Table 5. — Comparison of the three Recent species of Trochocyathus (Aplocyathus).

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Nature of Base</td>
<td>Rounded (protuberant); small, circular scar; porcellaneous</td>
<td>Usually flat; hexagonally shaped epitheca surrounds epicentre, substrate usually incorporated in base; porcellaneous</td>
<td>Usually flat; circular scar; granular</td>
</tr>
<tr>
<td>Costae near Calicular Margin</td>
<td>Finely granular</td>
<td>Coarsely granular</td>
<td>Coarsely granular</td>
</tr>
<tr>
<td>Maximum Calicular Diameter (mm)</td>
<td>18.0</td>
<td>26.1</td>
<td>17.0</td>
</tr>
<tr>
<td>Colour of Corallum</td>
<td>Upper theca and septa brown-black</td>
<td>Upper theca and septa usually reddish-brown</td>
<td>White</td>
</tr>
<tr>
<td>Number (Size) and Shape of Costal Spines</td>
<td>5 elongate (up to 15 mm) spines, circular in cross section</td>
<td>6 compressed spines (up to 8 mm), often ridged basally and extending to epicentre; often crooked or curved</td>
<td>6 elongate (up to 10 mm) spines, circular in cross section</td>
</tr>
<tr>
<td>Septal Formula (Number of Septa); S1 Dimorphism</td>
<td>S1&gt;S2&gt;S3&gt;S4&gt;S5 (48); 2 principal S1 smaller than others</td>
<td>S1&gt;S2&gt;S3&gt;S4&gt;S5 (48-72); all S1 equal-sized</td>
<td>S1-2&gt;S1&gt;S4 (48); all S1 equal-sized</td>
</tr>
<tr>
<td>Relative Palar Width (Number of Palar Crowns)</td>
<td>P1&lt;P2&lt;P3 (3 crowns)</td>
<td>P1.4 equal-sized (3 or 4 crowns)</td>
<td>P1.2&lt;P1&lt;P3 (2 crowns)</td>
</tr>
<tr>
<td>Distribution; Depth</td>
<td>Funafuti, Wallis, Vanuatu, Kermaedec Islands; 366-710 m</td>
<td>Banda Sea, Vanuatu region; 240-560 m</td>
<td>Philippines, Celebes Sea; 326-760 m</td>
</tr>
</tbody>
</table>

Trochocyathus (A.) brevispina Cairns & Zibrowius, 1997

Figs 9 f-i


Type Locality. — Karubar stn 3: 5°47'40"S, 132°12'11"E (Kai Islands, Banda Sea), 278-300 m.

Remarks. — Trochocyathus brevispina is compared to the other two Recent species in the subgenus in Table 5, and was described and illustrated by Cairns & Zibrowius (1997). It is easily distinguished from other species by its relative septal and palar sizes and by its frequent incorporation of substrate into its base. The most commonly incorporated substrates are gastropod and bivalve fragments (Figs 9 f, i), but also include: pteropod shells, sand conglomerate, pebbles, serpulid tubes, and other dead solitary corals.

The specimens reported above allow the observation that the costal spines are often curved or crooked, and can reach a length of up to 8 mm. Although not as long as the 10 mm costal spines of T. longispina, the distinction of costal spine length between these two species is not as much as previously thought and hardly warrants the etymological distinction; however, several other characters do distinguish these two species (Table 5).

Specimens from three stations (MUSORSTOM 8 stn 1004, 1058, and 1103) bear elaborate, irregularly-shaped, nodular proliferations at the base of their costal spines and sometimes around the entire calicular edge (Figs 9 g-h). It is unknown what stimulates or irritates the coral to produce these growths.
One aberrant specimen from MUSORSTOM 8 stn 963 of 16.5 mm GCD is septameral in septal and costal symmetry, having 7 septal systems (54 septa, 1 half-system lacking S4) and 7 costal spines.

**Distribution.** — Vanuatu region: Anatom, Erromango, Efate, and Malakula; 110-436 m. Elsewhere: Banda Sea; 240-560 m (Cairns & Zibrowius, 1997).

**Genus Tethocyathus** Kühn, 1933

*Tethocyathus virgatus* (Alcock, 1902)

*Tethocyathus virgatus* Alcock, v*1902a* 98-99; v.1902c: 16-17, pl. 2, fig. 13.  


**Type Locality.** — “Siboga” stns 96 and 105: Sulu Archipelago, 275 m.

**Remarks.** — *Tethocyathus virgatus* is more fully described and illustrated by Cairns (1995). One of the differences between this species and the species of the similar genus *Trochocyathus* is that the edge zone of *T. virgatus* periodically secretes additional non trabecular calcium carbonate on the outside of the corallum, which, in time, produces a very thick theca, transforming a conical corallum into a subcylindrical or cylindrical shape. The layering of the added calcium carbonate is particularly noticeable in a basal fracture, and additional evidence of the periodic layering is evidenced by the covering and incorporation into the theca of small epizoic organisms that become covered and subsequently buried in the increasingly thick theca. According to Stolarski (1995), the proper name for this deposit is textura, not epitheca, the latter term being reserved for non trabecular calcium carbonate that is secreted only at the calicular edge of a corallum (lappet cavity) and that does not periodically form layers. One of the adaptive values of textura (in the basal region) is to strengthen attachment to a substrate; however, it is suggested that another possible adaptive value of textura (in the wall region) is to guard against the boring of acrosthoracican cirripeds, to which this genus is particularly susceptible (see Zibrowius, 1976; Cairns, 1995; Cairns & Zibrowius, 1997). Coralla from two stations (MUSORSTOM 8 stns 972 and 982) contain coralla having the characteristic lenticular-shaped outline of acrosthoracican cirripede borings in the corallum of living specimens.

**Distribution.** — Wallis and Futuna: 450-650 m. Vanuatu region: Tanna, Efate, and Espiritu Santo; 320-460 m. Elsewhere: Philippines; Indonesia; ridges north of New Zealand; 137-530 m.

**Genus Polycyathus** Duncan, 1876

*Polycyathus octuplus* sp. nov.

Figs 10 a-c


Solomon Islands (Pelau): short drop off, 90 m, 3 paratypes (USNM 98954).
TYPE LOCALITY. — **MUSORSTOM 7** stn 494: 14°18.9'S, 178°03.0'W (Futuna), 100-110 m.

ETYMOLOGY. — The species name *octuplus* (Latin *óctuplas*, eight fold) refers to the octameral septal symmetry.

DESCRIPTION. — Corallum solitary, straight, and subcylindrical, firmly attached to substrate through a thick pedicel (PD:GCD = 0.56-0.79). Holotype 6.7 x 6.4 mm in CD, 4.4 mm in PD, and 7.5 mm in height. Calice circular to slightly elliptical: GCD:LCD = 1.02-1.20. Costae well developed and finely granular; however, at an early stage thin bands of epitheca are secreted around the corallum base, and as the coral increases in size the epithecal bands thicken, eventually extending from the base to the calicular edge. Underlying costae and outer edges of septa chocolate brown in colour, but overlying epitheca, basal encrustation, pali and columella are white.

Septa octameral symmetry in 2 or 3 size classes. Small coralla below a GCD of 4.6 mm usually have 8 primary septa and 24 equally-sized secondary and tertiary septa (8:8:16, 32 septa). Larger coralla have up to 5 pairs of quaternary septa (e.g., the holotype, 8:8:16:10, 42 septa) as 3 size classes of septa: primaries, secondaries, and tertiaries + quaternaries, the latter two of equal size. One aberrant specimen (**MUSORSTOM 7** stn 504) has heptameral symmetry (7:7:14:6, 34 septa, Fig. 10 c). Primary septa about 1.2 mm exsert, having moderately sinuous distal and axial edges. In small specimens, secondaries and tertiaries of equal exsertness (about 0.9 mm) and width (about 3/4 that of the primaries), also having sinuous distal and axial edges. In larger specimens containing sectors in which quaternaries are present, the secondaries are slightly wider than the remaining tertiaries and quaternaries. Quaternaries equal in size to tertiaries. Small pali (0.3-0.4 mm wide) occur on axial edges of the primary septa, whereas the pali flanking the secondary septa are twice as wide and rise slightly higher in the fossa. Occasionally there is an accessory paliform lobe internal to the P2. When quaternary septa occur in a sector, the flanked tertiary septum bears a palus of equal size to the P2, but slightly recessed from the columella and also rising slightly higher than the P2. All pali are obliquely carinate and highly sinuous, their peripheral edges (edge adjacent to their corresponding septum) being quite contorted. Fossa shallow, containing a discrete columella composed of a field of 10-16 slender, finely granular papillae.

REMARKS. — It is with some hesitation that this species is placed in *Polycyathus*, since it does not display the defining character for the genus, i.e., budding from a common encrusting coenosteum. It may be that all the specimens examined are founder corallites or that they were broken from the substrate above their common attachment. In all other characteristics, this species is characteristic of the genus *Polycyathus*. Five species of this genus are known from the western Pacific: *P. fulvus* Wijsman-Best, 1970; *P. hodgsoni*, *P. marigondoni*, and *P. furanaensis*, all described by Verheij and Best, 1987; and *P. norfolkensis* Cairns, 1995. *P. octuplus* differs from these and all other known species (Best et al., in press) in having primarily octameral septal symmetry.

DISTRIBUTION. — Wallis and Futuna region: Futuna; 110-441 m. Elsewhere: Solomon Islands, Pelau; 90 m.

Genus **BOURNEOTROCHUS** Wells, 1984

* Bourneotrochus stellulatus* (Cairns, 1984)

Figs 8 c, 10 d-g

*Trochocyathus hastatus* Bourne, v*1903: 32-37 (in part: pl. 6, figs 9-11).

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


*Bourneotrochus stellulatus* - Cairns, 1995: 71-72, pl. 18, figs f, i, pl. 19, figs a-c, map 18. — Cairns & Zibrowius, 1997: 115.

MATERIAL EXAMINED. — **Wallis and Futuna region.** **MUSORSTOM 7**: stn 509, 4 (MNHN) and SEM stub 879 (USNM 98708). — Stn 510, 3 including 1 anthocaulus (MNHN). — Stn 511, 14 including 3 anthocauli and SEM stubs 880-881 (USNM 98704). — Stn 512, 65 including 1 anthocaulus (MNHN). — Stn 513, 25 including 1 anthocaulus.


TYPE LOCALITY. — HON stn 9-3: 19°48'N, 154°58'W (off Hawaiian Islands), 337 m.

REMARKS. — The anthocyathus of B. steliulatus was recently redescribed and illustrated by Cairns (1995); however, the anthocaulus stage remained unknown. Of the 215 specimens reported above, 15 are the anthocaulus stage, in some cases still attached to an incipient anthocyathus (Fig. 10 e). The anthocaulus is cylindrical to barrel shaped, 1.5-2.9 mm in height and 2.6-3.3 mm in maximum diameter, usually having 36 septa, as in most of anthocyathi. The base is slightly expanded over the substrate and firmly attached to it. It has a white, porcellaneous theca and lacks spines. The small, still-attached anthocyathus also lack costal spines at this stage.

Most anthocyathi examined contained 36 septa, one pair of S4 in each system. Because the costal spines are associated with the C1, they are symmetrically distributed around the perimeter of the corallum (Fig. 10 d). However, about 20% of the examined corallia lack one to three pairs of S4, resulting in a total of 30-34 septa and a closer arrangement of the costal spines that border these systems. Some anthocyathi (e.g., MUSORSTOM 7 stn 513, 594, 604) appear to have the ability to asexually bud another anthocyathus from its calice. These "secondary" anthocyathi are small (2.7-3.0 mm in diameter), cylindrical corallia that have a well-developed basal scar, lack spines, and appear to have a primitive epithelial wall.

Although no anthocyathus was found to have a CD larger than that previously reported (i.e., 6 mm by CAIRNS, 1995), some specimens (e.g., MUSORSTOM 7-510) have elongate costal spines up to 4 mm long, twice the previously reported length.

Among the 21 coral species found cemented to Xenophora shells, B. stellulatus was most commonly found, 27 coralla recorded from six MUSORSTOM stations (see Material Examined). In all cases the calicular face was directed upward and in some cases the corallum appeared to have been alive when collected.

DISTRIBUTION. — Wallis and Futuna region: Wallis, Futuna, and Alofi; Tuscadora, Waterwitch, and Field Banks; 240-566 m. Vanuatu region: Anatom, Efate, Malakula, and Espiritu Santo; 280-458 m [Pleistocene of Espíritu Santo (Wells, 1984)]. Elsewhere: Queensland; ridges north of New Zealand; Indonesia; Chesterfield Islands; Funafuti and Tuvalu; Cook Islands; Hawaiian Islands; 263-476 m (CAIRNS & ZIBROWIUS, 1997).

Genus STEPHANOXYATHUS Seguenza, 1864

Subgenus STEPHANOXYATHUS (STEPHANOXYATHUS) Seguenza, 1864

Stephanocyathus (S.) regius Cairns & Zibrowius, 1997

Figs 10 h, 11 a-c


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

REMARKS. — Little can be added to the original description; however, the microstructure of an actively growing costal edge was examined, which revealed its irregularly-shaped tufts of calcareous fibres. The tufts measured 11-15 μm in diameter, and consisted of elongate fibres about 0.9 μm in diameter (Figs 11 b-c).

DISTRIBUTION. — Wallis and Futuna region: Tuscarora, Combe, and Rotumah Banks; 700-1280 m. Vanuatu region: Erromango, Efate, and Espiritu Santo; Guyot Bougainville; 775-1550 m. Elsewhere: South China Sea; Philippines; Indonesia; Kermadec Islands; 563-2160 m (CAIRNS & ZIBROWIUS, 1997).

Subgenus STEPHANOCYATHUS (ODONTOCYATHUS) Moseley, 1881

Stephanocyathus (O.) coronatus (Pourtalès, 1867)

Figs 11 d-f

Platycyathus coronatus Pourtalès, v*1867: 114.
Odontocyathus coronatus - MOSELEY, v.1881: 148-151, pl. 2, figs 4a-b, 5a-b.
Sabinotrochus flatiliseptis Alcock, v*1902a: 103; v.1902c: 26, pl. 4, figs 24, 24a (new synonym).
Stephanocyathus (O.) coronatus - CAIRNS. 1979: 109-111, pl. 20, figs 5-6, 8-9 (synonymy); 1995: 69, pl. 17, figs j-l, pl. 18, figs a-b.


TYPE LOCALITY. — 30°41’N, 77°03’W (Blake Plateau off Florida), 841 m.

REMARKS. — This species was recently redescribed and illustrated based on specimens collected from submarine ridges north of New Zealand (CAIRNS, 1995). The material reported herein contains several ontogenetic suites including coralla as small as 9 mm CD, which allows the synonymy of the juvenile specimen ALCOCK (1902a) reported as Sabinotrochus flatiliseptis. The holotype of ALCOCK’S species (CD = 11.6 mm) was figured by CAIRNS & ZIBROWIUS (1997: fig. 14i) and a similarly-sized corallum (CD = 9.1 mm) is figured herein (Fig. 11 f).

DISTRIBUTION. — Wallis and Futuna region: Combe Bank; 1280-1300 m. Vanuatu region: Anatom; Guyot Bougainville; 1175-1210 m. Elsewhere: Selayar, Flores Sea (ALCOCK, 1902a); Lord Howe Rise; Three Kings Ridge; Kermadec Ridge; western Atlantic; 543-1276 m (CAIRNS, 1995).

Stephanocyathus (O.) weberianus (Alcock, 1902)

Stephanocyathus (O.) ixine Squires, v*1958: 54 (in part: "Albatross" stn 5545, pl. 8, figs 3-4).
Stephanocyathus (O.) weberianus - CAIRNS, 1994: 57-58, pl. 25, figs d-f (synonymy); 1995: 68-69, pl. 17, figs g-i (synonymy). — CAIRNS & ZIBROWIUS, 1997: 119-120, figs 14g-h.

MATERIAL EXAMINED. — Vanuatu. MUSORSTOM 8: stn 1074, 7 (USNM 98662). — Stn 1080. 3 (MNHN).

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

REMARKS. — The species was redescribed and illustrated by CAIRNS (1994) and compared to S. (O.) coronatus by CAIRNS (1994, 1995). It is a relatively common deep-water species found throughout the western Pacific at depths of 700-1500 m.
DISTRIBUTION. — Vanuatu region: Espiritu Santo and Malakula; 798-799 m. Elsewhere: western Pacific from Japan to Lord Howe Seamount Chain; 206-1756 m, although most records are deeper than 700 m (CAIRNS & ZIBROWIUS, 1997).

Subgenus STEPHANOCYATHUS (ACINOCYATHUS) Wells, 1984

Stephanocyathus (A.) spiniger (Marenzeller, 1888)

Odontocyathus spiniger — YABE & EGUCHI, 1942: 124-125, pl. 10, figs 26-28 (synonymy).


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

REMARKS. — This commonly collected, distinctive species, characterised by having six elongate costal spines (C1) and highly exsert S1, has been described and figured several times in the recent past (see synonymy). It is compared to S. explanans, the only other Recent species in this subgenus, by CAIRNS & ZIBROWIUS (1997).

DISTRIBUTION. — Wallis and Futuna region: Wallis; 420 m. Vanuatu region: Anatom, Erromanga, Malakula, and Espiritu Santo; 319-400 m. Pleistocene of Vanuatu (WELLS, 1984). Elsewhere: widespread throughout Indo-West Pacific from southwestern Indian Ocean to Japan and South Australia; 120-695 m (CAIRNS & ZIBROWIUS, 1997). Neogene of Japan (YABE & EGUCHI, 1932b); Oligocene of Victoria, Australia (DENNANT, 1899; see YABE & EGUCHI, 1942).

Genus VAUGHANELLA Gravier, 1915

Vaughanella concinna Gravier, 1915

Figs 11 g-h


MATERIAL EXAMINED. — WALLIS AND FUTUNA REGION. MUSORSTOM 7: stn 572, 1 (MNHN).

TYPE LOCALITY. — 38°35'30"N, 28°05'45"W (Azores), 1250 m.

REMARKS. — One specimen is reported, measuring 30.4 x 27.9 mm in CD, 30.3 mm in height, 12.3 mm in pedicel diameter, and having 62 septa (7 pairs of S5). It is indistinguishable from coralla reported from the eastern Atlantic (e.g., Jean Charcot 134, USNM 48765) by ZIBROWIUS (1980). A re-evaluation of the specimens I (CAIRNS, 1995) previously reported from north of New Zealand as V. oreophila Keller, 1981 also appear to be typical V. concinna. KELLER’S (1981) type material of V. oreophila is not included as V. concinna because she stated that her specimens did not have P3, which are prominent in all coralla of V. concinna.
Distribution. — Wallis and Futuna region: Waterwitch Bank; 500-560 m. Elsewhere: Norfolk and Colville Ridges; 646-757 m (Cairns, 1995); eastern Atlantic between Celtic Sea, the Azores, and Madeira; 1022-3018 m (Zibrowius, 1980).

Genus Deltocyathus H. Milne Edwards & Haime, 1848

Deltocyathus magnificus Moseley, 1876

Fig. 11 i


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

Remarks. — Deltocyathus magnificus is one of four species in the genus to have 5 cycles of septa in its adult state, the others being D. rotulus (Alcock, 1898), D. suluensis Alcock, 1902, and D. sarsi (Gardiner & Waugh, 1939), the last thought to reproduce primarily by fragmentation. D. magnificus is the largest of the four species and was redescribed and illustrated by Cairns (1995) and Cairns & Parker (1992), and is distinguished from other western Pacific species in a key published by Cairns & Zibrowius (1997). The Vanuatu specimens differ from others previously reported in having only 72 septa, pairs of S5 lacking from each half-system adjacent to an S2. Perhaps because of this deficiency, some of these specimens have a hexameral outline (Fig. 11 i). Normally a corallum of 8 mm CD would have a full complement of 96 septa, but Vanuatu coralla as large as 25 mm CD have only 72 septa. All other characters being similar, the septal number and shape differences are considered to be only population differences.

Distribution. — Vanuatu region: Anatomi and Tanna; 408-433 m. Elsewhere: western Pacific from Japan to southeastern Australia; Western Australia; 88-1500 m (Cairns & Zibrowius, 1997).

Deltocyathus rotulus (Alcock, 1898)

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

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


Type locality. — "Investigator" stn 216: North Maldive Atoll, 1408-1756 m.

Remarks. — Medium- to large-sized specimens of Deltocyathus rotulus are easily distinguished as having 5 cycles of septa; a serrate (lancetted) calicular margin, each S4 and adjacent pair of S5 projecting beyond the S1-3; a large, undercut papillose columella; and a prominent crown of large P4. Smaller specimens (i.e., CD < 12 mm) may be confused with juveniles of D. suluensis, both species having between 48-72 septa at this size. Juvenile D. rotulus differ from D. suluensis by having S4 solidly attached to the S3, not just attached by trabecular processes, as in D. suluensis; and in having a lancetted calicular margin. It also appears to be adapted to a deeper...
(i.e., cooler) environment, most commonly found between 1000-2000 m. *D. rotulus* is more fully described and illustrated by Cairns (1994), and included in a key to congenerics by Cairns & Zibrowius (1997).

**DISTRIBUTION.** — Wallis and Futuna region: Field Bank; 1280-1300 m. Vanuatu region: Guyot Bougainville; 1050-1160 m. Elsewhere: Indo-West Pacific from Durban, South Africa to Japan; 210-1986 m (Cairns & Zibrowius, 1997).

*Deltocyathus suluensis* Alcock, 1902


*Deltocyathus formosus* Cairns, *1995: 73-74, pl. 19, figs f-g.


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

**REMARKS.** — *Deltocyathus suluensis* is characterised by having a relatively thin, flat, costate, coarsely granular base; a finely serrate (not lancetted) calicular edge, the lower cycle septa (e.g., S1-3) projecting beyond the higher cycle septa (e.g., S4-5); 5 cycles of septa (96) above a CD of 18 mm; and rudimentary S5, joined to adjacent S4 close to the columella by several slender processes. The largest known specimen (Musorstom 7 stn 540) is 22.3 mm in CD. The species is described in greater detail by Cairns (1995) as *D. formosus*, and included in a key to western Pacific *Deltocyathus* species by Cairns & Zibrowius (1997), who also figured one of the syntypes. It is one of four species in the genus that has 5 cycles of septa in the adult stage, three of which are reported herein.

**DISTRIBUTION.** — Wallis and Futuna region: Wallis, Waterwitch, Combe, Tuscarora, Field, and Bayonnaisc Banks; 400-650 m. Vanuatu region: Tanna and Efate; 566-624 m. Elsewhere: western Australia; Philippines to ridges north of New Zealand; 142-565 m (Cairns & Zibrowius, 1997).

*Deltocyathus taiwanicus* Hu, 1987

Figs 12 a-b

*Deltocyathus taiwanicus* Hu, *1987: 39, pl. 1, figs 1, 4-5, 10.


**TYPE LOCALITY.** — Maanshan Mudstone (Plio-Pleistocene), Tantzu Village, Nanwan Bay, Hengchun Peninsula, southern Taiwan.

**DESCRIPTION OF RECENT SPECIMENS.** — Corallum shaped as a shallow bowl, sometimes with a flat base, but always with upturned outer edges. Centre of base sometimes bears a concave scar or, just as often, is slightly protuberant. Calice circular, but often slightly irregularly formed; margin not lancetted or serrate. Largest specimen reported above (Musorstom 7 stn 541) 15.6 mm in CD; however the fossil holotype is 19.1 mm in CD. Costae equal in width and rounded, each bearing coarse (0.2 mm in diameter), unilinearly arranged granulations near...
the centre of base, which rather abruptly grade into very fine (0.05 mm in diameter) granulations arranged 4-7 across a costa nearer the calicular edge. Intercostal furrows deeply incised only near calicular edge. Well-preserved coralla have a light reddish-brown base.

Septa hexamerally arranged in 4 complete cycles and a portion of the fifth: S1,2>S3>S4>S5. Between a CD of about 6.5-7.0 mm, pairs of S5 begin to appear, up to an observed maximum of 13 pairs, or a total of 74 septa, e.g., in a specimen 12.4 mm in CD (MUSORSTOM 7 stn 546) as well as the holotype. A specimen of CD 13.2 mm (MUSORSTOM 7 stn 556) has 5 pairs of S5 (58 septa) and the largest specimen (CD = 15.6 mm) 11 pairs (70 septa), thus the correlation between CD and number of septa is not always direct. There also appears to be no order in which the S5 pairs are inserted, some half-systems in the same corallum having 2 pairs, 1 pair, or no S5. S1,2 about 1.2 mm exsert, extending about half distance to columella, where each is separated from its broad palus (up to 1.7 mm wide) by a deep notch; however, the 2 P1 associated with the principal septa are noticeably smaller, only about 0.9 mm wide. S3 about 0.7 mm exsert and half the width of the S1,2, each bordered by a P3 about 1.4 mm wide that is slightly recessed from the columella, its axial edge strongly fused to its adjacent P2. S4 dimorphic in size. If unflanked by S5, S4 are rudimentary, well developed only at the calicular edge and represented by discontinuous spines within the theca, joining to their adjacent S3 by 4 or 5 thin (0.15 mm in diameter) processes well below the S3-P3 notch (Fig. 12 b). However, if S4 are flanked by a pair of S5, they are 2/3 the width of an S3 and bear pali (P4) of equal size to the P3, the axial edges of which are strongly fused to the P3 and recessed slightly more from the columella than the P3. In this case the S5 resemble the unflanked S4 as described above. All septal and palar faces are covered with spinose granulations. Fossa shallow, containing a papillosse columella consisting of 10-22 granular elements, each about 0.3 mm in diameter. Columellar elements arranged in an elongate ellipse, the greater axis aligned with the 2 principal septa (by definition), which confers a bilateral symmetry to the corallum.

REMARKS. • *Deltocyathus taiwanicus* is very similar to *D. suluensis*, equal-sized coralla of both species having a similar septal insertion pattern and number of septa, and both species being found at many of the same stations. *D. taiwanicus*, however, seems to have a smaller corallum, a specimen of *D. taiwanicus* having a thick, upturned calicular edge at the same CD that a *D. suluensis* would have a thin, flat, serrate edge, characteristic of a juvenile corallum. *D. suluensis* ultimately achieves a full fifth cycle (96 septa) and a CD of 22.3 mm, whereas the largest *D. taiwanicus* is 19.1 mm (holotype) and yet no specimen is known to have over 74 septa. Furthermore, the costae of *D. taiwanicus* are finely granular at the calicular edge, whereas they are coarsely granular on *D. suluensis*. Also, the columellar elements of *D. taiwanicus* appear to be coarser and more independent than those in *D. suluensis*.

Although the three specimen type series was not examined (deposited at the Taiwan Normal University, Taipei), Hu's description and figures were considered adequate to identify the species.

**DISTRIBUTION.** • Wallis and Futuna region: Wallis and Futuna; Waterwitch, Combe, Tuscarora, and Field Banks; 320-697 m. Elsewhere: Plio-Pleistocene of southern Taiwan (Hu, 1987), *Deltocyathus vaughani Yabe & Eguchi, 1932a: 388-389. • CAIRNS, 1994: 54-55, pi. 23, figs i-j, pi. 24, figs a-c, f (syonymy). • CAIRNS & ZIBROWIUS, 1997: 122.

**MATERIAL EXAMINED.** • Vanuatu. MUSORSTOM 8: stn 1006, 1 (MNHN). • Stn 1011, 1 (MNHN).

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

**REMARKS.** • The species is distinguished from others in the region by having four cycles of septa, pali or paliform lobes before all septa, coarsely dentate costae, and equally exsert septa. The species can attain a CD of 27 mm and often has a patellate corallum, the basal angle ranging from 130° to 170°. It is fully described and illustrated by CAIRNS (1994), and included in a key to western Pacific *Deltocyathus* in CAIRNS & ZIBROWIUS.
s. D. CAIRNS (1997). Although coarsely dentate costae are diagnostic for the species, it is interesting to note that the specimen from MUSORSTOM stn 1006 (CD = 20.4 mm) has finely granular costae.

**DISTRIBUTION.** — Vanuatu region: Erromango and Efate; 585-919 m. Elsewhere: western Pacific from Japan through Indonesia; 88-1097 m (CAIRNS & ZIBROWIUS, 1997).

**Deltocyathus crassiseptum** sp. nov.

Figs 12 c-f


**TYPE LOCALITY.** — MUSORSTOM 8 stn 980: 19°21'S, 169°25'E (Tanna), 433-450 m.

**ETYMOLOGY.** — The species name *crassiseptum* (Latin *crassus*, thick + *septum*, partition) refers to the thick S1-2. The name is treated as a noun in apposition.

**DESCRIPTION.** — Corallum shaped as a small, shallow bowl, with a flat to slightly convex base and upturned calicular edge. Largest specimen (holotype) 14.1 mm in CD and 5.8 mm in height. Calice circular; theca relatively thick. Costae rounded and finely granular, the granules changing to slender spines near calicular edge. Costae separated by deep intercostal grooves at calicular edge, near point of upward thecal inflection. In most coralla, each intercostal groove is bisected by a low, narrow (0.1 mm wide) row of granules (Fig. 12 f). Most coralla bear evidence of a former scar of detachment located at or near the centre of base. This scar may be pear-shaped in outline, circular, or an irregularly-shaped depression. Circular-shaped scars may also occur in various diameters, those of 0.8 mm diameter usually showing the traces of 6 larger and 6 smaller septa; larger scars of 1.3 mm diameter or more showing 24 septa. In some cases there are 2 concentric scars, with different numbers of septa. Most coralla are uniformly white, but some well-preserved coralla (e.g., the holotype) have a light reddish-brown colour to the calicular edge.

Septa hexamerally arranged in 4 complete cycles (S1>S2>S3>S4), for a total of 48 septa; however, the holotype is missing one half-cycle, resulting in 11 major septa and a total of only 44 septa. S1 about 2 mm exsert, extend about half way to the columella, having straight, vertical to slightly concave axial edges. S1 can be remarkably thick, up to 1.0 mm at the calicular edge. S2 only slightly smaller than S1 and equally thick. S3 about half as exsert and wide as S1-2, and of normal thickness (i.e., 0.4 mm). S4 rudimentary in small coralla, but up to 3/4 exsertness and width of an S3 in larger coralla. Lower axial edges fuse to adjacent S4 low in fossa adjacent to columella through 3 or 4 slender processes. P1-3 all about 1 mm wide, the 6 P1 being the only independent pali, forming a crown low in the fossa encircling the columella. The 6 P2 rise slightly higher in the fossa, and the 12 P3 higher still and are recessed from the columella, the axial edges of each pair of P3 fusing to its adjacent P2 in the typical deltocyathid chevron arrangement. Fossa moderately deep, containing a papillose columella composed of many fine interconnected elements.

**REMARKS.** — Among the approximately 24 Recent *Deltocyathus* species, *D. crassiseptum* can most easily be distinguished by its unusually thick S1-2. Other consistent characters include its relatively small size, basal scar, deep peripheral intercostal grooves, and the small rows of granules that bisect each intercostal groove. It also appears to be restricted to a rather narrow bathymetric (i.e., temperature) range.

One corallum from MUSORSTOM 7 stn 585 showed evidence of a petracid ascothoracidan gall beneath its columella, a symbiosis previously reported in this genus by ZIBROWIUS & GRYGIER (1985), GRYGIER (1991), and GRYGIER & NOJIMA (1995).
AZOOXANTHELLATE SCLERACTINIA

DISTRIBUTION. — Wallis and Futuna region: Wallis, Futuna, and Alofi; Waterwitch and Field Banks; 420-510 m. Vanuatu region: Anatom, Tanna, and Malakula; 413-536 m.

Deltocyathus cameratus sp. nov.

Figs 12 g-i, 13 a


TYPE LOCALITY. — MUSORSTOM 8 stn 1007: 18°52'S, 168°52'E (Erromango), 720-830 m.

ETYMOLOGY. — The species name cameratus (Latin camerata, chambered) refers to the 24 elliptical chambers formed by the robust S4-P3 and P2-P3 fusions.

DESCRIPTION. — Coralium shaped as a shallow bowl, with a flat or slightly convex base. Holotype 13.7 mm in CD and 5.2 mm in height; largest specimen (MUSORSTOM 7 stn 557) 15.2 mm in CD. Calice circular but with a jagged margin, the 12 CS3 and adjacent pairs of CS4 projecting outward as short (about 0.9 mm) triangular to rectangular lancets. Costae inconspicuous except at calicular edge, where they are separated by intercostal grooves. Costae on base covered with a low granulation, changing to slender spines at calicular edge; no attachment scar. Most coralia uniformly white, but some (e.g., the holotype) are a light reddish-brown in the palmar region.

Septa hexamerally arranged in 4 complete cycles (S1>S2>S4>S3). In a large well-preserved corallum, S1 are about 1.6 mm exsert, extending about half distance to columella; S2 similar in shape and exertness but only slightly less wide. S3 about 1.3 mm exsert and half the width of an S1. S4, although less exsert than the S3 (about 1.0 mm), are slightly wider than the S3, the axial edges of each S4 pair solidly fused as a thick lamella to the outer edge of the adjacent P3. This fusion reaches as high as the S3-P3 notch and is thick and solid except near the columella, where it is perforated with several small pores. All septa uniformly thin and have straight axial edges. Pali (P1-3) uniform in width (about 1.2 mm) and separated from their corresponding septa by wide notches (about 0.8 mm). Axial edges of P1 and P2 solidly fused to the columella, although P2 rise slightly higher in the fossa. Axial edges of each pair of P3 solidly fused to their adjacent P2, this fusion being imperforate and reaching as high as the S3-P3 notch. The fossa is shallow to nonextant, containing a well-developed papillose columella consisting of 10-15 robust (0.3-0.6 mm in diameter), granular rods, in some coralia ornately sculptured (Fig. 13 a).

REMARKS. — The well-developed lamellar fusions of the S4 to P3 and P3 to P2 serve to differentiate this species from all others, as well as to subdivide the corallum into 24 elliptical compartments or chambers. In each system there are 2 small chambers formed by each pair of S4, bisected by the S3; 1 slightly larger compartment formed between each S3, bisected by the S2; and an elongate compartment between each system, bisected by an S1. This compartmentalization is better seen in a worn specimen in which the bisecting septa are reduced or missing (Fig. 12 i). At least two other species, *D. pourtalesi* Cairns, 1979 and *D. italicus* (Michelotti, 1838), both Atlantic species, have similarly high S4-P3/P3-P2 fusions, joining at or above the notch that separates septum from palus, but in neither case are these fusions as robust, and in both cases there are many other differences among the 3 species.

On corallum from MUSORSTOM 7 stn 557 showed evidence of a petaracid ascothoracidan gall beneath its columella.

DISTRIBUTION. — Wallis and Futuna region: Wallis, Waterwitch, Combe, Tuscarora, Field, and Rotumah Banks; 305-1010 m. Vanuatu region: Erromango and Malakula; 512-1175 m.
**Deltocyathus stella** Cairns & Zibrowius, 1997

Figs 13 b-c


**Type Locality.** — **Karubar** stn 35: 5°46'45"S, 132°11'10"E (Kai Islands, Banda Sea), 156-305 m.

**Table 6.** — Comparison of the spined species of Deltocyathus.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Calicular Margin</td>
<td>Lancetted</td>
<td>Polygonal, asymmetric</td>
<td>Circular</td>
<td>Prominently lancetted</td>
<td>Serrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>hexagonal</td>
<td></td>
<td></td>
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<tr>
<td>Maximum Calicular Diameter, Exclusive of Spines (mm)</td>
<td>12.3</td>
<td>5.4</td>
<td>10.4</td>
<td>12.0</td>
<td>14.8</td>
</tr>
<tr>
<td>Costal Spines: Number; Length; Shape</td>
<td>12 C₃: short (1.2 mm); stubby, thick</td>
<td>6-8 C₃: short (1.5 mm); wide-based, circular in cross section, attenuate</td>
<td>12 C₃: short (1.6 mm); slender, circular in cross section, flattened</td>
<td>12 C₃: long (3.5 mm); slender, circular in cross section</td>
<td>6 C₁: long (4.0 mm); slender, attenuate, circular in cross section</td>
</tr>
<tr>
<td>Corallum Shape</td>
<td>Shallow bowl</td>
<td>Shallow bowl</td>
<td>Discoidal (flat base)</td>
<td>Discoidal (flat base)</td>
<td>Patellate</td>
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<td></td>
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<tr>
<td>Costae: Relative Width; Granules/Costal Width</td>
<td>C₃&gt;C₁-2.4; 2 granules/costa</td>
<td>All costae equal; 1 granule/costa</td>
<td>C₃&gt;C₁-2.4; several granules/costa</td>
<td>C₃&gt;C₁-2.4 (C₃ prominent); 1 granule/costa</td>
<td>C₃&gt;C₁-2.4; 2-3 granules/costa</td>
</tr>
<tr>
<td>Number of Septa</td>
<td>48</td>
<td>40</td>
<td>48</td>
<td>48</td>
<td>48</td>
</tr>
<tr>
<td>Height and Nature of S₄-P₃ Junction</td>
<td>Just below S₃-P₃ notch, 4-5 slender processes</td>
<td>At S₃-P₃ notch, slender processes</td>
<td>Slightly below S₃-P₃ notch, slender processes</td>
<td>At S₃-P₃ notch, slender processes</td>
<td>Just below S₃-P₃ notch, 5-6 slender processes</td>
</tr>
<tr>
<td>Pali: Relative Width; P₁ Size Dimorphism</td>
<td>P₂&gt;P₁-2 (axial edges sinuous and dentate); P₁ dimorphic</td>
<td>P₂&gt;P₁-2; not dimorphic</td>
<td>All palar cycles equal sized, but P₁ dimorphic</td>
<td>All palar cycles equal sized, but P₁ dimorphic</td>
<td>P₃&gt;P₁-2; not dimorphic</td>
</tr>
<tr>
<td>Distribution; Depth</td>
<td>Philippines, Indonesia, Wallis and Futuna, Vanuatu; 206-355 m</td>
<td>Futuna, Vanuatu; 208-335 m</td>
<td>Wallis and Futuna, Vanuatu, Loyalty Islands; 73-360 m</td>
<td>Norfolk Ridge, Lord Howe Rise; 280-390 m</td>
<td>W. Atlantic; 81-675 m</td>
</tr>
</tbody>
</table>
Remarks. — Little can be added to the original description of this recently described species except to note that in well-preserved coralla the distal and axial edges of the P₃, and occasionally the P₁ and P₂, are dentate. *Dellocyathus stella* is most easily distinguished from other spined *Dellocyathus* (Table 6), by having short, thick, stubby costal spines, and large, sinuous, dentate P₃.

Distribution. — Wallis and Futuna region: Wallis and Futuna; Combe, Tuscarora, Waterwitch, Bayonnaise, and Field Banks; 240-597 m. Vanuatu region: Anatom and Espiritu Santo; 280-305 m. Elsewhere: Philippines and Indonesia; 206-280 m (Cairns & Zibrowius, 1997).

*Dellocyathus heteroclitus* Wells, 1984

Figs 13 d-g, Fig. A


Vanuatu. MusORSTOM 8: stn 1106, 2 cemented to *Xenophora* shells (MNHN).

Type Locality. — USGS stn 24918: Navaka River, Espiritu Santo, Vanuatu (Late Pleistocene).

Description. — Coralium shaped as a shallow bowl, the largest known specimen (MUSORSTOM 7 stn 514) 5.4 mm in CD (exclusive of costal spines). Costae coarsely granular and not well defined. Six to eight robust costal spines (C₃) project up to 1.5 mm from the calicular edge, spines forming only in half-systems in which the CS₃ is flanked by a pair of CS₄ (see Remarks). Costal spines thick at base, circular in cross section, attenuate at the tip, and coarsely granular. Corallium primarily white, but with a circular band of light red-brown pigmentation in palar region.

Septa hexamerally arranged in 4 cycles, but usually only 1 pair of S₄ occurs in each system, resulting in 36 septa (Fig. A, but see Remarks). S₁ only independent septa, each bordered axially by a slender (0.4 mm wide) palus. S₂ about 2/3 width of the S₁, each bearing a similarly sized palus, but rising higher in the fossa. S₃ dimorphic in size: S₃ unflanked by S₄ about 3/4 width of the S₂, their axial edges fused to the adjacent P₂, and often bear a small paliform lobe. S₃ flanked by S₄ are the smallest of septa, seeming to rest on the centre of the costal spine, each having a dentate upper edge and bordered by a prominent palus. P₃ wide (0.6 mm), sinuous, highly granular, and are the tallest and most recessed pali from the fossa. S₄ slightly wider than flanked S₃, have a dentate distal margin, a peripheral margin that borders the costal spine, and an axial margin that fuses to the adjacent P₃ at the level of the S₃-P₃ notch. Fossa shallow, containing a papillose columella composed of 5-9 well-formed (0.25 mm in diameter), finely granular elements.

Remarks. — I (Cairns, 1995: 72) questionably considered *D. heteroclitus* to be a junior synonym of *D. ornatus* Gardiner, 1899; however, this decision was based on a misconception of the latter species and the knowledge of only the small type series of the former. The additional MUSORSTOM specimens and subsequent examination of the type of *D. ornatus* show the two species to be distinct, as compared in Table 6. This is considered to be the first report of *D. heteroclitus* subsequent to its original description and the first record from the Recent, the types having been collected from the Late Pleistocene.

The pattern of costal spine insertion (as well as S₄ pair insertion) in *D. heteroclitus* is identical to that of *Anthemiphyllia spinifera* (Fig. A), the first 6 spines occurring in the "anterior" half-system of each system (i.e., half-systems I, III, V, VIII, X, and XII), which produces the "roughly hexagonal" calicular perimeter noted by Wells (1984). The majority of specimens (the holotype, 4 paratypes, and 12 of the MUSORSTOM specimens) have this complement, i.e., 6 costal spines and 36 septa. One paratype and 4 MUSORSTOM specimens have 7 costal spines and 38 septa, the additional costal spine occurring in half-system VI in two specimens, half-system VII in one specimen, and half-system IX in two specimens. Two MUSORSTOM specimens have 8 costal spines and 40 septa, one corallium being poorly preserved, the other with the additional costal spines in half-systems VI and VII (Fig. 13 g).

**Deltocyathus ornatus** Gardiner, 1899

Figs 13 h-i

*Deltocyathus ornatus* Gardiner, v*1899a: 163-164, pl. 20, figs 25a-b.

Not *Deltocyathus ornatus* - Cairns, 1995: 72-73, pl. 19, figs d-e (=*D. corrugatus* n. sp., described below in Remarks).

**Material Examined.** — **Wallis and Futuna region.** MUSORSTOM 7: stn 569, 1 (MNHN).


**Type Locality.** — Sandal Bay, Lifu, Loyalty Islands, 73 m.

**Remarks.** — *Deltocyathus ornatus* is compared to the other spined *Deltocyathus* in Table 6. It can be characterised as having a circular calice, 12 relatively short costal spines (C3), dimorphic P1, and an S4-P3 junction slightly below the S3-P3 notch. Before I examined the holotype of *D. ornatus* (deposited at the University Museum of Zoology, Cambridge), I (Cairns, 1995) incorrectly identified several specimens from New Zealand as this species, based on the resemblance in size and costal spines. It is now clear that the New Zealand specimens differ in having a strongly lancetted calicular margin; C3 so prominent that they give the base of the corallum a corrugated aspect; much longer costal spines; a higher S4-P3 fusion; and a flatter corallum (Table 6). To this, as yet unnamed, species I propose the name *Deltocyathus corrugatus*, new species, described and figured by Cairns (1995) as *Deltocyathus ornatus*, and diagnosed and compared in Table 6, herein. The holotype is the specimen figured by Cairns (1995: pl. 19, figs d-e, ex USNM 94169, now NZOI H 689) from NZOI stn P27 (28°54'36"S, 167°44'12"E, Norfolk Island, 390 m, = type locality), and the other 15 specimens from four NZOI stations reported by Cairns (1995) as *D. ornatus* are considered as paratypes. The name *corrugatus* (Latin *corrugatus*, ridged) refers to the corrugated base.

**Distribution.** — Wallis and Futuna region: Waterwitch Bank; 300-305 m. Vanuatu region: Anatom, Efate, and Espiritu Santo; 295-360 m. Elsewhere: Loyalty Islands; 73 m (holotype).

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

**Heterocyathus** sp. cf. *H. sulcatus* (Verrill, 1866)

Figs 14 a-d

*Stephanoseris sulcatus* Verrill, v*1866: 48.


**Type Locality.** — Ceylon (= Sri Lanka), depth not reported.

**Description.** — All specimens reported above are unattached, the base usually forming a low, flattened cylinder that completely encapsulates a small gastropod that was colonized by a sipunculid worm. If the gastropod was small or circular in diameter, the concentric internal sipunculid tube forms a regular cylinder, whereas if the
gastropod was elongate, an irregularly-shaped base results. A cylindrical corallum of smaller diameter sits upon the base, which contains the coral polyp. The corallum base is up to 6.0 mm in diameter and about 2.5 mm in height, whereas the upper corallum rarely exceeds 4.0 mm in diameter and is also up to 2.5 mm tall. The sipunculid canal is about 1.2 mm in diameter, opening to the surface of the coral through a pore of equal diameter on the lower lateral surface of the base. Smaller efferent pores associated with the sipunculid are rare, occasionally one 0.2 mm in diameter opening on the lower surface of the base or on the upper edge of the base. Costae well-developed, rounded and very finely granular; however, in older coralla tectural deposits completely cover the costae resulting in a smooth porcelainous surface. Costae occur only on lateral faces of the corallum, including both upper and lower sections, but the flat base of the corallum is smooth. The costal width must gradually increase in the region of the base that covers the sipunculid worm tube, in order to cover the larger circumference formed by the housing of the worm. Intercostal furrows quite thin (about 30 μm) and deep, such that the underlying theca cannot be seen.

C1-3 light brown to chocolate-brown in colour, alternating with the white C4; however, only the S1-2 are similarly coloured, the pigment of the C3 stopping at the calicular edge. Palar and columellar elements usually also pigmented, but in some cases are white.

Septa hexamerally arranged in 4 cycles, but a complete fourth cycle is rare, most coralla missing 1 or more pairs of S4 resulting in 36 to 46 septa: S1>S2>S4>S3. S1 about 1.1 mm exsert, extend about half way to columella, and bordered by 1 or 2 narrow paliform lobes. S2 0.7 mm exsert, about 3/4 width of the S1, and also bear 1 or 2 paliform lobes. S3 that are flanked by a pair of S4 are the smallest septa, only 0.5 mm exsert and half the size of the S2, but if not flanked by S4, an S3 is as wide as an S2 and often considerably thicker. S4 also dimorphic in size, those adjacent to S1 as wide as an S2 and fused to its adjacent S1 in a lancet. S4 adjacent to S2 are smaller, only slightly wider than an S3. Both S3 and S4 bear 2 or 3 slender paliform lobes. Septa crowded in arrangement and bear prominent granulations on their faces. All paliform lobes slender, not lamellar, about 0.25 mm in diameter, and bear obliquely oriented menianes. Fossa shallow, containing a papillosse columella consisting of 10-15 cylindrical elements that are similarly transversely ridged as the paliform lobes. In fact there is little difference between palar and columellar elements except that the former rise higher in the fossa and are aligned with particular septa.

Remarks. — Hoeksema & Best (1991) consolidated the 23 described species and subspecies of Heterocyathus into three species and provided a key for their differentiation. According to their diagnoses, coralla having a dark brown centre, alternating costal pigmentation, and a compact, cylindrical upper corallum, should be identified as H. sulcata. However, I have noted that several specimens in larger lots that were certainly conspecific did not have a dark brown centre, and I have also noted other specimens of Heterocyathus with dark brown centres that were otherwise very different from the species described herein. The type of H. sulcata (YPM 764) from Sri Lanka is now so damaged that it is of little use in defining the species; only about one-third of the original corallum is present. Because of the large number of nominal species and the variation inherent in this genus these specimens are only provisionally identified as H. sulcatus.

Specimens from six of the lots listed above, indicated with parentheses around the specimen number, differ in having a larger corallum (CD up to 6.0 mm, basal diameter up to 8.5 mm) and in having 2-6 sipunculid efferent pores located circumferentially at the junction of the base and upper corallum. These are assumed to be larger individuals of the same species, the larger size mediated by the increased development of the sipunculid.


Heterocyathus alternatus Verrill, 1865

Figs 14 e-f


Type locality. — "Gaspar Straits" = Selat Gelasa, between the islands of Bangka and Belitung, Sumatra, Indonesia.

Diagnosis (specimen from MUSORSTOM 8 stn 1004). — Corallum cylindrical and free: 10.2 x 9.4 mm in CD and 8.1 mm in height. Costae well defined, rounded, and finely granular (not porcellaneous); intercostal grooves narrow and relatively deep. Base flat and not costate, but covered with fine granulations; the sipunculid tube opening and one efferent pore also occur on the flat base. Septa hexamerally arranged in 4 complete cycles (S₁>S₂>S₄>S₃), although Hoeksema and Best (1991: fig. 17) show that this species may sometimes attain a full fifth cycle. S₁ highly exsert (3.7 mm), forming tall lancets with their adjacent S₄, and axially bordered with 2 or 3 slender paliform lobes. S₂ about 2.5 mm exsert, also forming lancets with their adjacent S₄. S₃ bear only 1 or 2 paliform lobes, whereas the larger S₄ bear 4 or 5 lobes that merge indistinguishably into the columella. All paliform lobes are slender (cylindrical) and not ridged. Fossa quite deep, containing a papillose columella composed of numerous fine elements.

Remarks. — These specimens appear to be conspecific with the diagnosis and illustrations of Hoeksema and Best (1991). The holotype (YPM 6828), although well preserved, appears to be a juvenile specimen. Heterocyathus alternatus differs markedly from the species described above as H. cf. sulcatus by having a larger corallum with more septa, granular costae (not porcellaneous) and base, more highly exsert S₁ and S₂, nonridged paliform lobes, a deeper fossa, and finer columellar elements.

Distribution. — Vanuatu region: Erromango and Efate; 301-319 m. Elsewhere: Indonesia; Philippines; northern Indian Ocean; Western Australia; South China Sea (Hoeksema & Best, 1991).

Genus CONOTROCHUS Seguenza, 1864

Conotrochus funicolumna (Alcock, 1902)


Type locality. — "Siboga" stns 95 and 100: Sulu Archipelago, 450-522 m.

Diagnosis. — Corallum ceratoid (edge angle up to 35°), straight, and attached by a narrow pedicel that is usually reinforced by an extensive secondary attachment along the lower edge of the corallum contiguous with the pedicel. Calice circular to slightly elliptical, the largest specimen reported herein 12.5 mm in GCD. The theca of a well-preserved corallum often bears slender, hollow, hispid granulations; worn coralla often show longitudinal costae. Theca of well-preserved coralla sometimes longitudinally streaked with brown pigmentation that occurs without symmetry, the streaks ranging from 1 to 8 septa in width, alternating with white theca. Theca thick, projecting 0.5-0.7 mm above the peripheral distal septal edges as a continuous rim;
stereome present internally. Septa hexamerally arranged in 4 cycles (S1>S2>S3>S4), a full fourth cycle complete in some coralla at a CD of 4.6 mm, but larger specimens sometimes lacking several pairs of S4. Columella a well-formed, discrete concentration of lamellar elements, often swirled in a circular manner, and occasionally fused into a more solid structure. Lamellar elements often fused to one another in a labyrinthiform arrangement.

REMARKS. — *Conotrochus funicolumna* is similar to *C. brunneus*, both species secondarily attached basally and having a similar thecal structure. *C. funicolumna* differs in having: a larger corallum (up to 12.5 mm CD vs <8.0 mm for *C. brunneus*); more septa at the same CD, most *C. funicolumna* have 48 septa, whereas most *C. brunneus* have only 36-40 septa; a more open corallum (slightly higher edge angle); less internal stereome; and occasionally a streaked theca, whereas that of *C. brunneus* is white or uniformly brown. The species is more fully described and figured by CAIRNS (1994).

DISTRIBUTION. — Wallis and Futuna region: Wallis, Futuna, and Alofi; Waterwitch, Combe, and Tuscarora Banks; 370-697 m. Vanuatu region: Malakula and Espiritu Santo; 350-700 m. Elsewhere: Philippines; Indonesia; Japan; Australia; Hawaiian Islands; 88-616 m (CAIRNS & ZIBROWIUS, 1997).

*Conotrochus brunneus* (Moseley, 1881)

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

*Conotrochus brunneus* - CAIRNS, 1995: 74-75, pl. 20, figs a-b (synonymy). — CAIRNS & ZIBROWIUS, 1997: 127-128, fig. 16e.


Type Locality. — "Challenger" stn 194: 4°34'S, 129°57'30"E (Banda Island, Banda Sea), 366 m.

REMARKS. — *Conotrochus brunneus* was redescribed and figured by CAIRNS (1995), and compared to *C. funicolumna* in the previous account.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch, Combe, Field, and Bayonnaise Banks; 300-580 m. Vanuatu region: Anatom, Tanna, Erromango, and Espiritu Santo; 321-574 m. Elsewhere: Indo-West Pacific from Madagascar to South China Sea; 97-1051 m (CAIRNS & ZIBROWIUS, 1997).

*Conotrochus asymmetros* sp. nov.

Figs 14 g, 15 a-e


Vanuatu. MUSORSTOM 8: stn 1016, 1 nontype cemented to a *Xenophora* shell (MNHN). — Stn 1017, 1 nontype cemented to a *Xenophora* shell (MNHN). — Stn 1097, 1 nontype cemented to a *Xenophora* shell (MNHN).

Type Locality. — MUSORSTOM 7 stn 496: 14°19.6'S, 178°04.3"W (Futuna), 250-330 m.

Etymology. — The species name *asymmetros* (Greek *asymmetros*, without symmetry) refers to the asymmetrical arrangement of septa within the calice.
DESCRIPTION. — Corallum varies from conical (edge angle = 30°) to flabellate (e.g., the holotype: edge angle up to 65°, face angle = 15°), depending on the corallum and its stage of thecal edge spine development. Holotype 8.9 x 4.6 mm in CD, 7.3 mm in height, and 1.3 mm in pedicel diameter. Calice elliptical (GCD:LCD = 1.2) to highly compressed (GCD:LCD = 2.0), the higher ratio characteristic of coralla in process of edge spine formation, which temporarily elongates the corallum. Elliptical calices are sometimes asymmetrical in shape, one face being almost straight, the other convex. Several more septa often originate from the convex thecal face than the straight face. Calicular edge finely serrate, separated from the peripheral septal edges by a shallow trough. Basal disc 0.8-1.3 mm in diameter, in many cases augmented by a contiguous secondary thecal attachment up to 2.0 mm in diameter. Thecal edges bear 1-3 pairs of spines (up to 2.0 mm long); short, triangular crests; or low evolutions. Transverse division not noted. Theca porcellaneous, covered with low, rounded granules characteristic of the genus. Theca usually white, but occasionally longitudinally streaked with brown pigment.

Septa hexameraly arranged in 3 size classes, usually resulting in 32 or 30 septa accordingly: 6:10:16 or 6:9:15. The 6 primary septa are up to 0.7 mm exsert, having straight axial edges that reach the columnella. Primary septa are not aligned with the greater calicular axis, as in all other known corals having an elliptical calice. Rather, they occur on either side of the calicular axis and on the lateral faces, resulting in a secondary or tertiary septum being aligned with the greater axis, usually one of each size class on either end of the corallum. Secondary septa 0.4 mm exsert, about 4/5 width and less thick than a primary septum. In coralla having 32 septa, all 6 systems contain at least one secondary septum and 4 systems contain a pair of equal-sized secondary septa; in coralla having 30 septa, only 3 systems contain a pair of secondaries. There seems to be no consistent arrangement in which systems contain pairs of secondaries, only that they are usually in contiguous systems and often occur in a system aligned with the greater axis. Tertiary septa nonexsert and rudimentary, only about 1/4 the width of a secondary, and quite thin. Fossa of moderate depth, containing a papillose columnella composed of 6-11 granular, interconnected papillae that are also attached to the lower, axial edges of primary and secondary septa.

REMARKS. — The unusual septal symmetry and thecal edge spines distinguish this species from all others in the genus. In fact, I know of no other scleractinian species that possesses a pair of equal-sized secondary septa within one system or a septal arrangement that aligns a secondary and/or tertiary septum on the greater calicular axis.

DISTRIBUTION. — Wallis and Futuna; 210-510 m. Vanuatu region: Efate and Espiritu Santo; 288-294 m.

Genus LOCHMAEOTROCHUS Alcock, 1902

Lochmaeotrochus gardineri sp. nov.

Figs 15 f-g


Vanuatu. MUSORSTOM 8; stn 956, 9 paratypes (MNHN). — Stn 992, 3 paratypes (USNM 98738). — Stn 1034, 1 paratype (MNHN). — Stn 1036, holotype (MNHN) and 13 paratypes (USNM 98737).

TYPE LOCALITY. — MUSORSTOM 8, stn 1036: 18°01'S, 168°48'E (Efate), 920-950 m.

ETYMOLOGY. — This species is named for J. Stanley Gardiner, in recognition of his pioneering work on azooxanthellate corals from the central and South Pacific (Gardiner, 1899a, b).

DESCRIPTION. — Corallum conical (ceratoid, having an edge angle of 18°-23°), straight, and free, having a basal disc about 1.1 mm in diameter that is occasionally reinforced with a small contiguous secondary attachment of equal diameter. Largest specimen (holotype) 10.8 mm in CD and 17.4 mm in height; calice circular. Theca covered with slender, hispid granulations, characteristic of the genus Conotrochus. Theca lipped with successive
circumferential growth ridges or lips, each projecting up to 0.3 mm in height, the uppermost thecal rim projecting upward about 0.7 mm and separated from the distal, peripheral septal edges by a shallow trough. Theca relatively thick, containing layers of internal stereome. Corallum uniformly white.

Septa hexamerally arranged in 4 cycles, the fourth cycle never complete: S1>S2>S3>S4. Most coralla have 1 pair of S4 in each system, resulting in 36 septa; however, the holotype has 40 septa, and a smaller specimen (CD 9.4 mm) has 42 septa. S1 nonexsert, extend about 3/4 distance to the columella, having straight, vertical axial edges. Rarely (e.g., the holotype) the S1 bear a small (0.6 mm wide), lamellar P1, separated from its septum by a deep, narrow notch. S2 about 3/4 width of the S1. S3 dimorphic in size: S3 unflanked by S4 about half the size of the S2, but those flanked by S4 are only slightly less wide than the S2 and usually bear a broad (1.2 mm wide), lamellar palus. The position of the P3 is variable. Although it is usually aligned with the S3, it is sometimes aligned between the S3 and adjacent S2, or may be absent. Even when aligned with the S3, lower in the fossa the P3 is usually connected to the adjacent S2. Also, in some systems having a full complement of 2 pairs of S4, only one palus is present before the S2, but this palus having connections to the 2 adjacent S3 lower in the fossa. S4 about half width of a flanked S3. Axial edges of S2-4 very slightly sinuous. Fossa moderately deep, containing a papillose columella composed of 0-10 interconnected cylindrical elements 0.2-0.3 mm in diameter.

REMARKS. — *Lochmaeotrochus gardinert* is similar to but differs from the only other species described in this genus, *L. oculatus* Alcock, 1902, in having: a solitary, free habit with a small basal disc (vs a quasicolonial habit with a broad secondary attachment); circumferential thecal ridges; fewer septa at a corresponding size and a lower maximum number of septa (most *L. oculatus* have 48 septa); wider and better developed pali; and a deeper fossa. It is also known from greater depths than *L. oculatus*.

*Lochmaeotrochus gardinert* is also similar to *Conotrochus funicolumna*, particularly in corallum size and thecal granulation; these species also co-occur at one station. *L. gardinert* is distinguished by having at least 6 lamellar pali (P3), which are different in shape from its cylindrical columellar elements, *C. funicolumna* only having swirled, interconnected (labyrinthiform) lamellar columellar elements and no pali. *L. gardinert* also has a narrower basal attachment, a deeper fossa, fewer septa at a corresponding CD, and a greater disparity between the width of its S1 and S2. *L. gardinert* also seems to be found, in general, at greater depths than *C. funicolumna*.

DISTRIBUTION. — Wallis and Futuna region: Combe and Tuscarora Banks; 608-700 m. Vanuatu region: Anatom, Erromango, and Efate; 750-1175 m.

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Genus *AULOCYATHUS* Marenzeller, 1904

*Aulocyathus recidivus* (Dennant, 1906)


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

REMARKS. — *Aulocyathus recidivus* was more fully redescribed and figured by *Cairns* (1982, 1994) and *Cairns & Parker* (1992). The four known species of *Aulocyathus* are compared in Table 7, and the three Pacific species illustrated by *Cairns* (1994: pl. 26). *A. recidivus* is unique in having a notch between the theca and peripheral septal edges, and is further distinguished by having a relatively large, fragile corallum with well-spaced septa and a well-developed columella.
TABLE 7. — Comparison of the four known species of *Aulocyathus.*

<table>
<thead>
<tr>
<th></th>
<th><em>A. recidivus</em></th>
<th><em>A. atlanticus</em></th>
<th><em>A. matricidus</em></th>
<th><em>A. juvenescens</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dentiat, 1906</td>
<td>Zibrowius, 1980</td>
<td>(Kent, 1871)</td>
<td>(Kent, 1871)</td>
</tr>
<tr>
<td>Calicular Diameter (mm)</td>
<td>15.0</td>
<td>9.5</td>
<td>8.5</td>
<td>4.5</td>
</tr>
<tr>
<td>HGCD</td>
<td>2.7</td>
<td>1.1-6.6</td>
<td>3.6</td>
<td>2.9-3.5</td>
</tr>
<tr>
<td>Costae</td>
<td>Hispid granules</td>
<td>Granular to hispid</td>
<td>Hispid, twice as many as septa</td>
<td>Porcellaneous</td>
</tr>
<tr>
<td>Number of Septa</td>
<td>32-66</td>
<td>&lt;48</td>
<td>36-48</td>
<td>30-32</td>
</tr>
<tr>
<td>Calicular Edge</td>
<td>Serrate</td>
<td>Serrate</td>
<td>Smooth</td>
<td>Serrate</td>
</tr>
<tr>
<td>Upper Peripheral Septa</td>
<td>Notched</td>
<td>Not notched</td>
<td>Not notched</td>
<td>Not notched</td>
</tr>
<tr>
<td>Columella</td>
<td>Well developed, papillose</td>
<td>Well developed, papillose</td>
<td>Rudimentary</td>
<td>Rudimentary</td>
</tr>
<tr>
<td>Distribution: Depth</td>
<td>Indo-West Pacific; 128-1137 m</td>
<td>Eastern Atlantic; 450-1716 m</td>
<td>Japan; 84-207 m</td>
<td>Indo-West Pacific; 182-463 m</td>
</tr>
</tbody>
</table>

**DISTRIBUTION.** — Wallis and Futuna region: Tuscarora and Combe Banks; 1020-1280 m. Elsewhere: Indo-West Pacific from southwest Indian Ocean to Japan; 128-1137 m (CAIRNS & ZIBROWIUS, 1997).

*Aulocyathus juvenescens* Marenzeller, 1904

**Fig. 15 h**


**TYPE LOCALITY.** — Pemba and Zanzibar Islands, Tanzania, 400-463 m.

**REMARKS.** — Two adult, intact coralla are reported herein: one (*MUSORSTOM* 8 stn 1070) 4.4 mm in CD and 14.6 mm in height, the other (*MUSORSTOM* 8 stn 976) 3.7 mm in CD and 11.0 mm in height. Both specimens have a smooth, porcellaneous theca with no indication of granulation or intercostal striae. The theca of the larger specimen has streaks of brown pigment, the other is pure white. Both coralla have a finely serrate, circular calicular margin and both have 32 septa arranged S1>S2>S3>S4; however, the size difference between the S2 and the flanking S3 is slight. The lower axial edges of S1 bear robust tubercles; the columella is rudimentary. These specimens resemble the syntypes of *A. juvenescens* in all respects except for thecal texture, the syntypes having faint, longitudinal intercostal striae and low, glisteny granulations.

*Aulocyathus juvenescens* is compared to the other Recent congeners in Table 7. It is distinguished by having the smallest calicular diameter, least number of septa, and a porcellaneous theca.

**DISTRIBUTION.** — Vanuatu region: Tanna and Espiritu Santo; 182-184 m. Elsewhere: Philippines; Tanzania; 196-463 m (CAIRNS & ZIBROWIUS, 1997).

Genus *DESMOPYLLUM* Ehrenberg, 1834

*Desmophyllum dianthus* (Esper, 1794)

*Madrepora dianthus* Esper, *1794: pl. 69, figs 1-3.
**Desmophyllum cristagalli** H. Milne Edwards & Haime, v*1848a*: 253.  
*Not Desmophyllum* sp. cf. *D. cristagalli* - Wells, 1954: 470 (= *Javania exserta*).  
*Desmophyllum dianthus* - Cairns, 1994: 26-27, pl. 9, figs a-d (synonymy and neotype designation); 1995: 77, pl. 21, figs d-f, map 4 (synonymy); 1998: 385-386. — Cairns & Zibrowius, 1997: 131, figs 17g-h.


**TYPE LOCALITY.** — Sagami Bay, Japan (depth not known).

**REMARKS.** — This ubiquitous coral has been redescribed and figured many times, often under the junior synonym name of *D. cristagalli* (see Zibrowius, 1980; Cairns, 1979, 1982, 1994, 1995). But, despite its widespread distribution and abundance in certain regions, it is rarely collected in the tropical South Pacific (Cairns & Zibrowius, 1997).

**DISTRIBUTION.** — Wallis and Futuna region: Rotumah Bank; 820-830 m. Vanuatu region: Espiritu Santo; Guyot Bougainville; 455-778 m. Elsewhere: cosmopolitan except off continental Antarctica and northern boreal Pacific; 35-2460 m (Cairns, 1994).

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**Genus THALAMOPHYLLIA** Duchassaing, 1870

**Thalamophyllia tenuescens** (Gardiner, 1899)

*Desmophyllum tenuescens* Gardiner, v*1899a*: 161-162, pl. 19, figs 1a-b.  

Lord Howe Island. NZOI: stn P115, 2 colonies (USNM 94363).

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

**REMARKS.** — This species was recently redescribed and illustrated by Cairns (1995). The largest known corallite, reported herein from Lord Howe Seamount Chain (NZOI P115), measures 24 x 15 mm in CD, 27 mm in height, and contains three pairs of S5 (54 septa).

**DISTRIBUTION.** — Futuna; 240-349 m. Elsewhere: Philippines; Indonesia; Bikini Island, Marshall Islands (Wells, 1954); Loyalty Islands (Gardiner, 1899a); Kermadec Islands; Lord Howe Seamount Chain (reported herein); off Queensland; 8-315 m (Cairns & Zibrowius, 1997).

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**Genus LOPHELIA** H. Milne Edwards & Haime, 1849

**Lophelia pertusa** (Linnaeus, 1758)

*Madrepora pertusa* Linnaeus, *1758*: 797.  
*Lophelia prolifera* - Cairns, 1979: 125-127, pl. 24, figs 1-5 (synonymy); 1991a: 17-18, pl. 6, fig. j.  

Type locality. — Not stated, but probably the fjords of Norway (Zibrowius, 1980).

Remarks. — This species, which is common in the Atlantic, is rarely collected in the Indo-Pacific, represented in this collection only by several dead fragments.

Distribution. — Wallis and Futuna region: Waterwitch Bank; 560-580 m. Elsewhere: cosmopolitan, except off continental Antarctica (rare in western Pacific); 60-2170 m (Cairns, 1995).

Genus DACTYLOTROCHUS Wells, 1954

Dactylotrochus cervicornis (Moseley, 1881)

Figs B, 16 a-f

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

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


Guam. East Agana Bay, 7.08.1986, 128-137 m, 1 (USNM 96503).

Type locality. — Unknown.

Description. — Corallum attached through a robust (3-6 mm in diameter) cylindrical to subcylindrical pedicel and a thin, slightly expansive base, the base and lower pedicel usually covered with several faint annular epithecal ridges. One damaged specimen (MUSORSTOM 8 stn 1095) and two syntypes display a polycyclic base, achieved by thecal bridging of raised costal ridges in the vicinity of the base. Above the pedicel, at a height of 3-10 mm, the theca and corresponding internal septa are divided into several (up to 8) elongate, tapered and sometimes bifurcating thecal extensions (Fig. B). The largest thecal extensions originate from the two thecal faces, the basal part of each extension 6-8 mm in length and 4-6 mm wide, beyond which it bifurcates into two smaller extensions 2-3 mm in width, which, in larger specimens, bifurcate once more. These laterally-placed, bifurcating extensions are vertical in orientation, producing a constricted fossa. In a well-developed corallum, between each laterally-placed extension and the greater axis may be 4 smaller, nonbifurcating extensions, each about 5 mm long, 3 mm in width, oriented outward from the calicular edge. Finally, 2 more nonbifurcating, upward-projecting extensions originate from the greater axis of the corallum, each about 4 mm long and 3 mm wide. Not all coralla have all 8 digitiform projections, but the two lateral and two axial extensions are usually

FIG. B. — Diagrammatic representation of the calice of Dactylotrochus cervicornis, showing the placement, length, and orientation of the calicular extensions. Thick lines represent a vertical extension; thin lines represent a horizontal to oblique extension. Length of extensions drawn in proportion to calicular diameter.
present even in the smallest coralla. Largest specimen (MUSORSTOM 8 stn 988) 23.1 x 12.9 mm in CD and 30 mm in height. Theca white, covered with granules that are sometimes arranged in longitudinal rows, but costae and intercostal striae absent.

Septal symmetry is difficult to determine. Large coralla have about 240 septa arranged in 7 size classes, each progressive size class being narrower and originating closer to the calicular margin. Septa closely spaced, have smooth faces, and bear 2-5 elongate ridges (menianes) oriented parallel to the septal edge. The menianes are 60-70 μm in height and about 30 μm wide, alternating in position with those from the adjacent septal faces (Figs 16 d-e), thus blocking a view of the lower interseptal spaces. Fossa deep and elongate; no columella.

**REMARKS.** — *Dactylotrochus cervicornis* is assumed to be a solitary coral since no stolons were detected and only one elongate fossa (one mouth) is present. All previous authors described the septate digitiform thecal extensions of this species as branches, but it seems incongruous to refer to a solitary coral as having branches, thus the term "thecal extension" is used.

The five syntypes of *T. primordialis* Gardiner, 1899 are deposited at the University Museum of Zoology, Cambridge, the largest specimen a juvenile 10 mm in height and 2.4 mm in pedicel diameter, having only 66 septa and only three septal extensions.

**DISTRIBUTION.** — Wallis and Futuna region: Wallis and Futuna; Field Bank; 245-400 m. Vanuatu region: Tanna and Espiritu Santo, 320-372 m. Elsewhere: Philippines; South China Sea; Guam (reported herein); Bikini. Marshall Islands; New Caledonia and Loyalty Islands; 73-400 m (CAIRNS & ZIBROWIUS, 1997).

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**Genus RHIZOSMILIA** Cairns, 1978

*Rhizosmilia robusta* Cairns, 1993


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

**REMARKS.** — Because of its size, shape, and palar configuration, this species can be taken for a *Caryophyllia* at first view, but differs from that genus in having a polycyclic base, endothecal dissepiments, and a columella composed of irregularly shaped papillae, not twisted lamellae.

**DISTRIBUTION.** — Wallis and Futuna; 240-300 m. Vanuatu region: Anatom, Efaté, Espiritu Santo, and Malakula; 110-360 m. Elsewhere: southwestern Indian Ocean; Philippines; 66-202 m (CAIRNS & ZIBROWIUS, 1997).

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**Genus ASTEROSMILIA** Duncan, 1867

*Asterosmilia gigas* (van der Horst, 1931), n. comb.

Figs 16 g-i, 17 a-b

*Caryophyllia gigas* van der Horst, *1931: 4-5, pl. 2, figs 1, 4. — ZIBROWIUS, 1980: 70.


TYPE LOCALITY. — Mauritius, 183-366 m.

DESCRIPTION. — Corallum robust and ceratoid, either regularly curved or irregularly bent in a scolecoid fashion. Corallum free, always with an open, broken base 1.5-2.5 mm in diameter revealing 12 septa. Base monocyclic, not reinforced with rootlets-like. Largest specimen reported herein (MusORSTOM 7 stn 515) 28.2 x 26.0 mm in CD and 65 mm in height; however, the holotype (BM 1939.7.20.851) measures 39.4 x 31.6 mm in CD and 79 mm in height. C1-3 expressed as low, rounded ridges; in some coralla C4-5 also present as faint ridges. No intercostal striae or granules. Theca white, often covered with encrusting organisms (e.g., foraminifera) and small buds, presumably of the same species. Buds are found on most coralla and cluster near the calicular margin, each measuring 1.5-3.0 mm in diameter and up to 2 mm in height and having 12 septa.

Septa hexamerally arranged in 5 cycles (S1>S2>S3>S4>S5); however, it is not unusual for even large coralla to lack several pairs of S5 resulting in less than 96 septa, or for some coralla to have additional pairs of S6. The holotype, for example, has 5 pairs of S6 for a total of 100 septa. S1 up to 3.5 mm exert, having straight vertical axial edges. S2,4 progressively and gradually narrower; however, S5 only half width of S4. Triangular lancets corresponding to S1 and S2 form at calicular margin. Wide (2.5-3.0 mm), thin paliform lobes (P4) usually border every S4 that is flanked by a pair of S5, the P4 appearing as pairs in those half-systems containing both pairs of S5; however, occasionally a paliform lobe occurs before an S3, even though pairs of S5 are present. Stereome sometimes present in base of corallum, giving it a dense aspect. Lower portion of corallum also filled with abundant vesicular endothecal dissepiments. Fossa of moderate depth, containing a well-developed, papillose columella composed of irregularly-shaped, crispate elements.

REMARKS. — This appears to be the first report of this species subsequent to its original description, which was based on one specimen, and the first record from the Pacific Ocean. Both van der Horst (1931) and Cairns & Keller (1993) noted that the broken cross section of the base of the holotype was surrounded by what appeared to be contiguous rootlets, which is characteristic of the genus Rhizosmilia. However, all specimens reported above propagated by asexual budding, the open base of every corallum corresponding in shape, size, and number of septa to the buds that occur on its theca. A budding mode of reproduction is inconsistent with the polycyclic reinforcement of a Rhizosmilia, and thus the root-like structures of the holotype are not interpreted as such, but as an artifact. Discounting the rootlet structures, this species belongs in the genus Asterosmilia, which often reproduces by asexual budding. In fact, A. gigas is remarkably similar to A. profunda (Duncan, 1864) (see Cairns & Wells, 1987), known only from the Eocene to Pliocene of the Caribbean.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch Bank; 252-510 m. Elsewhere: Mauritius; 183-366 m.

Family TURBINOLIIDAE H. Milne Edwards & Haime, 1848

Genus ALATOTROCHUS Cairns, 1994

Alatotrochus rubescens (Moseley, 1876)

Platyrhochus rubescens Moseley, v*1876: 553.
Sphenotrochus rubescens - Moseley, v.1881: 157-159, pl. 6, figs 8, 8a.
Alatotrochus rubescens - Cairns, 1994: 68-69, pl. 29, figs g-l; 1995: 84, pl. 24, figs a-b, map 14; 1997: 14, pl. 1, fig. a, pl. 4, fig. a; 1998: 390. — Cairns & Zibrowius, 1997: 141, fig. 18h.

MATERIAL EXAMINED. — Vanuatu. MusORSTOM 8: stn 1068, 2: 1 (MNHN), 1 (USNM 98755).
Type Locality. — "Challenger" stn 192: 5°49'15"S, 132°14'15"E (Kai Islands, Banda Sea), 236 m (not 136 m, as reported by Cairns (1994, 1995) and Cairns & Zibrowius (1997)). However, the "Challenger" station list presented as Appendix II of the "Narrative" (Tizzard et al., 1885) lists 140 fathoms (= 256 m) as the depth for station 192.

Remarks. — This species was recently redescribed and the types illustrated by Cairns (1994).

Distribution. — Vanuatu region: Malakula; 536-619 m. Elsewhere: Japan; Philippines; Banda Sea; northwestern Australia; southern Norfolk Ridge; 180-751 m (Cairns & Zibrowius, 1997).

Genus Pleotrochus Cairns, 1997

Pleotrochus venustus (Alcock, 1902)

Figs 17 d-e

Ceratotrochus venustus Alcock, v*1902a: 92; v.l902c: 10, pl. 1, figs 5, 5a.
Cryptotrochus venustus - Cairns, 1995: 88 (in part: only pl. 27, figs a-b; remaining figures and description pertain to P. zibrowii Cairns, *1997).
Pleotrochus venustus - Cairns, 1997: 14 , pl. 1, fig. b, pl. 4, fig. b.

Material Examined. — Vanuatu. Musorostom 8: stn 1114, 1 (MNHN).

Type Locality. — "Sihoga" stn 256: 5°26.6'S, 132°32.5'E (Kai Islands, Banda Sea), 397 m.

Remarks. — Although worn and obviously long dead when collected, the single specimen reported above is undoubtedly conspecific with P. venustus. It represents the first record outside the Banda Sea and the largest known corallum: 13.5 x 11.4 mm in CD and 11.7 mm in height. The species is more fully described by Cairns & Zibrowius (1997), and the species and genus are figured and discussed by Cairns (1997).


Pleotrochus zibrowii Cairns, 1997

Figs 17 g-h

Cryptotrochus venustus - Cairns, 1995: 88-89 (in part: pl. 26g-i; not pl. 27a-b, which is Ceratotrochus venustus Alcock, 1902).
Pleotrochus zibrowii Cairns, *1997: 14-15, pl. 1, fig. c, pl. 4, fig. c.


Vanuatu. Musorostom 8: stn 1113, 1 (USNM 98756).

Type Locality. — NZOI stn U584: 31°26.3'S, 172°35.6'E (Three Kings Ridge, New Zealand), 1137-1150 m.

Remarks. — Although worn and obviously dead when collected, the two specimens reported above are virtually identical to specimens in the type series, the larger specimen (MUSORSTOM 7 stn 637) measuring 13.4 x 12.6 mm in CD and 11.5 mm in height. These records represent the second collection of this recently described species.

Genus TROPIDOCYATHUS H. Milne Edwards & Haime, 1848

Tropidocyathus lessonii (Michelin, 1842)
Fig. 17 c

Tropidocyathus lessoni - CAIRNS, 1989a: 33-34, pl. 16, figs d-l (synonymy); 1994: 67, pl. 29, figs a-b (synonymy).
Tropidocyathus lessonii - CAIRNS & ZIBROWIUS, 1997: 146-147. — CAIRNS, 1997: 16, pl. 1, fig. e, pl. 4, fig. e, pl. 7, fig. d; 1998: 390-392.

MATERIAL EXAMINED. — Vanuatu. MUSORSTOM 8: stn 1016, 1 (MNHN).

TYPE LOCALITY. — Unknown.

REMARKS. — The single specimen reported above, worn and dead when collected, measures 12.8 x 10.7 mm in CD and 10.8 mm in height. This species is distinctive in having a rhomboidal calice (the lateral thecal faces bulging outward) and highly developed edge crests up to 3.4 mm in height. This relatively common deep-water species was redescribed, illustrated, and discussed by CAIRNS (1989, 1994, 1997).

DISTRIBUTION. — Vanuatu region: Efate; 291-300 m. Elsewhere: Indo-West Pacific from southwest Indian Ocean to Japan; 50-421 m (CAIRNS & ZIBROWIUS, 1997).

Tropidocyathus labidus Cairns & Zibrowius, 1997
Fig. 2 d


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

REMARKS. — This small, distinctive species was recently described and illustrated. All specimens reported above were alive when collected and well preserved.

DISTRIBUTION. — Vanuatu region: Anatom, Efate, and Malakula; 419-536 m. Elsewhere: Indonesia; Ryukyu Islands; tropical Western Australia; 206-425 m (CAIRNS, 1998).

Genus CYATHOTROCHUS Bourne, 1905

Cyathotrochus pileus (Alcock, 1902)

Trochocyathus pileus Alcock, v*1902a: 96-97; v.1902c: 15-16, pl. 2, figs 11, 11a.
Cyathotrochus pileus - CAIRNS, 1997: 16, pl. 1, figs f-g, pl. 4, fig. f; 1998: 392.

AZOOXANTHELLATE SCLERACTINIA

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

REMARKS. — Descriptions and illustrations of this commonly collected deep-water coral can be found in CAIRNS (1989a, 1994, 1997). Most of the specimens reported above were alive when collected and possess four cycles of septa.

DISTRIBUTION. — Vanuatu region: Anatom, Tanna, and Efate; 300-497 m. Elsewhere: Indo-West Pacific from southwest Indian Ocean to Japan; 123-522 m (CAIRNS & ZIBROWIUS, 1997).

Genus DELTOCYATHOIDES Yabe & Eguchi, 1932

Deltocyathoides orientalis (Duncan, 1876)

Deltocyathus orientalis Duncan, *1876: 431.
Peponocyathus australiensis - CAIRNS, 1989a: 29, 30-32, pl. 14, figs d-j, pl. 15, figs a-d (synonymy); 1994: 65-66, pl. 28, figs c-f, pl. 41, fig. 1 (synonymy). [Not Deltocyathus italicus var. australiensis Duncan, *1870].


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

REMARKS. — This small, commonly collected and locally abundant coral was redescribed and illustrated by CAIRNS (1989, 1994) as Peponocyathus australiensis.

DISTRIBUTION. — Wallis and Futuna; 245-455 m. Late Pleistocene of Espiritu Santo, Vanuatu (WELLS, 1984). Elsewhere: Indo-West Pacific from southwest Indian Ocean to Japan; 44-635 m.

Genus NOTOCYATHUS Tenison Woods, 1880

Notocyathus conicus (Alcock, 1902)

Citharocyathus conicus Alcock, v*1902b: 118-119; v.1902c: 22, pl. 3, figs 18, 18a.
Notocyathus conicus - CAIRNS, 1989a: 28, pl. 13, figs a-i (synonymy); 1994: 64-65, pl. 28, figs a-b; 1995: 91-92, figs c, g, map 10; 1997: 17, pl. 4, fig. j. — CAIRNS & ZIBROWIUS, 1997: 143-144.

MATERIAL EXAMINED. — Vanuatu. MUSORSTOM 8: stn 1018, 1 cemented to a Xenophora shell (MNHN). — Stn 1067, 2 (MNHN).

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

REMARKS. — Three well-preserved specimens of N. conicus are reported herein, the largest 6.2 mm in CD and 7.8 mm in height. This species was redescribed and figured by CAIRNS (1989, 1994), as well as compared to the other Recent sibling species, N. venustus (Alcock, 1902). WELLS (1984) reported the "venustus" form of N. conicus from the Pleistocene of Vanuatu, but the small size and poor condition of his specimens do not allow a definite attribution between these two very similar species.

DISTRIBUTION. — Vanuatu region: Efate and Malakula; 344-366 m. Elsewhere: Japan; Philippines; Indonesia; Norfolk and Kermadec Ridges; 34-923 m (CAIRNS & ZIBROWIUS, 1997).
Genus *CRYPTOTROCHUS* Cairns, 1988

*Cryptotrochus* brevipalus sp. nov.

Figs 17 f, i

**Material Examined/Types.** — *Vanuatu.* MUSORSTOM 8: stn 988, 2 paratypes (MNHN). — Stn 1014, 1 paratype (MNHN). — Stn 1028, 1 paratype (USNM 98762). — Stn 1034, holotype (MNHN) and 1 paratype (MNHN). — Stn 1067, 1 paratype (USNM 98763).

**Type Locality.** — MUSORSTOM 8: stn 1034: 17°54'S, 168°42'E (Efaté), 690-750 m.

**Etymology.** — The species name *brevipalus* (Latin brevis, short + palus, stick) is a reference to the relatively short pali (P2) of this species. The name is treated as a noun in apposition.

**Description.** — Corallum a regular inverted cone, the blunt basal angle ranging from 68° to 72° (turbinate). Largest specimen (holotype) 10.3 mm in CD and 10.0 mm in height. Calice circular; theca thick, about 0.7 mm. Costae 0.4-0.5 mm wide at calicular edge, separated by deep intercostal furrows 40-50% the costal width. C1-C2 independent in origin, but C4 originate by trifurcation of C3 2.3-2.5 mm above base. Costae serrate, the outer edge of each costa covered with a single row of small teeth about 0.15 mm in diameter and height; smaller spines about 0.1 mm in height and 0.04 mm diameter project laterally from each costa into the intercostal spaces, although they are so small and well spaced that they do not obscure the view of the underlying theca between the costae. Corallum uniformly white.

Septa hexamerally arranged in 4 complete cycles in all specimens examined (CD = 6.0-10.3 mm): S1>S2>S3>S4, 48 septa. S1 about 1.8 mm exsert, extend about 3/4 distance to columella, having straight, vertical axial edges that fuse to the columella lower in fossa, having straight, vertical axial edges that fuse to the columella lower in fossa. S2 about 1.2 mm exsert and 2/3 with of the S1, each bearing a prominent palus (P2). S3 about 0.9 mm exsert and 3/4 width of the S2, their lower axial edges strongly fused to the peripheral edge of the P2 lower in fossa, but easily visible in calicular view. In fact, in some specimens it would appear that each S3 bears a palus, a pair of which unite before their common S2 to form a V-shaped P2 (as in the case of *Notocyathus*); however, each P2 in this species rises higher in the fossa (usually just above the level of the columella) as a single slender structure. S4 about 0.7 mm exsert, 2/3 width of the S3, and have free axial edges. Septal faces covered with very small spines, the same size and shape as those occurring on the lateral faces of the costae. Fossa of moderate depth, containing a papillose columella of 4-7 strongly fused elements.

**Remarks.** — Of the two other species known in the genus, *C. brevipalus* is most similar to *C. javanus* Cairns, 1988 (Java Sea, 585 m) in size and shape, and in having independent S4; however, differs in having serrate costae (not granular), S3 fused to the peripheral edge of P2, and in having less prominent P2. *C. brevipalus* resembles *C. carolinensis* Cairns, 1988 (western Atlantic, 320-338 m) in having serrate costae and S3 that fuse with the P2, but differs in having a larger and more open corallum (higher basal angle), independent S4, and pointed P2 that rise slightly higher in the fossa. Although not in the same genus, *C. brevipalus* resembles *Pleotrochus zibrowii* Cairns, 1997, in size, shape, and in having S3 that fuse to the peripheral edge of the P2. The two species have also been found at the same station; however, *C. brevipalus* differs in having a costae:septa ratio of 1 (vs 2), costal trifurcation (vs independent origin), a blunt base (vs pointed), and less prominent P2.

**Distribution.** — Vanuatu region: Tanna, Efaté, Malakula, and Espiritu Santo; 466-700 m.

Genus *IDIOTROCHUS* Wells, 1935

*Idiotrochus kikutii* (Yabe & Eguchi, 1941)

*Placotrochides kikutii* Yabe & Eguchi, *1941: 104; 1942: 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; 1997: 21, pl. 5, fig. g, pl. 7, fig. 1; 1998: 390. — Cairns & Zibrowius, 1997: 148-149.


Type locality. — Toyama Bay, Honshu, Japan (depth not given).

Remarks. — This distinctive, wedge-shaped species is well described and illustrated by Cairns (1989a) and Cairns & Zibrowius (1997).

Distribution. — Wallis and Futuna region: Futuna; 240-260 m. Elsewhere: western Pacific from Japan through Indonesia; Western Australia; 97-645 m (Cairns & Zibrowius, 1997).

Genus PEPOCYATHUS Gravier, 1915

Peponocyathus folliculus (Pourtales, 1868)

Figs 18 a-b

Stephanophyllia folliculus Pourtales, v*1868: 139.

Peponocyathus variabilis Gravier, v*1915: 5; v*1920: 39, pl. 4, figs 60-73, pl. 13, fig. 202, pl. 14, figs 203-204. 


Material examined. — Vanuatu. MusORSTOM 8: stn 1088, 1 attached to a Xenophora shell (MNHN).

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

Remarks. — The single specimen reported herein is "gourd"- or "onion-shaped", measuring 4.9 mm in greatest diameter, but only 3.3 mm in CD, having 30 septa. The species is known to be variable in shape, the onion-shaped form being well illustrated and discussed by Gravier (1920) and Zibrowius (1980). The specimen was dead when collected, and basally incorporated into a Xenophora gastropod shell. Xenophora gastropods, also called "carrier shells", appear to be efficient collectors of small, otherwise rarely collected deep-water Scleractinia, this particular shell (Fig. 18 a) having cemented eight solitary corals to its outer whorls, including: one P. folliculus, two Caryophyllia abrupta, three Trochocyathus discus, and two as yet unidentified species (i.e., Gardineriidae gen. nov. sp. nov. sensu Stolarski, 1996).

Distribution. — Vanuatu region: Espiritu Santo; 425-455 m. Elsewhere: Atlantic; western Pacific from Japan through Indonesia; 50-582 m (Cairns & Zibrowius, 1997).

Superfamily FLABELLOIDEA Bourne, 1905

Family GUYNIIDAE Hickson, 1910

Genus GUYNIA Duncan, 1872

Guynia annulata Duncan. 1872

Material Examined. — Wallis and Futuna region. Musorston 7: stn 504, 4 attached to theca of dead corallum of Conoتروches asymmetros (MNHN). — Stn 513, 1 attached to theca of dead corallum of Heterocryathus cf. salicus (MNHN). — Stn 569, 1 attached to theca of dead corallum of Flabellum arcuatile, n. sp. (MNHN).

Vanuatu. Musorston 8: stn 1016, 1 attached to base of dead discoidal coral, perhaps a Deltocyathus (USNM 98765). — Stn 1097, 1 cemented to a Xenophora shell (MNHN).

Type Locality. — Adventure Bank, Mediterranean, 168 m.

Remarks. — This extremely small, serpulid-like corallum is often found attached to living and dead coralla of other scleractinian species (see Material Examined). Although difficult to detect in collections because of its small size (CD about 1 mm) and its sometimes cryptic habit, its widespread distribution is becoming increasingly well known as large collections are closely examined. The species is more fully described and illustrated by Zibrowius (1980), Cairns (1989a), and Cairns & Parker (1992).


Genus Truncatoguynia Cairns, 1989

Truncatoguynia irregularis Cairns, 1989

Fig. 18 c

Truncatoguynia irregularis Cairns, *1989a: 43, pl. 22, figs f-g, pl. 23, figs a-c, f; 1994: 70, pl. 30, figs e-f; 1995: 93-94, pl. 29, figs g-h, pl. 30, figs a-b, map 12.

Truncatoguynia sp. Cairns, 1989a: 43, pl. 23, figs d-e.

Material Examined. — Vanuatu. Musorston 8: stn 967, 4 (one in 5 pieces) (USNM 98766).

Type Locality. — "Albatross" stn 5311: 21°33'N, 116°15'E (north of Pratas Island, South China Sea), 161 m.

Remarks. — This species was described and illustrated several times recently as indicated in the synonymy. The specimens reported above pertain to the diminutive form of the species, similar to those reported from NZOI stn C531 by Cairns (1989a, 1995). These specimen are characterised by an elongate, curved corallum up to 21 mm in length, but having a small calice of only 2.4-2.8 mm GCD, resulting in a length:GCD ratio of 7.3-7.6. The basal scar is correspondingly small (1.1-1.8 x 0.9-1.4 mm), coralla containing only 24 hexamerally arranged septa: S1,2>>S3.

Distribution. — Vanuatu region: Anatom; 295-334 m. Elsewhere: Ryukyu Islands; South China Sea; Norfolk and Kermadec Ridges; 80-248 m (Cairns, 1995).

Genus Temnotrochus Cairns, 1995

Temnotrochus kermadecensis Cairns, 1995

Figs 18 d-e

Temnotrochus kermadecensis Cairns, *1995: 96, pl. 31, figs a-d.

Material Examined. — Vanuatu. Musorston 8: stn 963, 1 cemented to a Xenophora shell (MNHN). — Stn 1023, 2 cemented to a Xenophora shell (MNHN).
TYPE LOCALITY. — 3.7 km off Nugent Island, Raoul Island, Kermadec Ridge, 366-402 m.

REMARKS. — Little can be added to the original description based on these three specimens. Temnotrochus kermadecensis is characterised as having an elongate compressed-cylindrical anthocyathus that originates by transverse division, a papillose columella, and paliform lobes before the S1-2. The characteristic thecal spots are often difficult to see, and are evident only on the specimen from MUSORSTOM 8 stn 963. The specimens reported above constitute the second report of this species and include specimens larger than in the type series, one from MUSORSTOM 8 stn 963 being 2.1 mm in GCD and 6.0 mm in length. All three specimens were obtained as objects cemented to the "carrier" gastropod shell Xenophora, an efficient collector of azooxanthellate corals of this size range.


Family FLABELLIDAE Bourne, 1905

Genus FLABELLUM Lesson, 1831

Subgenus FLABELLUM (FLABELLUM) Lesson, 1831

Flabellum (F.) pavoninum Lesson, 1831

Figs 18 g-i

Flabellum pavoninum Lesson, v1831: 2. — Cairns, 1989a: 46-50, pl. 23, figs g-i, pl. 24, figs a-d, g-h (synonymy); 1994: 70-71, pl. 30, figs i-j. — Cairns & Zibrowius, 1997: 150-151, fig. 20h.

Flabellum coalitum Marenzeller, v1888a: 48-49. — Cairns, 1989a: 46, 47, 50, pl. 24, figs e-f, i-l.

Flabellum sp. - Cairns, 1989a: 24, pl. 24, figs e-f.


TYPE LOCALITY. — "Sandwich Islands" (= Hawaiian Islands), no depth given.

DESCRIPTION (coalitum form). — Corallum flabellate: angle of thecal faces, 27°-47°; angle of thecal edges bimodal, the lower 5 mm of the corallum (the pedicel) having an edge angle of 40°-50°, above which the corallum widens to an edge angle of 62°-143°. Thecal faces virtually planar, meeting in acute thecal edges that bear a prominent, discontinuous edge crest composed of 1-4 (depending on size of corallum) thecal eversions, each eversion an irregularly shaped discrete structure up to 2.5 mm in height. Largest specimen examined (MUSORSTOM 8 stn 1102) 29.1 x 16.3 mm in CD and 22.5 mm in height. Basal disc quite small (0.9-1.0 mm in diameter), containing 6 protosepta, only the smallest coralla maintaining its original attachment to substrate. Theca dull in lustre, covered with fine transversely oriented ridges, and often covered with encrusting organisms, in four cases (MUSORSTOM 7 stn 538, MUSORSTOM 8 stns 976, 1104 and 1132) bored by acrothoracican Crustacea (Fig. 18 h). Lower 5 mm of corallum (basal disc and lower pedicel) white; remaining theca a light reddish brown, with more intense radial stripes corresponding to S1-3.

Septa hexamerally arranged in 5 cycles and often part of a sixth cycle (S1-S2>S4>S6) in larger coralla, pairs of S6 particularly common in the quarter systems adjacent to the principal septa, but also occurring in random
order in lateral face quarter systems; largest corallum contains 140 septa. Distal peripheral edges of S1-3 nonexsert, separated from thecal edge by a low notch or slight concavity, then projecting into fossa as a prominent lobe; midaxial edges of S1-3 often slightly concave, and lower axial edges thickened and very sinuous. The two principal S1 aligned with the GCD are smaller than the other 4 S1. Distal edges of S4 not lobate and thus much narrower than S1-3, but lower in fossa almost 3/4 width of the S1-3; axial edges straight. S5 about 1/3 width of an S4. When pairs of S6 are present, the S5 they flank widen to 2/3 the width of an S4 and the S6 are the size of a typical S5. Fossa deep and elongate; lower axial edges of S1-3 fuse to form a rudimentary columella.

REMARKS. — Although recently redescribed and figured (CAIRNS, 1989a, 1994; CAIRNS & ZIBROWIUS, 1997), F. pavoninum is redescribed above based on the abundance of well-preserved specimens of this otherwise poorly represented species. All specimens reported above pertain to the "coalitum" form of the species, as discussed by CAIRNS (1994) and CAIRNS & ZIBROWIUS (1997), which is distinguished from the typical form by having a smaller corallum, a lower edge angle, and fewer septa.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch Bank; 286-455 m. Vanuatu region: Anatom, Tanna, Erromango, Efate, Espiritu Santo, and Malakula; 161-400 m. Elsewhere: Indo-Pacific from southwest Indian Ocean to Hawaiian Islands, forma coalitum being most common off Japan; 73-665 m (CAIRNS & ZIBROWIUS, 1997).

Flabellum (F.) arcuatile sp. nov.

Figs 19 a-d

Flabellum (F.) angiostomum - CAIRNS, 1995: 99, pl. 32, figs d-f, map 13 [Not Flabellum angiostomum Folkeson, v*1919].


TYPE LOCALITY. — NZOI stn 197: 32°22.9'S, 167°28.2'E (southern Norfolk Ridge), 540-544 m.

ETYMOLOGY. — The species name arcuatile (Latin arcuatilis, shaped like a bow) refers to the regular crescent-shaped arc formed by the calicular margin.

DIAGNOSIS. — Corallum flabellate, highly compressed (GCD:LCD = 2.1-3.1), never constricted, and robust. Corallum wider than tall: GCD: H = 1.25-1.45. Thecal edges always rounded, the lower 7-9 mm of the corallum having an edge angle of 60°-80°, changing to a more open 125°-180° with height. Face angle = 26°-39°. Holotype 38.4 x 15.4 mm in CD and 28.3 mm in height, chosen because it represents a corallum with a full sixth cycle of septa; largest corallum (paratype from NZOI 197, NZOI) 49.8 x 20.5 mm in CD and 33.8 mm in height. Pedicel small: 1.1-1.3 mm in diameter. Thecal of well-preserved specimens uniformly reddish brown. Septa hexamerally arranged in 6 or more cycles, the sixth cycle attained at a GCD of 20-25 mm, and larger coralla having some pairs of S7: S1.4>S3>S6>S7. Axial edges of S1-4 extremely sinuous.

REMARKS. — Among the 23 Recent species in the subgenus, F. arcuatile is one of three species to have a flabellate corallum with rounded thecal edges, the other two species being F. knoxi Ralph & Squires, 1962 (New Zealand region south of 38°S), and F. impensum Squires, 1962 (Antarctic, 46-2200 m). F. arcuatile is most similar to F. knoxi, but differs in having a more robust corallum, a smaller pedicel with fewer protosepta (6 vs 12), a lesser developed columella, and a more compressed corallum.

A fuller description of Flabellum arcuatile can be found in CAIRNS (1995), as Flabellum angiostomum. I (CAIRNS, 1998) subsequently examined the type of Flabellum angiostomum, transferred it to the genus Truncatoflabellum, and eliminated the New Zealand records from its range, but did not at that time indicate the
identity of the New Zealand specimens previously identified as *F. angiostomum*, which now form part of the type series of *F. arcuatile*.

**DISTRIBUTION.** — Wallis and Futuna region: Wallis; Waterwitch, Combe, and Field Banks; 300-640 m. Elsewhere: southern Norfolk Ridge; Three Kings Ridge; 544-590 m (CAIRNS, 1995).

**Subgenus FLABELLUM (ULOCYATHUS) Sars, 1851**

*Flabellum (U.) deludens* Marenzeller, 1904

Fig. 18 f


**MATERIAL EXAMINED.** — **Wallis and Futuna region.** MUSORSTOM 7: stn 532, 1 (MNHN). **TYPE LOCALITY.** — "Valdivia" stns 185 and 203: west of Sumatra, 614-660 m.

**REMARKS.** — Only one worn specimen is reported herein, measuring 27.8 x 16.1 mm in CD, 20.6 mm in height, and 1.8 x 1.5 mm in PD, containing 72 septa - a pair of rudimentary S5 flanking each S3. This specimen is unusual in that its C1-2 are produced as prominent, rounded ridges (Fig. 18 f). The species is redescribed and illustrated by CAIRNS (1989a, 1994) and a table comparing similar species is given by CAIRNS & ZIBROWIUS (1997: Table 2).

**DISTRIBUTION.** — Wallis and Futuna region: Waterwitch Bank; 516-530 m. Elsewhere: Indo-West Pacific from northern Indian Ocean through Indonesia to Japan; 106-1035 m (CAIRNS & ZIBROWIUS, 1997).

*Flabellum (U.) aotearoa* Squires, 1964

Fig. 19 e


**TYPE LOCALITY.** — "Ikatare" stn B-26: 35°04'S, 174°23.2'E (Bay of Islands, near Cape Brett, New Zealand), 184 m (see CAIRNS, 1995).

**REMARKS.** — Although previously known from the Late Pleistocene of Vanuatu (WELLS, 1984), this is the first record of living specimens from this archipelago. The species was recently redescribed and illustrated by CAIRNS (1995). It is characterised by having a scalloped calicular edge; a granular, but lustrous theca; and S1-4 with highly sinuous axial edges. Several stations reported above (indicated with an asterisk) include populations that are diminutive in size, the coralla never exceeding 15 mm in GCD. These specimens nonetheless have a full fifth cycle and often have highly developed edge crests (Fig. 19 e), resulting in an edge angle (crests included) of 180°.

**DISTRIBUTION.** — Vanuatu region: Anatom, Tanna, Erromango, Efate, Malakula, and Espiritu Santo (including Late Pleistocene, see WELLS, 1984): 287-436 m. Elsewhere: northern New Zealand and ridges north of New Zealand; Chesterfield Islands; 130-1300 m (CAIRNS, 1995).
Flabellum (U.) marcus Keller, 1974

Fig. 19 f

Flabellum deludens - VAUGHAN, v*1907: 63-65, pl. 3, fig. 5 [Not Flabellum deludens Marenzeller. *1904].
Flabellum marcus Keller, *1974: 208-209, pl. 1, fig. 5, pl. 3, figs 5-6, pl. 5, fig. 8, text-fig. 1; 1981a: 31-32, pl. 1, figs 7a-b, pl. 2, figs 5a-b. — CAIRNS, 1984: 21.


Type locality. — "Vityaz" stn 6363: 21°10’N, 163°16’E (Marcus-Necker Ridge), 1350 m.

Remarks. — The best description of this species is that of specimens from Hawaii by VAUGHAN (1907), as Flabellum deludens. The specimens reported above differ from the Hawaiian populations in having a lesser edge angle (125°-142° vs 180°), and a taller pedicel (up to 4 mm vs 1.5-1.8 mm in diameter). They are otherwise quite similar and found at a comparable depth range.

Distribution. — Vanuatu region: Anatom and Efate; Guyot Bougainville; 1050-1175 m. Elsewhere: central Pacific, including Marcus-Necker Ridge and Hawaiian Islands; 1261-1602 m (CAIRNS, 1984).

Flabellum (U.) hoffmeisteri Cairns & Parker, 1992


Material examined. — Vanuatu. MUSORSTOM 8: stn 1014, 1 (MNHN).

Type locality. — "Soela" stn 27: 37°59’S, 150°05’E (off Victoria, Australia). 452 m.

Remarks. — Only one poorly-preserved corallum is reported herein measuring 33.1 x 20.6 mm in CD and 22.5 mm in height. Descriptions and illustrations can be found in CAIRNS & PARKER (1992) and CAIRNS (1995), and a table comparing similar species in CAIRNS & ZIBROWIUS (1997: Table 2).

Distribution. — Vanuatu region: Efate; 495-498 m. Elsewhere: Indonesia; Western Australia; Victoria; Tasmania; Kermadec and Colville Ridges; 110-646 m (CAIRNS, 1998).

Flabellum (U.) apertum apertum Moseley, 1876

Flabellum patagonichum Moseley, v*1881: 166-167, pl. 15, figs 1-7.
Flabellum raukawaensis Squires & Keyes, v*1967: 27, pl. 4, figs 8-9.
Flabellum apertum apertum - CAIRNS, 1995: 104-105, pl. 35, figs a-c, map 4 (synonymy).


Type locality. — "Challenger" stn 145: 46°40’S, 37°50’E (off Prince Edward Island), 567 m.

Remarks. — Little can be added to the redescriptions and figures of CAIRNS (1982, 1995). Once thought to be a species with an antiboreal distribution, it is now known from the warm temperate region off New Zealand (CAIRNS, 1995), and now from beneath tropical waters.
DISTRIBUTION. — Wallis and Futuna region: Combe and Tuscarora Banks: 795-1280 m. Elsewhere: circum-Subantarctic; New Zealand region to Three Kings Islands; 220-1575 m (CAIRNS, 1995).

Genus **TRUNCATOFLABELLUM** Cairns, 1989

*Truncatoflabellum stabile* (Marenzeller, 1904)

Figs 19 i-j

*Truncatoflabellum* sp. cf. *T. stabile* - CAIRNS & KELLER, 1993: 264-265, fig. 10C, F.  
*Truncatoflabellum* sp. A - CAIRNS, 1994: 79, pl. 34, figs c-e.

**Material Examined.**  

**Type Locality.**  
"Valdivia" stn 37: 16°14'01"N, 22°38'03"W (Cape Verde Islands), 1694 m.

**Description.**  
*Anthocyathus:* Angle of straight thecal edges 59°-73°; inclination of slightly convex thecal faces, 29°-40°. Thecal faces meet in an acute angle at the edges and are very slightly ridged within 1-4 mm of the basal scar, but edges do not bear crests or spines. Largest specimen reported herein (MUSORSTOM 8 stn 996) 28.2 x 16.9 mm in CD and 28.4 mm in height. Calicular margin slightly arched and finely serrate; GCD:LCD = 1.36-1.67; GCD:H = 1.00-1.15. Basal scar small and elliptical: 3.6-6.4 x 2.6-4.1 mm. Theca overlying Ci-2 produced as low, rounded longitudinal ridges, perpendicular to which are fine growth lines. Theca uniformly white. Anthocaulus 5.3 mm in height and 2.0 mm in pedicel diameter, having 3 cycles of septa.

Septa hexamerally arranged in 5 complete cycles: S1-2>S3>S4>S5, the base of an anthocyathus having only 3 cycles plus several pairs of S4 (24-32 septa), and a full fourth cycle present by a GCD of 11 mm. S1-2 only slightly wider than S3, whereas S3 are twice the width of the S4, and S5 are only about 1/3 the width of the S4. Axial edges of all septa straight and vertical, those of the S1-3 thickened deep in fossa near their fusion to the columella. Fossa deep, containing a well-developed, elongate columella 1.8-2.0 mm wide.

**Remarks.**  
Although smaller than previously reported specimens from the Atlantic, Mozambique, and Japan, which reach 48 mm in GCD, the specimens reported herein are believed to be conspecific. MARENZELLER (1904) described his larger syntype as having a GCD of 60 mm, but his figure implies a corallum with a GCD of 41 mm. The syntypes of *Flabellum stabile* appear to be lost (ZIBROWIUS, 1980). Among the 29 Recent species of *Truncatoflabellum*, only four lack edge spines and edge crests: *T. inconstans* (Marenzeller, 1904); *T. trapezoides* (Keller, 1981); *T. paripavoninum* (Alcock, 1898); and *T. stabile* (Marenzeller, 1904), the last three being found at great depths. Although I previously hesitated in identifying Pacific specimens as *T. stabile*, I now believe them to be the same based on the examination of specimens from the Madeira Islands (see Material Examined). Discussions and comparisons of the nonspinose *Truncatoflabellum* species are found in ZIBROWIUS & GILI (1990) and CAIRNS (1994). Although they are similar in corallum morphology, *T. stabile* differs from: *T. trapezoides* in having a smaller basal scar; from *T. paripavoninum* in having a smaller basal scar, a small edge angle, less septa, and a more robust corallum; and from *T. inconstans* in having less septa, a more circular calice, and a much deep depth range.

**Distribution.**  
*Vanuatu region:* Erromango and Efate; Guyot Bougainville; 786-1160 m. Elsewhere: Cape Verde, Selvagens, and Madeira Islands; Mozambique; Ryukyu Islands; 964-3010 m (ZIBROWIUS & GILI, 1990).
**Truncatoflabellum dens** (Alcock, 1902)

Figs 19 g-h


**Type Locality.** — "Siboga" stn 95: 5°43.5'N, 119°40'E (Sulu Archipelago, Philippines), 522 m.

**Diagnosis.** — Corallum small and compressed (GCD:LCD = 1.7-2.3), the largest specimen reported herein (MUSORSTOM 8 stn 1060) 8.6 mm in CD. Thecal edges rounded, at a height of about 6 mm above basal scar changing from an angle of 60°-80° to a more slender 20°-35°. At point of angular change there is usually a pair of short edge spines or low crests, often broken or worn away, as in the case of the syntypes. Basal scar quite small and almost circular, ranging from 1.4-1.7 x 1.1-1.3 mm in diameter, containing only 6 protosepta. Well-preserved coralla often show a reddish-brown longitudinal striping. Septa hexamerally arranged in 4 cycles (S1-2>S3>S4); however, pairs of S4 often lacking in lateral half-systems, resulting in 40-44 total septa. Large coralla may have additional pairs of S5 in the end half-systems, but may also be lacking pairs of S4 in the lateral half-systems. Axial edges of S1-2 highly sinuous.

**Remarks.** — This species is more fully described by Cairns (1989a, 1995). It is distinctive in having a relatively small corallum with a bimodal edge angle, and a very small, almost circular basal scar.

**Distribution.** — Wallis and Futuna region: Wallis; Combe, Waterwitch, and Field Banks; 286-500 m. Vanuatu region: Anatom, Tanna, Efate, Malakula, and Espiritu Santo; 314-410 m. Elsewhere: Philippines; Indonesia; Kermadec and Norfolk Ridges; New Caledonia; 300-555 m (Cairns & Zibrowius, 1997).

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**Truncatoflabellum pusillum** Cairns, 1989

Fig. 20 a


**Material Examined.** — **Vanuatu.** MUSORSTOM 8: stn 973, 2 (USNM 98891). — Stn 988, 1 (MNHN). — Stn 1016, 1 cemented to a Xenophora shell (MNHN). — Stn 1094, 1 (MNHN). — Stn 1097, 10, including 1 cemented to a Xenophora shell (MNHN). — Stn 1098, 1 (USNM 98892). — Stn 1106, 3 attached to a Xenophora shells (MNHN).

**Type Locality.** — "Albatross" stn 5178: 12°43'N, 122°06'15"E (Sibuyan Sea, Philippines), 143 m.

**Remarks.** — The original description suffices for this species. It is characterised as having a small corallum (usually less than 7 mm GCD) with straight, rounded thecal edges (edge angle = 14°-18°), each edge bearing 2-4 downward projecting thecal spines. The basal scar is elliptical, up to 3.3 mm in greater diameter, bearing 12-24 septa. Septa are arranged in 3 cycles (S1-2>S3), larger specimen having pairs of S4 in their end half-systems (i.e., usually 24-32 septa). It differs from *T. dens* by having a larger basal scar with more septa, a constant edge angle, and additional pairs of edge spines.

**Distribution.** — Vanuatu region: Tanna and Espiritu Santo; 285-460 m. Elsewhere: Philippines; Indonesia; Mozambique; 85-300 m (Cairns & Zibrowius, 1997).
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Truncatoflabellum angustum Cairns & Zibrowius, 1997

Fig. 20 b

Truncatoflabellum dens - Cairns, 1995: 114 (in part, pl. 37, figs f, h; NZOI K858)[Not Flabellum dens Alcock, v*1902].


Type locality. -- MusORSTOM 3 stn 143: 11°28.3'S, 124°11.6'E (Visayan Sea, Philippines), 205-214 m.

Remarks. -- Truncatoflabellum angustum was recently described and figured. In that account, specimens from MoNZ stn BS441, previously illustrated as T. dens by Cairns (1995: pl. 37, fig. g), were incorrectly listed as nontype specimens of T. angustum. Instead, those specimens should be considered as valid T. dens. T. angustum is most similar to T. pusillum, but differs by having a larger corallum, a higher edge angle, and more septa (i.e., usually 56).

Most of the specimens reported herein and most of the paratypes differ from the holotype in having 20 highly sinuous primary septa, not 24 S1-3.

Distribution. -- Futuna; 516-530 m. Vanuatu region: Efôté, Malakula, and Espiritu Santo; 295-394 m. Elsewhere: Philippines; Indonesia; Kermadec Islands; 195-465 m (CAIRNS & ZIBROWIUS, 1997).

Truncatoflabellum phoenix Cairns, 1995

Truncatoflabellum sp. B. - Cairns, 1994: 79, pl. 33, figs i, l.


Type locality. -- NZOI stn C531: 29°14'40"S, 178°02'W (Raoul Island, Kermadecs Islands), 179 m.

Remarks. -- This species is best characterised in its original description, and is distinguished from other species by having a small corallum with parallel thecal edges, and often elongate coralla caused by incomplete separation of successive anthocyathi. The specimens listed above differ from previously reported specimens in having an edge angle of 0°-10°, which results in a calicular diameter slightly greater than that of the basal scar, and a basal scar that reveals only 12 protosepta, instead of 24 protosepta as in typical T. phoenix. All other characters are similar.

Distribution. -- Wallis and Futuna region: Futuna; Waterwitch Bank; 240-441 m. Elsewhere: Philippines; Indonesia; Ryukyu Islands; Kermadec Islands; 18-421 m (CAIRNS & ZIBROWIUS, 1997).

Truncatoflabellum vigintifarium sp. nov.

Figs 20 c-f

Material examined/types. -- Vanuatu. MusORSTOM 8: stn 1004, 1 paratype (MNHN). -- Stn 1018, 3 paratypes (USNM 98900). -- Stn 1060, 1 paratype (MNHN). -- Stn 1065, 3 paratypes (USNM 98899). -- Stn 1094,

**Type Locality.** — MUSORSTOM 8 stn 1098: 15°04'S, 167°10'E (northeast of Espiritu Santo), 277-285 m.

**Etymology.** — The species name *vigintifarium* (Latin *viginti*, twenty + *farius*, a suffix meaning a multiplication in number of parts) refers to the 20-fold septal symmetry of the anthocyathus.

**Description of Anthocyathus.** — Corallum flabellate; angle of straight, rounded thecal edges, 67°-84°; face angle, 25°-30°. Holotype 21.1 x 9.7 mm in CD, 17.3 mm in height, and 2.9 x 2.0 mm in basal scar diameter; largest specimen (MUSORSTOM 8 stn 1018) 26.4 x 13.4 mm in CD. Calice elliptical: GCD:LCD = 1.95-2.40. Thecal edges bear 2 or 3 (usually 3) pairs of elongate (up to 5 mm), attenuate spines, the first pair occurring 3-4 mm above the basal scar and additional pairs regularly spaced at 2.5-3.0 mm intervals. Basal scar small (2.9-3.6 x 2.0-2.7 mm) and elliptical in shape (ratio of greater to lesser scar diameters 1.24-1.37-1.60), clearly showing 12 septa (Fig. 20 c). Theca thin and transversely wrinkled in a chevron pattern. Theca longitudinally striped with reddish-brown pigment. Anthocaulus stage unknown.

Despite the hexameral arrangement of septa in the basal scar, the septa of mature (GCD over 20 mm) specimens as expressed at the calicular margin are arranged 20-fold: 20:20:40, resulting in 80 septa. The distal, axial edges of the 20 primary septa are not exsert, but project well into the fossa, having straight distal axial edges and sinuous lower axial edges. Secondary septa much narrower, reaching their greatest width near the columella where they are about half the width of the primaries. Tertiary septa often rudimentary, usually only half the width and length of a secondary. Fossa deep and narrow, the columella a fusion of the lower axial edges of the 20 primary septa.

**Remarks.** — Among the 30 known Recent species of *Truncatoflabellum*, only one other has decametrically arranged septa in the adult anthocyathus stage: *T. formosum* Cairns, 1989. *T. vigintifarium* differs from that species primarily in shape, having a more flabellate corallum characterised by a higher edge angle (67°-84° vs 37°-59°) and a higher GCD:LCD (1.95-2.4 vs 1.4-1.8). It has a smaller basal scar and usually one more pair of edge spines.

**Distribution.** — Vanuatu region: Erromango, Efaté, Malakula, and Espiritu Santo; 288-700 m; however, most records between 300 to 400 m.

*Truncatoflabellum mortenseni* Cairns & Zibrowius, 1997

*Truncatoflabellum mortenseni* Cairns & Zibrowius, *1997: 171-172, figs 22g-h.


**Type Locality.** — MORTENSEN'S JAVA-SOUTH AFRICA EXPEDITION stn 5: 11°36'N, 121°43'E (Sulu Sea), 120-122 m.

**Remarks.** — This species is characterised by having an anthocaulus that, even after forming a single pair of edge spines, usually resists the tendency to transversely divide. This results in a relatively large, triangular anthocaulus with a small pedicel (0.9-1.1 mm in diameter), 1 pair of edge spines, and 56, 64, or 80 septa, depending on the development of the fifth septal cycle. Most of the specimens reported above represent this distinctive anthocaulus stage; however, some coralla represent the anthocyathus stage, which has a greater basal scar diameter of 6-8 mm, several pairs of edge spines, and usually a full five cycles of septa (96). Anthocauli and anthocyathi are often found at the same station.
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1.23

DISTRIBUTION. — Wallis; 350-455 m. Vanuatu region: Anatom, Malakula, and Espiritu Santo; 165-400 m. Elsewhere: Philippines; Indonesia; 50-156 m (CAIRNS & ZIBROWIUS, 1997).

Truncatoflabeilum vanuatu (Wells, 1984)


* Truncatoflabeilum vanuatu - CAIRNS, 1989a: 63, 69, pl. 36, fig. c.


Type locality. — Kere River (Late Pleistocene), Espíritu Santo, Vanuatu.

Remarks. — This species is characterised as having a small basal scar (4.1-4.9 mm in greater diameter) with 12 protosepta, low edge and face angles (20°-27°, 12°-17°, respectively), and a relatively tall corallum that bears up to five pairs of edge spines. In small to medium-sized coralla there are 16 primary septa (16:16: 24-32, = 56-64 septa), but in larger coralla there may be up to 20 primary septa (20:20:32-40, = 72-80 septa). Theca reported herein are all smaller than those in the type series, most having 16 primary septa and 56 septa. They are the first report of this species subsequent to its original description and first report from the Recent.

DISTRIBUTION. — Wallis and Futuna; 240-335 m. Vanuatu region: Late Pleistocene of Espíritu Santo (Wells, 1984).

Truncatoflabeilum aculeatum (H. Milne Edwards & Haime, 1848)

* Flabellum aculeatum H. Milne Edwards & Haime, v*1848a: 272, pl. 8, figs 3, 3a.

* Truncatoflabeilum aculeatum - CAIRNS, 1989a: 61, 64, table 6, pl. 31, figs h-t, pl. 32, figs a-c (synonymy); 1998: 399-400, table 4. — CAIRNS & ZIBROWIUS, 1997: 166-167.


Type locality. — Philippines (depth not given).

Remarks. — Although not reported from the MUSORSTOM cruises in this region, probably because of its shallow depth range, two typical specimens are reported from an independent collection made by J. N. CARNEY in 1975. The appearance of the specimens suggests a fossil age, perhaps Late Pleistocene, similar to the fauna reported by Wells (1984). T. aculeatum was redescribed and illustrated by CAIRNS (1989a).

DISTRIBUTION. — Vanuatu region: Espíritu Santo; 30-50 m. Elsewhere: Philippines; Indonesia (also Pleistocene of Talaud); Western Australia; Northern Territory; 11-115 m (CAIRNS, 1998).

Truncatoflabeilum candeanum (H. Milne Edwards & Haime, 1848)

* Flabellum candeanum H. Milne Edwards & Haime, *1848a: 278, pl. 8, fig. 13.


Material examined. — Vanuatu. MUSORSTOM 8: stn 1086, 4: 3 (MNHN), 1 (USNM 98907).

Type locality. — "Albatross" stn 5369: 13°48'N, 121°43'E (Luzon, Philippines), 194 m.
REMARKS. — Only one lot of this species is reported herein, probably because of its relatively shallow depth range. It is distinguished from other species by its slightly scalloped calicular margin and its three pairs of flattened edge spines. It is more fully described and illustrated by Cairns (1989a).

DISTRIBUTION. — Vanuatu region: Malakula; 182-215 m. Elsewhere: western Pacific from Kyushu through Indonesia; 70-290 m (Cairns & Zibrowius, 1997).

_{Truncatoflabellum martensii_} (Studer, 1878)

Figs 21 a-f

Flabellum Martensii Studer, v*1878: 630-631, pl. 1, figs 4a-b; 1889: 268.


TYPE LOCALITY. — "Gazelle" stn 40: 26°51.1'S, 153°29.6'E (off Brisbane, Queensland), 139 m.

DESCRIPTION. — Corallum flabellate: edge angle, 40°-63°; face angle, 17°-19°. Thecal faces almost planar, meeting in straight, sharply defined (but not carinate) edges that usually bear 3 pairs of spines. Holotype (ZMB 1798) 21.7 x 10.9 mm in CD, 7.7 mm in greater basal scar diameter, and 18.6 mm in height; largest known specimen (Pleistocene specimen figured by Wells, 1984; USNM 71858) 28.6 x 12.0 mm in CD, 8.3 mm in greater basal scar diameter, and 22.9 mm in height. Range of greater basal scar diameter 7.2-9.3 mm, well-preserved scars showing 4 complete cycles of septa. Theca dark reddish-brown overall, with more intense longitudinal striping associated with the S1-3. Basal scar, edge spines, and septa white. Anthocaulus unknown.

Septa hexamerally arranged in 5 cycles, small coralla having less than 96 septa, larger coralla having additional pairs of S6 in half-systems adjacent to the principal septa (See Remarks). Septa formula: S1-3>S4>S5>S6. Axial edges of S1-3 highly sinuous, their lower axial edges fusing into a columellar structure low in centre of fossa. S4-6 progressively narrower and less sinuous, their axial edges not attaining the columella.

REMARKS. — The number of septa per corallum is roughly a function of the GCD, the largest specimen (Wells' Pleistocene corallum from Vanuatu) of 28.6 mm GCD having 15 pairs of S6, or 126 septa, whereas a small anthocyathus of 16 mm GCD (e.g., MUSORSTOM 8 stn 1085) has only 64 septa. The transition to a full fifth cycle of 96 septa occurs at a GCD of 20-22 mm, the holotype of GCD 21.7 mm still having only 88 septa, but other specimens of similar GCD having 96 or even 104 septa. The first S6 occur in the four half-systems adjacent to the two principal septa, resulting in 104 septa, and are progressively inserted in half-systems away from the edge.

This is believed to be the first report of this species subsequent to its original description from off Brisbane. It is distinguished from other congeners by its sharply angled thecal edges, almost planar thecal faces, and its overall reddish-brown theca.

DISTRIBUTION. — Vanuatu region: Malakula; 161-182 m. Vanuatu region: Late Pleistocene of Espiritu Santo (Wells, 1984). Elsewhere: off Brisbane, Queensland, 139 m (Studer, 1878).

Genus _JAVANIA_ Duncan, 1876

_Javania lamprotichum_ (Moseley, 1880)

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Type locality. - Unknown.

Remarks. - Of the ten Recent species in this genus, J. lamprotichum is one of five that has five cycles of septa. It is further distinguished by having a relatively large corallum, a flared calice, and usually having a reddish-brown theca, although the thick tectural deposits reinforcing the pedicel are usually white. Reported herein is the largest known specimen of this species (MUSORSTOM 8 stn 975), measuring 46.8 x 36.2 mm in CD and 47.9 mm in height, the base being broken above its attachment. One corallum, from MUSORSTOM 8 stn 974, contains several acrothoracican cirripede borings, a commensalism previously reported for this species by Cairns & Zibrowius (1997) and Cairns (1998). The species was most recently redescribed and illustrated by Cairns (1995).

Distribution. - Wallis and Futuna region: Wallis; 890-920 m. Vanuatu region: Tanna and Efate; 466-536 m. Elsewhere: central and western Pacific (Hawaiian Islands, Johnston Atoll, Philippines, Kermadec Ridge); Western Australia; 191-842 m (Cairns, 1998).

Javania fusca (Vaughan, 1907) comb. nov.

Figs 20 g-i

Placotrochus fuscus Vaughan, v*1907: 66-67, pl. 4, figs 2-3.
"Placotrochus" fuscus - Cairns, 1989a: 45, 75.
Javania pachytreca Cairns, *1995; 112-113, pl. 36, figs j-l, pl. 37, fig. a, map 17. - Cairns & Zibrowius, 1997: 165, figs 21i, 22a.


Type locality. - "Albatross" stns 3886 and 3999: Kauai and Molokai Islands, Hawaiian Islands. 271 m.

Diagnosis. - Corallum small (GCD usually less than 9 mm), straight, and ceratoid to subcylindrical, with a thickened pedicel. Calice only slightly elliptical: GCD:LCD = 1.1-1.2; calicular edge serrate, triangular apices corresponding to the 24 S1-3, these projections best preserved and seen in small specimens. Theca thick, covered with numerous, very small, porcellaneous granules. Base colour of corallum white, but often pigmented with brownish-black rings encircling the theca, and irregular pigmentation of the same colour on the distal peripheral faces of the S1-2. Septa hexamerally arranged in 4 complete cycles: S1-2>S3>S4 (48 septa). S1-2 1.2-1.5 mm exsert, having slightly sinuous axial edges. S3 up to 0.5 mm exsert and only 1/2-1/3 width of the S1-2, having moderately sinuous axial edges. S4 only 1/5-1/4 width of the S3, also having moderately sinuous axial edges. Fossa deep and lacking a columella, as is consistent with the generic definition.

Remarks. - This species was originally placed in the genus Placotrochus by Vaughan because of the presence of a well-formed lamellar columella in one of the three syntypes (corallum number "1" of Vaughan, 1907, USNM 20734), notwithstanding the fact that a columella could not be found in the other two syntypes. After careful cleaning and examination, it was discovered that the columella in specimen 1 was simply a fragment from a distal septal margin, probably from the same specimen, that had accidently become lodged in an axial
columellar position. This fragment has now been removed from the fossa. Lacking a columella, this species naturally falls into the genus *Javania*; in fact, it is the senior synonym of a species I recently described as *J. pachytheca* Cairns, 1995.

VAUGHAN (1907) originally designated three syntypes of *Placotrochus fuscus*, two from "Albatross" stn 3999 and one from stn 3886, listing two USNM catalog numbers for the specimens: 20731 and 20732. Whereas USNM 20732 applies to the single syntype (specimen #2: VAUGHAN's pl. 4, fig. 2) from "Albatross" stn 3886, USNM 20731 was previously assigned to the holotype of *Gardineria hawaiiensis*, a species described by VAUGHAN on the page previous to *Placotrochus fuscus*. The true catalog numbers (see CAIRNS, 1991b) for the remaining two syntypes from "Albatross" stn 3999 are: 20733 (specimen #3, VAUGHAN's pl. 4, fig. 3) and 20734 (specimen #1, unfigured by VAUGHAN).

Two of the specimens examined have acrothoracican cirripede borings: one from MUSORSTOM 8 stn 988 (Fig. 20 i), the other being one of the three syntypes (USNM 20733).

**DISTRIBUTION.** — Wallis and Futuna region: Wallis and Futuna; Waterwitch, Combe, and Field Banks; 600-730 m. Vanuatu region: Anatom, Tanna, and Espiritu Santo; Guyot Bougainville; 314-778 m. Elsewhere: Indonesia; Malaysia; northern New Zealand; Kermadec Ridge; Lord Howe Seamount Chain; Aitutaki Atoll, Cook Islands [not Chesterfield Islands, as incorrectly reported by CAIRNS (1995) and CAIRNS & ZIBROWIUS (1997) for *J. pachytheca*]; Hawaiian Islands; 271-1045 m.

**Javania exserta** sp. nov.

Figs 21 g-i


*Javania* sp. - CAIRNS & ZIBROWIUS, 1997: 165, figs 22b-c.


**Philippines.** MUSORSTOM 1: stn 65, 1 paratype (MNHN).


**Caroline Islands (Pelau).** "Short drop off"; 91 m, 1 fragment of a corallum, paratype (USNM 98956).

**TYPE LOCALITY.** — **KARUBAR** stn 44: 7°52'27"S, 132°48'24"E (south of Tanimbar Island), 291-295 m.

**ETYMOLOGY.** — The species name *exserta* (Latin *exsertus*, project or exsert) refers to the highly exsert S1-2 of this species.

**DESCRIPTION.** — *Corallum* ceratoid and straight, having a slightly flared calicular edge. Calice slightly elliptical: GCD:LCD = 1.05-1.20. Holotype 15.6 x 13.7 mm in CD, 33.8 mm in height, and 7.2 mm in PD. Calicular edge highly serrate, a tall, acute triangular apex corresponding to each S1-2. Calicular edge between S1-2 of small specimens straight, but with increasing size becoming slightly convex or rounded, and in the largest specimens expressed as a low, obtuse, triangular apex corresponding to the S3. Theca porcellaneous and usually white; however, specimens from KARUBAR stations pigmented a light purple-grey. Ridged C1-2 sometimes expressed within 0-3 mm of calicular edge.

Septa hexamerally arranged in 4 complete cycles (48 septa): S1>S2>S3>S4. S1 extremely exsert, in the holotype as much as 6.5 mm, but even in coralla of moderate size, 3-4 mm. Axial edges of S1 straight and vertical, the 4 lateral S1 almost meeting in centre of fossa. S2 also quite exsert but only 1/2-2/3 that of the S1, about 3/4 width of the S1, and also less thick than the S1. S3 not exsert: rudimentary or absent near calicular edge,
increasing to about 3/4 width of S2 lower in fossa. S4 also nonexsert, 1/3-1/2 width of the S3. Axial edges of S1-2 slightly sinuous. Fossa deep and narrow.

**Remarks.** — *Javania exserta* is distinguished from the other three Recent species in the genus that have four cycles of septa (*J. cailleti* Duchassaing & Michelotti, 1864); *J. pseudoalabastra* Zibrowius, 1974; and *J. fusca* (Vaughan, 1907)) by its relative septal exsertness: its S1 being larger than its S2, and its S3-4 being nonexsert.

Specimens from MUSORSTOM 8 stn 1085 and KARUBAR stn 86 contain acrothoracican cirripede borings.

**Distribution.** — Wallis and Futuna region: Wallis and Futuna; Waterwitch Bank; 295-455 m. Vanuatu region: Anatom, Tanna, Efate, Epi, and Malakula; 130-408 m. Elsewhere: Philippines; Arafura Sea south of Tanimbar Island; Pelau; Bikini, Marshall Islands; 91-291 m.

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

**Rhizotrochus typus** H. Milne Edwards & Haime, 1848

Fig. 22a

*Rhizotrochus typus* H. Milne Edwards & Haime, 1848a: 282, pl. 8, fig. 16. — Cairns, 1989a: 79-81, pl. 41, figs f-j (synonymy); 1994: 81, pl. 35, figs a-c, pl. 40, figs h-i (synonymy). — Cairns & Zibrowius, 1997: 161, figs 22d-e.


**Type Locality.** — Singapore, South China Sea (depth not given).

**Remarks.** — Three specimens of this common, relatively shallow-water azooxanthellate are reported herein. The genus is distinguished from other genera in the region by having several cycles of discrete (free standing, not contiguous with corallum), hollow rootlets. *R. levidensis* Gardiner, 1899, known from nearby Loyalty Islands at 84 m, differs in having a much smaller corallum (*GCD < 6 mm*) and fewer septa (< 34). *R. typus* was recently redescribed and figured by Cairns (1989a).

**Distribution.** — Vanuatu region: Efate, Malakula, and Espiritu Santo; 130-194 m. Elsewhere: Indo-West Pacific from Red Sea to Japan; 20-1048 m (Cairns & Zibrowius, 1997).

**Rhizotrochus flabelliformis** Cairns, 1989

*Flabellum latum* - Alcock, v.1902c: 31 [Not *F. latum* Studer, 1878].

*Rhizotrochus flabelliformis* Cairns, 1989a: 81, pl. 41, figs k-l, pl. 42, figs b, d; 1995: 109-110, pl. 35, figs g-i, pl. 36, figs a-b, map 17.


**Material Examined.** — Wallis and Futuna region. MUSORSTOM 7: stn 511, 1 (MNHN).

**Type Locality.** — "Siboga" stn 105: 6°08′N, 121°19′E (Sulu Archipelago, Philippines), 275 m.

**Remarks.** — One relatively small (*GCD=24 mm*), worn specimen is reported herein, still in the process of forming its edge rootlets. It is distinguished from all other corals in this region by having two massive rootlets, one on each corallum edge. It is best described and illustrated by Cairns (1995).

**Distribution.** — Futuna; 400-450 m. Elsewhere: Philippines; Indonesia; New Zealand; 228-419 m (Cairns & Zibrowius, 1997).
Genus **POLYMYCES** Cairns, 1979

*Polymyces wellsi* Cairns, 1991


**MATERIAL EXAMINED.** — Vanuatu. Musorostom 8: stn 975, 1 (MNHN).

**TYPE LOCALITY.** — "Johnson-Sea-Link" stn 1916: 1°18.7’S, 89°48.8’W (Española, Galápagos), 545-562 m.

**REMARKS.** — One live specimen, with tissue preserved, is reported. This species is distinctive in having four asymmetrically arranged, contiguous rootlets, all four rootlets occurring on one side of the corallum. It is best described and illustrated by CAIRNS (1995).

**DISTRIBUTION.** — Vanuatu region: Tanna; 536-566 m. Elsewhere: Philippines; Indonesia; northwestern Australia; northeastern New Zealand; Kermadec Islands; Galápagos; 355-1165 m (CAIRNS & ZIBROWIUS, 1997).

Superfamily **VOLZEOIDEA** Melnikova, 1974

Family **GARDINERIIDAE** Stolarski, 1996

Genus **GARDINERIA** Vaughan, 1907

*Gardineria hawaiiensis* Vaughan, 1907


*Gardineria musorstonica* Cairns, *1989a: 82-83, pl. 42, figs c, e-g.


**TYPE LOCALITY.** — "Albatross" stn 3991: 22°15'24"N, 159°23'15"W (Kauai, Hawaiian Islands), 497-541 m.

**REMARKS.** — This species is characterised by having a thick epithecal wall, and hexamerally arranged septa in four cycles and three size classes, the last cycle incomplete (24-44 septa). Larger specimens possess 6 P2 and a rudimentary columella. *G. hawaiiensis* is best described and figured by STOLARSKI (1996).

**DISTRIBUTION.** — Vanuatu region: Erromango, Efâ‘é‘, and Malakula; 366-574 m. Elsewhere: Philippines; New Caledonia (STOLARSKI, 1996); Norfolk Ridge; Kermadec Islands; Bay of Plenty, New Zealand; Western Australia; Hawaiian Islands; 142-602 m (CAIRNS, 1995).

*Gardineria paradoxa* (Pourtales, 1868)

Fig. 22 b

*Haplophylia paradoxa* Pourtales, *1868: 140-141.


**MATERIAL EXAMINED.** — Vanuatu. MUSORSTOM 8: 1014, 1 (MNHN).

**TYPE LOCALITY.** — "Bibb" stn 22: 24°14'20"N, 80°59'40"W (Straits of Florida), 692 m.
REMARKS. — The single specimen reported herein measures 9.3 mm in CD and 36.6 mm in length, having a lateral thecal attachment for the basal 17 mm. It has 40 septa (20:20:40) and is very similar to the specimen reported by CAIRNS & ZIBROWIUS (1997) from the Banda Sea. *G. paradoxa* is distinguished from other congeners by having decamerally arranged septa, a strong lateral thecal attachment, and a heavily encrusted and worn looking corallum, even when the coral is collected alive.

DISTRIBUTION. — Vanuatu region: Efate; 495-498 m. Elsewhere: Banda Sea; western Atlantic (Antilles); 91-700 m.

Suborder DENDROPHYLLIINA

Family DENDROPHYLLIIDAE Gray, 1847

Genus *BALANOPHYLLIA* Searles Wood, 1844

REMARKS. — There are approximately 58 valid Recent species of *Balanophyllia* worldwide, and the genus is badly in need of revision (CAIRNS, 1995: 118). There are several reasons for the confused state of taxonomy in this genus. First, the range of corallum variation is poorly known for most species, several species known only from their type specimens. In an extreme case [i.e., *B. corniculans* (Alcock, 1902a)], the species was based on one specimen that is now lost, and no figure of the holotype or indication of the type locality was included in the original description. Secondly, basally-broken corallites of other genera, such as *Rhizopsammia*, *Eguchipsammia*, *Cladopsammia*, and even *Dendrophyllia*, could be mistaken for a *Balanophyllia*, and the juvenile stage of all of these genera pass through a solitary *Balanophyllia*-like stage. Third, most species of *Balanophyllia* are provincial in distribution, endemic to one side of an ocean basin, and thus a large number of species have been described, making it difficult to do a comprehensive comparison of unidentified material. Although the Atlantic species have been revised (CAIRNS, 1977; ZIBROWIUS, 1980), there has been no comprehensive worldwide revision of the genus. A subgeneric division or a good dichotomous key would alleviate some of these difficulties. At this point, however, it is useful to compare specimens collected from a geographic region to others known from that region. For instance, there are 10 species known from the western Atlantic, 4 from the eastern Atlantic, 5 from the southwestern Indian Ocean, 4 from the northern Indian Ocean, 5 from eastern Australia, 3 from New Zealand, 5 from the Hawaiian Islands, 21 from the tropical western Pacific (including northwestern Western Australia), 3 from the eastern Pacific, and one from the Subantarctic. There appears to be little cross over of species between regions. For instance, there are no species in common between the eastern and western Atlantic, and the eastern Pacific fauna is also discrete; however, there are several species that have wider distributions in the tropical western Pacific and the Hawaiian Islands and/or Japan and/or New Zealand. Therefore, in identifying the specimens collected by MUSORSTOM 7 and 8, all species known from the western and central Pacific were considered, but, even so, I was only able to confidently identify about one-third of the specimens available as one of six of the more common species.

*Balanophyllia desmophylloides* Vaughan, 1907

Fig. 22 c

*Balanophyllia desmophylloides* Vaughan, v*1907: 149-150, pl. 45, fig. 1. — CAIRNS & ZIBROWIUS, 1997: 177-178, figs 23g-h.


**Balanophyllia laysanensis** Vaughan, 1907

*Figs 22 d-e*

*Balanophyllia laysanensis* Vaughan, v*1907*: 150-151, pl. 45, figs 2a-b.


**TYPE LOCALITY.** — “Albatross” stn 3937: 25°52′05″N, 171°46′47″W (Laysan Island, Hawaiian Islands), 238-271 m.

**REMARKS.** — Little can be added to the VAUGHAN’s original description. The species can be characterised as having a straight, ceratoid corallum with a highly serrate calicular margin. The theca is highly porous and coarsely granular; costae are poorly defined, but the C1-2 are prominent. Septa are arranged in 4 complete cycles, pairs of S4 bending toward but not quite fusing before their enclosed S3 relatively low in fossa.

This is the first report of *B. laysanensis* subsequent to its original description.

**DISTRIBUTION.** — Vanuatu region: Anatom; 377-400 m. Elsewhere: Laysan, Hawaiian Islands; 238-271 m (= type locality).

**Balanophyllia rediviva** Moseley, 1881


**MATERIAL EXAMINED.** — *Vanuatu*. **MUSORSTOM 8:** stn 970, 1 (MNHN). — Stn 1077, 2 (USNM 98928). — Stn 1134, 2 (MNHN).

**TYPE LOCALITY.** — “Challenger” stn 192: 5°49′15″S, 132°14′15″E (Kai Islands, Banda Sea), 256 m.

**REMARKS.** — *Balanophyllia rediviva* was recently redescribed and figured by CAIRNS & ZIBROWIUS (1997). It is distinguished by having an elongate, subcylindrical corallum that often shows signs of rejuvenescence, the rejuvenated corallum often smaller in calicular diameter than the parent. Its costae (C1-3) are also characteristically slightly ridged.
DISTRIBUTION. — Vanuatu region: Anatom, Malakula, and Espiritu Santo; 210-252 m. Elsewhere: Philippines; Indonesia; 90-256 m (CAIRNS & ZIBROWIUS, 1997).

Balanophyllia gemma (Moseley, 1881)

_Thecopsammia gemma_ Moseley, v*1881: 195, pl. 15, figs 8a-b. 
_Balanophyllia gemma_ - CAIRNS & ZIBROWIUS, 1997: 179, figs 24g-i (synonymy).


**TYPE Locality.** — "Challenger" stn 201: 7°03'N, 121°48'E (Sulu Sea), 187 m.

**REMARKS.** — _Balanophyllia gemma_ was recently redescribed and the holotype illustrated by CAIRNS & ZIBROWIUS (1997). It is characterised by having a well-developed epithecathat covers most of the theca; low, equal costae; and a shallow fossa containing a discrete, swirled columella.

DISTRIBUTION. — Vanuatu region: Efate; 397-430 m. Elsewhere: Philippines; Indonesia; 137-522 m (CAIRNS & ZIBROWIUS, 1997).

Balanophyllia gigas Moseley, 1881


**MATERIAL EXAMINED.** — **Vanuatu.** MUSORSTOM 8: stn 977, 1 (MNHN).

**TYPE LOCALITY.** — Japan (depth unknown).

**REMARKS.** — _Balanophyllia gigas_ is well described and figured by CAIRNS (1994, 1995), including an illustration of the holotype. The single specimen reported herein measures 24.5 x 21.5 mm in CD and 54.5 mm in height. WELLS’ (1984) Pleistocene specimens from Vanuatu (USNM 71862) were re-examined and considered conspecific. _B. gigas_ attains the largest size of all _Balanophyllia_, and usually has five cycles of septa, if not some _S6_ in various half-systems.

DISTRIBUTION. — Vanuatu region: Tanna; 410-505 m; Late Pleistocene of Espiritu Santo (WELLS, 1984). Elsewhere: widely distributed in western Pacific from Hawaiian Islands to New Zealand and West Australia; 90-640 m (CAIRNS & ZIBROWIUS, 1997).

Balanophyllia crassitheca Cairns, 1995

_Balanophyllia crassitheca_ Cairns, *1995: 120-121, map 18, pl. 40, fig. i, pl. 41, figs a-b.

**MATERIAL EXAMINED.** — **Vanuatu.** MUSORSTOM 8: stn 978, 1 (MNHN).

**TYPE LOCALITY.** — 37°17.0'S, 176°51.0'E (Rangatira Knoll, northwest of White Island, Bay of Plenty, New Zealand), 251-308 m.

**REMARKS.** — The single record reported herein does little more than extend the known distribution slightly to the north. The species is distinguished by having a very thick theca and crowded septa.

DISTRIBUTION. — Vanuatu region: Tanna; 408-413 m. Elsewhere: northeastern New Zealand; Lord Howe and Norfolk Islands; Kermadec Ridge; 190-508 m (CAIRNS, 1995).
Genus *ENDOPACHYS* H. Milne Edwards & Haime, 1848

*Endopachys grayi* H. Milne Edwards & Haime, 1848

Fig. 22 f


**TYPE LOCALITY.** — Unknown.

**REMARKS.** — Most specimens of this commonly collected species are easily distinguished by having unattached, cuneiform-shaped coralla with prominent edge cressts; assexual budding; and five cycles of septa. Its wide distribution may be due to its reproductive success, which employs two modes of asexual reproduction: transverse division and anthoblast production (= bud shedding)(see CAIRNS, 1989b). In the first case, once an attached anthocaulus reaches a height of about 7 mm and a GCD of 3.5-4.0 mm, it forms a crested anthocyathus that subsequently transversely divides from the anthocaulus (Fig. 22 f). The detached, free-living anthocyathus maintains the characteristic basal scar (greater diameter 3.5-4.0 mm) for a time but eventually heals its base, which becomes rounded. Each anthocyathus has the potential to form numerous buds (anthoblasts), which form at the calicular edge, usually adjacent to the edge cressts. Only one other coral species is known to employ both asexual reproduction strategies, *Blastotrochus nutrix* H. Milne Edwards & Haime, 1848, a member of a different suborder.

**DISTRIBUTION.** — **Wallis and Futuna region:** Futuna; 390-441 m. **Vanuatu region:** Anatom, Tanna, Erromango, Efate, Espiritu Santo, and Malakula; 181-360 m. **Elsewhere:** widespread throughout tropical and warm temperate Indo-Pacific, from the southwestern Indian Ocean to the Gulf of California; 37-386 m (CAIRNS & ZIBROWIUS, 1997).

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

*Heteropsammia cochlea* (Spengler, 1781)

*Madrepora cochlea* Spengler, *1781*: 240-248, figs A-D.


**TYPE LOCALITY.** — Tranquebar, off southeastern India.

**REMARKS.** — The species is easily distinguished by its obligate symbiotic association with a sipunculid worm, which is housed in the base of the corallum and communicates with the environment through one large efferent pore in the base of the corallum and several smaller pores on the lower theca. It is similar in shape to
species of *Heterocyathus*, which also lives with an obligate sipunculid, but differs in having a porous upper theca, and septa that are arranged in a Pourtalès plan. *H. cochlea* is best described and figured by VERON & PICHON (1980) and HOEKSEMA & BEST (1991). Shallow-water representatives of this species are assumed to be azooxanthellate, whereas the deeper specimens must be azooxanthellate.

**DISTRIBUTION.** — Wallis and Futuna region: Futuna; 110-441 m. Vanuatu region: Anatom, Tanna, and Espiritu Santo; 110-622 m. Elsewhere: widespread throughout tropical Indo-West Pacific; 9-137 m, although depths have rarely been reported (HOEKSEMA & BEST, 1991).

**Genus DENDROPHYLLIA** Blainville, 1830

*Dendrophyllia ijimai* Yabe & Eguchi, 1934


*Dendrophyllia subcornigera* - WELLS, v.1984: 215-216, fig. 5 (4-5) [Not *D. subcornigera subcornigera* Eguchi, 1968].

*Dendrophyllia* sp. cf. *D. ijimai* - CAIRNS & ZIBROWIUS, 1997: 191-192, fig. 29e.

**MATERIAL EXAMINED.** — USGS stn 25715 (*Dendrophyllia subcornigera* of WELLS, 1984): figured specimen (USNM 71863), 12 branches (USNM 73976).

**TYPE LOCALITY.** — Unknown, but presumed to be from off Japan.

**REMARKS.** — *Dendrophyllia ijimai* belongs to the "first group" of *Dendrophyllia* species sensu CAIRNS (1995), this group characterised by having a robust axial corallite from which additional corallites bud at right angle. WELLS (1984) correctly identified the Vanuatu Pleistocene specimens as *D. subcornigera*, listing *D. ijimai* as a junior synonym, not realizing that *D. ijimai* was described earlier. The nominal subspecies of *D. subcornigera* is probably a junior synonym of *D. arbúsculo* van der Horst, 1922 (see CAIRNS, 1995). *D. ijimai* was recently redescribed and figured by CAIRNS (1995).


*Dendrophyllia arbuscula* van der Horst, 1922


*Dendrophyllia horsti* Gardiner & Waugh, v*1939: 237-238, pl. 2, figs 5-6.

**MATERIAL EXAMINED.** — Vanuatu. MUSORSTOM 8: stn 1018, 4 colonies (USNM 98938). — Stn 1021, 1 colony (MNHN). — Stn 1030, 2 colonies and 2 branches (MNHN). — Stn 1058, 2 colonies and 1 branch (MNHN).

**TYPE LOCALITY.** — "Siboga" stns 260 and 277: Banda Sea, 45-90 m.

**REMARKS.** — *Dendrophyllia arbuscula* is the only species reported herein that belongs to *Dendrophyllia* "group 2" sensu CAIRNS (1995), i.e., species having relatively small, bushy colonies with irregular branching from a short, but robust axial corallite. It is distinctive in having a relatively shallow fossa with a well-developed columnella that is often constricted into three lobes. It was recently redescribed and figured by CAIRNS (1994, 1995).
DISTRIBUTION. — Vanuatu region: Efate and Malakula; 130-319 m. Elsewhere: Indo-West Pacific from southwestern Indian Ocean to Japan; 2-353 m (CAIRNS, 1998).

**Dendrophyllia alcocki** (Wells, 1954)

*Dendrophyllia alcocki* - *ZIBROWIUS, 1974b: 570-573, figs 10-14. — CAIRNS, 1995: 126-127, pl. 43, figs g-i, pl. 44, figs a-b, map 3 (synonymy); 1998: 408, fig. 9g. — CAIRNS & ZIBROWIUS, 1997: 193.

**MATERIAL EXAMINED.** — **Wallis and Futuna region.** MUSORSTOM 7: stn 506, 1 colony (MNHN). — Stn 514, 3 branches (USNM 98943).  

**TYPE LOCALITY.** — Bikini Atoll, Marshall Islands, 177-243 m.

**REMARKS.** — *Dendrophyllia alcocki* belongs to the “third group” of *Dendrophyllia* species sensu CAIRNS (1995), i.e., those species having dendroid coralla produced by sympodial branching. *D. alcocki* is further distinguished as having dense, spinose coenosteum (porous only near distal branch tips); three cycles of septa; and prominent P2. It was recently redescribed and illustrated by CAIRNS (1995).

**DISTRIBUTION.** — Wallis and Futuna region: Futuna; 355-400 m. Vanuatu region: Anatom, Tanna, Efate, and Espiritu Santo; 315-475 m. Elsewhere: Indo-West Pacific from Maldive Islands to New Zealand, including the Marshall Islands and South China Sea; 118-616 m (CAIRNS, 1998).

Genus *Enallopsammia* Michelotti, 1871

**Enallopsammia rostrata** (Pourtalès, 1878)

*Amphihelia rostrata* Pourtalès, v*1878: 204, pl. 1, figs 4-5.  

*Enallopsammia amphelioides* - *ZIBROWIUS, 1973: 45-46 (Tuamotu Archipelago).


**TYPE LOCALITY.** — "Blake" stn 2: 23°14'N, 82°25'W (Strait of Florida), 1472 m.

**REMARKS.** — This widespread species varies in calicular diameter and the expression of the costoseptal rostrum (see CAIRNS, 1982, 1995). All Vanuatu specimens lack the costoseptal rostrum and have calices of intermediate size (2.6-3.5 mm GCD), whereas those from the Wallis and Futuna region represent rostrate and nonrostrate forms (see Material Examined). There seems to be no correlation between having a rostrum and GCD, the rostrate forms ranging from 2.3 (MUSORSTOM 7 stn 574) to 4.1 (MUSORSTOM 7 stn 530) mm in GCD. *E. rostrata* was recently redescribed and figured by CAIRNS (1994, 1995). It is easily distinguished from other colonial deep-water corals
AZOOXANTHELLATE SCLERACTINIA from this region by having a flabellate colony with unifacially arranged corallites, the corallites often having a prominent costoseptal rostrum; and three cycles of normally inserted septa.

The corallum of one specimen from MUSORSTOM 7 stn 501 contained several acrothoracican crustacean borings.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch Bank; 400-920 m. Vanuatu region: Anatom, Tanna, Erromango, and Efate; 370-574 m. Elsewhere: cosmopolitan, except for eastern Pacific and off continental Antarctica; 110-2165 m (CAIRNS & ZIBROWIUS, 1997).

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