS. — Among the laterally compressed *Flabellum (Ulocyathus)*, *F. japonicum* is very similar to *F. deludens* (Table 2), but can be distinguished by having: smaller, triangular calicular apices resulting in a serrate (not lacerate) calicular edge; less developed edge crests that do not extend to the calice edge; more convex thecal faces; a more open calice characterised by a higher face angle; and a lessened thecal pigmentation, often discoloured basally. *F. japonicum* is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Lubang Island and Verde Island Passage; Tablas Strait; Sibuyan Sea; Bohol Strait and Sea; Sulu Sea (Sulu Archipelago); 425-865 m. *Indonesia*: Bali Sea; 1060 m. *Elsewhere*: Japan (Honshu, Shikoku, and Kyushu); 119-1141 m.

Flabellum (U.) hoffmeisteri Cairns & Parker, 1992

Flabellum japonicum - ALCOCK, 1902c: 32-33 (in part: "Siboga" stn 212). — HOFFMEISTER, 1933: 7, pl. 1, figs 1-2. [Not *Flabellum japonicum* Moseley, 1881].

Flabellum n. sp. - CAIRNS, 1989a: 57 (in part: pl. 29, figs j-k).

Flabellum (U.) hoffmeisteri Cairns & Parker, 1992: 47-48, pl. 16, figs d-f (synonymy). — CAIRNS, 1995: 103-104, pl. 33, figs g-h.

MATERIAL EXAMINED. — **Indonesia.** "Siboga": stn 212, 1 (ZMA).

DEKI: stn 56, 3 (NNM 22541).

KARUBAR: stn 9, 1 (USNM 97411). — Stn 10, 13 (MNHN). — Stn 12, 83 (USNM 97412). — Stn 13, 1 (MNHN). — Stn 35, 1 (POLIPI). — Stn 39, 2 (USNM 97413). — Stn 40, 16 (MNHN). — Stn 59, 76 (MNHN). — Stn 69, 19 (MNHN). — Stn 70, 6 (MNHN). — Stn 71, 1 (USNM 97415). — Stn 75, 2 (POLIPI). — Stn 77, 23 (MNHN).

TYPE LOCALITY. — "Soela" stn 27: 37°59'S, 150°05'E, Victoria, Australia, 452 m.

DIAGNOSIS. — Angle of thecal edges variable, 63°-112°; angle of thecal faces 50°-67°. Largest known specimen (KARUBAR stn 12) 41.5 x 62.5 mm in calicular diameter and 46.1 mm in height. Corallum campanulate, relatively robust, and laterally compressed, having slightly convex thecal faces meeting in sharp thecal edges. Edge crests absent or very low, in the latter case not extending to calicular edge. Calicular edges moderately serrate, a low (less than 2 mm), triangular apex corresponding to the 16 primary septa. Upper corallum bears faint reddish-brown

stripes associated with primary septa; lower part often discoloured and encrusted by other organisms (*i.e.*, brachiopods). Pedicel elliptical in cross section (2.3-2.7 mm in greater diameter), short, containing 12 protosepta at the basal disc. Septa arranged in 4 size classes: 16 primary, 16 secondary, 32 tertiary, and a variable number of quaternary septa. Pairs of quaternary septa first form adjacent to secondary septa and only in large coralla do they occur adjacent to primary septa. Septa of a 5th size class occur in end-sectors of largest coralla. Thus, coralla may have 64 septa (no quaternaries), 96 septa (1/2 of quaternaries present), 128 septa (a full 4th size class), or over 128 septa, if some septa of the 5th size class are present.

REMARKS. — Among the laterally compressed species of this subgenus, *F. hoffmeisteri* is similar to *F. japonicum* but is distinguished by its decahexamerall (x16) septal symmetry; its moderately serrate calicular edge and its lower face angle (angle between thecal faces) (Table 2). It differs from the other decahexamerally symmetrical species, *F. marenzelleri* and some *F. deludens*, in having a much less jagged calicular edge, convex thecal faces, virtually no edge crests, and a larger face angle.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar); Flores Sea (Selayar Island); 345-477 m. *Elsewhere*: Victoria and Tasmania; Kermadec and Colville Ridges; 110-646 m.

Flabellum (U.) messum Alcock, 1902

Flabellum laciniatum var. *messum* Alcock, 1902c: 31.

Flabellum (U.) messum - CAIRNS, 1989a: 58-59, pl. 30, figs f-i, k (synonymy); 1995: 101-102, pl. 33, figs a-c. — CAIRNS & KELLER, 1993: 263, pl. 10, figs G-H.

MATERIAL EXAMINED. — *Indonesia*. KARUBAR: stn 56, 8 (MNHN). — Stn 57, 14: 6 (MNHN), 8 (USNM 97474). — Stn 72, 1 (POLIPI). — Stn 91, 2 (USNM 97475).

TYPE LOCALITY. — "Siboga" stns 45, 284, and 314: *Indonesia*, 694-828 m.

DIAGNOSIS. — Corallum highly compressed and constricted medially. Angle of straight, crested thecal edges 131°-210°; angle of concave thecal faces 36°-44°. Largest known specimen (KARUBAR stn 57) 31 x 56 mm in calicular diameter and 42 mm in height. Thecal edge crests extend from pedicel to calicular edge. Calicular edge highly lacerate, but rarely well preserved because of extreme fragility. Pedicel circular to slightly elliptical in cross section, up to 3.4 mm in greater diameter, short, and containing 12 protosepta at the basal disc. Thecal faces rough in texture. Corallum reddish-brown, except for pedicel and edge crests, which are white. Septa hexamerally arranged in 5 cycles: S₁₋₃>S₄>S₅ (96 septa). Fossa deep and narrow.

REMARKS. — *Flabellum messum* is unique in this region within the subgenus in having a "constricted" corallum (CAIRNS, 1989a). It is further distinguished by its reddish-brown theca (no stripes); short, stout pedicel; and roughly textured theca. *Flabellum messum* is more fully described and illustrated by CAIRNS (1989a, 1995).

DISTRIBUTION. — *Philippines*: Verde Island Passage; 368 m. *Indonesia*: Celebes Sea (south of Basilan); Arafura Sea (southeast of Tanimbar Islands); Timor Sea (southeast of Timor); eastern Java Sea; 476-949 m. *Elsewhere*: Malaysia (Darvel Bay, Celebes Sea); Mascarene Plateau, southwest Indian Ocean; Kermadec Ridge; 430-1035 m.

Flabellum (U.) sp.

Figs 21 d-f

MATERIAL EXAMINED. — *Philippines*. MUSORSTOM 2: stn 78, 1 (MNHN).

New Zealand Region: "Tangaroa": stn G3, 1 (USNM 94329). — Stn U582, 3 (USNM 94330).