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Cnidaria Anthozoa: Deep-water azooxanthellate Scleractinia from Vanuatu, and Wallis and Futuna Islands

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ABSTRACT

A total of 134 Recent species of azooxanthellate Scleractinia are reported from the Vanuatu (116 species) and Wallis and Futuna (83 species) Archipelagos, all but one being new records for this region of the tropical central Pacific. The newly reported specimens originate primarily from the MUSORSTOM 7 and 8 expeditions, including approximately 4400 specimens from 227 stations, most of these stations from deeper than 100 m. Sixteen new species and one new subspecies are described, and two new combinations are proposed: *Asterosmilia gigas* and *Javania fusca*. Tables of comparison are provided for the Indo-Pacific species of *Fungiacyathus (Fungiacyathus)*; the Recent *Trochocyathus (Aplocyathus)*; all species of *Aulocyathus*; all species of spined *Deltocyathus*; and the Recent species and subspecies of *Anthemiphyllia*. To facilitate comparisons of species among these taxa, three additional species having distributions other than the Vanuatu/Wallis and Futuna region are described as new: *Deltocyathus corrugatus, Anthemiphyllia multidentata*, and *A. macrolobata*.

The distribution and bathymetric ranges of the 134 species known from the Vanuatu/Wallis and Futuna region are tabulated. Within the tropical central Pacific these corals show a strong affinity with those from the ridges and islands north of New Zealand (56 species) and a lesser relationship with the Hawaiian Island fauna (24 species). Other regions in the central Pacific are too poorly known for comparison. Beyond the tropical central Pacific, the Vanuatu/Wallis and Futuna fauna is part of the larger Indo-Polynesian province, sharing 95 (71%) of its species with the tropical western Pacific and 62 species (46%) with the Indian Ocean. Only seven species are found in common with the tropical eastern Pacific and 11 with the Atlantic Ocean. Finally, 43 species from the Vanuatu/Wallis and Futuna Archipelagos are also known from temperate Japan (exclusive of the Ryukyu Islands) and 32 from temperate New Zealand and southern Australia.

Examples of commensal/parasitic relationships are reported to occur with petrarcid ascothoracican crustaceans (2 coral hosts) and acrothoracican cirripede crustaceans (8 hosts). The shells of the gastropod *Xenophora* ("carrier shells") were found to be effective collectors of deep-water corals; a total of 19 coral species were found incorporated into the shells, including three species that were found only on these shells and another five species that were otherwise very rarely collected by conventional means.

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RÉSUMÉ

Cnidaria Anthozoa : Scléractiniaires d'eau profonde sans zooxanthelles du Vanuatu et des îles Wallis et Futuna.

Cent-trente-quatre espèces récentes de Scléractiniares sans zooxanthelles sont recensées dans l'archipel du Vanuatu (116 espèces) et aux îles Wallis et Futuna (83 espèces). À une exception près, il s'agit de signalisations nouvelles pour cette région du Pacifique central tropical. Le matériel étudié provient essentiellement des campagnes MUSORSTOM 7 et 8 et comprend environ 4400 spécimens provenant de 227 stations, le plus souvent à plus de 100 m de profondeur. Seize espèces nouvelles (*Fungiacytahus sandoi, Anthemiphyllia spinifera, Caryophyllia abrupta, Oxysmilia corrugata, O. epithecata, Trochocyathus efateensis, T. patelliformis, Polycyathus octuplus, Deltocyathus crassiseptum, D. cameratus, Conotrochus asymmetros, Lochmaeotrochus gardineri, Cryptotrochus brevipalus, Flabellum arcuatile, Truncatoflabellum vigintifarium,* et *Javania exserta*) et une sous-espèce nouvelle (*Anthemiphyllia patera costata*) sont décrites et 2 combinaisons nouvelles sont proposées (*Asterosmilai gigas* et *Javania fusca*). Des tableaux de comparaison sont fournis pour les espèces indo-pacifiques de *Fungiacyathus (Fungiacyathus)*, les espèces récentes de *Trochocyathus (Aplocyathus)*, toutes les espèces d'*Aulocyathus*, toutes les espèces de *Deltocyathus* à épines et les espèces et sous-espèces d'*Anthemiphyllia*. Afin de faciliter les comparaisons, trois espèces nouvelles d'origine autre que MUSORSTOM 7 et 8 (*Deltocyathus corrugatus, Anthemiphyllia multidentata*, et *A. macrolobata*) sont incluses dans les tableaux.

Les répartitions géographique et bathymétrique des 134 espèces connues du Vanuatu et de Wallis et Futuna sont rassemblées dans un tableau. A l'intérieur du Pacifique central tropical, la faune étudiée ici a une forte affinité avec celle des rides et îles se trouvant au nord de la Nouvelle-Zélande (56 espèces) et une affinité moindre avec la faune des îles Hawaii (24 espèces). Les autres régions du Pacifique central sont trop peu connues pour être comparées. Au vu de leur faune, la région du Vanuatu et celle de Wallis et Futuna font partie de la large province biogéographique indo-polynésienne. Elles ont en commun 95 espèces (71%) avec le Pacifique occidental tropical et 62 (46%) avec l'océan Indien. Seules sept espèces sont connues aussi dans le Pacifique oriental tropical et onze dans l'Atlantique. Par ailleurs, si l'on compare cette faune à celles de quelques régions tempérées du Pacifique, on relève que 43 des 134 espèces recensées au Vanuatu et aux îles Wallis et Futuna sont connues aussi au Japan et 32 en Nouvelle-Zélande et dans l'Australie du Sud.

Les relations commensales ou parasites observées concernent les crustacés ascothoraciques Petrarcidae (deux espèces hôtes) et les crustacés cirripèdes acrothoraciques (huit espèces hôtes). Des coraux de profondeur sont souvent incorporés dans les coquilles des gastéropodes *Xenophora*. Dix-neuf espèces de coraux ont ainsi été trouvées sur ces coquilles "porteuses"; dont trois n'ont pas été récoltées autrement et cinq n'ont été que très rarement récoltées par les engins de capture conventionnels.

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INTRODUCTION

The azooxanthellate corals of Vanuatu, Wallis, and Futuna Archipelagos are representative of the tropical central Pacific, which, in turn, is very closely tied to that of the Indo-West Pacific fauna. For the purpose of this study, the tropical central Pacific is defined as those islands east of the Philippines, Indonesia, New Guinea, and Australia, and extending to the Tuamotu Archipelago in the east, the Hawaiian Islands to the north, and the Kermadec Islands to the south. Although this vast region was and is still not comprehensively sampled, the intensive MUSORSTOM collections provide a good basis for the deep-water coral fauna for this province, and provide zoogeographic data for one of the last poorly-known deep-water coral faunas. It should be noted that, whereas Table 1 lists all papers pertaining to azooxanthellates in the central tropical Pacific, the MUSORSTOM collections made very few collections shallower than 200 m or deeper than 1500 m, which reduces the number of species reported herein.

LIST OF ABBREVIATIONS

MUSEUMS:

MNHN Muséum National d'Histoire Naturelle, Paris.
MoNZ Museum of New Zealand Te Papa Tonga-rewa, Wellington (formerly the National Museum of New Zealand: **NMNZ**).
NHM The Natural History Museum, London (formerly the British Museum (Natural History): **BMNH**).
NMV National Museum Victoria, Melbourne.
NMNH National Museum of Natural History, Smithsonian, Washington, D. C.
NZOI New Zealand Oceanographic Institute, Wellington.
USNM United States National Museum, now the National Museum of Natural History, Smithsonian, Washington, D.C.
YPM Yale Peabody Museum, New Haven.
ZMB Zoologisches Museum, Berlin.

EXPEDITIONS AND VESSELS:

Throughout the paper, the names of vessels are given in italics and quotation marks.

BANZARE British, Australian, New Zealand Antarctic Research Expedition, 1929-1931.
CANCAP III *"Tydeman"*, Madeira-Mauritania Expedition 1978. Initiated by the Nationaal Natuurhistorisch Museum (Leiden). Named for **Can**aries and **Cap**e Verde Islands.
HURL Hawaiian Underseas Research Laboratory.
KARUBAR French-Indonesian expedition (1991) that collected in the southeastern Banda Sea. Named for the **Ka**i, **Aru**, and Tanim**bar** Islands.
MUSORSTOM Cruises organized jointly by the **Mus**éum National d'Histoire Naturelle and the Institut Français de Recherche Scientifique pour le Développement en Coopération (formerly: **O**ffice de la **R**echerche **S**cientifique et **T**echnique d'**O**utre-**M**er, = **ORSTOM**).
USGS United States Geological Survey.

MORPHOLOGICAL TERMS:

CD Calicular diameter.
GCD Greater calicular diameter.
GCD:LCD Ratio of greater calicular diameter to lesser calicular diameter.

PD	Pedicel diameter.
PD:GCD	Ratio of pedicel diameter to greater calicular diameter of a solitary corallum.
Sx, Cx, Px	Septa, costae, or pali (respectively) of cycle designated by numerical subscript.
Sx>Sy	In the context of a septal formula, septa of cycle x more wide than septa of cycle y.

COMBINED LIST OF STATIONS AND OF SPECIES OBTAINED PER STATION

This list provides the data for all stations mentioned in this report. Vessels and expeditions are listed alphabetically, whereas listing of species per station follows the order of the text. If the specimen was collected as a result of being cemented to a *Xenophora* gastropod shell, the species name is followed by an X in brackets.

BANZARE

Stn 115. — 24.03.1931, 41°03'S, 148°42'E, 128 m, northeastern Tasmania: *Anthemiphyllia multidentata.*

CANCAP

Stn 3.053. — 20.10.1978, 32°25'N, 16°57'W, 2850-3010 m, south of Madeira: *Truncatoflabellum stabile.*

HURL

Stn 83-202. — 16.10.1983, 16°41'12"N, 169°24'18"W, 183 m, Johnston Atoll: *Madracis kauaiensis.*

Stn P5-063. — 23.05.1988, 20°35.8'N, 156°03.5'W, 1020 m, Alenuihaha, Hawaiian Is: *Trochocyathus* (*Trochocyathus*) *patelliformis.*

KARUBAR, *"Baruna Jaya I"*

Stn 5. — 22.10.1991, 5°46'39"S, 132°20'04"E, 285-323 m, Kai Is: *Trochocyathus* (*Trochocyathus*) *vasiformis.*

Stn 18. — 24.10.1991, 5°17'49"S, 133°01'51"E, 205-212 m, Kai Is: *Anthemiphyllia spinifera.*

Stn 44. — 29.10.1991, 7°52'27"S, 132°48'24"E, 291-295 m, Tanimbar Is: *Javania exserta.*

Stn 49. — 29.10.1991, 7°59'51"S, 132°58'50"E, 206-209 m, Tanimbar Is: *Javania exserta.*

Stn 86. — 04.11.1991, 9°23'59"S, 131°14'29"E, 222-226 m, Tanimbar Is: *Javania exserta.*

KIMBLA

Stn K7/73-37. — 23.11.1973, 39°02.0'S, 148°36.5'E, 256 m, northeastern Tasmania: *Anthemiphyllia multidentata.*

MUSORSTOM 1, *"Vauban"*

Stn 65. — 27.03.1976, 14°00.0'N, 120°19.2'E, 194-202 m, SW Luzon, Philippines: *Javania exserta.*

MUSORSTOM 3, *"Coriolis"*

Stn 87. — 31.05.1985, 14°00.6'N, 120°19.6'E, 191-197 m, SW Luzon, Philippines: *Aulocyathus juvenescens.*

MUSORSTOM 7, *"Alis"*

Stn 494. — 10.05.1992, 14°18.9'S, 178°03.0'W, 100-110 m, Futuna: *Polycyathus octuplus*, *Heterocyathus* cf. *sulcatus*, *Heteropsammia cochlea*

Stn 495. — 10.05.1992, 14°19.2'S, 178°04.3'W, 180-210 m, Futuna: *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros*, *Truncatoflabellum phoenix, Heteropsammia cochlea.*

Stn 496. — 10.05.1992, 14°19.6'S, 178°04.3'W, 250-330 m, Futuna: *Madracis kauaiensis*, *Caryophyllia (Acanthocyathus) grayi*, *Oxysmilia epithecata*, *Trochocyathus (Trochocyathus) philippinensis*, *Polycyathus octuplus*, *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros*, *Thalamophyllia tenuescens*, *Balanophyllia desmophyllioides*, *Heteropsammia cochlea*.

Stn 499. — 10.05.1992, 14°19.6'S, 178°04.6'W, 290-395 m, Futuna: *Madracis kauaiensis*, *Madrepora porcellana*, *Caryophyllia (Acanthocyathus) grayi*, *Trochocyathus (Trochocyathus) maculatus*, *Polycyathus octuplus*, *Thalamophyllia tenuescens*, *Dactylotrochus cervicornis*, *Truncatoflabellum vanuatu*, *Javania exserta*, *Endopachys grayi*.

Stn 500. — 11.05.1992, 14°19.5'S, 178°04.1'W, 350-394 m, Futuna: *Madracis kauaiensis*, *Madrepora porcellana*, *Balanophyllia desmophyllioides*.

Stn 501. — 11.05.1992, 14°19.8'S, 178°06.1'W, 500-530 m, Futuna: *Truncatoflabellum angustum*, *Enallopsammia rostrata*.

Stn 502. — 11.05.1992, 14°19.8'S, 178°06.5'W, 516-535 m, Futuna: *Madracis kauaiensis*, *Madrepora oculata* forma *tenuis*, *M. porcellana*, *Caryophyllia (Caryophyllia) lamellifera*, *Crispatotrochus rubescens*, *Truncatoflabellum angustum*, *Balanophyllia desmophyllioides*.

Stn 504. — 11.05.1992, 14°19.6'S, 178°04.5'W, 300-390 m, Futuna: *Madracis kauaiensis*, *Caryophyllia (Caryophyllia) hawaiiensis*, *Trochocyathus (Trochocyathus) maculatus*, *Polycyathus octuplus*, *Conotrochus asymmetros*, *Thalamophyllia tenuescens*, *Dactylotrochus cervicornis*, *Guynia annulata*, *Flabellum (Flabellum) pavoninum*, *Endopachys grayi*, *Heteropsammia cochlea*.

Stn 505. — 11.05.1992, 14°19.5'S, 178°04.3'W, 245-400 m, Futuna: *Trochocyathus (Trochocyathus) maculatus*, *Truncatoflabellum vanuatu*.

Stn 506. — 11.05.1992, 14°19.8'S, 178°05.0'W, 400 m, Futuna: *Dendrophyllia alcocki*.

Stn 507. — 11.05.1992, 14°19.6'S, 178°06.7'W, 419-425 m, Futuna: *Madracis kauaiensis*, *Madrepora oculata forma formosa*, *Crispatotrochus rubescens*, *Oxysmilia epithecata*, *Endopachys grayi*.

Stn 508. — 11.05.1992, 14°19.5'S, 178°04.5'W, 245-400 m, Futuna: *Madracis kauaiensis*, *Madrepora porcellana*, *Trochocyathus (Trochocyathus) maculatus*.

Stn 509. — 12.05.1992, 14°14.8'S, 178°11.5'W, 200-240 m, Futuna: *Madracis kauaiensis*, *Madrepora porcellana*, *Oxysmilia epithecata*, *Trochocyathus (Trochocyathus) maculatus*, *Polycyathus octuplus*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros*, *Thalamophyllia tenuescens*, *Rhizosmilia robusta*, *Idiotrochus kikutii*, *Truncatoflabellum phoenix*, *T. vanuatu*, *Balanophyllia desmophyllioides*, *Heteropsammia cochlea*.

Stn 510. — 12.05.1992, 14°14.5'S, 178°11.5'W, 280-370 m, Futuna: *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Asterosmilia gigas*.

Stn 511. — 12.05.1992, 14°14.0'S, 178°11.5'W, 400-450 m, Futuna: *Anthemiphyllia dentata*, *Crispatotrochus rubescens*, *C. rugosus*, *Oxysmilia epithecata*, *Tethocyathus virgatus*, *Bourneotrochus stellulatus*, *Deltocyathus crassiseptum*, *Deltocyathus stella*, *Conotrochus funicolumna*, *C. brunneus*, *Rhizotrochus flabelliformis*.

Stn 512. — 12.05.1992, 14°13.5'S, 178°10.3'W, 210-245 m, Futuna: *Madrepora porcellana*, *Anthemiphyllia spinifera*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros*, *Thalamophyllia tenuescens*, *Dactylotrochus cervicornis*, *Deltocyathoides orientalis*, *Idiotrochus kikutii*, *Truncatoflabellum phoenix*, *Balanophyllia desmophyllioides*, *Heteropsammia cochlea*.

Stn 513. — 12.05.1992, 14°13.5'S, 178°10.8'W, 260-300 m, Futuna: *Madrepora minutiseptum*, *M. porcellana*, *Anthemiphyllia spinifera*, *Polycyathus octuplus*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Conotrochus brunneus*, *C. asymmetros*, *Thalamophyllia tenuescens*, *Dactylotrochus cervicornis*, *Idiotrochus kikutii*, *Guynia annulata*, *Flabellum (Flabellum) pavoninum*, *Truncatoflabellum phoenix*, *Javania exserta*.

Stn 514. — 12.05.1992, 14°13.3'S, 178°10.7'W, 349-355 m, Futuna: *Madrepora porcellana*, *Anthemiphyllia spinifera*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *D. heteroclitus*, *Heterocyathus* cf. *sulcatus*, *Thalamophyllia tenuescens*, *Dactylotrochus cervicornis*, *Truncatoflabellum phoenix*, *Javania exserta*, *Dendrophyllia alcocki*.

Stn 515. — 12.05.1992, 14°13.5'S, 178°10.3'W, 224-252 m, Futuna: *Madracis kauaiensis*, *Madrepora minutiseptum*, *M. porcellana*, *Dactylotrochus cervicornis*, *Asterosmilia gigas*.

Stn 516. — 12.05.1992, 14°13.5'S, 178°11.6'W, 441-550 m, Futuna: *Polycyathus octuplus*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum phoenix*, *Endopachys grayi*, *Heteropsammia cochlea*.

Stn 517. — 12.05.1992, 14°13.4'S, 178°10.4'W, 233-235 m, Futuna: *Madrepora minutiseptum*.

Stn 520. — 13.05.1992, 14°10.6'S, 176°16.7'W, 920-930 m, Wallis: *Deltocyathus cameratus*, *Javania lamprotichum* (or station 521), *Enallopsammia rostrata*.

Stn 521. — 13.05.1992, 14°11.0'S, 176°17.3'W, 890-915 m, Wallis: *Javania lamprotichum* (or station 520).

Stn 522. — 13.05.1992, 13°10.7'S, 176°15.0'W, 650-765 m, Wallis: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Anthemiphyllia dentata*, *A. patera costata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Tethocyathus virgatus*, *Deltocyathus suluensis*, *D. taiwanicus*, *Conotrochus funicolumna*, *Enallopsammia rostrata*.

Stn 523. — 13.05.1992, 13°12.0'S, 176°15.6'W, 455-515 m, Wallis: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Stephanophyllia complicata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Crispatotrochus rubescens*, *C. rugosus*, *Oxysmilia epithecata*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Deltocyathus taiwanicus*, *D. crassiseptum*, *D. stella*, *Conotrochus funicolumna*, *Asterosmilia gigas*, *Deltocyathoides orientalis*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*, *Javania exserta*.

Stn 524. — 13.05.1992, 13°11.8'S, 176°15.6'W, 300 m, Wallis: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Trochocyathus*) *maculatus*, *Rhizosmilia robusta*, *Flabellum* (*Flabellum*) *arcuatile*, *Truncatoflabellum vanuatu*, *Balanophyllia desmophyllioides*.

Stn 525. — 13.05.1992, 13°10.6'S, 176°14.7'W, 500-600 m, Wallis: *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *marmorea*, *Deltocyathus taiwanicus*, *Conotrochus funicolumna*, *C. brunneus*, *Javania fusca*.

Stn 527. — 14.05.1992, 13°24.1'S, 176°14.6'W, 540-560 m, Wallis: *Trochocyathus* (*Trochocyathus*) *vasiformis*.

Stn 529. — 16.05.1992, 12°31.4'S, 176°39.6'W, 500 m, Waterwitch Bank: *Deltocyathus suluensis*, *D. taiwanicus*, *D. crassiseptum*.

Stn 530. — 16.05.1992, 12°32.7'S, 176°39.3'W, 580-600 m, Waterwitch Bank: *Anthemiphyllia dentata*, *A. patera costata*, *A. spinifera*, *Caryophyllia* (*Caryophyllia*) *rugosa*, *C.* (*C.*) *abrupta*, *Deltocyathus suluensis*, *D. cameratus*, *Conotrochus brunneus*, *Lophelia pertusa*, *Flabellum* (*Flabellum*) *arcuatile*, *Javania fusca*, *Enallopsammia rostrata*.

Stn 532. — 16.05.1992, 12°28.9'S, 176°41.0'W, 516-530 m, Waterwitch Bank: *Deltocyathus suluensis*, *Conotrochus funicolumna*, *Flabellum* (*Ulocyathus*) *deludens*.

Stn 534. — 16.05.1992, 12°23.3'S, 176°42.0'W, 440-500 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *C.* (*C.*) *marmorea*, *Deltocyathus suluensis*, *Flabellum* (*Flabellum*) *arcuatile*.

Stn 535. — 16.05.1992, 12°29.6'S, 176°41.3'W, 340-470 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Stephanophyllia complicata*, *Anthemiphyllia dentata*, *A. patera costata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Deltocyathus suluensis*, *D. taiwanicus*, *Conotrochus funicolumna*, *Asterosmilia gigas*, *Flabellum* (*Flabellum*) *arcuatile*.

Stn 537. — 16.05.1992, 12°30.0'S, 176°41.0'W, 325-400 m, Waterwitch Bank: *Anthemiphyllia dentata*, *A. spinifera*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Deltocyathus taiwanicus*, *D. crassiseptum*, *D. cameratus*, *D. stella*, *Conotrochus funicolumna*, *Asterosmilia gigas*, *Javania exserta*.

Stn 538. — 16.05.1992, 12°30.8'S, 176°40.3'W, 275-295 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *hawaiiensis*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum phoenix*, *Javania exserta*, *Balanophyllia desmophyllioides*.

Stn 539. — 17.05.1992, 12°27.3'S, 177°27.3'W, 700 m, Combe Bank: *Trochocyathus* (*Trochocyathus*) *discus*, *Lochmaeotrochus gardineri*.

Stn 540. — 17.05.1992, 12°26.7'S, 177°28.4'W, 600 m, Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *F.* (*F.*) *sandoi*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Stephanophyllia complicata*, *Anthemiphyllia dentata*, *A. patera costata*, *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Deltocyathus suluensis*, *D. taiwanicus*, *Conotrochus funicolumna*, *Javania fusca*.

Stn 541. — 17.05.1992, 12°26.7'S, 177°28.0'W, 500-505 m, Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Anthemiphyllia spinifera*, *Deltocyathus suluensis*, *D. taiwanicus*, *D. cameratus*, *D. stella*, *Conotrochus funicolumna*.

Stn 542. — 17.05.1992, 12°26.4'S, 177°28.2'W, 370 m, Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Stephanophyllia neglecta*, *Anthemiphyllia dentata*, *A. patera costata*, *A. spinifera*, *Crispatotrochus rugosus*, *Deltocyathus taiwanicus*, *D. cameratus*, *Conotrochus funicolumna*, *Flabellum* (*Flabellum*) *arcuatile*.

Stn 546. — 17.05.1992, 12°26.9'S, 177°29.1'W, 550-552 m, Combe Bank: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Anthemiphyllia dentata*, *A. patera costata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Trochocyathus*) *maculatus*, *Deltocyathus suluensis*, *D. taiwanicus*, *D. cameratus*, *Conotrochus brunneus*, *Flabellum* (*Flabellum*) *arcuatile*.

Stn 548. — 17.05.1992, 12°23.3'S, 177°24.4'W, 700-740 m, Combe Bank: *Lochmaeotrochus gardineri*.

Stn 551. — 18.05.1992, 12°15.3'S, 177°28.1'W, 791-795 m, Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Madrepora oculata forma tenuis*, *Flabellum* (*Ulocyathus*) *apertum apertum*.

Stn 552. — 18.05.1992, 12°15.7'S, 177°27.8'W, 786-800 m, Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Madrepora oculata* forma *tenuis*, *Caryophyllia* (*Caryophyllia*) *scobinosa*, *Deltocyathus cameratus*, *Flabellum* (*Ulocyathus*) *apertum apertum*.

Stn 555. — 19.05.1992, 11°47.5'S, 178°19.2'W, 540-542 m, Tuscarora Bank: *Anthemiphyllia dentata*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Deltocyathus taiwanicus*, *D. cameratus*, *Conotrochus funicolumna*

Stn 556. — 19.05.1992, 11°48.7'S, 178°18.0'W, 440 m, Tuscarora Bank: *Stephanophyllia neglecta*, *Caryophyllia* (*Caryophyllia*) *quadragenaria*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus*, *Deltocyathus taiwanicus*, *D. stella*, *Heterocyathus* cf. *sulcatus*, *Conotrochus funicolumna*.

Stn 557. — 19.05.1992, 11°48.1'S, 178°18.2'W, 600-608 m, Tuscarora Bank: *Stephanophyllia complicata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Deltocyathus suluensis*, *D. taiwanicus*, *D. cameratus*, *Conotrochus funicolumna*, *Lochmaeotrochus gardineri*.

Stn 560. — 19.05.1992, 11°47.0'S, 178°20.0'W, 697-702 m, Tuscarora Bank: *Deltocyathus taiwanicus*, *D. cameratus*, *Conotrochus funicolumna*, *Lochmaeotrochus gardineri*.

Stn 564. — 20.05.1992, 11°46.1'S, 178°27.4'W, 1015-1020 m, Tuscarora Bank: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Caryophyllia* (*Caryophyllia*) *ambrosia*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Aulocyathus recidivus*, *Flabellum* (*Ulocyathus*) *apertum apertum*.

Stn 565. — 20.05.1992, 11°47.4'S, 178°25.3'W, 900 m, Tuscarora Bank: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Caryophyllia* (*Caryophyllia*) *scobinosa*, *C.* (*C.*) *ambrosia*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Flabellum* (*Ulocyathus*) *apertum apertum*.

Stn 567. — 20.05.1992, 11°47.0'S, 178°27.3'W, 1010-1020 m, Tuscarora Bank: *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus*, *Aulocyathus recidivus*, *Flabellum* (*Ulocyathus*) *apertum apertum*.

Stn 569. — 21.05.1992, 12°30.0'S, 176°51.2'W, 300-305 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Anthemiphyllia dentata*, *A. spinifera*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *D. ornatus*, *D. cameratus*, *Guynia annulata*, *Flabellum* (*Flabellum*) *pavoninum*, *Javania exserta*.

Stn 570. — 21.05.1992, 12°30.9'S, 176°51.4'W, 420-439 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Deltocyathus crassiseptum*, *Heterocyathus* cf. *sulcatus*, *Conotrochus funicolumna*.

Stn 571. — 21.05.1992, 12°31.3'S, 176°51.7'W, 502-508 m, Waterwitch Bank: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Conotrochus funicolumna*.

Stn 572. — 21.05.1992, 12°31.8'S, 176°52.2'W, 500-560 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Vaughanella concinna*, *Lophelia pertusa*.

Stn 574. — 21.05.1992, 12°30.9'S, 176°52.3'W, 105-410 m, Waterwitch Bank: *Enallopsammia rostrata*.

Stn 575. — 21.05.1992, 12°30.9'S, 176°52.3'W, 425 m, Waterwitch Bank: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Anthemiphyllia patera costata*, *Deltocyathus suluensis*.

Stn 578. — 22.05.1992, 13°08.2'S, 176°15.6'W, 640-730 m, North of Wallis: *Anthemiphyllia patera costata*, *Deltocyathus suluensis*, *D. cameratus*, *Flabellum* (*Flabellum*) *arcuatile*, *Javania fusca*.

Stn 581. — 22.05.1992, 13°09.9'S, 176°13.9'W, 461-550 m, North of Wallis: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Caryophyllia* (*Caryophyllia*) *crosnieri*.

Stn 584. — 22.05.1992, 13°11.2'S, 176°14.3'W, 360-400 m, North of Wallis: *Crispatotrochus rugosus*, *Dactylotrochus cervicornis*.

Stn 585. — 22.05.1992, 13°10.2'S, 176°12.6'W, 415-475 m, North of Wallis: *Madrepora oculata* forma *formosa*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *marmorea*, *Crispatotrochus rubescens*, *Bourneotrochus stellulatus*, *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Deltocyathus taiwanicus*, *D. crassiseptum*, *D. stella*, *Conotrochus funicolumna*, *Truncatoflabellum mortenseni*.

Stn 586. — 22.05.1992, 13°10.7'S, 176°13.1'W, 510-600 m, North of Wallis: *Madrepora oculata* forma *formosa*, *Anthemiphyllia dentata*, *A. patera costata*, *A. spinifera*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Bourneotrochus stellulatus*, *Deltocyathus crassiseptum*, *Conotrochus brunneus*, *C. asymmetros*, *Asterosmilia gigas*.

Stn 589. — 23.05.1992, 12°16.2'S, 174°41.4'W, 400 m, Field Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Anthemiphyllia dentata*, *A. spinifera*, *Caryophyllia* (*Caryophyllia*) *lamellifera*, *Crispatotrochus rugosus*, *Deltocyathus taiwanicus*, *D. cameratus*, *Dactylotrochus cervicornis*, *Flabellum* (*Flabellum*) *arcuatile*, *Balanophyllia desmophyllioides*.

Stn 590. — 23.05.1992, 12°31.4'S, 174°18.7'W, 400 m, Field Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Anthemiphyllia dentata*, *A. patera costata*, *Deltocyathus suluensis*, *D. taiwanicus*, *Conotrochus brunneus*.

Stn 591. — 23.05.1992, 12°31.1'S, 174°19.4'W, 320 m, Field Bank: *Anthemiphyllia dentata*, *A. patera costata*, *Bourneotrochus stellulatus*, *Deltocyathus taiwanicus*, *Conotrochus brunneus*.

Stn 592. — 24.05.1992, 12°32.4'S, 174°22.0'W, 730-775 m, Field Bank: *Javania fusca*.

Stn 594. — 24.05.1992, 12°31.0'S, 174°19.9'W, 495-505 m, Field Bank: *Anthemiphyllia dentata*, *A. patera costata*, *Bourneotrochus stellulatus*, *Deltocyathus suluensis*, *D. taiwanicus*, *D. stella*.

Stn 595. — 24.05.1992, 12°30.9'S, 174°18.9'W, 566-580 m, Field Bank: *Anthemiphyllia patera costata*, *Bourneotrochus stellulatus*, *Deltocyathus suluensis*.

Stn 597. — 24.05.1992, 12°31.4'S, 174°18.6'W, 469-475 m, Field Bank: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Letepsammia franki*, *Anthemiphyllia dentata*, *Deltocyathus taiwanicus*, *D. crassiseptum*, *D. cameratus*, *Conotrochus brunneus*.

Stn 598. — 24.05.1992, 12°30.5'S, 174°18.4'W, 702-708 m, Field Bank: *Madrepora oculata* forma *tenuis*, *Caryophyllia* (*Caryophyllia*) *ambrosia*.

Stn 601. — 25.05.1992, 13°18.7'S, 176°17.2'W, 350 m, SE of Wallis: *Madrepora oculata* forma *formosa*, *Truncatoflabellum mortenseni*, *Balanophyllia desmophyllioides*.

Stn 604. — 26.05.1992, 13°21.4'S, 176°08.3'W, 415-420 m, SE of Wallis: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Crispatotrochus rubescens*, *Bourneotrochus stellulatus*, *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Deltocyathus crassiseptum*, *Conotrochus funicolumna*.

Stn 605. — 26.05.1992, 13°21.3'S, 176°08.4'W, 335-340 m, SE of Wallis: *Fungiacyathus* (*Fungiacyathus*) *sandoi*, *Anthemiphyllia spinifera*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Dactylotrochus cervicornis*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum vanuatu*.

Stn 606. — 26.05.1992, 13°21.4'S, 176°08.3'W, 420-430 m, SE of Wallis: *Madrepora oculata* forma *formosa*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Stephanocyathus* (*Acinocyathus*) *spiniger*.

Stn 608. — 26.05.1992, 13°21.7'S, 176°08.5'W, 440-458 m, SE of Wallis: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Bourneotrochus stellulatus*, *Deltocyathus crassiseptum.*

Stn 609. — 26.05.1992, 13°21.5'S, 176°08.5'W, 430 m, SE of Wallis: *Madrepora oculata* forma *formosa*, *Trochocyathus* (*Trochocyathus*) *vasiformis.*

Stn 610. — 26.05.1992, 13°21.5'S, 176°08.9'W, 286 m, SE of Wallis: *Anthemiphyllia spinifera*, *Caryophyllia* (*Caryophyllia*) *rugosa*, *Crispatotrochus rugosus*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Conotrochus asymmetros*, *Flabellum* (*Flabellum*) *pavoninum.*

Stn 618. — 27.05.1992, 14°21.7'S, 178°00.5'W, 420-435 m, E + SE of Alofi: *Stephanophyllia neglecta*, *Madrepora oculata* forma *formosa*, *M. porcellana*, *Anthemiphyllia dentata*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Bourneotrochus stellulatus*, *Deltocyathus crassiseptum*, *Conotrochus funicolumna.*

Stn 619. — 27.05.1992, 14°21.8'S, 178°00.4'W, 455 m, E + SE of Alofi: *Fungiacyathus* (*Bathyactis*) *granulosus*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Conotrochus funicolumna.*

Stn 620. — 28.05.1992, 12°34.4'S, 178°11.0'W, 1280 m, bank SW of Combe Bank: *Madrepora oculata* forma *formosa*, *Aulocyathus recidivus*, *Flabellum* (*Ulocyathus*) *apertum apertum.*

Stn 621. — 28.05.1992, 12°35.0'S, 178°11.5'W, 1280-1300 m, bank SW of Combe Bank: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Madrepora oculata* forma *tenuis*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Stephanocyathus* (*Odontocyathus*) *coronatus*, *Deltocyathus rotulus*, *Flabellum* (*Ulocyathus*) *apertum apertum.*

Stn 622. — 28.05.1992, 12°34.5'S, 178°10.9'W, 1280-1300 m, bank SW of Combe Bank: *Stephanocyathus* (*Odontocyathus*) *coronatus*, *Deltocyathus rotulus*, *Aulocyathus recidivus.*

Stn 623. — 28.05.1992, 12°34.2'S, 178°15.1'W, 1280-1300 m, bank SW of Combe Bank: *Madrepora oculata* forma *tenuis*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Stephanocyathus* (*Odontocyathus*) *coronatus*, *Deltocyathus rotulus*, *Aulocyathus recidivus*, *Flabellum* (*Ulocyathus*) *apertum apertum.*

Stn 625. — 29.05.1992, 11°52.4'S, 179°33.8'W, 425-430 m, Bayonnaise Bank: *Conotrochus brunneus.*

Stn 626. — 29.05.1992, 11°53.6'S, 179°32.0'W, 597-600 m, Bayonnaise Bank: *Deltocyathus stella.*

Stn 631. — 29.05.1992, 11°54.0'S, 179°31.6'W, 600 m, Bayonnaise Bank: *Deltocyathus suluensis.*

Stn 635. — 30.05.1992, 13°49.0'S, 179°56.0'E, 700-715 m, SW of Rotumah Bank: *Anthemiphyllia patera costata*, *Caryophyllia* (*Caryophyllia*) *scobinosa*, *C.* (*C.*) *ambrosia*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus.*

Stn 636. — 30.05.1992, 13°39.4'S, 179°55.5'E, 650-700 m, SW of Rotumah Bank: *Caryophyllia* (*Caryophyllia*) *ambrosia*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus.*

Stn 637. — 30.05.1992, 13°37.2'S, 179°56.0'E, 820-830 m, SW of Rotumah Bank: *Madrepora oculata* forma *tenuis*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Desmophyllum dianthus*, *Pleotrochus zibrowii.*

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Stn 956. — 20.09.1994, 20°33'S, 169°35'E, 1175-1210 m, Anatom: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Stephanocyathus* (*Odontocyathus*) *coronatus*, *Deltocyathus cameratus*, *Lochmaeotrochus gardineri*, *Flabellum* (*Ulocyathus*) *marcus.*

Stn 958. — 20.09.1994, 20°20'S, 169°47'E, 497-570 m, Anatom: *Stephanophyllia neglecta*, *Trochocyathus* (*Trochocyathus*) *discus*, *Deltocyathus crassiseptum*, *Cyathotrochus pileus.*

Stn 959. — 20.09.1994, 20°20'S, 169°48'E, 436-475 m, Anatom: *Stephanophyllia complicata*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *diomedeae*, *Oxysmilia epithecata*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *T.* (*A.*) *brevispina*, *Deltocyathus crassiseptum*, *Conotrochus brunneus*, *Cyathotrochus pileus*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Javania fusca*, *Enallopsammia rostrata.*

Stn 961. — 21.09.1994, 20°18'S, 169°49'E, 100-110 m, Anatom: *Trochocyathus* (*T.*) *maculatus*, *T.* (*T.*) *cooperi*, *Rhizosmilia robusta*, *Heteropsammia cochlea.*

Stn 962. — 21.09.1994, 20°19'S, 169°49'E, 370-400 m, Anatom: *Letepsammia franki*, *Madrepora porcellana*, *Caryophyllia (Caryophyllia) quadragenaria, Oxysmilia epithecata*, *Flabellum* (*Flabellum*) *pavoninum*, *Javania exserta*, *Balanophyllia laysanensis.*

Stn 963. — 21.09.1994, 20°20'S, 169°49'E, 400-440 m, Anatom: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *F.* (*F.*) *paliferus*, *Fungiacyathus* (*Bathyactis*) *margaretae*, *Stephanophyllia neglecta*, *S. complicata* [X], *Madrepora porcellana*, *Caryophyllia* (*Caryophyllia*) *abrupta* [X],*Trochocyathus* (*Aplocyathus*) *hastatus*, *T.* (*A.*) *brevispina*, *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Deltocyathus magnificus*, *Bourneotrochus stellulatus* [X], *Tropidocyathus labidus* [X], *Temnotrochus kermadecensis* [X], *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum mortenseni*, *Balanophyllia laysanensis*.

Stn 964. — 21.09.1994, 20°19'S, 169°49'E, 360-408 m, Anatom: *Madrepora porcellana*, *Caryophyllia* (*Caryophyllia*) *octonaria*, *Trochocyathus* (*Aplocyathus*) *brevispina*, *Deltocyathus magnificus*, *D. ornatus*, *Rhizosmilia robusta*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum mortenseni*, *Javania exserta*, *Balanophyllia desmophyllioides*.

Stn 965. — 21.09.1994, 20°20'S, 169°51'E, 361-377 m, Anatom: *Stephanophyllia neglecta*, *Caryophyllia* (*Caryophyllia*) *quadragenaria*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum dens*, *Javania fusca*, *Balanophyllia laysanensis*.

Stn 967. — 21.09.1994, 20°19'S, 169°53'E, 295-334 m, Anatom: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *rugosa*, *C.* (*C.*) *quadragenaria*, *Deltocyathus stella*, *D. ornatus*, *Truncatoguynia irregularis*, *Truncatoflabellum mortenseni*, *Endopachys grayi*, *Heteropsammia cochlea*.

Stn 968. — 21.09.1994, 20°18'S, 169°53'E, 199-214 m, Anatom: *Madrepora porcellana*.

Stn 969. — 21.09.1994, 20°19'S, 169°53'E, 252-280 m, Anatom: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Stephanophyllia neglecta*, *Madrepora porcellana*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *hawaiiensis*, *C.* (*C.*) *octonaria*, *Trochocyathus* (*Trochocyathus*) *philippinensis*, *Bourneotrochus stellulatus*, *Deltocyathus stella*, *Heterocyathus* cf. *sulcatus*, *Truncatoflabellum mortenseni*, *Balanophyllia desmophyllioides*, *Endopachys grayi*, *Heteropsammia cochlea*.

Stn 970. — 21.09.1994, 20°18'S, 169°53'E, 252-310 m, Anatom: *Truncatoflabellum mortenseni*, *Balanophyllia rediviva*.

Stn 971. — 21.09.1994, 20°19'S, 169°53'E, 250-315 m, Anatom: *Rhizosmilia robusta*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*, *Dendrophyllia alcocki*.

Stn 973. — 22.09.1994, 19°21'S, 169°27'E, 460-480 m, Tanna: *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Tethocyathus virgatus*, *Truncatoflabellum pusillum*.

Stn 974. — 22.09.1994, 19°21'S, 169°28'E, 492-520 m, Tanna: *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Javania lamprotichum*, *Enallopsammia rostrata*.

Stn 975. — 22.09.1994, 19°23'S, 169°29'E, 536-566 m, Tanna: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Deltocyathus suluensis*, *Javania lamprotichum*, *Polymyces wellsi*.

Stn 976. — 22.09.94, 19°25'S, 169°27'E, 160-182 m, Tanna: *Madrepora porcellana*, *Caryophyllia* (*Caryophyllia*) *octonaria*, *Trochocyathus* (*Trochocyathus*) *philippinensis*, *Heterocyathus* cf. *sulcatus*, *Aulocyathus juvenescens*, *Flabellum* (*Flabellum*) *pavoninum*, *Endopachys grayi*, *Heteropsammia cochlea*.

Stn 977. — 22.09.1994, 19°25'S, 169°29'E, 410-505 m, Tanna: *Fungiacyathus* (*Bathyactis*) *granulosus*, *Anthemiphyllia dentata*, *Crispatotrochus rugosus*, *Oxysmilia circularis*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *T.* (*T.*) *rhombocolumna*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Tethocyathus virgatus*, *Deltocyathus crassiseptum*, *Conotrochus brunneus*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum dens*, *Balanophyllia gigas*, *Dendrophyllia alcocki*, *Enallopsammia rostrata*.

Stn 978. — 22.09.1994, 19°23'S, 169°27'E, 408-413 m, Tanna: *Stephanophyllia neglecta*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Tethocyathus virgatus*, *Deltocyathus crassiseptum*, *Javania exserta*, *Balanophyllia crassitheca*, *Dendrophyllia alcocki*.

Stn 980. — 22.09.1994, 19°21'S, 169°25'E, 433-450 m, Tanna: *Fungiacyathus* (*Bathyactis*) *granulosus*, *Letepsammia franki*, *Deltocyathus magnificus*, *D. crassiseptum*, *Cyathotrochus pileus*, *Dendrophyllia alcocki*

Stn 982. — 23.09.1994, 19°22'S, 169°26'E, 408-410 m, Tanna: *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Tethocyathus virgatus*, *Javania fusca*, *Dendrophyllia alcocki*.

Stn 983. — 23.09.1994, 19°22'S, 169°28'E, 475-480 m, Tanna: *Anthemiphyllia dentata*, *Crispatotrochus rubescens*, *Oxysmilia circularis*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Deltocyathus crassiseptum*, *Dendrophyllia alcocki*..

Stn 988. — 23.09.1994, 19°16'S, 169°24'E, 372-466 m, Tanna: *Madracis kauaiensis*, *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Stephanophyllia neglecta*, *Madrepora porcellana*, *Anthemiphyllia spinifera*, *Caryophyllia* (*Caryophyllia*) *rugosa*, *C.* (*C.*) *abrupta*, *Crispatotrochus rugosus*, *Labyrinthocyathus limatulus*, *Dactylotrochus cervicornis*, *Cryptotrochus brevipalus*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum dens*, *T. pusillum*, *Javania lamprotichum*, *J. fusca*, *Balanophyllia desmophyllioides*, *Dendrophyllia alcocki*.

Stn 990. — 24.09.1994, 18°52'S, 168°51'E, 980-990 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*.

Stn 992. — 24.09.1994, 18°52'S, 168°55'E, 748-775 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Caryophyllia* (*Caryophyllia*) *scobinosa*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus*, *Lochmaeotrochus gardineri*.

Stn 996. — 24.09.1994, 18°52'S, 168°56'E, 764-786 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Truncatoflabellum stabile*.

Stn 999. — 25.09.1994, 18°49'S, 169°00'E, 80-110 m, Erromango: *Trochocyathus* (*Aplocyathus*) *brevispina*.

Stn 1001. — 25.09.1994, 18°49'S, 168°59'E, 150-250 m, Erromango: *Caryophyllia* (*Acanthocyathus*) *grayi*.

Stn 1002. — 25.09.1994, 18°49'S, 168°59'E, 200-300 m, Erromango: *Caryophyllia* (*Acanthocyathus*) *grayi*.

Stn 1003. — 25.09.1994, 18°49'S, 168°59'E, 200-327 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Trochocyathus* (*Aplocyathus*) *brevispina*, *Stephanocyathus* (*Acinocyathus*) *spiniger*.

Stn 1004. — 25.09.1994, 18°49'S, 168°59'E, 319-350 m, Erromango: *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Aplocyathus*) *brevispina*, *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Heterocyathus alternatus*, *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum vigintifarium*.

Stn 1005. — 25.09.1994, 18°49'S, 168°59'E, 360-450 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Stephanophyllia complicata*, *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Endopachys grayi*.

Stn 1006. — 25.09.1994, 18°50'S, 168°57'E, 574-611 m, Erromango: *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Deltocyathus vaughani*, *Conotrochus brunneus*, *Gardineria hawaiiensis*, *Enallopsammia rostrata*.

Stn 1007. — 25.09.1994, 18°52'S, 168°56'E, 720-830 m, Erromango: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus*.

Stn 1009. — 27.09.1994, 17°46'S, 168°13'E, 430-460 m, Efaté: *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Balanophyllia gemma*.

Stn 1011. — 27.09.1994, 17°50'S, 168°11'E, 547-585 m, Efaté: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Deltocyathus vaughani*, *Gardineria hawaiiensis*.

Stn 1014. — 27.09.1994, 17°54'S, 168°19'E, 495-498 m, Efaté: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Anthemiphyllia spinifera*, *Caryophyllia* (*Caryophyllia*) *diomedeae*, *Cryptotrochus brevipalus*, *Flabellum* (*Ulocyathus*) *hoffmeisteri*, *Javania lamprotichum*, *Gardineria hawaiiensis*, *G. paradoxa*.

Stn 1015. — 27.09.1994, 17°54'S, 168°22'E, 375-420 m, Efaté: *Crispatotrochus rugosus*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Tethocyathus virgatus*, *Truncatoflabellum dens*, *Balanophyllia gemma*, *Dendrophyllia alcocki*, *Enallopsammia rostrata*.

Stn 1016. — 27.09.1994, 17°53'S, 168°28'E, 291-300 m, Efaté: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Letepsammia franki*, *Anthemiphyllia dentata*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Conotrochus asymmetros* [X], *Tropidocyathus lessonii*, *Cyathotrochus pileus*, *Guynia annulata*, *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum angustum*, *Truncatoflabellum pusillum* [X], *Endopachys grayi*..

Stn 1017. — 27.09.1994, 17°53'S, 168°26'E, 294-295 m, Efaté: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Letepsammia franki*, *Deltocyathus ornatus*, *Conocyathus asymmetros* [X], *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum angustum*, *Endopachys grayi* [X].

Stn 1018. — 27.09.1994, 17°53'S, 168°25'E, 300-301 m, Efaté: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Letepsammia franki*, *Stephanophyllia complicata*, *?Caryophyllia* (*C.*) *lamellifera*, *Crispatotrochus rugosus*, *Oxysmilia epithecata*, *Deltocyathus ornatus*, *Bourneotrochus stellulatus* [X], *Heterocyathus alternatus*, *Notocyathus conicus* [X], *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum angustum*, *T. vigintifarium*, *Endopachys grayi*, *Dendrophyllia arbuscula*.

Stn 1019. — 28.09.1994, 17°38'S, 168°34'E, 397-430 m, Efaté: *Stephanophyllia neglecta*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *T.* (*T.*) *efateensis*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *Balanophyllia gemma*, *Dendrophyllia alcocki*.

Stn 1020. — 28.09.1994, 17°40'S, 168°35'E, 380-391 m, Efaté: *Trochocyathus* (*Trochocyathus*) *efateensis*, *Trochocyathus* (*Aplocyathus*) *hastatus*, *T.* (*A.*) *brevispina*.

Stn 1021. — 28.09.1994, 17°43'S, 168°37'E, 124-130 m, Efaté: *Trochocyathus* (*Trochocyathus*) *maculatus*, *T.* (*T.*) *cooperi*, *Rhizosmilia robusta*, *Javania exserta*, *Rhizotrochus typus*, *Dendrophyllia arbuscula*.

Stn 1023. — 28.09.1994, 17°48'S, 168°49'E, 321 m, Efaté: *Letepsammia franki*, *?Caryophyllia* (*C.*) *lamellifera*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus* [X], *Temnotrochus kermadecensis* [X], *Flabellum* (*Ulocyathus*) *aotearoa*, *Dendrophyllia alcocki*.

Stn 1024. — 28.09.1994, 17°48'S, 168°39'E, 335-370 m, Efaté: *Enallopsammia rostrata*.

Stn 1026. — 28.09.1994, 17°50'S, 168°39'E, 437-504 m, Efaté: *Oxysmilia epithecata*, *Trochocyathus* (*Trochocyathus*) *efateensis*, *Tethocyathus virgatus*, *Tropidocyathus labidus*.

Stn 1028. — 28.09.1994, 17°54'S, 168°40'E, 624-668 m, Efaté: *Madrepora oculata forma tenuis*, *Deltocyathus suluensis*, *Cryptotrochus brevipalus*.

Stn 1030. — 29.09.1994, 17°51'S, 168°30'E, 180-190 m, Efaté: *Crispatotrochus rugosus*, *Oxysmilia circularis*, *O. corrugata*, *Javania exserta*, *Balanophyllia desmophyllioides*, *Dendrophyllia arbuscula*.

Stn 1031. — 29.09.1994, 17°52'S, 168°33'E, 310 m, Efaté: *Madrepora oculata* forma *tenuis*, *Anthemiphyllia pacifica*.

Stn 1034. — 29.09.1994, 17°54'S, 168°42'E, 690-750 m, Efaté: *Caryophyllia* (*Caryophyllia*) *scobinosa*, *Lochmaeotrochus gardineri*, *Cryptotrochus brevipalus*.

Stn 1035. — 29.09.1994, 17°56'S, 168°44'E, 765-780 m, Efaté: *Caryophyllia* (*Caryophyllia*) *scobinosa*.

Stn 1036. — 29.09.1994, 18°01'S, 168°48'E, 920-950 m, Efaté: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus cameratus*, *Lochmaeotrochus gardineri*, *Truncatoflabellum stabile*.

Stn 1037. — 29.09.1994, 18°03'S, 168°54'E, 1058-1086 m, Efaté: *Flabellum* (*Ulocyathus*) *marcus*, *Truncatoflabellum stabile*.

Stn 1042. — 30.09.1994, 16°52'S, 168°27'E, 200-260 m, Epi: *Javania exserta*.

Stn 1043. — 30.09.1994, 16°52'S, 168°25'E, 350-372 m, Epi: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Crispatotrochus rugosus*.

Stn 1047. — 30.09.1994, 16°53'S, 168°10'E, 486-494 m, Epi: *Trochocyathus* (*Trochocyathus*) *maculatus*.

Stn 1051. — 01.10.1994, 16°36'S, 167°59'E, 555-558 m, Epi: *Fungiacyathus* (*Bathyactis*) *margaretae*, *Caryophyllia* (*Caryophyllia*) sp. cf. *calveri*.

Stn 1056. — 01.10.1994, 16°33'S, 167°55'E, 602-620 m, Epi: *Caryophyllia* (*Caryophyllia*) sp. cf. *calveri*.

Stn 1058. — 02.10.1994, 16°12'S, 167°20'E, 319 m, Malakula: *Trochocyathus* (*Aplocyathus*) *brevispina*, *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Dendrophyllia arbuscula*.

Stn 1059. — 02.10.1994, 16°12'S, 167°20'E, 408-430 m, Malakula: *Conotrochus funicolumna*.

Stn 1060. — 02.10.1994, 16°13'S, 167°20'E, 375-397 m, Malakula: *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Conotrochus funicolumna*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum dens*, *T. vigintifarium*, *Javania exserta*.

Stn 1061. — 02.10.1994, 16°14'S, 167°20'E, 458-512 m, Malakula: *Bourneotrochus stellulatus*, *Deltocyathus crassiseptum*, *D. cameratus*.

Stn 1065. — 02.10.1994, 16°16'S, 167°21'E, 360-419 m, Malakula: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Aplocyathus*) *brevispina*, *Conotrochus funicolumna*, *Tropidocyathus labidus*, *Flabellum* (*Flabellum*) *pavoninum*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum angustum*, *T. vigintifarium*, *T. mortenseni*, *Balanophyllia desmophyllioides*.

Stn 1067. — 02.10.1994, 16°16'S, 167°21'E, 344-366 m, Malakula: *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Notocyathus conicus*, *Cryptotrochus brevipalus*, *Gardineria hawaiiensis*.

Stn 1068. — 02.10.1994, 16°15'S, 167°19'E, 536-619 m, Malakula: *Deltocyathus crassiseptum*, *Alatotrochus rubescens*, *Tropidocyathus labidus*.

Stn 1069. — 04.10.1994, 15°32'S, 167°14'E, 122-125 m, SE of Espiritu Santo: *Caryophyllia* (*Acanthocyathus*) *grayi*, *Heterocyathus* cf. *sulcatus*.

Stn 1070. — 04.10.1994, 15°36'S, 167°16'E, 184-190 m, SE of Espiritu Santo: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Letepsammia franki*, *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Trochocyathus*) *philippinensis*, *Aulocyathus juvenescens*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*.

Stn 1071. — 04.10.1994, 15°36'S, 167°16'E, 180-191 m, SE of Espiritu Santo: *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Trochocyathus*) *philippinensis*, *Rhizosmilia robusta*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*, *Endopachys grayi*.

Stn 1072. — 04.10.1994, 15°39'S, 167°19'E, 622-625 m, SE of Espiritu Santo: *Caryophyllia* (*Caryophyllia*) *octonaria*, *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Conotrochus funicolumna*, *Heteropsammia cochlea*.

Stn 1074. — 04.10.1994, 15°48'S, 167°24'E, 775-798 m, SE of Espiritu Santo: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Caryophyllia* (*Caryophyllia*) *crosnieri*, *C.* (*C.*) *scobinosa*, *Stephanocyathus* (*Odontocyathus*) *weberianus*.

Stn 1077. — 05.10.1994, 16°04'S, 167°06'E, 180-210 m, Malakula: *Madracis kauaiensis*, *Oculina virgosa*, *Madrepora porcellana*, *Caryophyllia* (*Caryophyllia*) *lamellifera*, *Trochocyathus* (*Trochocyathus*) *maculatus*, *Rhizosmilia robusta*, *Truncatoflabellum mortenseni*, *Balanophyllia rediviva*.

Stn 1078. — 05.10.1994, 16°03'S, 167°26'E, 194-230 m, Malakula: *Rhizosmilia robusta*, *Rhizotrochus typus*.

Stn 1080. — 05.10.1994, 15°57'S, 167°27'E, 799-850 m, Malakula: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Caryophyllia* (*Caryophyllia*) *diomedeae*, *Stephanocyathus* (*Odontocyathus*) *weberianus*.

Stn 1084. — 05.10.94, 15°50'S, 167°17'E, 207-280 m, Malakula: *Madrepora porcellana*, *Rhizosmilia robusta*, *Flabellum* (*Flabellum*) *pavoninum*.

Stn 1085. — 05.10.1994, 15°48'S, 167°18'E, 155-161 m, Malakula: *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum martensii*, *Javania exserta*, *Endopachys grayi*.

Stn 1086. — 05.10.1994, 15°36'S, 167°16'E, 182-215 m, Malakula: *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Trochocyathus*) *philippinensis*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum candeanum*, *T. martensii*, *Endopachys grayi*.

Stn 1087. — 06.10.1994, 15°10'S, 167°14'E, 394-421 m, NE of Espiritu Santo: *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Bourneotrochus stellulatus* [X], *Conotrochus funicolumna*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum angustum*.

Stn 1088. — 06.10.1994, 15°09'S, 167°15'E, 425-455 m, NE of Espiritu Santo: *Madrepora oculata* forma *formosa*, *Caryophyllia* (*Caryophyllia*) *abrupta*, *Trochocyathus* (*Trochocyathus*) *discus*, *Conotrochus funicolumna*, *Desmophyllum dianthus*, *Peponocyathus folliculus*.

Stn 1089. — 06.10.1994, 15°08'S, 167°17'E, 494-516 m, NE of Espiritu Santo: *Madrepora porcellana*, *Trochocyathus* (*Trochocyathus*) *discus*, *Conotrochus brunneus*, *Desmophyllum dianthus*.

Stn 1090. — 06.10.1994, 15°08'S, 167°17'E, 470-502 m, NE of Espiritu Santo: *Trochocyathus* (*Trochocyathus*) *discus*, *Conotrochus brunneus*.

Stn 1091. — 06.10.1994, 15°10'S, 167°13'E, 344-350 m, NE of Espiritu Santo: *Stephanophyllia complicata* [X], *Caryophyllia* (*Caryophyllia*) *abrupta* [X], *Conotrochus funicolumna*, *Flabellum* (*Flabellum*) *pavoninum* [X], *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum angustum*.

Stn 1092. — 06.10.1994, 15°10'S, 167°12'E, 314-321 m, NE of Espiritu Santo: *Stephanocyathus* (*Acinocyathus*) *spiniger*, *Conotrochus brunneus* [X].

Stn 1094. — 06.10.1994, 15°08'S, 167°11'E, 312-314 m, NE of Espiritu Santo: *Caryophyllia* (*Caryophyllia*) *abrupta*, *Deltocyathus ornatus*, *Heterocyathus* cf. *sulcatus*, *Truncatoflabellum pusillum*, *T. vigintifarium*.

Stn 1095. — 06.10.1994, 15°07'S, 167°11'E, 304-320 m, NE of Espiritu Santo: *Caryophyllia* (*Caryophyllia*) *rugosa*, *?C. (C.) lamellifera*, *Crispatotrochus rugosus*, *Tethocyathus virgatus*, *Dactylotrochus cervicornis*, *Dendrophyllia alcocki*.

Stn 1097. — 07.10.1994, 15°05'S, 167°10'E, 281-288 m, NE of Espiritu Santo: *Stephanophyllia complicata* [X], *Caryophyllia* (*Caryophyllia*) *rugosa*, *Oxysmilia epithecata*, *Bourneotrochus stellulatus* [X], *Deltocyathus stella* [X], *Heterocyathus* cf. *sulcatus*, *Conotrochus asymmetros* [X], *Guynia annulata* [X], *Truncatoflabellum pusillum*, *T. vigintifarium*, *Javania fusca*.

Stn 1098. — 07.10.1994, 15°04'S, 167°10'E, 277-285 m, NE of Espiritu Santo: *Truncatoflabellum pusillum*, *T. vigintifarium*, *Balanophyllia desmophyllioides*.

Stn 1102. — 07.10.1994, 15°03'S, 167°08'E, 208-210 m, NE of Espiritu Santo: *Oculina virgosa*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*.

Stn 1103. — 07.10.1994, 15°03'S, 167°07'E, 163-165 m, NE of Espiritu Santo: *Caryophyllia* (*Acanthocyathus*) *grayi*, *Trochocyathus* (*Trochocyathus*) *semperi*, *Flabellum* (*Flabellum*) *pavoninum*, *Truncatoflabellum mortenseni*.

Stn 1106. — 07.10.1994, 15°05'S, 167°11'E, 305-314 m, NE of Espiritu Santo: *Fungiacyathus* (*Fungiacyathus*) *paliferus*, *Caryophyllia* (*Caryophyllia*) *quadragenaria*, *Crispatotrochus rugosus*, *Bourneotrochus stellulatus* [X], *Deltocyathus stella*, *D. heteroclitus* [X], *Truncatoflabellum vigintifarium*, *T. pusillum* [X], *Javania fusca*

Stn 1107. — 07.10.1994, 15°05'S, 167°15'E, 397-402 m, NE of Espiritu Santo: *Trochocyathus* (*Trochocyathus*) *vasiformis*, *Conotrochus funicolumna*.

Stn 1108. — 07.10.1994, 15°04'S, 167°15'E, 405-419 m, NE of Espiritu Santo: *Caryophyllia* (*Caryophyllia*) *crosnieri*, *Tethocyathus virgatus*, *Dendrophyllia alcocki*.

Stn 1109. — 08.10.1994, 14°52'S, 167°18'E, 1550-1620 m, N of Espiritu Santo: *Stephanocyathus* (*Stephanocyathus*) *regius*.

Stn 1110. — 08.10.1994, 14°49'S, 167°15'E, 1360 m, N of Espiritu Santo: *Stephanocyathus* (*Stephanocyathus*) *regius*.

Stn 1111. — 08.10.1994, 14°51'S, 167°14'E, 1210-1250 m, N of Espiritu Santo: *Trochocyathus* (*Trochocyathus*) *patelliformis*.

Stn 1113. — 08.10.1994, 14°52'S, 167°06'E, 700-736 m, N of Espiritu Santo: *Stephanophyllia complicata*, *Conotrochus funicolumna*, *Pleotrochus zibrowii*, *Cryptotrochus brevipalus*, *Truncatoflabellum vigintifarium*.

Stn 1114. — 08.10.1994, 14°52'S, 167°03'E, 647 m, N of Espiritu Santo: *Pleotrochus venustus*, *Javania fusca*.

Stn 1125. — 10.10.1994, 15°57'S, 166°38'E, 1160-1220 m, Guyot Bougainville: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Stephanocyathus* (*Odontocyathus*) *coronatus*, *Deltocyathus rotulus*, *Truncatoflabellum stabile*.

Stn 1127. — 10.10.1994, 15°58'S, 166°37'E, 1052-1058 m, Guyot Bougainville: *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus rotulus*, *Truncatoflabellum stabile*.

Stn 1128. — 10.10.1994, 16°02'S, 166°38'E, 778-811 m, Guyot Bougainville: *Fungiacyathus* (*Fungiacyathus*) *pusillus pacificus*, *Caryophyllia* (*Caryophyllia*) *diomedeae*, *Desmophyllum dianthus*, *Javania fusca*.

Stn 1129. — 10.10.1994, 16°00'S, 166°39'E, 1014-1050 m, Guyot Bougainville: *Fungiacyathus* (*Fungiacyathus*) *stephanus*, *Stephanocyathus* (*Stephanocyathus*) *regius*, *Deltocyathus rotulus*, *Flabellum* (*Ulocyathus*) *marcus*

Stn 1131. — 11.10.1994, 15°38'S, 167°03'E, 140-175 m, S of Espiritu Santo: *Rhizotrochus typus*.

Stn 1132. — 11.10.1994, 15°38'S, 167°02'E, 161-182 m, S of Espiritu Santo: *Flabellum* (*Flabellum*) *pavoninum*.

Stn 1134. — 11.10.1994, 15°39'S, 167°02'E, 230-287 m, S of Espiritu Santo: *Letepsammia franki*, *Caryophyllia* (*Caryophyllia*) *octonaria*, *Caryophyllia* (*Acanthocyathus*) *grayi*, *Flabellum* (*Ulocyathus*) *aotearoa*, *Truncatoflabellum mortenseni*, *Balanophyllia rediviva*, *Endopachys grayi*.

Stn 1135. — 11.10.1994, 15°40'S, 167°02'E, 282-375 m, S of Espiritu Santo: *Flabellum* (*Flabellum*) *pavoninum* [X], *Truncatoflabellum angustum* [X].

NIMBUS

Stn 12. — ?.07.1968, 26°32'S, 153°45'E, depth unknown, Queensland: *Anthemiphyllia multidentata*.

Stn 55. — 1968, 26°27'S, 153°50'E, 270-272 m, Queensland: *Anthemiphyllia multidentata*.

NZOI (New Zealand Oceanographic Institute), *"Tangaroa"*

Stn C527. — 18.09.1960, 32°30.0'S, 179°12.0'W, 508 m, southern Kermadec Ridge: *Anthemiphyllia macrolobata*.

Stn I92. — 23.07.1975, 29°24.8'S, 168°13.2'E, 570-578 m, Norfolk I.: *Flabellum* (*Flabellum*) *arcuatile*.

Stn I97. — 25.07.1975, 32°22.9'S, 167°28.2'E, 540-544 m, southern Norfolk Ridge: *Flabellum* (*Flabellum*) *arcuatile*.

Stn I741. — 12.05.1979, 22°43.0'S, 159°16.0'E, 328 m, Lord Howe Seamount Chain: *Balanophyllia desmophyllioides*.

Stn K803. — 22.07.1974, 29°16.0'S, 177°50.3'W, 190-140 m, Raoul I., Kermadec Is: *Madracis kauaiensis*.

Stn K825. — 25.07.1974, 28°47.8'S, 177°47.8'W, 145 m, Raoul I., Kermadec Is: *Madracis kauaiensis*.

Stn K826. — 25.07.1974, 28°48.0'S, 177°48.0'W, 142 m, Raoul I., Kermadec Is: *Madracis kauaiensis*.

Stn K830. — 26.07.1974, 29°11.5'S, 177°53.0'W, 545-590 m, Raoul I., Kermadec Is: *Oxysmilia circularis*.

Stn K842. — 29.07.1974, 30°10.2'S, 178°35.9'W, 325-370 m, McCauley I., Kermadec Is: *Anthemiphyllia pacifica*.

Stn K858. — 30.07.1974, 30°34.2'S, 178°29.8'W, 465-501 m, Curtis I., Kermadec Is: *Oxysmilia circularis*.

Stn K872. — 2.08.1974, 31°20.4'S, 178°49.2'W, 280-235 m, Esperance Rock, Kermadec Is: *Anthemiphyllia pacifica*

Stn P115. — 31.05.1977, 31°25.9'S, 159°02.2'E, Lord Howe Is: *Thalamophyllia tenuescens*.

Stn U599. — 08.02.1988, 30°43.0'S, 173°16.0'E, 640-590 m, Three Kings Ridge, New Zealand: *Flabellum* (*Flabellum*) *arcuatile*.

"Townsend Cromwell"

Stn 81-01-14. — 02.02.1981, 23°15'48"N, 161°50'12"W, 369 m, Hawaiian Is: *Anthemiphyllia macrolobata*.

"Toyoshio-Maru"

Stn 11. — 11.11.1995, 28°05'N, 129°47'40"E, 302 m, Ryukyu Is: *Madrepora minutiseptum*.

USGS (United States Geological Survey)

Stn 24918. — Late Pleistocene, Navaka River, Espiritu Santo: *Madrepora porcellana*.

Stn 25715. — Late Pleistocene, Kere River, Espiritu Santo: *Madrepora porcellana*, *Caryophyllia* (*Acanthocyathus*) *grayi*, *Dendrophyllia ijimai*.

Stn 25718. — Late Pleistocene, Kere River, Espiritu Santo: *Madrepora porcellana*.

Stns SM242, 129a and 129b. — Late Pleistocene, Kere River, Espiritu Santo: *Caryophyllia* (*Acanthocyathus*) *grayi*.

HISTORICAL REVIEW

No azooxanthellate Scleractinia were previously known from the Wallis and Futuna region, and only two authors reported azooxanthellate corals from Vanuatu: *Neohelia porcellana* from Epi (MOSELEY, 1881), and 17 Late Pleistocene species from Espiritu Santo (WELLS, 1984). However, many species have been reported from other islands throughout the tropical central Pacific, which are summarized in Table 1. Although the specimens reported in this paper are primarily deep-water in habitat, it was attempted to include references to all azooxanthellate species in Table 1, regardless of depth. Only some of the more significant papers are briefly discussed below.

TABLE 1. — Summary of azooxanthellate Scleractinia previously reported from the tropical central Pacific. (S = 0-100 m, D = over 100 m, + = fossil).

Year	Author	Locality	Depth	Species reported
1831	LESSON	Hawaiian Is.	D	*Flabellum pavoninum* sp. nov.
1846	DANA	Fiji	S	3 species: *Tubastraea* and *Culicia*, including two new species.
1878	STUDER	Solomon Is. (Bougainville)	S	*Madracis hellana, Phyllangia papuensis* sp. nov.
1881	MOSELEY	Admiralty, Kermadec Is., Fiji, **Vanuatu**, Caroline, Louisiade Is.	D	6 species, including 4 new
1892	REHBERG	Fiji	D	*Madracis singularis* sp. nov.
1898	WHITELEGGE	Tuvalu (Funafuti)	SD	*Caryophyllia "clavus"*
1899a	GARDINER	Loyalty Is. (Lifou)	S	9 new species, all from Sandal Bay (73 m)
1899b	GARDINER	Tuvalu (Funafuti)	D	*Rhizotrochus levidensis*
1900	GARDINER	Loyalty Is.	S	*Coenopsammia willeyi* sp. nov.
1903	BOURNE	Funafuti (Tuvalu)	D	4 species, including 2 new
1907	VAUGHAN	Hawaiian Is.	D	32 species and 7 varieties, 27 new
1936	YABE & SUGIYAMA	Palau	D	3 species, including 2 new *Madracis*
1954	WELLS	Bikini Atoll (Marshall Is.)	SD	13 species, including a new genus, 2 new species, 1 new variety
1971	CHEVALIER	New Caledonia	S	3 species of *Culicia* and *Oulangia*, including 2 new
1973	ZIBROWIUS	Tuamotu Is.	D	*Enallopsammia rostrata*
1974	KELLER	Marcus-Necker Ridge	D	*Flabellum marcus* sp. nov.
1976	KELLER	Caroline, Marquesas, Tuamotu Is.	D	*Fungiacyathus fragilis fragilis* subsp. nov.
1977	WELLS	Tonga (Late Eocene)	+	17 species, including 13 new
1978	CHEVALIER	Marquesas	S	4 species, 3 unidentified to species
1980	CHEVALIER	Tubuai	S	2 species, both unidentified to species
1981a	KELLER	Marcus-Necker Ridge, Hermit Atoll, Dimitri Mendeleev Seamount, Hawaiian Is.	D	8 species, including 1 new
1981b	KELLER	Bonin Is., Marcus-Necker Ridge	D	*Caryophyllia pacifica* sp. nov., *C. scobinosa*
1982	KELLER	Cook, Kermadec, Hawaiian Is.	D	3 species of *Deltocyathus*
1984	CAIRNS	Hawaiian, Christmas, Line Is.	D	19 new records, including 8 new species
1984	WELLS	**Vanuatu** (Late Pleistocene)	+	17 species, including 3 new species
1985	ZIBROWIUS & GRYGIER	New Caledonia, Guam, Cook, Hawaiian, Santa Cruz Is.	D	6 species as hosts of ascothoracidan Crustacea

Year	Author	Locality	Depth	Species reported
1985	GRYGIER & NEWMAN	Tonga, Hawaiian Is.	D	*Enallopsammia rostrata* as host of acrothoracican cirripedes
1985	ZIBROWIUS	Chesterfield Is.	S	2 species of budd-shedding *Balanophyllia*
1985	RANDALL & MYERS	Guam	S	5 species
1989	SIEG & ZIBROWIUS	New Caledonia	D	4 unidentified species as hosts for tanaiedacean
1991	MANNING	New Caledonia	D	*Dendrophyllia alcocki* as host for cryptochirid crab
1991	GRYGIER	Johnston Atoll	D	*Enallopsammia rostrata* as host of ascothoracidan Crustacea
1995	CAIRNS	Kermadec, Colville, Norfolk Ridges; Chesterfield, Cook, Tonga, Samoa Is.	DS	76 species, including 15 new species, mostly from southern border of tropical region
1995	GUERRIERO *et al.*	Loyalty Is.	D	steroids from *Deltocyathus magnificus*
1996	STOLARSKI	Loyalty Is.	D	unidentified gardinariid genus and species
1997	CAIRNS & ZIBROWIUS	Fiji, New Caledonia, Palau, Marquesas, Kermadecs Is.; Norfolk Ridge	DS	9 species, including 2 new species
1998	CAIRNS (this paper)	**Vanuatu, Wallis and Futuna**, Hawaiian Is., Chesterfield Is., Guam, Lord Howe Seamount Chain	D	134 species (see Historical Review), including 15 new species

The first azooxanthellate coral reported from the tropical central Pacific was *Flabellum pavoninum* Lesson, 1831 from the "Sandwich Islands" (= Hawaiian Islands), which is ironic, since it is a deep-water species that was collected before the era of deep-water dredging. The *"Challenger"* Expedition, which ushered in the era of deep-water biology, collected 6 species from various localities throughout the central Pacific, including one new species (*Neohelia porcellana*) from the Vanuatu archipelago (MOSELEY, 1881). The collection of the nine species reported by GARDINER (1899a) from the Loyalty Islands, all from Sandal Bay at 73 m, is significant in that many of these species are also found at greater depths, as reported herein. GARDINER's specimens were split between the British Museum and the University Museum of Zoology, Cambridge.

The Hawaiian azooxanthellate fauna is relatively well known, due to the seminal work of VAUGHAN (1907) and later additions by CAIRNS (1984), all specimens of which are deposited at the USNM. Although a northern outlier to the central Pacific region, the Hawaiian fauna includes many species found throughout the Indo-Pacific (see Distribution section), as well as some apparent endemics.

Another significant paper on corals from the central tropical Pacific was that of WELLS (1954) on the Recent corals of the Marshall Islands, in which 13 azooxanthellate species are reported from Bikini Atoll, mostly from depths shallower than 200 m. These specimens are deposited at the USNM.

KELLER (1981a) reported eight species from several exotic central Pacific bathyal localities, including the Marcus-Necker Ridge (18-23°N, 157-178°E), Hermit Atoll (1°S, 145°E), Demitri Mendeleev Seamount (5°N, 155°E), and the Hawaiian Islands. These specimens are deposited at the Institute of Oceanology, Moscow.

As the Hawaiian Islands are to the northern border of the central tropical Pacific, the ridges and islands north of New Zealand (north of 33°S) are to the southern central tropical Pacific. In his revision of the New Zealand azooxanthellate Scleractinia, CAIRNS (1995: Table 2) listed 76 species from the Kermadec and the Lord Howe Islands, and the northern Colville, Three Kings, and Norfolk ridges; additional records of 12 of these species were also reported from Chesterfield, Cook, Tonga, and Samoa Islands.

Azooxanthellate species were reported in an incidental fashion in a number of papers published after 1984 (see Table 1), often as host species for symbionts, or as a part of a larger checklist of the shallow water coral fauna

from a region. It was attempted to make Table 1 as complete as possible, but undoubtedly some references of this nature were overlooked.

As a result of this study, 116 azooxanthellate species are reported from the Vanuatu Archipelago and 83 from the Wallis and Futuna Archipelago (Table 2). Incidental records are also reported from the Kermadec Islands (3 species), Hawaiian Islands (2), Johnston Atoll (1), Lord Howe Seamount Chain (1), Guam (1), Chesterfield Island (1), and the ridges and islands north of New Zealand (1).

The following azooxanthellate coral faunas have been reviewed from regions bordering the tropical central Pacific: northern temperate Pacific (CAIRNS, 1994), eastern temperate Pacific (CAIRNS, 1994), eastern tropical Pacific (CAIRNS, 1991a), southern temperate Pacific (CAIRNS, 1982, 1995), and western tropical Pacific (CAIRNS, 1989a; CAIRNS & ZIBROWIUS, 1997).

MATERIAL

This study was based on the examination of approximately 4400 specimens (1042 lots) collected from 227 stations. Most of the specimens were collected by the French research expedition MUSORSTOM 7 in the Wallis and Futuna archipelago in 1992 (RICHER DE FORGES & MENOU, 1993) and MUSORSTOM 8 in the Vanuatu archipelago in 1994 (RICHER DE FORGES, FALIEX & MENOU, 1996).

A novel source of specimens heretofore overlooked by most are those deep-water corals that have been cemented into the shell of *Xenophora* carrier shells. Nineteen species and several more unidentified taxa were distinguished from 40 *Xenophora* shells from the MUSORSTOM 8 expedition in the Vanuatu Archipelago, some shells bearing as many as 6 different species. This source of specimens is considered promising because, despite numerous stations made by the MUSORSTOM expedition in this region, of the 19 species found on these shells, three (*Fungiacyathus variegatus, Peponocyathus folliculus*, and *Temnotrochus kermadecensis*) are known from this region only as *Xenophora*-collected, and another five species (*Guynia annulata, Tropidocyathus labidus, Notocyathus conicus, Deltocyathus heteroclitus*, and *Trochocyathus discus*) were otherwise rarely collected from this region by conventional means. The depth ranges of the *Xenophora*-collected coralla are consistent with the known depth range of the coral species, implying that bathymetric transport by the gastropod is probably negligible. Furthermore, although most coralla cemented to *Xenophora* shells are dead, some were still alive when attached and when collected.

METHODS

Species descriptions and illustrations are provided only for those species described as new or for those for which no adequate description previously existed. Shorter diagnoses are provided for most of the remaining species for which new material is reported, with an indication as to where to find a more complete description.

Species synonymies are complete unless otherwise indicated with a reference to a more complete account; however, it was attempted to include in the synonymies all references to specimens reported from the tropical central Pacific. When possible, historical records were verified, but when material was unavailable and the published account unclear, the synonymy entry and corresponding distribution record are queried. In order to clarify what historical material was examined by the author, the following convention was employed (see MATTHEWS, 1973). The three symbols used in the synonymies, which always precede the year of publication, are:

*, meaning this entry represents a valid species under the terms of the ICZN (1985);

v*, meaning that the author (SDC) has examined the type of this species;

v., meaning that the author (SDC) has examined this/these nontype specimens and agrees that they belong in synonymy.

The letter "v" is Latin for *vidimus* (we have seen). The *vidimus* convention is not used for publications written by the author of the cited publication, since it is self-evident that he has seen the specimens that he has previously reported.

In the "Material Examined" sections, the number of specimens examined follows the station number, followed by the museum of deposition, and its catalog number, if any. Holotypes and paratypes are deposited primarily at the MNHN and NMNH.

In order to avoid erroneous depth ranges for species as a result of bathymetrically wide-ranging trawls, a confirmed depth range is employed in this paper, which is defined as the deepest shallow to the shallowest deep component of all trawls considered. For example, if a species was trawled at a station indicating 20-300 m and again at a station indicating 250-500 m, the confirmed depth range is 250-300 m, a depth range within which the species must occur.

Conventional photography was done by the author, in some cases the corallum dyed black with cloth dye and recoated with sublimed ammonium chloride in order to improve contrast for photography.

DISTRIBUTION

Inter-regional comparisons. — The Vanuatu archipelago and Wallis and Futuna islands and adjacent seamounts lie near the centre of the large Indo-Polynesian tropical marine province as defined by BRIGGS (1974), which extends from the Persian Gulf to the Tuamotu Archipelago. The 116 azooxanthellate species listed for the Vanuatu region (Table 2) compare closely in number to the 125 listed by CAIRNS & ZIBROWIUS (1997) for the highly diverse Kai Islands, Indonesia, especially considering that the shallow and extremely deep environments of the Vanuatu region were not sampled. Indeed, 95 (71%) of the 134 species from the Vanuatu and Wallis and Futuna regions are also known in the tropical western Pacific region, this number decreasing to 62 (46%) farther west in the tropical Indian Ocean (Table 2). On the other hand, only seven species are found in common with the Vanuatu/Wallis and Futuna region and the tropical eastern Pacific: five of those being cosmopolitan; one, *Endopachys grayi*, being Indo-Pacific in distribution; and the seventh, *Polymyces wellsi*, amphi-Pacific in distribution. Ironically, the Vanuatu/Wallis and Futuna region has more species in common with the Atlantic Ocean (11) than the eastern Pacific (7)(see Table 2). Among these 11 species, 6 may be considered to be cosmopolitan; two (*Caryophyllia ambrosia* and *Truncatoflabellum stabile*) have potentially continuous distributions via the Indian Ocean; but three species (*Stephanocyathus coronatus*, *Vaughanella concinna*, and *Peponocyathus folliculus*) have apparent disjunct distributions between the central Pacific and the western or northern Atlantic.

Because deep water temperature gradients do not always exactly correspond to shallow water gradients, the zoogeographic boundaries of deep-water corals are sometimes less well-defined than for shallow-water organisms (BRIGGS, 1974; CAIRNS, 1994, 1995). Thus, it is not considered unusual that 43 species from the Vanuatu/Wallis and Futuna region are also known from the warm to cold temperate region of Japan, and 32 species extend to the temperate regions of New Zealand and southern Australia (Table 2).

Intraregional comparisons. — Within the tropical central Pacific, the Vanuatu/Wallis and Futuna azooxanthellates have a strong affinity (56 species, Table 2) to those species found in the tropical regions to the south, composed of the Kermadec Islands and Ridge, Colville Ridge, Norfolk Island and Ridge, and the Lord Howe Islands and Seamount Chain. These submarine ridge systems north of New Zealand form a natural conduit for the migration of corals in both directions between the New Zealand region and the Tonga Platform and the New Caledonian region. And, whereas only 9 species are listed for the New Caledonian region in Table 2, unstudied MUSORSTOM collections from this region and the Loyalty Islands suggest an extremely diverse fauna very similar to that of the Vanuatu region. The Hawaiian azooxanthellate fauna constitutes a separate province in the tropical Pacific (Briggs, 1974), having an endemic component of 48% (CAIRNS, 1984). Nonetheless, 24 species known from the Vanuatu/Wallis and Futuna region also occur off the Hawaiian Islands (Table 2). Other than the Hawaiian Islands, the ridges north of New Zealand, and the region under study, azooxanthellates are poorly known from other tropical central Pacific regions, only 17 species listed in Table 2: column 5, symbol X; see also Table 1.

TABLE 2. — Geographic distribution and bathymetric ranges of the Recent azooxanthellate scleractinian species known from the regions of Wallis & Futuna and Vanuatu Archipelagos.

Key to areas: **1-7**, **Tropical regions**: 1, Indian Ocean; 2, western Pacific; 3, Vanuatu region; 4, Wallis and Futuna region; 5, other central Pacific islands (H, Hawaiian Islands; NZ, ridges north of New Zealand; NC, New Caledonia, Loyalty Islands, and/or Chesterfield Islands; OI, other central Pacific islands); 6, eastern Pacific; 7, Atlantic Ocean. — **8-9**, **Temperate regions**: 8, Japan (excluding Ryukyu Isl.); 9, New Zealand, Australia.
Bathymetric ranges (given in meters) only for records from Vanuatu/Wallis and Futuna region.
Symbols: + fossil occurrence.

	TROPICAL							TEMPERATE		Depth (m)
	1	2	3	4	5	6	7	8	9	
POCILLOPORIDAE										
Madracis kauaiensis Vaughan, 1907	?		x	x	H, NZ, OI					210-516
FUNGIACYATHIDAE										
Fungiacyathus (F.) stephanus (Alcock, 1893)	x	x	x	x	NZ			x	x	440-1280
F. (F.) pusillus pacificus Cairns, 1995			x	x	NZ				x	425-811
F. (F.) sandoi sp. nov.				x						295-600
F. (F.) paliferus (Alcock, 1902)	x	x	x					x	x	190-400(+)
F. (Bathyactis) margaretae Cairns, 1995			x	x	NZ					440-175
F. (B.) granulosus Cairns, 1989	x	x	x	x				x		433-455
F. (B.) variegatus Cairns, 1989	x	x	x					x		400-440(+)
MICRABACIIDAE										
Letepsammia franki Owens, 1994	x		x	x						190-475
Stephanophyllia neglecta Boschma, 1923		x	x	x						280-497
S. complicata Moseley, 1876	x	x	x	x	NZ				x	288-700(+)
OCULINIDAE										
Oculina virgosa Squires, 1958			x						x	180-210
Madrepora oculata Linnaeus, 1758	x	x	x	x	H, NZ	x	x	x	x	310-1280
M. minutiseptum Cairns & Zibrowius, 1997		x		x						233-260
M. porcellana (Moseley, 1881)		x	x	x	NC					115-516(+)
ANTHEMIPHYLLIIDAE										
Anthemiphyllia dentata (Alcock, 1902)	x	x	x	x	H, NZ					280-650
A. pacifica Vaughan, 1907			x		H, NZ					310
A. patera costata subsp. nov.				x						320-700
A. spinifera sp. nov.		x	x	x						245-510
CARYOPHYLLIIDAE										
Caryophyllia (C.) hawaiiensis Vaughan, 1907		x	x	x	H, NZ					252-300
C. (C.) crosnieri Cairns & Zibrowius, 1997	x	x	x	x	NZ				x	386-600
C. (C.) rugosa Moseley, 1881	x	x	x	x				x	x	314-440
C. (C.) octonaria Cairns & Zibrowius, 1997		x	x							182-622
C. (C.) abrupta sp. nov.			x	x						300-650
C. (C.) marmorea Cairns, 1984				x	H					475-600
C. (C.) quadragenaria Alcock, 1902	x	x	x	x				x	x	314-440
C. sp. cf. *C. (C.) calveri* Duncan, 1873	x	x	x	x				x	x	314-440
C. (C.) diomedeae Marenzeller, 1904	x	x	x		NZ, OI	x	x		x	475-799
C. (C.) lamellifera Moseley, 1881	?	x	x	x	NZ					180-516
C. (C.) scobinosa Alcock, 1902	x	x	x	x	NZ, OI			x		715-900
C. (C.) ambrosia Alcock, 1898	x	x		x	NZ		x	x	x	715-1015

	TROPICAL							TEMPERATE		Depth (m)
	1	2	3	4	5	6	7	8	9	
C. (Acanthocyathus) grayi (H. Milne Edwards & Haime, 1848)	x	x	x	x				x		125-160(+)
Crispatotrochus rubescens (Moseley, 1881)		x	x	x	H, OI			x		420-516
C. rugosus Cairns, 1995	x	x	x	x	NZ					190-455
Labyrinthocyathus limatulus (Squires, 1964)			x		NZ				x	372-466
Oxysmilia circularis Cairns	x		x		NZ					190-475
O. corrugata sp. nov.			x							180-190
O. epithecata sp. nov.			x	x						240-455
Trochocyathus (T.) vasiformis Bourne, 1903		x	x	x	OI					366-650
T. (T.) rhombocolumna Alcock, 1902	x	x	x		H, NZ					397-410
T. (T.) philippinensis Semper, 1872	x	x	x	x						182-330
T. (T.) maculatus Cairns, 1995		x	x	x	NZ					110-550
T. (T.) efateensis sp. nov.			x							391-437
T. (T.) patelliformis sp. nov.			x		H					1210-1250
T. (T.) semperi Cairns & Zibrowius, 1997		x	x							163-165
T. (T.) cooperi (Gardiner, 1905)	x	x	x		OI			x		101-124
T. (T.) discus Cairns & Zibrowius, 1997		x	x	x						455-470
T. (Aplocyathus) hastatus Bourne, 1903			x	x	NZ, OI					391-540
T. (A.) brevispina Cairns & Zibrowius, 1997		x	x							110-436
Tethocyathus virgatus (Alcock, 1902)		x	x	x	NZ					320-650
Polycyathus octuplus sp. nov.				x						110-441
Bourneotrochus stellulatus (Cairns, 1984)		x	x	x	H, NZ, NC, OI					240-566(+)
Stephanocyathus (S.) regius Cairns & Zibrowius, 1997		x	x	x	NZ					700-1550
S. (Odontocyathus) coronatus (Pourtalès, 1867)		x	x	x	NZ		x			1175-1300
S. (O.) weberianus (Alcock, 1902)		x	x		NZ			x		798-799
S. (Acinocyathus) spiniger (Marenzeller, 1888)	x	x	x	x	NZ			x	x	319-420(+)
Vaughanella concinna Gravier, 1915				x	NZ		x			500-560
Deltocyathus magnificus Moseley, 1876	x	x	x					x	x	408-433
D. rotulus (Alcock, 1902)	x	x	x	x				x		1050-1300
D. suluensis Alcock, 1902	x	x	x	x	NZ					400-650
D. taiwanicus Hu, 1987		+		x						320-697
D. vaughani Yabe & Eguchi, 1932		x	x					x		585-919
D. crassiseptum sp. nov.			x	x						413-536
D. cameratus sp. nov.			x	x						305-1175
D. stella Cairns & Zibrowius, 1997		x	x	x						240-597
D. heteroclitus Wells, 1984			x	x						208-355(+)
D. ornatus Gardiner, 1899			x	x	NC					295-360
Heterocyathus sp. cf. *H. sulcatus* (Verrill, 1866)	x	x	x	x						110-312
H. alternatus Verrill, 1865	x	x	x							301-319
Conotrochus funicolumna (Alcock, 1902)	x	x	x	x	H			x		350-700
C. brunneus (Moseley, 1881)	x	x	x	x	NZ					300-580
C. asymmetros sp. nov.			x	x						210-510
Lochmaeotrochus gardineri sp. nov.			x	x						608-1175
Aulocyathus recidivus (Dennant, 1906)	x	x		x	NZ			x	x	1020-1280
A. juvenescens Marenzeller, 1904	x	?	x							182-184
Desmophyllum dianthus (Esper, 1794)	x	x	x	x	H, NZ	x	x	x	x	455-830
Thalamophyllia tenuescens (Gardiner, 1899)	x	x		x	NZ, NC, OI					240-249

	TROPICAL							TEMPERATE		Depth (m)
	1	2	3	4	5	6	7	8	9	
Lophelia pertusa (Linnaeus, 1758)	x			x		x	x	x		560-580
Dactylotrochus cervicornis (Moseley, 1881)		x	x	x	NC, OI					245-400
Rhizosmilia robusta Cairns, 1993	x	x	x	x						100-360
Asterosmilia gigas (van der Horst, 1931)	x			x						252-510
TURBINOLIIDAE										
Alatotrochus rubescens (Moseley, 1876)		x	x		NZ			x		536-619
Pleotrochus venustus (Alcock, 1902)		x	x		NZ					647
P. zibrowii Cairns, 1997			x	x	NZ					700-830
Tropidocyathus lessonii (Michelin, 1842)	x	x	x					x		291-300
T. labidus Cairns & Zibrowius, 1997	x	x	x							419-536
Cyathotrochus pileus (Alcock, 1902)	x	x	x		NZ			x		300-497
Deltocyathoides orientalis (Duncan, 1876)	x	x	+	x				x	x	245-455(+)
Notocyathus conicus (Alcock, 1902)		x	x		NZ			x		301-366
N. venustus (Alcock, 1902) sensu WELLS, 1984	x	x	?+					x		(+)
Cryptotrochus brevipalus sp. nov.			x							466-700
Idiotrochus kikutii (Yabe & Eguchi, 1941)	x	x		x				x		240-260
Peponocyathus folliculus (Pourtalès, 1868)		x	x				x	x		425-455
GUYNIIDAE										
Guynia annulata Duncan, 1872	x	x	x	x	H		x		x	260-300
Truncatoguynia irregularis Cairns, 1989		x	x		NZ					295-334
Temnotrochus kermadecensis Cairns, 1995			x		NZ					321-400
FLABELLIDAE										
Flabellum (F.) pavoninum Lesson, 1831	x	x	x	x	H			x		161-455
F. (F.) arcuatile sp. nov.				x	NZ					300-640
F. (Ulocyathus) deludens Marenzeller, 1904	x	x		x				x		516-530
F. (U.) aotearoa Squires, 1964			x		NZ, NC				x	287-436(+)
F. (U.) marcus Keller, 1974			x		H, OI					1050-1075
F. (U.) hoffmeisteri Cairns & Parker, 1992	x	x	x		NZ				x	495-498
F. (U.) apertum apertum Moseley, 1876	x			x					x	795-1280
Truncatoflabellum stabile (Marenzeller, 1904)	x	x	x			x				786-1160
T. dens (Alcock, 1902)		x	x	x	NZ, NC					286-500
T. pusillum Cairns, 1989	x	x	x							285-460
T. angustum Cairns & Zibrowius, 1997		x	x	x	NZ					295-530
T. phoenix Cairns, 1995		x		x	NZ			x		240-441
T. vigintifarium sp. nov.			x							288-700
T. mortenseni Cairns & Zibrowius, 1997		x	x	x						165-455
T. vanuatu (Wells, 1984)			+	x						240-375(+)
T. aculeatum (H. Milne Edwards & Haime, 1848)	x	x	x							30-50
T. candeanum (H. Milne Edwards & Haime, 1848)		x	x					x		182-215
T. martensii (Studer, 1878)			x						x	161-182(+)
Javania lamprotichum (Moseley, 1880)	x	x	x	x	H, NZ, OI					486-920
J. fuscus (Vaughan, 1907)		x	x	x	H, NZ, OI				x	314-778
J. exserta sp. nov.		x	x	x	OI					130-455
Rhizotrochus typus H. Milne Edwards & Haime, 1848	x	x	x					x		130-194

	TROPICAL							TEMPERATE		Depth (m)
	1	2	3	4	5	6	7	8	9	
R. flabelliformis Cairns, 1989		x		x	NZ				x	400-450
Polymyces wellsi Cairns, 1991		x	x		NZ	x				536-566
GARDINERIIDAE										
Gardineria hawaiiensis Vaughan, 1907	x	x	x		H, NZ, NC				x	366-574
G. paradoxa (Pourtalès, 1868)		x	x					x		495-498
DENDROPHYLLIIDAE										
Balanophyllia desmophyllioides Vaughan, 1907		x	x	x	H, NC					190-516
B. laysanensis Vaughan, 1907			x		H					
B. rediviva Moseley, 1881		x	x							210-252
B. gemma (Moseley, 1881)		x	x							397-430
B. gigas Moseley, 1881	x	x	x		H			x	x	410-505(+)
B. crassitheca Cairns, 1995			x		NZ				x	408-413
Endopachys grayi H. Milne Edwards & Haime, 1848	x	x	x	x	H, NZ	x		x	x	181-441
Heteropsammia cochlea (Spengler, 1781)	x	x	x	x						110-622
Dendrophyllia ijimai Yabe & Eguchi, 1934	x	x	+					x		(+)
D. arbuscula van der Horst, 1922	x	x	x		NZ			x		130-319
D. alcocki (Wells, 1954)	x	x	x	x	NZ, OI				x	315-475
Enallopsammia rostrata (Pourtalès, 1878)	x	x	x	x	H, NZ, OI	x	x	x	x	370-920

NUMBER OF SPECIES IN EACH AREA: **1** = 62; **2** = 95; **3** = 116; **4** = 83; **5** = 72; **6** = 7; **7** = 11; **8** = 42; **9** = 32.

SYSTEMATIC ACCOUNT

Order SCLERACTINIA

Suborder ASTROCOENIINA

Family POCILLOPORIDAE

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

Madracis kauaiensis Vaughan, 1907

Figs 1 a-e

?*Madracis Hellena* - STUDER, 1878: 636 [Not *M. hellana* H. Milne Edwards & Haime, 1850].
?*Madracis singularis* Rehberg, v*1892: 10-11, pl. 1, figs 3-4 (Not specimen from Fiji).
Madracis kauaiensis Vaughan, v*1907: 83-84, pl. 9, figs 1-4. — CAIRNS, 1984: 6.
?*Madracis interjecta* Marenzeller, *1907: 20-21, pl. 2, fig. 3.

MATERIAL EXAMINED. — **Wallis and Futuna Islands**. MUSORSTOM 7: stn 496, 1 branch (MNHN). — Stn 499, 1 branch (98543). — Stn 500, 1 branch (USNM 98544). — Stn 502, 1 branch (MNHN). — Stn 504, 6 branches (MNHN). — Stn 507, 1 branch (MNHN). — Stn 508, 1 branch (MNHN). — Stn 509, 1 large colony and numerous branches (MNHN), 5 branches and SEM stubs 869-870 (USNM 98541). — Stn 515, 5 branches (MNHN).

Vanuatu. MUSORSTOM 8: stn 988, 41 branches (MNHN). — Stn 1077, 2 colonies and several branches (USNM 98549).

Hawaii Islands. HURL: stn 83-202, 1 colony (USNM 83460).

New Zealand. NZOI: stn K803, 1 branch (USNM 93996). — Stn K825, 4 branches (USNM 93997). — Stn K826, 1 branch (USNM 93998).

TYPE LOCALITY. — *"Albatross"* stn 3982: 21°56'25"N, 159°21'40"W (Kauai, Hawaiian Islands), 73-426 m.

DIAGNOSIS. — Colonies flabellate to slightly bushy; irregularly branched; lower branches of large colonies often anastomosing with one another. Largest corallum (MUSORSTOM 7 stn 509) 14 cm in height, 14 cm wide, and uniplanar. Branches circular in cross-section: basal branches up to 8 mm in diameter, distal branches 2.5-3.0 mm in diameter. Corallites slightly elliptical in shape, their greater axis aligned with the branch axis; corallites 1.25-1.35 mm in greater diameter, occurring homogeneously and well spaced on all branch surfaces. Coenosteum white, bearing prominent spines up to 15 mm in height. Corallites contain 10 equal-sized septa, each about 0.15 mm exsert and bordered internally by a small (0.05 mm wide) paliform lobe. Central region of calice a broad, flat platform, connected to axial edges of septa and supporting a laterally compressed styliform to lamellar columella, the greater axis of columella aligned with the greater axis of corallite.

REMARKS. — H. MILNE EDWARDS & HAIME (1850) described *Madracis hellana* from Reunion at a depth of 37 m, for a branching species of this genus having 10-12 septa per corallite. STUDER (1878) reported a second specimen of this species from Bougainville Island (88 m), this specimen deposited at the ZMB, the first report of this genus for the Pacific. REHBERG (1892), believing that STUDER's southwest Pacific specimen must be different from the western Indian Ocean *M. hellana*, redescribed STUDER's specimen as *Madracis singularis*, n. sp., and reported another specimen of his presumed new species from Viti (Fiji) at 146 m. Finally, VAUGHAN (1907) described another decameral Pacific *Madracis* species, *M. kauaiensis*, from the Hawaiian Islands (44-541 m). The type of *M. hellana* was not examined and the type of *M. singularis* Rehberg, 1892 (Studer's *M. hellana* from Bougainville, ZMB 1842) was not available for examination and thus their identity with the specimens reported herein remains in doubt, but the second specimen reported by REHBERG from Fiji at 80 fathoms (= 146 m)(ZMB 601) was examined and found to be quite different from the specimens reported herein. The Fiji specimen, which might be interpreted as a syntype of *M. singularis*, has thicker, blunt to clavate branches; larger calices (GCD 1.6-2.2 mm); no paliform lobes; and a continuous, spinose ridge that encircles each calice. The specimens reported above are, however, indistinguishable from the type series of *M. kauaiensis* Vaughan, 1907, and thus are identified as such.

DISTRIBUTION. — Wallis and Futuna region: Futuna; 240-516 m. Vanuatu region: Tanna and Malakula; 210-372 m. Elsewhere: Hawaiian Islands; Johnston Island (reported herein); Kermadec Ridge (reported herein); ?Bougainville (STUDER, 1878); ?Gulf of Aqaba (MARENZELLER, 1907); 44-541 m.

Suborder FUNGIINA

Family FUNGIACYATHIDAE

Genus *FUNGIACYATHUS* Sars, 1872

Subgenus *FUNGIACYATHUS (FUNGIACYATHUS)* Sars, 1872

Fungiacyathus (F.) stephanus (Alcock, 1893)

Bathyactis stephanus Alcock, *1893: 149, pl. 5, figs 12-12a.

Bathyactis sibogae Alcock, v*1902a: 108 (in part); v.1902c: 38 (in part: *"Siboga"* stn 95 and large specimen of 57 mm GCD).

Fungiacyathus (F.) stephanus - CAIRNS, 1989a: 7-9, pl. 1, figs a-k, pl. 2, figs a-b (synonymy); 1994: 37, pl. 13, figs g-i; 1995: 31-32, pl. 1, figs a-c, map 1; 1998: 369. — CAIRNS & ZIBROWIUS, 1997: 68-69 (synonymy).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 551, 2 (MNHN). — Stn 552, 3 (MNHN). — Stn 565, 1 (MNHN). — Stn 621, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 963, 2 (MNHN). — Stn 975, 1 (MNHN). — Stn 990, 1 (MNHN). — Stn 992, 1 (USNM 98539). — Stn 996, 3 (USNM 98537). — Stn 1007, 1 (MNHN). — Stn 1036, 3 (MNHN). — Stn 1074, 1 (MNHN). — Stn 1080, 1 (USNM 98540). — Stn 1125, 1 (MNHN). — Stn 1129, 13 (MNHN).

TYPE LOCALITY. — *"Investigator"* stn 133: 15°43'30"N, 81°19'30"E (off Kristna Delta, Bay of Bengal), 1240 m.

TABLE 3. — Characteristics of the seven Indo-Pacific species of *Fungiacyathus (Fungiacyathus)*.

	F. stephanus (Alcock, 1893)	*F. fragilis* Sars, 1872	*F. pusillus pacificus* Cairns, 1995	*F. sandoi* sp. nov.	*F. paliferus* (Alcock, 1902)	*F. multicarinatus* Cairns, 1998	*F.* sp. A sensu CAIRNS, 1994
Maximum Calicular Diameter (mm)	57	45	23	20	25	26	36
Shape of Base	Concave or flat	Flat to slightly concave	Flat to slightly concave	Patellate (140°-170°)	Flat to slightly concave	Undulating	Flat
Nature of Costae	Thin, serrate, sinuous ridges	Thin ridges	Thin, serrate, closely spaced ridges	Rounded, coarsely granular	Rounded, finely granular	Finely dentate ridges	Thin ridges
Marginal Shelf	Present, especially in concave-based forms	Present	Present	Well developed	Present	Absent	Present
Septal Faces; Septal Edges	Corrugated; sinuous	Corrugated; sinuous	Planar; straight	Planar; straight	Planar; straight	Planar; straight	Planar; straight
Number and Largest of S_1 Synapticulae	12-15 (6-8th tallest)	12-14 (6-7th tallest)	11-12 (6th tallest)	7-9 (4-5th tallest)	9-14 (7th tallest)	Small, poorly developed	8-9 (8th tallest)
Number of S_1 Carinae/Face	20-23	11-12	28-34	15-21	15-20	30-34	20-23
S_2 Paliform Lobes or Spines	Small, acute, triangular lobes	Crispate spines	Slender trabecular spines	Thick, blunt spines	Small, rounded paliform lobes	Spatulate spines	Spinose
Other Characters	Very fragile; S_{1-2} lobes high	Very fragile	Robust; innermost S_3 spines most prominent; peripheral septal edges form vertical wall	Robust; S_{1-3} lobes tall and slender, undercut at calicular edge	Robust; corallum regeneration common	Robust; corallum regeneration; septal carinae quite tall	Fragile; septal canopies and columella porous
Distribution; Depth	Indo-West Pacific; 245-2000 m	N. Atlantic; Macquarie Ridge; Hawaiian Is.; 285-2200 m	New Zealand to Wallis and Futuna; 350-988 m	Wallis and Futuna; 295-600 m	Indo-West Pacific; 69-823 m	Western Australia; 348-350 m	Kuril Islands; 3175-4110 m

REMARKS. — This species is more fully described and illustrated by CAIRNS (1989a, 1994). It is distinguished from its consubgenerics by having corrugated septa and sinuous costae; small, acute paliform lobes (P_2); and a very fragile corallum, probably a result of its greater depth of occurrence (Table 3).

DISTRIBUTION. — Wallis and Futuna region: Combe Bank; 795-1280 m. Vanuatu region: Anatom, Tanna, Erromango, Efaté, Espiritu Santo, and Malakula; Guyot Bougainville; 440-1160 m. Elsewhere: widespread throughout Indo-West Pacific; 245-2000 m (CAIRNS & ZIBROWIUS, 1997).

Fungiacyathus (F.) pusillus pacificus Cairns, 1995

Fungiacyathus (F.) pusillus pacificus Cairns, *1995: 32-33, pl. 1, figs g-i, l, map 13.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 3 (MNHN). — Stn 534, 1 (USNM 98536). — Stn 535, 2 (MNHN). — Stn 540, 2 (MNHN). — Stn 570, 1 (MNHN). — Stn 572, 3 (USNM 98535). — Stn 575, 1 (USNM 98534). — Stn 581, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1128, 1 (MNHN).

TYPE LOCALITY. — NZOI stn U599: 30°43'S, 173°16'E (northern Three Kings Ridge), 590-640 m.

REMARKS. — Based on these specimens little can be added to the original description, except to note a maximum size of 23.3 mm GCD (MUSORSTOM 7 stn 535). The species is distinguished by its tall S_{1-4} septal lobes, the peripheral edges of which all extend about the same distance outward and are almost vertical, which results in an almost cylindrical corallum with a domed surface, like a thick button. The species is compared to other consubgenerics from this region in Table 3.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch and Combe Banks; 425-650 m. Vanuatu region: Guyot Bougainville; 778-811 m. Elsewhere: Norfolk, Three Kings, and Colville Ridges north of New Zealand; 350-988 m.

Fungiacyathus (F.) sandoi sp. nov.

Figs 1 f-h

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 523, 2 paratypes (MNHN). — Stn 538, holotype (MNHN) and 1 paratype (USNM 98531). — Stn 540, 1 paratype (MNHN). — Stn 541, 1 paratype (MNHN). — Stn 542, 1 paratype (USNM 98533). — Stn 569, 5 paratypes (USNM 98532). — Stn 589, 1 paratype (MNHN). — Stn 590, 3 paratypes (MNHN). — Stn 597, 1 paratype (MNHN). — Stn 605, 1 paratype (MNHN).

TYPE LOCALITY. — MUSORSTOM 7, stn 538: 12°30.8'S, 176°40.3'W (Waterwitch Bank), 275-295 m.

ETYMOLOGY. — This species is named in honour of my friend and colleague William J. SANDO (1927-1996), noted Lower Carboniferous coral taxonomist and stratigrapher.

DESCRIPTION. — Corallum circular: largest specimen (MUSORSTOM 7 stn 542) 20.2 mm in CD; holotype 15.2 mm in CD. Base slightly convex, the basal angle ranging from 140°-170°. All costae equally wide and prominent (no cycle larger than another), rounded, each ornamented with a row of coarse (0.16-0.18 mm diameter) rounded granules. All costae project about 0.4 mm beyond calicular edge. Septa hexamerally arranged in 5 complete cycles in typical fungiacyathid fashion, the S_5 easily visible in a corallum of 8 mm CD. S_1 consist of 3 or 4 blunt, axial trabecular spines inclined toward the fossa; peripheral to these spines is a tall septal lobe composed of 9-13 vertically oriented trabeculae, each trabeculum corresponding to a serrate ridge on the septal face. The peripheral edge of the S_1 lobe is vertical, changing abruptly into a low marginal shelf region consisting of 3 or 4 low spines. Seven to nine synapticular plates occur along the length of an S_1, the 4th or 5th from the centre being the tallest. S_2 also consist of 3 or 4 blunt, axial trabecular spines, but these spines are longer and wider than

those on the S_1, some composed of 2 trabeculae; peripheral to these spines is a prominent septal lobe composed of 7-9 trabeculae, the lobe inclined slightly outward. The peripheral edge of the S_2 lobe is vertical to slightly undercut, also changing abruptly to a low marginal shelf. S_3 consist of 4-6 slender, axial trabecular spines peripheral to which is a small septal lobe composed of 3-6 trabeculae. S_3 septal lobe shorter and more inclined outward than S_3 lobe, but its peripheral edge is similar. S_4 consist of 5-7 small trabecular spines; S_5, 3 or 4 spines. All septa planar, with straight upper and peripheral edges. A low marginal shelf of about 0.4 mm width surrounds the corallum. The columella is an intermingling of the innermost, blunt S_{1-2} trabecular spines.

REMARKS. — *Fungiacyathus sandoi* appears to be most similar to *F. paliferus* (Alcock, 1902), both species having granular costae, a similar septal structure, and achieving the same size. But, *F. sandoi* is distinguished in having: a convex base; coarsely granular costae; thick, blunt S_2 trabecular spines (not small P_2 paliform lobes); and uniformly exsert costosepta (Table 3).

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch, Combe, and Field Banks; 295-600 m.

Fungiacyathus (F.) paliferus (Alcock, 1902)

Fig. 2 a

Bathyactis palifera Alcock, v*1902a: 108; v.1902c: 38, pl. 5, figs 34, 34a.
Fungiacyathus sp. cf. *F. stephanus* - WELLS, v.1984: 207, fig. 1, 3-4 (USGS 25715, USNM 71828).
Fungiacyathus fragilis - WELLS, v.1984: 205-206 (in part: USGS 25718, USNM 73957).
Fungiacyathus (F.) paliferus - CAIRNS, 1989a: 9-10, pl. 2, figs c-i, pl. 3, figs a-c (synonymy and description); 1994: 37-38, pl. 14, figs a-e (synonymy and description); 1998: 369-370. — CAIRNS & ZIBROWIUS, 1997: 69-70.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 963, 8 (USNM 98529). — Stn 967, 3 (USNM 98530). — Stn 969, 1 (MNHN). — Stn 988, 1 (MNHN). — Stn 1003, 5 (MNHN). — Stn 1005, 3 (MNHN). — Stn 1016, 2 (MNHN). — Stn 1017, 2 (MNHN). — Stn 1018, 9 (USNM 98528). — Stn 1043, 1 (MNHN). — Stn 1070, 1 (MNHN). — Stn 1106, 1 (MNHN).

TYPE LOCALITY. — *"Siboga"* stns 153 and 98: Sulu Sea and Moluccas, 141-350 m.

REMARKS. — The species was redescribed and illustrated by CAIRNS (1989a, 1994); however, several well-preserved specimens listed above allow an additional observation that the CS_{1-2}, and their adjacent CS_5, project about 1.2 mm beyond the other costosepta as rectangular lancets.

All specimens reported above were intact coralla, not the result of asexual fragmentation. Comparisons to other species in this region are made in Table 3.

Although the Pleistocene Vanuatu specimens reported by WELLS (1984) as *F. fragilis* from USGS stn 25718 are reidentified herein as *F. paliferus*, those he reported and illustrated from USGS stn 24918 (USNM 71837 and 73977) belong to the subgenus *F. (Bathyactis)*, but are too small to identify to species.

DISTRIBUTION. — Vanuatu region: Anatom, Tanna, Erromango, Efaté, Epi, and Espiritu Santo (also Pleistocene of Vanuatu: WELLS, 1984); 190-400 m. Elsewhere: widespread throughout Indo-West Pacific; 69-823 m (CAIRNS & ZIBROWIUS, 1997).

Subgenus ***FUNGIACYATHUS (BATHYACTIS)*** Moseley, 1881

Fungiacyathus (B.) margaretae Cairns, 1995

Figs 2 b-c

Fungiacyathus (B.) margaretae Cairns, *1995: 33-34, pl. 2, figs a-c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 534, 9 (MNHN). — Stn 535, 4 (MNHN). — Stn 540, 21 (USNM 98524). — Stn 541, 1 (MNHN). — Stn 546, 7 (MNHN). — Stn 564, 57 (USNM 98527). — Stn 565, 56 (MNHN).
Vanuatu. MUSORSTOM 8: stn 956, 2 (MNHN). — Stn 963, 47 (MNHN). — Stn 1011, 1 (USNM 98525). — Stn 1014, 1 (MNHN). — Stn 1051, 2 (USNM 98526).

TYPE LOCALITY. — NZOI stn P944: 27°20.8'S, 179°20.9'W (northern Colville Ridge), 673 m.

REMARKS. — Previously known from a type series of only 5 specimens: 188 additional coralla are reported herein, the largest specimen (MUSORSTOM 8 stn 963) 18.6 mm in CD, the same diameter as the largest type. Although the base of this species is always concave, the MUSORSTOM specimens show that the types had unusually concave bases. Many of these specimens also show a pronounced ridging of the C_{1-2} (Fig. 2 c).

Fungiacyathus margaretae is most similar to *F. granulosus*, small and/or damaged specimens of the latter being difficult to distinguish from the former. In general, *F. margaretae* is distinguished by having a concave base (that of *F. granulosus* is usually flat); higher S_1 septal lobes with vertical peripheral edges, and constructed of vertically aligned trabeculae (the S_1 septal lobes of *F. granulosus* are lower and sloped at the peripheral calicular edge, and composed of trabeculae that are inclined outward toward the peripheral edge); and having taller synapticular plates between septa. Both species have fine or coarse granular costae, and often granular coenosteum between the costae.

DISTRIBUTION. — Wallis and Futuna region: Waterwitch, Combe, and Tuscarora Banks; 470-1015 m. Vanuatu region: Anatom, Efaté, and Epi; 440-1175 m. Elsewhere: northern Colville Ridge; 635-673 m.

Fungiacyathus (B.) granulosus Cairns, 1989

Fungiacyathus (B.) granulosus Cairns, *1989a: 11, pl. 4, figs d-i; 1994: 39, pl. 15, figs d-e; 1998: 370. — CAIRNS & ZIBROWIUS, 1997: 71.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 619, 2 (MNHN).
Vanuatu. MUSORSTOM 8: stn 977, 1 (MNHN). — Stn 980, 3 (USNM 98520).

TYPE LOCALITY. — *"Albatross"* stn 5590: 4°10'50"N, 118°39'35"E (Celebes Sea off Sabah), 567 m.

REMARKS. — See Remarks for previous species.

DISTRIBUTION. — Wallis and Futuna region: Alofi; 455 m. Vanuatu region: Tanna; 433-450 m. Elsewhere: northern Ryukyu Islands to Rowley Shoals, Western Australia; 287-640 m (CAIRNS & ZIBROWIUS, 1997; CAIRNS, 1998).

Fungiacyathus (B.) variegatus Cairns, 1989

Fig. 2 d

Fungiacyathus fragilis - WELLS, v.1984: 205-206 (in part: USGS 24918, pl. 1, figs 1-2) [Not *F. fragilis* Sars, 1872].
Fungiacyathus variegatus Cairns, *1989a: 11-12, pl. 5, figs a-h; 1994: 38-39, pl. 15, figs a-b. — CAIRNS & ZIBROWIUS, 1997: 71-72.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 963, 1 cemented to *Xenophora* shell (MNHN).

TYPE LOCALITY. — *"Albatross"* stn 5113: 13°52'N, 120°51'E (Verde Is. Passage, Luzon, Philippines), 291 m.

REMARKS. — This species is more fully described by CAIRNS (1989a) and CAIRNS & ZIBROWIUS (1997).

DISTRIBUTION. — Vanuatu region: Anatom; 400-440 m (Late Pleistocene of Espiritu Santo, WELLS, 1984). Elsewhere: Japan through Indonesia; 84-715 m (CAIRNS & ZIBROWIUS, 1997).

Family MICRABACIIDAE Vaughan, 1905

Genus ***LETEPSAMMIA*** Yabe & Eguchi, 1932

Letepsammia franki Owens, 1994

Letepsammia franki Owens, v*1994: 586-589, figs 1-2.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 597, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 962, 1 (MNHN). — Stn 980, 3 (MNHN). — Stn 1016, 2 (MNHN). — Stn 1017, 8 (MNHN). — Stn 1018, 18 (USNM 98519). — Stn 1023, 1 (USNM 98518). — Stn 1070, 2 (MNHN). — Stn 1134, 1 (USNM 98517).

TYPE LOCALITY. — *"Anton Bruun"* stn 390-S: 29°35'S, 31°42'E (off Durban, South Africa), 138 m.

REMARKS. — In describing the type material, OWENS (1994) stated that the septa were highly perforate, which led to an assignment of this species to *Letepsammia*. However, re-examination of the type series shows that, whereas the higher cycle septa are always highly perforate, the S_1 of the holotype and most paratypes are imperforate. (The S_1 of some paratypes from the same lots are highly perforate). The same is the case for the southwest Pacific specimens reported above. The imperforate nature of the S_1 suggests an affinity with *Rhombopsammia*, and the variation in the expression of this character casts doubt on the distinction between the genus *Rhombopsammia* and *Letepsammia*.

The specimens reported above are very similar to the type series, except that many of the specimens contain 108 septa (18 septa per system), instead of 120 septa (20 septa per system). The largest paratype (USNM 75640) measures 32.2 mm in CD (slightly larger than that reported by OWENS, 1994), whereas the largest Pacific (MUSORSTOM 8 stn 1018) specimen measures 32.4 mm in CD.

Letepsammia franki differs from *L. formosissima* in having a papillose columella, coarser septal dentition, and a more robust corallum. It differs from *L. superstes* in having more septa; a larger corallum; and nondentate, vertical axial edges of the S_1.

DISTRIBUTION. — Wallis and Futuna region: Field Bank; 469-475 m. Vanuatu region: Anatom, Tanna, Efaté, and Espiritu Santo; 190-433. Elsewhere: southwest Indian Ocean; 50-650 m.

Genus ***STEPHANOPHYLLIA*** Michelin, 1841

Stephanophyllia neglecta Boschma, 1923

Stephanophyllia neglecta Boschma, v*1923: 144-145, pl. 10, figs 28-30. — CAIRNS, 1989a: 23-24, pl. 11, figs c-j (synonymy). — CAIRNS & ZIBROWIUS, 1997: 77.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 542, 1 (MNHN). — Stn 556, 5 (MNHN). — Stn 618, 1 (USNM 98523).
Vanuatu. MUSORSTOM 8: stn 958, 1 (MNHN). — Stn 963, 1 (MNHN). — Stn 965, 7 (MNHN). — Stn 969, 2 (MNHN). — Stn 978, 1 (MNHN). — Stn 988, 3 (USNM 98522). — Stn 1019, 1 (USNM 98521).

TYPE LOCALITY. — *"Siboga"* stn 260: 5°36.5'S, 132°55.2'E (Kai Islands, Banda Sea), 90 m.

REMARKS. — This species was redescribed and compared to all congenerics by Cairns (1989a).

DISTRIBUTION. — Wallis and Futuna region: Alofi; Combe and Tuscarora Banks; 370-440 m. Vanuatu region: Anatom, Tanna, and Espiritu Santo; 280-497 m. Elsewhere: Philippines; Indonesia; 49-555 m (CAIRNS & ZIBROWIUS, 1997).

Stephanophyllia complicata Moseley, 1876

Stephanophyllia complicata Moseley, v*1876: 558-561, text-fig.; v.1881: 198-201, pl. 4, fig. 12, pl. 13, figs 3-5. — CAIRNS, 1989a: 21, pl. 12, figs a-b; 1995: 37-38, pl. 3, fig. h, pl. 4, figs a-e, map 10 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 77-78.

Stephanophyllia japonica - WELLS, v.1984: 207, pl. 1, figs 5-6 (USGS stn 24918, USNM 71839) [Not *S. japonica* Yabe & Eguchi, 1934a].

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 523, 2 (MNHN). — Stn 535, 2 (MNHN). — Stn 540, 10 (USNM 98552). — Stn 557, 9 (USNM 98551).

Vanuatu. MUSORSTOM 8: stn 959, 22 (USNM 98553). — Stn 963, 3, including 1 cemented to *Xenophora* shell (MNHN). — Stn 1005, 1 (MNHN). — Stn 1018, 1 (MNHN). — Stn 1091, 1 cemented to *Xenophora* shell (MNHN). — Stn 1097, 1 cemented to *Xenophora* shell (MNHN). — Stn 1113, 1 (MNHN).

TYPE LOCALITY. — *"Challenger"* stn 192: 5°42'S, 132°25'E (Kai Islands, Banda Sea), 236 m.

REMARKS. — *Stephanophyllia complicata* was redescribed and illustrated by CAIRNS (1989a, 1995). It is distinguished from *S. neglecta* by having a thin, lamellar columella; a narrow marginal shelf; S_1 with vertical, non-spinose axial edges; and in attaining a larger size.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch, Combe, and Tuscarora Banks; 470-600 m. Vanuatu region: Anatom, Erromango, Efaté, and Espiritu Santo (also Pleistocene, WELLS, 1984); 288-700 m. Elsewhere: Indo-West Pacific; 73-635 m (CAIRNS & ZIBROWIUS, 1997).

Suborder FAVIINA

Superfamily FAVIOIDEA Gregory, 1900

Family OCULINIDAE Gray, 1847

Genus *OCULINA* Lamarck, 1816

Oculina virgosa Squires, 1958

Oculina virgosa Squires, v*1958: 39, pl. 5, figs 8-16, text-fig. 11. — CAIRNS, 1995: 40, pl. 4, figs f, i, pl. 5, figs c-d, color frontispiece (top left), color cover (synonymy and description), map 8.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1077, 6 branches: 4 (MNHN), 2 (USNM 98550). — Stn 1102, 1 colony (MNHN).

TYPE LOCALITY. — Sandstone, Waitemata Group, The Funnel, Kaipara Harbour, Auckland, North Island (Altonian, early Miocene).

REMARKS. — This species was recently redescribed and figured by CAIRNS (1995). The two lots reported above differ slightly from New Zealand specimens in lacking S_4, all corallites having only 24 septa arranged in three complete cycles, the New Zealand populations usually having 28 septa. This is the first report of this species outside New Zealand waters.

DISTRIBUTION. — Vanuatu region: southeast and northeast of Espiritu Santo; 180-210 m. Elsewhere: northeastern North Island, New Zealand; 29-388 m (CAIRNS, 1995); early Miocene to early Pliocene, New Zealand (SQUIRES, 1958).

Genus *MADREPORA* Linnaeus, 1758

Madrepora oculata Linnaeus, 1758

Figs 2 e-f

Madrepora oculata Linnaeus, *1758: 798. — ZIBROWIUS, 1974a: 762-766, pl. 2, figs 3-5 (synonymy). — CAIRNS, 1991a: 9-10, pl. 2, fig. j, pl. 3, figs a-d (synonymy); 1994: 18-19, pl. 3, figs f-h (synonymy); 1995: 41, pl. 5, figs e-f, pl. 6, figs a-b, map 2; 1998: 372-373, figs 1 f-i. — CAIRNS & ZIBROWIUS, 1997: 79-80.
Lophohelia tenuis Moseley, *1881: 180-181, pl. 8, figs 11-14. — BOURNE, 1903: 26.
Cyathohelia formosa Alcock, *1898: 26-27, pl. 3, figs 2, 2a.
Sclerohelia formosa - ALCOCK, 1902c: 36.
Madrepora kauaiensis Vaughan, v*1907: 81-83, pl. 8, figs 1-2.
Madrepora tenuis - FAUSTINO, 1927: 107-108, pl. 14, figs 2, 5.
Madrepora formosa - ZIBROWIUS, 1974b: 568-570, figs 6-9.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: forma *tenuis*: stn 502, 1 branch (MNHN). — Stn 551, numerous branches (USNM 98545). — Stn 552, 19 branches (MNHN), SEM stub 874 (USNM 98548). — Stn 598, 6 branches (MNHN). — Stn 621, 8 branches (MNHN). — Stn 623, 1 branch (USNM 98547). — Stn 637, 2 branches (MNHN); forma *formosa*: Stn 507, 3 branches (MNHN). — Stn 585, 1 branch (MNHN). — Stn 586, 1 branch (USNM 98581). — Stn 601, 1 branch (MNHN). — Stn 606, 5 colonies and numerous branches (USNM 98583). — Stn 609, 3 colonies (MNHN), SEM stub 875 (USNM 98580). — Stn 618, 3 branches (MNHN). — Stn 620, 5 branches (USNM 98546).
Vanuatu. MUSORSTOM 8: forma *tenuis*: stn 1028, 2 branches (98546). — Stn 1031, 1 branch (MNHN); forma *formosa*: stn 1088, 1 branch (MNHN).

TYPE LOCALITY. — Tyrrhenian Sea and off Sicily (depth not given).

REMARKS. — This widespread and variable species has been redescribed and discussed at great length (ZIBROWIUS, 1974a,b; CAIRNS, 1991a, 1994, 1995; CAIRNS & ZIBROWIUS, 1997). Two forms of the species occur in the material reported herein. One form is characterized by having rather large, uniplanar colonies with nonanastomosing branches formed of regular, sympodially budded corallites. The coenosteum is light beige, finely granular, and longitudinally striate. Corallites are 3.0-3.6 mm in CD, containing 2 or 3 cycles of slightly exsert septa, the S_3 often rudimentary or absent. The axial edges of S_2 often bear laciniate paliform lobes. The fossa is deep and the columella rudimentary. This form corresponds to MOSELEY's (1881) *Madrepora tenuis*; probably *M. kauaiensis* Vaughan, 1907; *Madrepora oculata* forma *beta* of CAIRNS (1991a); and most specimens reported by CAIRNS & ZIBROWIUS (1997) from the Philippines and Indonesia. It is herein reported as forma *tenuis*. The second form is characterized by having smaller, uniplanar to bushy colonies. Colonies are formed by sympodially branched corallites, but often result in anastomosing branches caused by a symbiosis with a eunicid polychaete worm, which produces a gall tube along the larger branches. The coenosteum is usually white and finely granular. Corallites are smaller (2.2-2.5 mm in CD), more closely spaced, containing 3 cycles of highly exsert septa, the S_1 usually well developed. The axial edges of the S_2 usually bear prominent paliform lobes. The fossa is shallow and the columella well developed. This form was described as *Cyathohelia formosa* by ALCOCK (1898) and as the "symbiotic form" by CAIRNS (1995). It is herein reported as forma *formosa*.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Combe, Field, Rotumah, and Alofi Banks; 350-1280 m. Vanuatu region: Efaté and Espiritu Santo; 310-624 m. Both forms are equally distributed in these regions. Elsewhere: cosmopolitan, except for off continental Antarctica; 15-1500 m (CAIRNS & ZIBROWIUS, 1997).

Madrepora minutiseptum Cairns & Zibrowius, 1997

Madrepora minutiseptum Cairns & Zibrowius, *1997: 82-84, figs 4a-d, 5a-b.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 513, 3 branches (MNHN). — Stn 515, 3 colonies and several branch fragments (MNHN). — Stn 517, 4 colonies and many branch fragments (USNM 98549).
Ryukyu Islands. *"Toyoshio-Maru"* : stn 11, 2 colonies (USNM 98461).

TYPE LOCALITY. — *"Snellius 2"* stn 4.196: 6°23'S, 120°26.5'E (southwest of Salayer, Flores Sea), 150- 200 m.

REMARKS. — Nothing can be added to the description of this recently named species. It is distinctive within the genus by having 24 rudimentary septa; small, infundibuliform corallites; and a low, papillose columella. All colonies contain a polychaete-induced tubular deformation that runs the length of all major branches.

DISTRIBUTION. — Wallis and Futuna region: Futuna; 233-260 m. Elsewhere: Ryukyu Islands (reported herein), Taiwan, Indonesia; 150-302 m.

Madrepora porcellana (Moseley, 1881)

Neohelia porcellana Moseley, v*1881: 176-177, pl. 10, figs 7, 7a. — PRATT, 1900: 591-603, pls 62-63. — HICKSON, 1903: 344.
Madrepora porcellana - WELLS, v.1984: 207, figs 1, 7-9.
Neohelia sp. cf. *N. porcellana* - CAIRNS & ZIBROWIUS, 1997: 84-85, figs 5c-e, g-h.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 499, 1 branch (MNHN). — Stn 500, 1 branch (MNHN). — Stn 502, 1 branch (MNHN). — Stn 508, 2 branches (MNHN). — Stn 509, 2 branches (MNHN). — Stn 512, 4 branches (MNHN). — Stn 513, 5 branches (MNHN). — Stn 514, 1 colony (USNM 98569). — Stn 515, 3 colonies (USNM 98575). — Stn 618, 1 branch (MNHN).
Vanuatu. MUSORSTOM 8: stn 962, 4 colonies (USNM 98578). — Stn 963, 1 branch (MNHN). — Stn 964, 5 branches (MNHN). — Stn 968, 1 colony (MNHN). — Stn 969, 1 colony (USNM 98576). — Stn 976, 1 branch (MNHN). — Stn 988, 2 branches (MNHN). — Stn 1077, 2 branches (MNHN). — Stn 1084, 2 colonies (USNM 98577). — Stn 1089, 1 branch (MNHN).
USGS: stn 25718, 6 fragments (USNM 73958). — Stn 25715, (USNM 71840). — Stn 24918 (USNM 71841), all reported by WELLS (1984).

TYPE LOCALITY. — *"Challenger"* stn 177: 16°45'S, 168°07'E [Api (= Epi), Vanuatu Archipelago], 115 m.

REMARKS. — Without explanation, WELLS (1984) placed this species in *Madrepora*, which automatically synonymized the genus *Neohelia* with *Madrepora*, a view not adopted by CAIRNS & ZIBROWIUS (1997). The basic difference between the genera is that *Neohelia* is reputed to lack a columella, *Madrepora* to have one. However, examination of many additional specimens of *Neohelia* shows that it usually does have a well-formed papillose columella, even though some distal corallites sometimes lack one. Likewise, corallites of *Madrepora* often have well-developed columella, but sometimes lack them altogether. Because the presence or absence of a columella does not appear to be a conservative generic character, even within species, I now agree with WELLS (1984) in considering *Neohelia porcellana* to belong to the genus *Madrepora*.

All of the specimens reported above are pentamerally symmetrical, having 20 septa. The hexamerally symmetrical specimens having 24 septa reported by CAIRNS & ZIBROWIUS (1997) from Indonesia are considered as a form of *M. porcellana* that occurs to the west and usually in shallower water than the typical form.

This species was recently redescribed by CAIRNS and ZIBROWIUS (1997) and more fully monographed by Pratt (1900). A consistent characteristic of the species is a tubular cavity that runs the length of the larger branches, which is lined by a parchment-like encrustation. PRATT (1900) suggested that the encrustation was secreted by the coral, but HICKSON (1903) implied that a polychaete was responsible. Polychaetes are often found in these tubes, and it cannot be doubted that gorgonians or antipatharians often form the framework for the encrustation of *M. porcellana*. However, the specimens reported herein also indicate that a thecate hydroid may be responsible for the internal parchment-like lining of the tubes, short branches of which project from the apertures of the tube through the coenosteum. This complex symbiosis is a fascinating one that requires the examination of additional well-preserved specimens.

DISTRIBUTION. — Wallis and Futuna region: Futuna and Alofi; 240-516 m. Vanuatu region: Anatom, Tanna, Epi, Malakula, and Espiritu Santo (also Pleistocene: WELLS, 1984); 115-494 m. Elsewhere: Loyalty Islands; New Caledonia; Indonesia (as the hexameral form); 55-238 m.

Family ANTHEMIPHYLLIIDAE Vaughan, 1907

Genus *ANTHEMIPHYLLIA* Pourtalès, 1878

Anthemiphyllia dentata (Alcock, 1902)

?Discotrochus investigatoris Alcock, *1893: 142, pl. 5, figs 5, 5a.
Discotrochus dentatus Alcock, v*1902a: 104; v.1902c: 27, pl. 4, figs 26, 26a.
Not *Anthemiphyllia dentata* - CAIRNS, 1984: 11, pl. 1, figs F-G (= *A. macrodentata* sp. nov.).
Anthemiphyllia dentata - ZIBROWIUS & GRYGIER, 1985: 137 (New Caledonia). — CAIRNS & PARKER, 1992: 16-17 (in part: only those specimens from Western Australia). — CAIRNS, 1994: 44, pl. 18, figs d-f (synonymy); 1995: 41-42 (in part: not stns NZOI K842 and K872 (= *A. pacifica*) and C527 (= *A. macrodentata*), pl. 6, figs c-g (synonymy); 1998: 374-375. — CAIRNS & ZIBROWIUS, 1997: 86.
Deltocyathus andamanicus - KELLER, 1982: 52 (in part: pl. 1 [=4], figs 3-4, *Dimitri Mendeleev* stn 1411) [Not *D. andamanicus* Alcock, 1898].

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 1 (MNHN). — Stn 522, 3 (MNHN). — Stn 525, 1 (MNHN). — Stn 530, 6 (MNHN). — Stn 534, 2 (MNHN). — Stn 535, 12 (USNM 98565). — Stn 537, 3 (MNHN). — Stn 538, 2 (MNHN). — Stn 540, 1 (MNHN). — Stn 542, 4 (MNHN). — Stn 546, 1 (MNHN). — Stn 555, 1 (MNHN). — Stn 569, 3 (MNHN). — Stn 570, 6 (USNM 98564). — Stn 572, 2 (USNM 98563). — Stn 585, 3 (USNM 98562). — Stn 586, 1 (USNM 98566). — Stn 589, 2 (MNHN). — Stn 590, 4 (MNHN). — Stn 591, 4 (USNM 98574). — Stn 594, 3 (USNM 98561). — Stn 597, 1 (USNM 98560). — Stn 618, 1 (USNM 98567). — Stn 619, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 959, 2 (MNHN). — Stn 967, 2 (MNHN). — Stn 969, 2 (MNHN). — Stn 977, 6 (MNHN). — Stn 982, 1 (MNHN). — Stn 983, 1 (MNHN). — Stn 1016, 1 (MNHN).

TYPE LOCALITY. — *"Siboga"* stns 95, 98, 100: Sulu Sea, 350-522 m.

REMARKS. — The holotype of *Discotrochus investigatoris* Alcock, 1893 is probably a juvenile specimen of *A. dentata* and thus would have nomenclatural priority. It has a CD of only 8 mm and 48 septa, which is consistent with the number of septa present in an *A. dentata* at that size. However, the type, presumed to be deposited at the Indian Museum, Calcutta, was not examined by the author. Until this verification can be made, the later name of *A. dentata* is used.

Whereas some of the largest specimens have a full fifth cycle (96 septa), most adult coralla have 60-72 septa, resulting from the insertion of one or two pairs of S_5 in each system, respectively. The addition of S_5 pairs usually occurs in a fixed manner as follows. In most coralla a bilateral symmetry can be determined by drawing a line through the slightly elongate or elliptical columella, dividing the corallum into two halves each containing six half-systems (Fig. A). If the 12 half-systems are numbered clockwise, pairs of S_5 first occur in half-systems I, II, V, VIII, X, and XII, which results in a mirror image septal complement, but with two adjacent half-systems with pairs of S_5 (I and XII) and two other half-systems (V and VIII) separated by two half-systems having no S_5 at all. Note that the numbering of half-systems is somewhat arbitrary in that, if the corallum is rotated 180°, the half-systems with pairs of S_5 are then: II, IV, VI, VII, IX, and XI, but the configuration is the same.

Anthemiphyllia dentata is more fully described by CAIRNS (1995) and compared to other congenerics in Table 4. All specimens were unattached, except for one (MUSORSTOM 8 stn 977), which was firmly attached to a rock. I (CAIRNS & PARKER, 1992; CAIRNS, 1995) had previously identified all *Anthemiphyllia* with S_5 as *A. dentata* (synonymy), but it now appears that at least three other species are involved, which consistently differ from one another in corallum shape, basal ornamentation, and septal architecture (Table 4).

Table 4. — Comparison of the Recent species and subspecies of the genus *Anthemiphyllia*.

	A. dentata Alcock, 1902	*A. multi-dentata* sp. nov.	*A. pacifica* Vaughan, 1907	*A. macro-lobata* sp. nov.	*A. patera costata* subsp. nov.	*A. patera patera* Pourtalès, 1878	*A. spinifera* sp. nov.	*A. frustum* Cairns, 1994
Shape of Colony; Attachment	Flat to shallow bowl; usually free	Shallow bowl;free	Shallow bowl to turbinate; free or attached	Deep bowl; attached or free	Shallow bowl; free	Shallow bowl; free or attached	Short cylinder with 6 costal spines; anthocyathus free	Frustum-shaped; anthocyathus free
Maximum Calicular Diameter (mm)	26.4	25.3	10.5	16.9	9.3	13.1	6.2	9.9
Nature of Base	Costate, with intercostal ridges	Costate, with intercostal ridges	Covered with epithecal bands	Costate	Costate	Porcellaneous (no costae)	Porcellaneous	Costate
Transverse Division	No	No	No	No	No	No	Yes	Yes
Colour of Corallum	White	White	White	White	White	White	Reddish-brown calicular margin	White to reddish brown
Septal Formula; Adult Number of Septa	$S_1>S_2>S_3>S_4>>S_5$; 60-72-96	$S_1>S_2>S_3>S_4>>S_5$; 96	$S_1>S_2>S_3>>S_4>S_5$; 48-56	$S_1>S_2>S_3>S_4>>S_5$; 60	$S_1>S_{2-3}>>S_4$; 48	$S_1>S_{2-3}>>S_4$; 48	$S_{1-3}>>S_4$; 36	$S_1>S_2>S_3>S_4$; 48
S_1 Trabecular Spines: Number; Largest Spine; Cross Section of Inner S_1 Spines	10-12; 3-4th from calicular edge; circular	20-23; uniform-sized; flattened perpendicular to septal plane	7; 3rd from calicular edge; circular	5-8; outermost septum a large lobe; inner spines flattened perpendicular to septal plane	7-8; 4-5th from edge; flattened perpendicular to septal plane	7-9; 4-5th from edge; flattened perpendicular to septal plane	4-5; equal-sized; slightly flattened in septal plane	6-7; largest lobes near columella; flattened in septal plane
Columella: Type; Similarity to Inner Trabeculae	Papillose; indistinguishable	Papillose; indistinguishable	Papillose; indistinguishable	Papillose; indistinguishable	Massive: irregularly shaped elements, undercut; discrete	Massive: irregularly shaped elements, undercut; discrete	Fused papillae; discrete	Papillose; indistinguishable
Distribution; Depth	Indo-West Pacific; 50-570 m	Southeastern Australia; 128-270 m	Hawaiian Is., Vanuatu, Kermadec Is; 205-325 m	Hawaiian Is, Kermadec Ridge; 369-508 m	Wallis & Futuna Is.; 320-700 m	Tropical northwestern Atlantic; 500-700 m	Tropical southwestern Pacific; 282-534 m	Japan through Indonesia; 209-340 m

DISTRIBUTION. — Wallis and Futuna region: Wallis, Futuna, and Alofi; Waterwitch, Combe, Tuscarora, and Field Banks; 295-650 m. Vanuatu region: Anatom, Tanna, and Efaté; 280-475 m. Elsewhere: widespread throughout Indo-West Pacific; 50-570 m (CAIRNS & ZIBROWIUS, 1997).

Anthemiphyllia multidentata sp. nov.

Figs 3 a-b

Anthemiphyllia dentata - Wells, v.1958: 264, pl. 1, figs 8-11. — CAIRNS & PARKER, 1992: 16-17, figs 4e-f (in part: all but Western Australian specimen).

MATERIAL EXAMINED/TYPES. — **Australia**. Off Cronulla, NSW, depth unknown, holotype (USNM 83010).
"Nimbus": stn 12, 1 paratype (USNM 78611). — Stn 55, 2 paratypes (USNM 78609).
BANZARE: stn 115, 3 paratypes (SAM H500-501).
"Kimbla": stn K7/73-37, 1 paratype (NMV F57153).

TYPE LOCALITY. — Off Cronulla, New South Wales, depth unknown.

ETYMOLOGY. — The species name *multidentata* (Latin *multi*, many + *dens*, tooth), literally bearing many teeth, refers to the numerous trabecular teeth on all septa.

DESCRIPTION. — Corallum unattached, with a flat to slightly bowl-shaped base. Holotype 25.3 mm in CD and 6.5 mm in height. Costae equal in width, rounded, and finely granular. Intercostal grooves shallow; however, in most specimens there is a very narrow ridge that bifurcates the intercostal region. No evidence of transverse division or attachment to substrate. Corallum white.

Septa hexamerally arranged in 5 cycles, the fifth cycle often missing several pairs of septa, e.g., the holotype has only 88 septa. Septal formula: $S_1>S_2>S_3>S_4»S_5$ regarding size and exsertness; S_{1-3} all extend to the columella, whereas the S_4 do only as rudimentary structures. All septa low in profile, closely fitting contour of inner wall. S_1 bear 20-23 tall, slender, similarly-sized trabecular spines, the innermost (axial) spines highly compressed perpendicular to plane of septum. S_2, S_3, and S_4 similar in shape to S_1 but progressively smaller and having more slender trabecular spines. There are actually more spines on the S_3 (22-24) than the S_{1-2} because the spines on the S_3 are more slender and yet the width of the septum is about the same. S_5 bear 10-13 extremely slender trabecular spines, the septa becoming rudimentary near the columella. Fossa shallow, containing a papillose columella consisting of numerous small papillae that are indistinguishable from the inner (axial) septal spines.

REMARKS. — *Anthemiphyllia multidentata* is similar to *A. dentata*, and has been reported as such at least twice (see synonymy). However, *A. multidentata* differs from that species in having a significantly different septal architecture, consisting of more uniformly-sized trabecular spines per septum, and spines that are flattened in the plane perpendicular to the septum (Table 4). Thus far, *A. multidentata* is known only from southeastern Australia at relatively shallow depths. Although not found in the study region of this report, it is included to make the name available, and to facilitate comparisons among all Recent species (Table 4).

DISTRIBUTION. — Southeastern Australia from northeastern Tasmania to New South Wales; 128-270 m.

Anthemiphyllia pacifica Vaughan, 1907

Figs 2 g-h

Anthemiphyllia pacifica Vaughan, v*1907: 79-80, pl. 7, fig. 5. — CAIRNS, 1984: 10-11.
Anthemiphyllia dentata - CAIRNS, 1995: 41-42 (in part: NZOI stns K842 and K872).

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1031, 1 (MNHN).

TYPE LOCALITY. — *"Albatross"* stn 3858: 21°01'25"N, 156°47'20"W (off Molokai, Hawaiian Islands), 225-252 m.

REMARKS. — Both VAUGHAN (1907) and CAIRNS (1984) noted that this species occurred in the free and attached (pedicellate) forms, the types being free. The MUSORSTOM specimen reported above belongs to the pedicellate form and is the largest specimen known, measuring 10.5 mm in CD and 7.3 mm in height, with a basal fracture of 5.2 mm. It bears well-developed epithecal bands, characteristic of the species, and perhaps because of its large size, contains 56 septa (4 pairs of S_4). It is otherwise similar to typical Hawaiian specimens and is compared to other congenerics in Table 4. One of the pedicellate species reported as *A. dentata* by CAIRNS (1995) is reidentified as *A. pacifica* herein.

DISTRIBUTION. — Vanuatu region: Efaté; 310 m. Elsewhere: Hawaiian Islands; Kermadec Islands (reported herein); 205-325 m.

Anthemiphyllia macrolobata sp. nov.

Figs 3 c-d

Anthemiphyllia dentata - CAIRNS, 1984: 11, pl. 1, figs F-G; 1995: 41-42 (in part: NZOI stn C527).

MATERIAL EXAMINED. — **Haiwaiian Islands**. *"Townsend Cromwell"*: stn 81-01-14, holotype (USNM 60559). **Kermadec Ridge**. NZOI: stn C527, 9 paratypes (USNM 93990).

TYPE LOCALITY. — *"Townsend Cromwell"* stn 81-01-14: 23°15'48"N, 161°50'12"W (Hawaiian Is.), 369 m.

ETYMOLOGY. — The species name *macrolobata* (Greek *makros*, long or large + *lobos*, lobe), literally bearing large lobes, refers to the large septal lobes on the S_{1-3}.

DESCRIPTION. — Holotype shaped as a deep bowl, unattached, measuring 16.9 mm in CD and 10.0 mm in height. Costae well developed, rounded, and finely granular, separated by deep intercostal grooves only at calicular edge. No evidence of transverse division; however, the Kermadec paratypes are firmly attached to the substrate. Corallum white.

Septa hexamerally arranged in 5 cycles, the fifth incomplete, only 1 pair of S_5 occurring in each system, resulting in 60 septa. Each S_1 consists of a highly exsert (3.3 mm), very wide (up to 5 mm) peripheral septal lobe, which occasionally bears shallow indentations, but is not completely subdivided into smaller lobes. Proximal to this lobe are 1-3 (depending on size of peripheral lobe) smaller, blunt lobes that are cylindrical in cross section. Most proximal (axial) are 3 or 4 narrow septal spines that are flattened perpendicular to septal plane. S_2 similar in shape to S_1, but slightly less exsert, having smaller peripheral lobes. S_3 and S_4 that are flanked by S_5 are equally as wide as S_2, but slightly less exsert and have smaller septal lobes. S_5 and unflanked S_4 are smallest septa, only about half the width of an S_3, bearing 10-12 narrow trabecular teeth. All septa bear relatively low granules on their faces. Fossa deep, containing a well-developed papillose columella composed of elements that are indistinguishable from the inner axial septal spines.

REMARKS. — As well as being reported as *A. dentata* twice (see synonymy), this species has been referred to as an "undescribed species" by CAIRNS & PARKER (1992), CAIRNS (1995), and CAIRNS & ZIBROWIUS (1997). Although not yet found in the study region, this species is included to make the name available, and to facilitate comparisons among the Recent species (Table 4). *A. macrolobata* is unique in having large peripheral S_{1-3} septal lobes.

DISTRIBUTION. — Hawaiian Islands; Kermadec Ridge; 369-508 m.

Anthemiphyllia patera costata subsp. nov.

Figs 3 e-h, 4 a-b

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 1 paratype (MNHN). — Stn 530, 5 paratypes (USNM 98558). — Stn 535, 2 paratypes (MNHN). — Stn 540, 2 paratypes (MNHN). — Stn 542, 1 paratype (MNHN). — Stn 546, 1 paratype (USNM 98557). — Stn 575, 19 paratypes (USNM 98554). — Stn 578,

2 paratypes (MNHN). — Stn 586, holotype (MNHN), and 7 paratypes (MNHN). — Stn 590, 5 paratypes (MNHN). — Stn 591, 1 paratype (MNHN). — Stn 594, 8 paratypes (MNHN), SEM stub 871 (USNM 98555). — Stn 595, 7 paratypes (USNM 98556). — Stn 635, 5 paratypes (USNM 98559).

TYPE LOCALITY. — MUSORSTOM 7, stn 586: 13°10.7'S, 176°13.1'W (north of Wallis), 510-600 m.

ETYMOLOGY. — The subspecies name *costata* (Latin *costa*, rib) refers to the presence of costae on the theca of this species.

DESCRIPTION. — Corallum shaped as a shallow bowl, with rounded, slightly upturned edges. Holotype 8.3 mm in CD and 3.9 mm in height; largest specimen (MUSORSTOM 7 stn 594) 9.3 mm in CD. Base covered by equal, rounded, finely granulated costae. Intercostal regions shallow and narrow on base, but deeply incised at calicular edge, as in a turbinoliid. No evidence of a basal scar or propagation by transverse division. Corallum uniformly white.

Septa hexamerally arranged in 4 complete cycles (48 septa) according to the formula: $S_1 > S_{2-3} >> S_4$. S_1 bear 7 or 8 narrow trabecular spines, the outermost peripheral spines quite small and directed outward, the fourth and fifth from the outside usually the tallest, and the innermost (axial) 2 or 3 inclined toward and over the columella, these spines highly compressed perpendicular to plane of septum. S_1 extend approximately 1 mm into central columella. S_{2-3} only slightly less wide than the S_1, usually bearing one less trabecular spine. S_4 much smaller, about one-third width of S_{1-3}, but equally as exsert, consisting of 2 or 3 slender trabecular spines, and a laciniate axial edge that follows the contour of the inner theca. Fossa shallow, containing a massive (up to 4 mm in diameter), irregularly circular, flat columella composed of irregularly-shaped, fused elements. The columella protrudes into each of the 6 systems, fusing with and uniting the axial edges of the S_2 and their flanking S_3, increasing the columellar diameter to over 5 mm at these points. Edges of columella undercut, being wider at the top than the base.

REMARKS. — This subspecies is very similar to the nominate subspecies *A. patera patera* Pourtalès, 1878, both taxa having the same septal and columellar structure and corallum shape. *A. patera costata* differs primarily in having a costate base (that of *A. patera patera* is smooth and porcellaneous), and in not attaining quite as large a size (Table 4). *A. patera patera* is also known to have attached as well as free coralla. The nominate subspecies is known only from tropical northwestern Atlantic at depths of 500-700 m (CAIRNS, 1979). Because of these slight, but consistent morphological differences and the apparent geographic separation, a new subspecies is warranted.

Anthemiphyllia patera costata is compared to other Recent congeners in Table 4, but it also bears a resemblance to the fossil species *A. catinata* Wells, 1977 (Late Eocene, Tonga), as noted by WELLS (1977). Both species are similar in corallum size and shape, costal ornamentation, and columellar structure, but *A. patera costata* differs in having more septa (48 vs 32-40). Details of septal dentition are similar, but not possible to compare due to the poor preservation of the four known specimens of the fossil species.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch, Combe, Field, and Rotumah Banks; 320-700 m.

Anthemiphyllia spinifera sp. nov.

Figs A, 4 c-j,

Discotrochus sp. Alcock, v.1902c: 27-28.
Deltocyathus andamanicus - KELLER, 1982: 52 (in part: pl. 1 [= 4], figs 5a-b).

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 512, 1 paratype (USNM 98571). — Stn 513, 2 paratypes (MNHN). — Stn 514, 13 paratypes: 12 (MNHN), 1 (USNM 98573). — Stn 530, 2 paratypes (MNHN). — Stn 537, 2 paratypes (USNM 98572). — Stn 541, 1 paratype (MNHN). — Stn 542, 4 paratypes (USNM 98569). — Stn 569, 3 paratypes (MNHN). — Stn 586, 1 paratype (MNHN). — Stn 589, 1 paratype (MNHN). — Stn 605, holotype (MNHN) and 18 paratypes (MNHN). — Stn 610, 2 paratypes, including SEM stub 872 (USNM 98570).

Vanuatu. MUSORSTOM 8: stn 988, 1 paratype (MNHN). — Stn 1014, 1 paratype (MNHN).
Indonesia *(Moluccas)*. KARUBAR: stn 18, 6 paratypes (USNM 96777).
"Albatross": stn 5584, 4°17'40"N, 118°57'42"E, 532 m, 27.09.1909, 1 paratype (USNM 87605).

TYPE LOCALITY. — MUSORSTOM 7 stn 605: 13°21.3'S, 176°08.4'W (southeast of Wallis), 335-340 m.

ETYMOLOGY. — The species name *spinfera* (Latin *spina*, thorn + *fer*, to bear) refers to the 6 costal spines.

DESCRIPTION. — Corallum (anthocyathus) discoidal, with a flat base, vertical edges, and circular calice. Holotype 4.76 mm in CD and 2.34 mm in height; largest specimen (MUSORSTOM 7 stn 513) 6.2 mm in CD and tallest (MUSORSTOM 7 stn 605) 3.8 mm in height. Base smooth, porcellaneous, and white, usually with a small (2.3 mm in diameter), slightly concave scar or repaired scar of attachment in centre. Six elongate, tapered, smooth costal spines (C_3) project from the calicular edge in a specific pattern (see Remarks). Spines straight, or sometimes curved or bent, and often broken, the longest spine 3.7 mm. Well-preserved coralla reddish brown at calicular edge, otherwise white. One anthocaulus is known (MUSORSTOM 8 stn 1014, Fig. 4j), consisting of a nondescript, faintly costate, cylindrical corallum 2.3 mm in height and 4.2 mm in diameter, bearing an anthocyathus 4.8 mm in CD. There is an annular constriction between the anthocaulus and anthocyathus, but at this stage they are still firmly attached. The attached anthocyathus bears 36 septa but has no evidence of costal spines.

Septal hexamerally arranged in 3 1/2 cycles, each system containing one pair of S_4 inserted in a very specific pattern (see Remarks), resulting in 36 septa. Only 2 size classes of septa exist: the larger septa, consisting of the 12 S_{1-2} and the 6 S_3 that are flanked by S_4 (18 of the 36 septa), and the smaller septa, consisting of all 12 S_4 and the remaining 6 S_3 that are unflanked by S_4 (the remaining 18 septa), which alternate with the larger septa. The larger septa extend to the columella, and bear of 4 or 5 equally sized, prominent, highly granular trabecular spines, the innermost spines only slightly compressed in the plane of the septum. Innermost 2 trabecular spines of larger septa inclined toward columella more than peripheral spines, the latter being vertical, which produces a small notch in each septum, and altogether, a narrow circumferential demarcation about half way between the columella and calicular edge. Although the S_{1-3} are of the same size, the S_2 and accelerated S_3 can be distinguished because the columella extends slightly outward in each system to fuse these inner edges of the S_2 and its adjacent accelerated S_3, as in *A. patera costata*. Smaller septa only about one-third width of the larger septa, bearing 3 slender trabecular teeth. Fossa shallow, containing a low, massive (up to 2 mm in diameter) papillose columella, the elements of which are often fused. Columellar elements usually easily distinguished from inner septal trabeculae.

REMARKS. — Most specimens reported above bear six elongate costal spines (C_3) associated with the 6 S_3 that are flanked by pairs of S_4, one of which occurs in each half-system. Because the columella is circular, not elongate as in *A. dentata*, an obvious plane of symmetry is not available for the numbering of half-systems. But, if the 12 half-systems are arbitrarily numbered in a clockwise direction beginning from the S_1 that occurs between the two most closely spaced spines (Fig. A), then the costal spines invariably occur in half-systems I, III, V, VIII, X, and XII, which are the same half-systems in which S_5 pairs first occur in *A. dentata*. This results in two closely spaced spines (half-systems XII and I) separated from one another by only 3 septa, or an angular separation of 40°; and four spines (half-systems III, V, VIII, and X) separated from their adjacent dorsal spines by 5 septa, or 60°; and the spines of half-systems V and VIII separated from each other by 80° (Fig. A). There are only three anomalies to this pattern in the material examined: a specimen from *"Albatross"* 5584 has 8 spines and thus 40 septa, the additional costal spines occurring in half-systems IV and IX; a specimen from MUSORSTOM 7 stn 542 has 7 spines and 38 septa, the additional spine in half-system V; and the specimen reported by KELLER (1982), which appears to have a seventh spine in half-system VIII.

Anthemiphyllia spinifera is easily distinguished from congeners by having costal spines. Other differences are noted in Table 4.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch, Combe, and Field Banks; 245-510 m. Vanuatu region: Tanna and Efaté; 466-495 m. Elsewhere: Indonesia (Kai Islands, Banda Sea; south of Sumba); Malaysia (Darvel Bay); Celebes Sea (off Mindanao); 212-534 m.

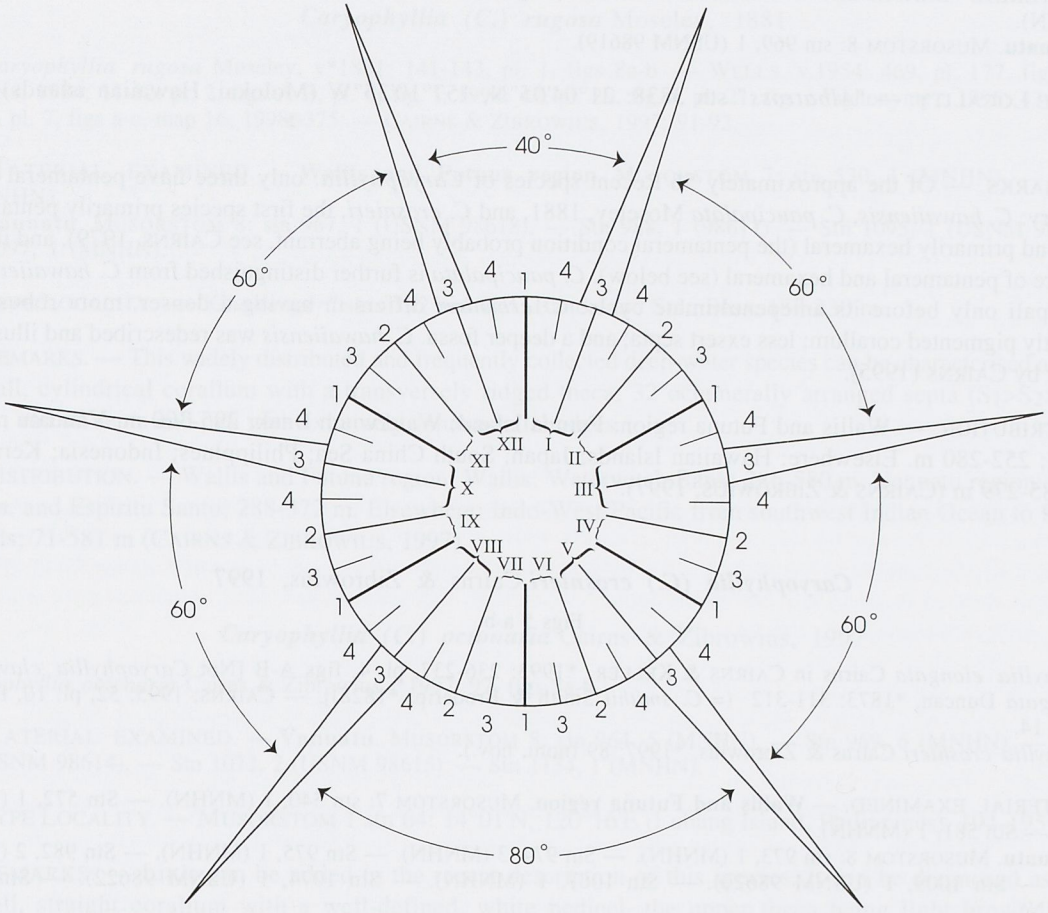


FIG. A. — Diagrammatic representation of the calice of *Anthemiphyllia spinifera* or *Deltocyathus heteroclitus*, showing the insertion pattern of the six costal spines (C_3). Roman numerals define the 12 half-systems in the corallum, arbitrarily beginning with the S_1 that bifurcates the smallest angular separation of costal spines, and proceeding in a clockwise direction. Arabic numerals indicate the respective septal cycles. Length of costal spines and septa drawn in proportion to calicular diameter of *A. spinifera*.

Suborder CARYOPHYLLIINA

Superfamily CARYOPHYLLIOIDEA Dana, 1846

Family CARYOPHYLLIIDAE Dana, 1846

Genus ***CARYOPHYLLIA*** Lamarck, 1816

Subgenus ***CARYOPHYLLIA (CARYOPHYLLIA)*** Lamarck, 1816

Caryophyllia (C.) hawaiiensis Vaughan, 1907

Caryophyllia hawaiiensis Vaughan, v*1907: 76, pl. 5, figs 4a-b. — CAIRNS, 1984: 11; 1995: 44-45, pl. 7, figs d-f, map 18. — CAIRNS & ZIBROWIUS, 1997: 93.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 504, 1 (MNHN). — Stn 538, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 969, 1 (USNM 98619).

TYPE LOCALITY. — *"Albatross"* stn 3838: 21°04'05"N, 157°10'35"W (Molokai, Hawaiian islands), 168-388 m.

REMARKS. — Of the approximately 56 Recent species of *Caryophyllia*, only three have pentameral septal symmetry: *C. hawaiiensis*, *C. paucipalata* Moseley, 1881, and *C. crosnieri*, the first species primarily pentameral, the second primarily hexameral (the pentameral condition probably being aberrant, see CAIRNS, 1979), and the last a mixture of pentameral and hexameral (see below). *C. paucipalata* is further distinguished from *C. hawaiiensis* by having pali only before its antepenultimate cycle. *C. crosnieri* differs in having a denser, more robust, and differently pigmented corallum; less exsert septa; and a deeper fossa. *C. hawaiiensis* was redescribed and illustrated in detail by CAIRNS (1995).

DISTRIBUTION. — Wallis and Futuna region: Futuna Island; Waterwitch Bank; 295-300 m. Vanuatu region: Anatom; 252-280 m. Elsewhere: Hawaiian Islands; Japan; South China Sea; Philippines; Indonesia; Kermadec Ridge; 85-279 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) crosnieri Cairns & Zibrowius, 1997

Figs 5 a-b

Caryophyllia elongata Cairns in CAIRNS & KELLER, *1993: 236-237, pl. 4, figs A-B [Not *Caryophyllia clavus* var. *elongata* Duncan, *1873: 311-312 (= *C. smithii* Smith & Broderip, *1828)]. — CAIRNS, 1995: 52, pl. 10, figs d-f, map 14.
Caryophyllia crosnieri Cairns & Zibrowius, *1997: 89 (nom. nov.).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 540, 1 (MNHN). — Stn 572, 1 (USNM 98623). — Stn 581, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 973, 1 (MNHN). — Stn 974, 3 (MNHN). — Stn 975, 1 (MNHN). — Stn 982, 2 (USNM 98621). — Stn 1009, 1 (USNM 98620). — Stn 1067, 1 (MNHN). — Stn 1074, 1 (USNM 98622). — Stn 1108, 1 (MNHN).

TYPE LOCALITY. — *"Vityaz "* stn 2716: 33°17'S, 44°55'E (Walters Shoal, Madagascar Plateau), 630-680 m.

REMARKS. — Additional large, well-preserved specimens reported herein allow the observation that this species is not consistently hexamerally symmetrical. Whereas most previously reported specimens were hexamerally symmetrical ($S_1>S_2>S_4\geq S_3$, 48 septa and 12 pali), most of the specimens listed above are pentamerally symmetrical (5:5:10:20, 40 septa and 10 pali), only the 3 specimens from MUSORSTOM 8 stns 975, 1067, and 1074 being hexamerally symmetrical ($S_1>S_2>S_4>S_3$, 12 pali), and the specimen from MUSORSTOM 8 stn 974 having 11 pali (44 septa). Furthermore, a lot reported by CAIRNS & ZIBROWIUS (1997), e.g., KARUBAR stn 31, contains a mixture of specimens with pentameral or hexameral symmetry.

The species may be diagnosed as having: a robust, cylindrical corallum with a broadly encrusting base; noncostate, coarsely granular, yellowish-brown theca; pentameral or hexameral septal symmetry, usually resulting in 40 or 48 septa, respectively; highest cycle septa equal to or wider than penultimate septal cycle; carinate septal faces; and a very deep fossa with a well-defined columella of 3-9 slender twisted elements. The axial palar edges are highly sinuous, and, in some specimens, form a narrow lamella on their axial margin oriented perpendicular to the plane of the palus.

DISTRIBUTION. — Wallis and Futuna region: Waterwitch and Wallis; Combe Bank; 550-600 m. Vanuatu region: Tanna, Efaté, Malakula, and Espiritu Santo; 366-536 m. Elsewhere: southwest Indian Ocean; Philippines; Indonesia; Kermadec and Three Kings Ridges; 165-680 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) rugosa Moseley, 1881

Caryophyllia rugosa Moseley, v*1881: 141-143, pl. 1, figs 8a-b. — WELLS, v.1954: 469, pl. 177, figs 5-6. — CAIRNS, 1984: 11-12, pl. 2, figs A-B, pl. 4, fig. I; 1994: 47, pl. 20, fig. i, pl. 21, fig. a (synonymy); 1995: 43-44, pl. 6, fig. h, pl. 7, figs a-c, map 16; 1998: 375. — CAIRNS & ZIBROWIUS, 1997: 91-92.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 530, 1 (MNHN). — Stn 610, 2 (MNHN).

Vanuatu. MUSORSTOM 8: stn 967, 1 (USNM 98618). — Stn 988, 1 (98617). — Stn 1095, 1 (USNM 98616). — Stn 1097, 1 (MNHN).

TYPE LOCALITY. — *"Challenger"* stns 192 and 201: Banda and Sulu Seas, 187-230 m.

REMARKS. — This widely distributed and frequently collected deep-water species can be characterised as having: a small, cylindrical corallum with a transversely ridged theca; 32 octamerally arranged septa ($S_1>S_2>S_3$) and 8 pali; and all septa and pali with extremely sinuous axial edges.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch Bank; 286-580 m. Vanuatu region: Anatom, Tanna, and Espiritu Santo; 288-372 m. Elsewhere: Indo-West Pacific from southwest Indian Ocean to Hawaiian Islands; 71-581 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) octonaria Cairns & Zibrowius, 1997

Caryophyllia octonaria Cairns & Zibrowius, *1997: 92, figs 7a-b.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 964, 5 (MNHN). — Stn 969, 6 (MNHN). — Stn 976, 12 (USNM 98614). — Stn 1072, 2 (USNM 98615). — Stn 1134, 1 (MNHN).

TYPE LOCALITY. — MUSORSTOM 1 stn 64: 14°01'N, 120°16'E (Lubang Island, Philippines), 194-195 m.

REMARKS. — Little can be added to the recent description of this species. It can be diagnosed as having: a small, straight corallum with a well-defined, white pedicel, the upper theca being light brown; granular costae sometimes covered with epitheca; a circular to only slightly elliptical calice; 32 octamerally arranged septa ($S_1>S_{2-3}$) with only moderately sinuous axial edges; and eight very sinuous pali with carinate faces.

DISTRIBUTION. — Vanuatu region: Anatom and Espiritu Santo; 182-622 m. Elsewhere: Philippines; 186-194 m.

Caryophyllia (C.) abrupta sp. nov.

Figs 5 d-e

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 1 paratype (MNHN). — Stn 523, 8 paratypes (MNHN). — Stn 524, 2 paratypes (USNM 98607). — Stn 530, 1 paratype (MNHN). — Stn 534, 4 paratypes (MNHN). — Stn 535, holotype (MNHN), 14 paratypes (USNM 98609). — Stn 537, 2 paratypes (MNHN). — Stn 546, 2 paratypes (MNHN). — Stn 557, 3 paratypes (USNM 98610). — Stn 569, 1 paratype (USNM 98611). — Stn 570, 1 paratype (MNHN). — Stn 571, 2 paratypes (MNHN). — Stn 586, 4 paratypes (MNHN). — Stn 604, 5 paratypes (MNHN). — Stn 605, 2 paratypes (MNHN). — Stn 606, 1 paratype (MNHN). — Stn 608, 2 paratypes (USNM 98606). — Stn 619, 2 paratypes (USNM 98608).

Vanuatu. MUSORSTOM 8: stn 963, 1 nontype cemented to a *Xenophora* shell (MNHN). — Stn 988, 1 (MNHN). — Stn 1016, 1 paratype (USNM 98612), and another nontype cemented to a *Xenophora* shell (MNHN). — Stn 1065, 1 paratype (MNHN). — Stn 1088, 2 nontypes cemented to a *Xenophora* shell (MNHN). — Stn 1091, 2 nontypes cemented to *Xenophora* shells (MNHN). — Stn 1094, 1 paratype (MNHN).

TYPE LOCALITY. — MUSORSTOM 7 stn 535: 12°29.6'S, 176°41.3'W (Waterwitch Bank), 340-470 m.

ETYMOLOGY. — The species name *abrupta* (Latin *abruptus*, broken off, separated, sheer) refers to the process of transverse division that separates the anthocyathus from the anthocaulus.

DESCRIPTION. — Anthocaulus stage unknown. Anthocyathus ceratoid, curved between 45°-90° usually in plane of GCD; one to 7 episodes of rejuvenescence not uncommon in larger coralla. Holotype 8.4 x 7.5 mm in CD and 18.5 mm in height; largest corallum (MUSORSTOM 7 stn 619) 10.9 x 8.4 mm in CD. Basal scar circular to slightly elliptical: 1.8-2.1 x 1.7-1.8 mm in diameter, displaying 8 major septa. Calice strongly compressed: GCD:LCD = 1.12-*1.29*-1.37 (N=8). Costal expression variable, but 8 primary costae usually prominent, the other 24 flat and poorly defined; however, in some specimens the theca is smooth or bears uniformly small granules. Most coralla uniformly white, but some are reddish brown near calicular edge.

Septa usually octamerally arranged in 3 size classes: 8:8:16 (32 septa); however, two specimens of 6.6 mm CD from MUSORSTOM 7 stn 535 have a septal complement of 6:6:12 (6 pali) and 7:7:14 (7 pali), and the largest specimen has an extra pair of septa resulting in 34 septa and 9 pali. Eight primary septa highly exsert (1.5-1.6 mm), extend 3/4 distance to columella, having moderately sinuous axial edges. Secondary septa about half width and exsertness of primaries, but have extremely sinuous axial edges. Tertiaries slightly more exsert than secondaries, being fused to their adjacent primary septa to form low, triangular lancets. Tertiaries equal to or slightly less wide than secondaries, becoming relatively wider with age, having slightly sinuous axial edges. Fossa of moderate depth, containing 8 narrow P_2 that form a distinct palar crown, each palus having extremely sinuous edges, equivalent to those of the secondary septa they border. Columella fascicular, composed of 2-4 narrow elements arranged linearly or in a rhomboid pattern.

REMARKS. — There are six species of octamerally symmetrical *Caryophyllia*, all of which generally have 32 septa: *C. rugosa* Moseley, 1881; *C. octopali* Vaughan, 1907; *C. mabahithi* Gardiner & Waugh, 1938; *C. barbadensis* Cairns, 1979; *C. marmorea* Cairns, 1984; and *C. octonaria* Cairns & Zibrowius, 1997; a seventh species has a variable symmetry that includes octameral: *C. cornuformis* Pourtalès, 1868. *C. abrupta* differs from these species by propagating by transverse division, and by having a compressed corallum. It is perhaps most similar to *C. cornuformis* (a species known only from the Atlantic and the southwest Indian Ocean) in size, shape, and septal architecture. Both species also have an abruptly terminated base: in the case of *C. abrupta*, due to transverse division, in the case of *C. cornuformis*, probably due to budding, which results in an irregularly-shaped, open base. *C. abrupta* also differs from that species in having a very regular octameral symmetry with a well-defined palar crown, an elongate calice, exsert primary and secondary septa, and often prominent primary costae.

One other species of this genus is known to have transverse division: *C. secta* Cairns & Zibrowius, 1997, from the Philippines and Indonesia (220-366 m), which differs from *C. abrupta* in septal symmetry (hexameral, 48 septa), size (up to 15.7 mm GCD), and corallum shape (straight, trochoid).

DISTRIBUTION. — Wallis and Futuna region: Wallis and Alofi; Waterwitch, Combe, and Tuscarora Banks; 305-650 m. Vanuatu region: Anatom, Tanna, Efaté, Malakula, and Espiritu Santo; 300-400 m.

Caryophyllia (C.) marmorea Cairns, 1984

Figs 5 c, f

Caryophyllia marmorea Cairns, *1984: 13, pl. 2, figs C-D.

MATERIAL EXAMINED. — MUSORSTOM 7: stn 525, 1 (MNHN). — Stn 534, 1 (USNM 98613). — Stn 585, 1 (MNHN).

TYPE LOCALITY. — Deep Ocean Disposal Site Investigations, Hawaii, Stn HON 9-3: 19°48'N, 154°58'W (off Hilo, Hawaii), 337 m.

REMARKS. — This species is diagnosed as having a small (CD < 4 mm), straight, attached subcylindical corallum. The theca is light brown, granular, and glisteny; primary costae are prominent. Septa are octamerally arranged: $S_1>S_2>S_3$ (32 septa). This is the first report of this species subsequent to its original description from Hawaii.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch Bank; 475-500 m. Elsewhere: Hawaii, Hawaiian Islands; 331-337 m.

Caryophyllia (C.) quadragenaria Alcock, 1902

Caryophyllia quadragenaria Alcock, v*1902a: 91-92; v.1902c: 10, pl. 1, figs 4, 4a. — CAIRNS, 1994: 46-47, pl. 20, figs c-h, pl. 41, figs c-d (synonymy); 1995: 45-46, pl. 7, figs g-h, map 7 (synonymy); 1998: 375. — CAIRNS & ZIBROWIUS, 1997: 93.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 556, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 962, 1 (MNHN). — Stn 965, 1 (MNHN). — Stn 967, 5 (USNM 98603). — Stn 1106, 1 (MNHN).

TYPE LOCALITY. — *"Siboga"* stns 90, 251, and 289: Makassar Strait, Banda, and Timor Seas, 54-281 m.

REMARKS. — In addition to *C. quadragenaria*, there are six other decamerally symmetrical *Caryophyllia*: *C. abyssorum* Duncan, 1873; *C. calveri* Duncan, 1873; *C. antillarum* Pourtalès, 1874; *C. zopyros* Cairns, 1979; *C. perculta* Cairns, 1991; and *C. solida* Cairns, 1991. *C. quadragenaria* can be diagnosed as having: a relatively small (GCD < 12 mm), straight corallum attached by a narrow pedicel; poorly defined costae; three cycles of decamerally arranged septa resulting in 40 septa, the tertiary septa usually equal to or wider than the secondaries; and a well-formed palar crown of 10 pali. The species was recently redescribed and illustrated by CAIRNS (1994, 1995).

DISTRIBUTION. — Wallis and Futuna region: Tuscarora Bank; 440 m. Vanuatu region: Anatom, Efaté, and Espiritu Santo; 314-430 m. Elsewhere: western Pacific from Japan to New Zealand; 54-385 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) sp. cf. *C. calveri* Duncan, 1873

Figs 5 g-i

?*Caryophyllia calveri* Duncan, *1873: 316. — ZIBROWIUS, v.1980: 57-59, pl. 21, figs A-L.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1051, 1 (MNHN). — Stn 1056, 11: 7 (MNHN), 4 (USNM 98605).

TYPE LOCALITY of *C. calveri*. — *"Porcupine"*: stn 24, 37°19'N, 9°13'W (off Portugal), 534 m.

DESCRIPTION. — Corallum elongate-conical and straight, having a robust pedicel (PD:GCD = 0.32-0.62) that is firmly attached by a thin, broadly encrusting base. All specimens examined attached to small bits of pumice. Largest specimen (MUSORSTOM 8 stn 1056) 10.9 x 9.3 mm in CD, and 3.5 mm in PD, having a basal encrustation of 16 mm. Calice slightly elliptical: GCD:LCD = 1.08-1.19. Costae low and poorly defined, the intercostal striae being infilled with glisteny textura. Base, pedicel, and calicular elements white; however, upper theca a light yellow-brown.

Septal symmetry variable. Half of the specimens examined have hexameral symmetry ($S_{1-2}>S_4\geq S_3$, 48 septa and 12 pali); 5 specimens have decameral symmetry (10:10:20, 40 septa and 10 pali); and one specimen has nonameral symmetry (11:11:22, 44 septa and 11 pali). The 10-12 larger septa (primaries) are highly exsert

(up to 2.1 mm), extend about 3/4 distance to the columella, and have moderately sinuous axial edges. Second size class of septa (secondaries) about 0.7 mm exsert, 4/5 width of a primary septum, also having moderately sinuous axial edges. Third size class of septa (tertiary septa) equal to or slightly wider than the secondaries, and about 0.9 mm exsert, fusing with their adjacent primary septa at the calicular edge to form low, triangular lancets. Depending on septal symmetry, 10-12 wide (1.1-1.2 mm) pali form a well-defined crown, the pali having highly sinuous edges and bearing prominent granules and short ridges. Fossa of moderate depth, bearing a fascicular columella composed of an elongate field of 3-10 slender (0.5 mm diameter), tightly twisted and closely spaced elements.

REMARKS. — Of the approximately 56 Recent valid species of *Caryophyllia*, nine species can be characterised as having an attached corallum, decameral or hexameral symmetry, and its highest cycle septa equal to or wider than its penultimate cycle: *C. calveri* Duncan, 1873; *C. atlantica* (Duncan, 1873); *C. polygona* Pourtalès, 1878; *C. lamellifera* Moseley, 1881; *C. arnoldi* Vaughan, 1900; *C. panda* Alcock, 1902; *C. alberti* Zibrowius, 1980; *C. quadragenaria* Alcock, 1902; and *C. perculta* Cairns, 1991, the last two species usually having decameral symmetry. The specimens reported above from Epi are morphologically indistinguishable from specimens identified as *C. calveri* by ZIBROWIUS (1980), even to the point of having a variable septal symmetry that includes both decameral and hexameral. *C. calveri* is known only from the northeast Atlantic and Mediterranean at 130-1050 m (ZIBROWIUS, 1980). This disjunct distribution would imply that the Epi Island population represents a different species or that intermediate populations between the south Pacific and northeast Atlantic have not yet been recorded.

DISTRIBUTION. — Vanuatu region: Epi; 558-602 m.

Caryophyllia (C.) diomedeae Marenzeller, 1904

Caryophyllia diomedeae Marenzeller, v*1904: 79-80, pl. 1, fig. 2. — CAIRNS, 1995: 49-50, pl. 9, figs a-d, map 3 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 88.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 959, 1 (MNHN). — Stn 1014, 1 (USNM 98604). — Stn 1080, 1 (MNHN). — Stn 1128, 3 (MNHN).

TYPE LOCALITY. — *"Albatross"* stn 3358: 6°30'N, 81°44'W (off Coiba Island, Panama), 1043 m.

REMARKS. — This widespread species was redescribed and discussed by CAIRNS (1995). It can be characterised as having: an elongate, slender but slightly flared, straight corallum attached by a narrow pedicel; flat to porcellaneous theca; only slightly exsert septa; a septal formula of $S_{1-2}>S_3>S_4$ (48 septa); and a shallow fossa.

DISTRIBUTION. — Vanuatu region: Anatom, Efaté, and Malakula; Guyot Bougainville; 475-799 m. Elsewhere: widespread, including Indo-Pacific and Atlantic Ocean; 225-2200 m (CAIRNS, 1995).

Caryophyllia (C.) lamellifera Moseley, 1881

Caryophyllia lamellifera Moseley, v*1881: 140-141, pl. 1, figs 7a-b. — CAIRNS, 1995: 51-52, pl. 9, fig. i, pl. 10, figs a-c, map 18 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 90.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 502, 1 (MNHN). — Stn 589, 2 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1077, 1 (USNM 98591).

TYPE LOCALITY. — *"Challenger"* stn 170: 29°55'S, 178°14'W (north of Macauley Island, Kermadec Ridge), 1152 m.

REMARKS. — *Caryophyllia lamellifera* is distinguished from the many other Pacific *Caryophyllia*, by having a fine, transversely ridged, brown-striped theca. The species is more fully described by CAIRNS (1995), who also compared it to the other two congenerics that have transversely ridged theca: *C. rugosa* and *C. corrugata*. CAIRNS (1995) noted variation in septal symmetry (12-14 primary septa) and relative width of the S_4 and S_3 (S_4 being wider, as in the holotype, or narrower than S_3, as in most other specimens). The four specimens reported above all have 48 septa arranged as: $S_{1-2}>S_3>S_4$. However, three other specimens from MUSORSTOM 8 stns 1018, 1023, 1091, and 1095 (not reported above), are only tentatively assigned to this species. They differ from the typical form in lacking transverse thecal ridges and in having S_4 that are equal to or slightly wider than their S_3, as in the holotype. It is possible that both of these characters may be found to constitute intraspecific variation for some species.

DISTRIBUTION. — Wallis and Futuna region: Futuna; Field Bank; 400-516 m. Vanuatu region: Malakula; 180-210 m. Elsewhere: Philippines; Indonesia; Kermadec and Norfolk Ridges; Taupo Tablemount; 89-1152 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) scobinosa Alcock, 1902

Caryophyllia scobinosa Alcock, v*1902: 8, pl. 1, figs 2, 2a. — CAIRNS, 1995: 52-53, pl. 10, figs g-i, pl. 11, figs a-c, map 16 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 94.

Not *Caryophyllia scobinosa* - WELLS, v.1984: 207-209, figs 2 (1-4) [= *Asterosmilia* sp. cf. *A. marchadi* (Chevalier, 1966)].

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 552, 1 (MNHN). — Stn 565, 1 (MNHN). — Stn 635, 2 (USNM 98601).

Vanuatu. MUSORSTOM 8: stn 992, 2 (MNHN). — Stn 1034, 11 (MNHN). — Stn 1035, 7 (USNM 98602). — Stn 1074, 2 (MNHN).

TYPE LOCALITY. — *"Siboga"* stns 45 and 102: Flores and Sulu Seas, 535-794 m.

REMARKS. — This species was redescribed and figured by CAIRNS (1995). It is distinguished from the other unattached cornute species known from this region, *C. ambrosia*, by having a much smaller, and more slender corallum (GCD < 16 mm); and only 48 septa and 12 pali.

DISTRIBUTION. — Wallis and Futuna region: Combe, Tuscarora, and Rotumah Banks; 715-900 m. Vanuatu region: Erromango, Efaté, and Espiritu Santo; 750-775 m. Elsewhere: Indo-West Pacific from southwest Indian Ocean to Japan and Tonga; 353-1276 m (CAIRNS & ZIBROWIUS, 1997).

Caryophyllia (C.) ambrosia Alcock, 1898

Caryophyllia ambrosia Alcock, v*1898: 12, pl. 1, figs 1, 1a. — ZIBROWIUS, v.1980: 63-65, pl. 25, figs A-K (synonymy). — CAIRNS, 1994: 48, pl. 21, figs d-h; 1995: 53-54, pl. 11, figs d-e, map 7. — CAIRNS & ZIBROWIUS, 1997: 95-96.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 564, 2 (MNHN). — Stn 565, 2 (MNHN). — Stn 598, 1 (USNM 98599). — Stn 635, 2 (USNM 98600). — Stn 636, 4 (MNHN).

TYPE LOCALITY. — *"Investigator"* stns 104 and 176: Laccadive Sea, Arabian Sea, 1829-1957 m.

REMARKS. — The regional variation of corallum size and number of septa was discussed by CAIRNS (1994, 1995), who also provided descriptions and illustrations of the species. The specimens reported above have 14-22 (mode = 16) primary septa and 56-88 (mode = 64) total septa, which allies them most closely with northern Indian Ocean populations. Populations to the north (Japan), west (Indonesia), and south (New Zealand), usually have more septa, e.g., 18-30 primary septa or a total of 72-120 septa.

DISTRIBUTION. — Wallis and Futuna region: Tuscarora, Field, and Rotumah Banks; 700-1015 m. Else where: Amphi-Atlantic; Indo-West Pacific, including Japan and New Zealand; 311-2670 m (CAIRNS & ZIBROWIUS, 1997).

Subgenus *CARYOPHYLLIA (ACANTHOCYATHUS)* H. Milne Edwards & Haime, 1848

Caryophyllia (A.) grayi (H. Milne Edwards & Haime, 1848)

Acanthocyathus grayi H. Milne Edwards & Haime, *1848a: 293, pl. 9, figs 2, 2a. — UMBGROVE, 1950: 641-642, pl. 81, figs 27-32 (synonymy). — WELLS, v.1984: 209, pl. 2, figs 5-9.
Caryophyllia (A.) grayi - CAIRNS, 1994: 49, pl. 21, figs i-k (synonymy); 1998: 377. — CAIRNS & ZIBROWIUS, 1997: 97-98, figs 7 c, f, i.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 496, 1 (USNM 98598). — Stn 499, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1001, 1 (MNHN). — Stn 1002, 1 (USNM 98597). — Stn 1004, 2 (USNM 98596). — Stn 1065, 1 (MNHN). — Stn 1069, 1 (MNHN). — Stn 1070, 2 (MNHN). — Stn 1071, 2 (MNHN). — Stn 1086, 4 (MNHN). — Stn 1103, 3 (MNHN). — Stn 1134, 1 (USNM 98595).
USGS *(Late Pleistocene of Kere River, Espiritu Santo)*: stn 25715, 4 (USNM 71844, 71846, 78610), WELLS, 1984; Stn SM242, 129a and 129b, 4 (USNM 71845 and 73963), WELLS, 1984.

TYPE LOCALITY. — Unknown.

REMARKS. — The species is characterised as having a compressed, ceratoid corallum, with a narrow pedicel and rounded thecal edges, each of which bears several thecal spines that are circular in cross section. Costae are rounded, not ridged, and the theca is often reddish brown. Septa are usually arranged: 14:14:28, resulting in 56 septa and 14 pali, but large coralla have 16 and even 18 primary septa, resulting in up to 72 septa (CAIRNS, 1995). The species was redescribed and figured by CAIRNS (1995) and CAIRNS and ZIBROWIUS (1997), the latter including a key and discussion of most of the species in this subgenus.

DISTRIBUTION. — Wallis and Futuna region: Futuna; 290-300 m. Vanuatu region: Erromango, Malakula, and Espiritu Santo (also Late Pleistocene, WELLS, 1984); 125-360 m. Elsewhere: Indo-West Pacific from South Africa to Japan; 37-490 m (CAIRNS & ZIBROWIUS, 1997).

Genus *CRISPATOTROCHUS* Tenison Woods, 1878

Crispatotrochus rubescens (Moseley, 1881)

Cyathoceras rubescens Moseley, *1881: 157, pl. 2, figs 8a-c. — Cairns, 1984: 15.
Cyathoceras tydemani Alcock, v*1902a: 93-94; v.1902c: 14, pl. 1, figs 7, 7a.
Cyathoceras diomedeae Vaughan, v*1907: 77-78, pl. 7, figs 1-2.
Crispatotrochus rubescens - CAIRNS, 1994: 51, pl. 22, figs g-h (synonymy). — CAIRNS & ZIBROWIUS, 1997: 103-104, figs 10 a-c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 502, 1 (USNM 98585). — Stn 507, 2 (MNHN). — Stn 511, 1 (MNHN). — Stn 523, 1 (MNHN). — Stn 585, 5 (MNHN). — Stn 604, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 983, 1 (USNM 98584).

TYPE LOCALITY. — *"Challenger"* stn 192: 5°49'15"S, 132°14'15"E (Kai Islands, Banda Sea), 236 m.

REMARKS. — This species was recently redescribed and figured by CAIRNS (1994).

DISTRIBUTION. — Wallis and Futuna; 420-516. Vanuatu region: Tanna; 475-480 m. Elsewhere: western and central Pacific: Japan; South China Sea; Philippines; Indonesia; Hawaiian and Christmas Islands; 110-634 m (CAIRNS & ZIBROWIUS, 1997).

Crispatotrochus rugosus Cairns, 1995

Figs 6 a-b

Crispatotrochus rugosus Cairns, *1995: 57, pl. 13, figs a-b, map 16; 1998: 378. — CAIRNS & ZIBROWIUS, 1997: 104.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 1 (MNHN). — Stn 523, 1 (MNHN). — Stn 542, 1 (MNHN). — Stn 584, 2 (USNM 98586). — Stn 589, 1 (MNHN). — Stn 610, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 977, 3 (MNHN). — Stn 988, 8 (USNM 98589). — Stn 1015, 3 (USNM 98590). — Stn 1018, 6 (USNM 98587). — Stn 1030, 2 (MNHN). — Stn 1043, 1 (MNHN). — Stn 1095, 2 (MNHN). — Stn 1106, 1 (USNM 98588).

TYPE LOCALITY. — NZOI stn Q70: 26°59.7'S, 159°18.9'E (Lord Howe Seamount Chain), 376 m.

REMARKS. — *Crispatotrochus rugosus* is distinguished from the other 10-12 species in the genus by having fine, transverse thecal ridges, and S_1 that are larger than the S_2. All but one of the specimens reported above are consistent with the type series, having 48 septa arranged in 4 cycles. However, the specimen from MUSORSTOM 8 stn 1043 (Figs 6 a-b) is considerably larger (CD = 29.2 x 18.3 mm, height = 37.1 mm) and has a fifth cycle of septa, although missing 4 pairs of S_5 (88 septa). This large specimen is similar to the fragmented specimen reported by CAIRNS and ZIBROWIUS (1997) that had an estimated GCD of 32 mm.

Corallum pigmentation is variable, including uniformly white, uniformly brownish-black, and white with brown longitudinal stripes corresponding to the C_{1-2} near the calicular edge. One specimen from MUSORSTOM 8 stn 988 contains an acrothoracican cirripede boring in its pedicel.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Combe and Field Banks; 286-455 m. Vanuatu region: Tanna, Efaté, Epi, and Espiritu Santo; 190-410 m. Elsewhere: Kermadec Islands; Lord Howe Seamount Chain; Philippines; Malaysia; Western Australia; 142-508 m (CAIRNS & ZIBROWIUS, 1997).

Genus *LABYRINTHOCYATHUS* Cairns, 1979

Labyrinthocyathus limatulus (Squires, 1964)

Ceratotrochus (Ceratotrochus) limatulus Squires, v*1964: 3-5, pl. 1, figs 5-9. — SQUIRES & KEYES, v.1967: 24, pl. 2, figs 9-10.
Labyrinthocyathus limatulus - CAIRNS, 1979: 70; 1995: 58, pl. 13, figs c-f, map 17.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 988, 3: 2 (MNHN), 1 (USNM 98592).

TYPE LOCALITY. — 7.2 km northeast of the Alderman Islands, Coromandel Peninsula, North Island, New Zealand, 102 m.

REMARKS. — This is the only species in the genus to have a transversely ridged theca, the ridging becoming less apparent toward the calicular edge. It is more fully described by CAIRNS (1995). This is the first record of *L. limatulus* outside the New Zealand region.

DISTRIBUTION. — Vanuatu region: Tanna; 372-466 m. Elsewhere: northern New Zealand region; Lord Howe Seamount Chain; 20-508 m (CAIRNS, 1995).

Genus *OXYSMILIA* Duchassaing, 1870

Oxysmilia circularis Cairns, 1998

Figs 6 g-h, 7 a

Oxysmilia circularis Cairns, *1998: 378, figs 2 i-k.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 977, 1 (MNHN). — Stn 983, 2 (USNM 98624). — Stn 1030, 2 (MNHN).
Kermadec Islands. NZOI: stn K830, 1 (USNM 99293). — Stn K858, 1 (USNM 99294).

TYPE LOCALITY. — *"Soela"* stn 02/82/16: 18°41'S, 117°54'E (off Port Hedland, Western Australia), 200-204 m.

REMARKS. — A characteristic of this species is the irregularity of S_5 pair insertion, some half-systems within the same specimen having a full two pairs of S_5, some only one pair, and some no S_5. A redescription of the species is not included here since it was so recently described. A specimen from MUSORSTOM 8 stn 983 is the largest known, measuring 29.8 x 27.9 mm in CD and 41.0 mm in height.

DISTRIBUTION. — Vanuatu region: Tanna and Efaté; 190-475 m. Elsewhere: northwestern Western Australia; Kermadec Islands (Curtis and Raoul), reported herein; 201-545 m.

Oxysmilia corrugata sp. nov.

Figs 6g-h, 7a

MATERIAL EXAMINED/TYPES. — **Vanuatu**. MUSORSTOM 8: stn 1030, 11: holotype and 7 paratypes (MNHN), 3 (USNM 98625).

TYPE LOCALITY. — MUSORSTOM 8 stn 1030: 17°51'S, 168°30'E (Efaté), 180-190 m.

ETYMOLOGY. — The species name *corrugata* (Latin *corrugatus*, ridged) refers to the fine file-like, regularly corrugated thecal ridging.

DESCRIPTION. — Corallum straight and elongate-conical, with a slightly flared calice. Largest specimen (holotype) 11.0 x 9.6 mm in CD, 4.3 mm in PD, and 12.5 mm in height. Calice slightly elliptical: GCD:LCD = 1.07-*1.14*-1.27. Corallum firmly attached through a thick, robust pedicel: PD:GCD = 0.39-*0.60*-0.77. Theca uniformly covered with well-defined, thin-edged, transverse ridges, about 6 parallel ridges per mm. Whereas thecal ridges occasionally bifurcate and rejoin one another, they often run uninterrupted for the entire circumference of the pedicel. Ridges cover the entire thecal surface, from base to distal peripheral edges of septa, but are often encrusted toward the base by bryozoa, foraminifera, and sponges. Corallum white.

Septa hexamerally arranged in 4 complete cycles: $S_1 > S_2 > S_3 > S_4$ (48 septa), the complete fourth cycle attained at a GCD of 5.7 mm or less. S_1 about 2.4 mm exsert, thick, having straight axial edges that penetrate into the columella, and coarsely granular faces. S_2 similar to the S_1 but slightly less wide and less exsert. S_3 slightly less exsert, wide, and thick than S_2. S_4 only slightly less exsert and wide as S_3. Thus, there are four size classes of septa, but the differences in size are minimal. Fossa of moderate depth. Columella composed of 4-6 coarse, granular papillae, which in larger coralla fuse into a solid, elongate, massive structure. The linear shape of the columella is sometimes modified into a cross-shape by short symmetrical outpocketings of the columella into the two lateral septal systems.

REMARKS. — There are three other Recent species of *Oxysmilia*: *O. rotundifolia* (H. Milne Edwards & Haime, 1848); *O. circularis* Cairns, 1998; and *O. epithecata*. *O. corrugata* differs from the first two in having a smaller

corallum with fewer septa, a transversely ridged theca, and a better-developed columella. It is compared to *O. epithecata* in the account of that species (below).

DISTRIBUTION. — Vanuatu region: Efaté; 180-190 m.

Oxysmilia epithecata sp. nov.

Figs 6 d-e, 7 b-g

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 496, 1 paratype (MNHN), SEM stub 873 (USNM 98626). — Stn 507, 2 paratypes (USNM 98627). — Stn 509, 1 paratype (USNM 98628). — Stn 511, 1 paratype (MNHN). — Stn 514, 6 paratypes (USNM 98629). — Stn 523, 2 paratypes (MNHN). — Stn 556, 1 paratype (MNHN). — Stn 605, 17 paratypes (USNM 98630). — Stn 610, 1 paratype (MNHN).
Vanuatu. MUSORSTOM 8: stn 959, 1 paratype (MNHN). — Stn 962, 1 paratype (MNHN). — Stn 1018, holotype (MNHN). — Stn 1023, 5 paratypes (MNHN). — Stn 1026, 1 paratype (MNHN). — Stn 1097, 7 paratypes (MNHN).

TYPE LOCALITY. — MUSORSTOM 8 stn 1018: 17°53'S, 168°25'W (Efaté), 300-301 m.

ETYMOLOGY. — The species name *epithecata* (Greek *epi*, on + *theke*, sheath) refers to the wrinkled epitheca that covers the lower corallum.

DESCRIPTION. — Corallum straight and elongate-conical, with a slightly flared calice. One to four coralla often originate from the dead calicular edge of a conspecific corallum, producing a small, bushy pseudocorallum (Fig. 7 b). Holotype 7.1 x 6.4 mm in CD, 3.3 mm in PD, and 10.7 mm in height; largest specimen (MUSORSTOM 8 stn 1026) 11.3 mm in GCD. Calice circular as juvenile, becoming elliptical with age (GCD:LCD = 1.07-1.34). Corallum firmly attached through a robust pedicel (PD:GCD = 0.33-0.46) and thin, expansive, encrusting base, the base often twice the diameter of the calice. Entire base and lower quarter to half of theca covered with fine transverse epithecal ridges, those ridges on the base (6 per mm) more widely spaced than those on the pedicel (13 per mm). As in *O. corrugata*, the ridges may run uninterrupted around the entire circumference of the pedicel or base, but, in general, are more irregular in arrangement and spacing. The ridges are about 10 µm wide and 30 µm tall (Figs 7 f-g). Proximal to the epithecal ridging, the upper 3/4 to half of the theca is costate, the C_{1-2} usually slightly ridged; all costae granular. Corallum white.

Septa hexamerally arranged in 4 cycles, the fourth cycle complete only in the largest corallum: $S_1>S_2>S_3>S_4$. Coralla below 3.5 mm in GCD contain only 3 cycles of septa (24), whereas coralla with a GCD between 3.5 and 11.0 mm have an increasing number S_4, the intermediate number of 36 septa being most common. The holotype has 44 septa. S_1 up to 1.3 mm exsert, having straight axial edges that reach the columella. S_2 slightly less exsert (about 0.9 mm), also having straight axial edges that reach the columella. S_3 less exsert than S_2 and well developed only in large coralla, where they are about half the width of an S_2, their lower axial edges sometimes fusing to the adjacent S_2. S_4 least exsert septa, only developed in largest of coralla; otherwise restricted to exsert lobes at the calicular edge. Fossa deep, usually containing a deep-seated papillose columella. Small coralla often have no columella, whereas most larger coralla have a small columella composed of several small fused papillae, and one specimen (MUSORSTOM 8 stn 1097) has a robust columella.

REMARKS. — *Oxysmilia epithecata* is most similar to *O. corrugata*, both species being about the same size, having the same number of septal cycles, and having transverse thecal ridges. *O. epithecata* differs in having finer, irregular transverse ridges that are restricted to the lower corallum, and a granular costate upper theca; a less robust pedicel; less septa at a corresponding GCD; a deeper fossa; and a less developed columella.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Tuscarora Bank; 240-455 m. Vanuatu region: Anatom, Efaté, and Espiritu Santo; 288-437 m.

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

Subgenus *TROCHOCYATHUS (TROCHOCYATHUS)* H. Milne Edwards & Haime, 1848

Trochocyathus (T.) vasiformis Bourne, 1903

Figs 8 a-b, f

Trochocyathus vasiformis Bourne, v*1903: 27-28, pl. 5, figs 6-7.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 1 (MNHN). — Stn 527, 1 (MNHN). — Stn 535, 2 (MNHN). — Stn 609, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 959, 2 (USNM 98634). — Stn 973, 2 (USNM 98636). — Stn 977, 19 (MNHN), SEM stub 883 (USNM 98635). — Stn 978, 4 (MNHN). — Stn 983, 3 (MNHN). — Stn 1006, 1 (MNHN). — Stn 1011, 1 (MNHN). — Stn 1015, 1 (USNM 98633). — Stn 1019, 1 (MNHN). — Stn 1067, 8 (USNM 98632). — Stn 1072, 1 (MNHN). — Stn 1107, 1 (MNHN).

Indonesia *(Mollucas)*. KARUBAR: stn 5, 2 (USNM 98637).

TYPE LOCALITY. — Tutanga, Funafuti, Tuvalu Islands, 366 m.

DESCRIPTION. — Corallum straight, elongate-conical (ceratoid), and attached through a robust pedicel (PD:GCD = 0.47-0.84) and an encrusting base. Largest specimen (MUSORSTOM 8 stn 977) 14.9 x 11.9 mm in CD and 25 mm in height. Calice elliptical: GCD:LCD = 1.11-1.35. Theca thick; costae usually low, rounded, and finely granular, but occasionally C_{1-2} are slightly ridged. Theca and outer septa a light yellow-brown (beige), the pali and columella white; however, one specimen (MUSORSTOM 8 stn 1107) completely white.

Septa regularly hexamerally arranged in 4 complete cycles: $S_{1-2}>S_{3-4}$ (48 septa). S_{1-2} exsert (up to 2.5 mm), having straight axial edges each bordered by a small (0.4 mm wide) palus; however, the 2 P_1 aligned with the greater calicular axis (those before the principal septa) only about half width and not as exsert as the other P_{1-2}. S_{3-4} equal in width, about 3/4 that of the S_{1-2}; although equal in width, S_3 slightly more exsert than S_4. A single, well-defined, elliptical palar crown occurs in the fossa, composed of 12 P_{1-2} and 12 P_3, the P_3 2-3 times the width (0.9-1.0 mm) of the P_{1-2} and usually rising slightly higher in the fossa. A large P_3 alternates with each smaller P_{1-2}, but axial edges of all pali are the same distance from the columella, which gives the impression of a single crown, even though the pali are of three size classes and heights. Each palus bears several prominent, finely dentate, obliquely-oriented menianes (Fig. 8f). Outer edges of P_3 quite broad, occupying not only space before the S_3 but the two adjacent S_4. Fossa of moderate depth. Columella an elliptical field of 10-25 slender, foliaceous elements. Columellar elements often shaped as papillae that support several horizontal to slightly inclined, circular plates, the papillae passing through the centre of these platelets (Fig. 8f). The shape of the columellar elements is intermediate between the typical papillose elements characteristic of *Trochocyathus* and the twisted elements common to *Caryophyllia*.

REMARKS. — This is believed to be the first report of this species subsequent to its description, most of the specimens reported above collected in the same sector of the Pacific as the type locality (Funafuti), and at similar depths to the types. The species is distinctive in having prominent menianes on its pali, a beige corallum, and distinctively shaped columellar elements.

BOURNE (1903) stated in the original description that the smaller, worn syntype had only 42 septa, lacking 3 pairs of S_4, but that specimen (BM 1903.12.1.5-6) actually has 44 septa, lacking pairs of S_4 only in half-systems II and IV, as counted from a principal septum.

Specimens from four stations contained coralla that were bored by acrothoracican cirripede Crustacea: MUSORSTOM 7 stn 609, MUSORSTOM 8 stns 959, 977, and 1011.

DISTRIBUTION. — Wallis and Futuna region: Wallis; Waterwitch Bank; 430-650 m. Vanuatu region: Anatom, Tanna, Erromango, Efaté, Malakula, and Espiritu Santo; 366-622 m. Elsewhere: Banda Sea (recorded herein); Funafuti; 323-366 m.

Trochocyathus (T.) rhombocolumna Alcock, 1902

Trochocyathus rhombocolumna Alcock, v*1902a: 98; v.1902c: 16, pl. 2, fig. 12. — CAIRNS, 1995: 60-61, pl. 13, fig. 1, pl. 14, figs a-b, map 19 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 106-107.
Paracyathus tenuicalyx Vaughan, v*1907: 69-70, pl. 6, figs 1a-b.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 977, 1 (MNHN). — Stn 1060, 1 (USNM 98631).

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

REMARKS. — This relatively commonly collected species is distinguished by having a transversely ridged theca (basally); hexamerally symmetrical septa ($S_1>S_2>S_4>S_3$); three size classes of pali, the P_{2-3} of each system arranged in a distinctive chevron pattern; and robust columellar elements. It is more fully described and illustrated by CAIRNS (1995).

DISTRIBUTION. — Vanuatu region: Tanna and Malakula; 397-410 m. Elsewhere: Indo-West Pacific from southwestern Indian Ocean to Hawaiian Islands; 110-530 m (CAIRNS & ZIBROWIUS, 1997).

Trochocyathus (T.) philippinensis Semper, 1872

Trochocyathus philippinensis Semper, v*1872: 253, pl. 20, fig. 16. — CAIRNS & ZIBROWIUS, 1997: 107-108, figs 10 d-e. — CAIRNS, 1998: 380.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 496, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 969, 2 (MNHN). — Stn 976, 23 (USNM 98678). — Stn 1070, 1 (MNHN). — Stn 1071, 1 (MNHN). — Stn 1086, 2 (MNHN).

TYPE LOCALITY. — Pandanon, Philippines, 27-54 m.

REMARKS. — *Trochocyathus philippinensis* is characterized as having a small straight, ceratoid corallum; a porcellaneous theca that is pigmented chocolate-brown near the calicular edge; and a hexameral symmetry of $S_{1-2}>S_{3-4}$. Some specimens have several thecal edge spines or slightly more prominent edge costae. The species was more fully described and illustrated by CAIRNS & ZIBROWIUS (1997).

DISTRIBUTION. — Wallis and Futuna region: Futuna; 250-330 m. Vanuatu region: Anatom, Tanna, Espiritu Santo, and Malakula; 182-252 m. Elsewhere: Ryukyu Islands; South China Sea; Philippines; Indonesia; northwestern Australia; 54-268 m (CAIRNS & ZIBROWIUS, 1997).

Trochocyathus (T.) maculatus Cairns, 1995

Trochocyathus maculatus Cairns, *1995: 61, pl. 14, figs c-d. — CAIRNS & ZIBROWIUS, 1997: 107.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 499, 2 (USNM 98641). — Stn 504, 11 (MNHN). — Stn 505, 1 (MNHN). — Stn 508, 3 (MNHN). — Stn 509, 3 (USNM 98639). — Stn 524, 4 (USNM 98640). — Stn 546, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 961, 1 (MNHN). — Stn 1021, 2 (MNHN). — Stn 1047, 1 (MNHN). — Stn 1077, 1 (MNHN).

TYPE LOCALITY. — NZOI stn P115: 31°25.9'S, 159°02.2'E (Lord Howe Island), 183 m.

REMARKS. — This species is distinguished from other *Trochocyathus* by having distinctively speckled (brown-black) theca and septa, and by having exothecal dissepiments that cover raised costae around its base, similar to the morphology of *Rhizosmilia*. It was fully described and figured by CAIRNS (1995).

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Combe Bank; 240-550 m. Vanuatu region: Anatom, Efaté, Epi, and Malakula; 110-486 m. Elsewhere: Philippines; Kermadec Islands; Lord Howe Islands; seamounts off eastern Australia; 92-183 m.

Trochocyathus (T.) efateensis sp. nov.

Figs 8 d-e

MATERIAL EXAMINED/TYPES. — **Vanuatu**. MUSORSTOM 8: stn 1019, 25: holotype and 19 paratypes (MNHN), 5 paratypes (USNM 98642). — Stn 1020, 1 paratype (MNHN). — Stn 1026, 1 paratype (MNHN).

TYPE LOCALITY. — MUSORSTOM 8 stn 1019: 17°38'S, 168°34'E (Efaté), 397-430 m.

ETYMOLOGY. — Although this species is not thought to be endemic to Efaté, it is named for the island of its type locality.

DESCRIPTION. — Corallum straight, elongate-conical, having a slightly flared calice, and attached through a slender (PD:GCD = 0.29-0.42), but solid, pedicel. Pedicel reinforced with layers of textura, which are usually subsequently encrusted by epizoic organisms. Calice strongly elliptical (GCD:LCD = 1.21-2.00), small coralla being closer to circular, larger coralla becoming more elongate, sometimes slightly constricted medially. The constriction is accentuated by an upward arching of the calicular edges as viewed from the side. Holotype 16.7 x 11.2 mm in CD, 5.7 mm in PD, and 21.6 mm in height; largest specimen (MUSORSTOM 8 stn 1028) 17.3 x 13.6 mm in CD. Costae broad, equal in width, and inconspicuous, covered with low, rounded granules. Corallum uniformly white.

Septa hexamerally arranged in 5 cycles, the fifth cycle never complete ($S_{1-2}>S_3>S_4>S_5$). One specimen (MUSORSTOM 8 stn 1019) of 13.4 mm GCD contains only 4 cycles of septa (48), but all other coralla have between 1 and 10 pairs of S_5, resulting in 50-68 septa. The holotype contains 68 septa. Order of insertion of S_5 pairs quite irregular, but S_5 pairs tend to be more common in end systems; some systems may contain 3 pairs of S_5 and other systems within the same corallum no S_5. All septa equally exsert (1.3-1.5 mm), having straight axial edges. S_{1-2} quite thick: 0.8-1.1 mm at their widest upper edges. The remaining three size classes of septa are less thick and progressively less wide, the S_5 being about half the width of an S_{1-2}. All pali have straight, thin axial edges that border the columella, and broad, ridged peripheral edges that are separated from their corresponding septa by narrow slits. Distal edges of all pali bluntly pointed, not evenly rounded as in most species of the genus. The 12 slender (0.8 mm wide) P_{1-2} form an elliptical crown around the columella. The 12 P_3 are about twice the width and rise higher in the fossa than the P_{1-2}, but, since their axial edges are in the same position relative to the columella as those of the P_{1-2}, the P_3 contribute to the same palar crown. P_4 present only when pairs of S_5 occur, these pali about the same width of a P_{1-2}, but recessed farther from the columella and positioned higher in the fossa. Fossa of moderate depth. Columella papillose, composed of 9-20 robust, irregularly-shaped, granular elements, in some coralla rhomboidal in cross section.

REMARKS. — Of the 29 Recent species in the nominate subgenus of *Trochocyathus*, *T. efateensis* is most similar to *T. caryophylloides* Alcock, 1902. Although both species may have 64 septa, *T. caryophylloides* achieves it by having 16 sectors (three size classes of septa and two size classes of pali), whereas *T. efateensis* retains a hexameral symmetry and has four size classes of septa and three size classes of pali. *T. efateensis* is further differentiated by its thick S_{1-2}, equally exsert septa, highly elliptical calice, and arched upper thecal faces.

DISTRIBUTION. — Vanuatu region: Efaté; 391-437 m.

Trochocyathus (T.) patelliformis sp. nov.

Figs 8 g, 9 a-c

MATERIAL EXAMINED/TYPES. — **Vanuatu**. MUSORSTOM 8: stn 1111, 1 paratype (MNHN).
Hawaiian Islands. HURL: stn P5-063, holotype (USNM 83026).

TYPE LOCALITY. — HURL stn P5-063: 20°35.8'N, 156°03.5'W (Alenuihaha Channel, Hawaiian Is.), 1020 m.

ETYMOLOGY. — The species name *patelliformis* (Latin *patella*, small pan + *forma*, shape) refers to the patelliform shape of the corallum, which in Scleractinia includes those species having a basal angle of 80°-160°.

DESCRIPTION. — Corallum short and patellate, the thecal edges diverging at about 120° from a massive basal attachment. Holotype 22.7 x 19.2 mm in CD, 9.0 mm in pedal attachment, and only 11.0 mm in height. Smaller paratype 10.9 mm in GCD. Costae well defined, rounded, and covered with fine, spiny granules. Intercostal grooves equal in width to costae on lower corallum, becoming wider and deeper near calicular edge. Corallum uniformly white.

Septa hexamerally arranged in 5 cycles, the fifth cycle incomplete ($S_{1-2}>S_3>S_4>S_5$). The holotype contains 12 pairs of irregularly inserted S_5: 5 half-systems having 2 pairs of S_5, 5 having no S_5, and 2 half-systems having 1 pair of S_5, for a total of 72 septa. The smaller paratype contains 8 pairs of incipient S_5, also irregularly distributed, or 64 septa. S_{1-2} highly exsert (up to 3.7 mm), having straight axial edges and granular faces. S_3 less exsert (about 3.3 mm) and 3/4 width of S_{1-2}. S_4 less exsert (about 2.7 mm) but almost as wide as the S_3. S_5 about 1.3 mm exsert and 3/4 width of an S_4. Two size classes and 4 crowns of pali occur in the holotype. The 6 S_1 are quite large (2.2 mm wide), each having a straight axial edge that abuts the columella, but a moderately sinuous peripheral edge, separated from its corresponding septum by a small notch. Remaining pali (P_2-P_4) all about 1.7 mm wide, each cycle progressively more recessed from the columella and rising slightly higher in the fossa. Fossa shallow. Columella composed of several finely granulated massive papillae that are fused into an irregular, elongate mass.

REMARKS. — *Trochocyathus patelliformis* is unique among the approximately 29 Recent, valid species in the genus in having a patellate-shaped corallum, in having P_1 that are significantly broader than the higher cycle pali, and in having finely spinose costae. The Hawaiian holotype was diagnosed as a potentially new species shortly after its collection in 1988 but put aside until more specimens might be collected. The Vanuatu paratype, while apparently a juvenile corallum, was collected from a similar depth range and is morphologically consistent with the holotype.

DISTRIBUTION. — Vanuatu region: Espiritu Santo; 1210-1250 m. Elsewhere: Hawaiian Islands; 1010 m.

Trochocyathus (T.) semperi Cairns & Zibrowius, 1997

Trochocyathus (T.) semperi Cairns & Zibrowius, *1997: 108-109, figs 10g-h, 11f.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1103, 1 (MNHN).

TYPE LOCALITY. — CORINDON 2 stn 251: 0°53.7'S, 119°29.6'E (Makassar Strait), 65 m.

REMARKS. — This recently described species is distinguished from all others in the genus by having spatulate edge spines and decameral septal symmetry (10:10:20, 40 septa).

DISTRIBUTION. — Vanuatu region: Espiritu Santo; 163-165 m. Elsewhere: Philippines; Indonesia; 38-245 m (CAIRNS & ZIBROWIUS, 1997).

Trochocyathus (T.) cooperi (Gardiner, 1905)

Tropidocyathus cooperi Gardiner, *1905: 955, pl. 93, fig. 30.
Trochocyathus cooperi - CAIRNS, 1994: 54, pl. 23, figs f-g. — CAIRNS & ZIBROWIUS, 1997: 111, fig. 11e (synonymy).

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 961, 1 (MNHN). — Stn 1021, 1 (MNHN).

TYPE LOCALITY. — Kolumadulu and Suvadiva, Maldive Islands, 64-70 m.

REMARKS. — This is a very distinctive species, characterised by having transverse division, thecal edge crests, and usually a brown mottled pigmentation at the calicular edge. It is more fully described and illustrated by CAIRNS (1994).

DISTRIBUTION. — Vanuatu region: Anatom and Efaté; 101-124 m. Elsewhere: widespread from Maldive Islands to northern Ryukyu Islands and the Marquesas; 25-100 m (CAIRNS & ZIBROWIUS, 1997).

Trochocyathus (T.) discus Cairns & Zibrowius, 1997

Figs 9 d-e, 18 a

Trochocyathus (T.) discus Cairns & Zibrowius, *1997: 112, figs 11 g-h, 12 a-c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: 539, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 958, 1 (MNHN). — Stn 1088, 3 cemented to a *Xenophora* gastropod shell (MNHN). — Stn 1089, 1 (MNHN). — Stn 1090, 1 (USNM 98643).

TYPE LOCALITY. — KARUBAR stn 3: 5°48'S, 132°12'E (Kai Islands, Banda Sea), 278-300 m.

REMARKS. — Little can be added to the original description except to note that the corallum from MUSORSTOM 8 stn 1089 (Figs 9 d-e) is the largest yet recorded: 11.3 x 9.3 mm in CD and 7.9 mm in height. The species is characterised by having a discoidal to bowl-shaped corallum; a flat base, the result of transverse division; four cycles of septa, the S_4 adjacent to the S_1 being wider than the S_3; and having a reddish-brown pigment to the calicular edge.

DISTRIBUTION. — Wallis and Futuna region; Combe Bank; 700 m. Vanuatu region: Anatom and Espiritu Santo; 455-497. Elsewhere: Banda Sea; 240-278 m (CAIRNS & ZIBROWIUS, 1997).

Subgenus *TROCHOCYATHUS (APLOCYATHUS)* d'Orbigny, 1849

Trochocyathus (A.) hastatus Bourne, 1903

Trochocyathus hastatus Bourne, v*1903: 29-32 (in part: pl. 5, figs 2-3; not pl. 6, figs 8-11, = *Bourneotrochus stellulatus* Cairns, *1984). — CAIRNS, 1995: 63-64, pl. 15, figs c-h, map 21.
Stephanocyathus (Acinocyathus) hastatus - WELLS, v.1984: 213.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 523, 1 (MNHN). — Stn 555, 1 (MNHN). — Stn 586, 1 (MNHN). — Stn 618, 1 (MNHN). — Stn 619, 2 (MNHN).
Vanuatu. MUSORSTOM 8: stn 959, 7 (MNHN). — Stn 963, 3 (USNM 98645). — Stn 977, 2 (USNM 98646). — Stn 1019, 2 (USNM 98644). — Stn 1020, 1 (MNHN).

TYPE LOCALITY. — Tutanga, Funafuti, Tuvalu, 366 m.

REMARKS. — *Trochocyathus hastatus* is compared to the other two Recent species in the subgenus in Table 5, and was redescribed and illustrated by CAIRNS (1995). It is easily distinguished from congenerics by having hexameral septal symmetry but only 5 costal spines. CAIRNS (1995) noted that the S_1 unaccompanied by a costal spine was always significantly smaller than the other S_1; however, both this septum and the opposing principal S_1 (opposite to the first) are equally small, the 4 other lateral S_1 being significantly wider and more exsert.

DISTRIBUTION. — Wallis and Futuna region: Wallis and Alofi; Tuscarora Bank; 435-540 m. Vanuatu region: Anatom and Efaté; 391-436 m. Elsewhere: Kermadec Islands; Funafuti; 366-710 m (CAIRNS, 1995).

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

	T. (A.) hastatus Bourne, 1903	*T. (A.) brevispina* Cairns & Zibrowius, 1997	*T. (A.) longispina* Cairns & Zibrowius, 1997
Nature of Base	Rounded (protuberant); small, circular scar; porcellaneous	Usually flat; hexagonally shaped epitheca surrounds epicentre, substrate usually incorporated in base; porcellaneous	Usually flat; circular scar; granular
Costae near Calicular Margin	Finely granular	Coarsely granular	Coarsely granular
Maximum Calicular Diameter (mm)	18.0	26.1	17.0
Colour of Corallum	Upper theca and septa brown-black	Upper theca and septa usually reddish-brown	White
Number (Size) and Shape of Costal Spines	5 elongate (up to 15 mm) spines, circular in cross section	6 compressed spines (up to 8 mm), often ridged basally and extending to epicentre; often crooked or curved	6 elongate (up to 10 mm) spines, circular in cross section
Septal Formula (Number of Septa); S_1 Dimorphism	$S_1>S_2>S_4><S_3$ (48); 2 principal S_1 smaller then others	$S_1>S_2>S_4\geq S_3>S_5$ (48-72); all S_1 equal-sized	$S_{1\text{-}2}>S_3>S_4$ (48); all S_1 equal-sized
Relative Palar Width (Number of Palar Crowns)	$P_1<P_2<<P_3$ (3 crowns)	$P_{1\text{-}4}$ equal-sized (3 or 4 crowns)	$P_{1\text{-}2}<<P_3$ (2 crowns)
Distribution; Depth	Funafuti, Wallis, Vanuatu, Kermadec Islands; 366-710 m	Banda Sea, Vanuatu region; 240-560 m	Philippines, Celebes Sea; 326-760 m

Trochocyathus (A.) brevispina Cairns & Zibrowius, 1997

Figs 9 f-i

Trochocyathus (A.) brevispina Cairns & Zibrowius, *1997: 113, figs 12 d-f.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 959, 2 (MNHN). — Stn 963, 65: 56, including one cemented to a *Xenophora* shell (MNHN), 9 (USNM 98649). — Stn 964, 14 (MNHN). — Stn 999, 1 (USNM 98647). — Stn 1003, 4 (MNHN). — Stn 1004, 12: 8 (MNHN), 4 (USNM 98648). — Stn 1020, 1 (MNHN). — Stn 1058, 2 (MNHN). — Stn 1065, 1 (MNHN).

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 S_4) and 7 costal spines.

DISTRIBUTION. — Vanuatu region: Anatom, Erromango, Efaté, and Malakula; 110-436 m. Elsewhere: Banda Sea; 240-560 m (CAIRNS & ZIBROWIUS, 1997).

Genus *TETHOCYATHUS* Kühn, 1933

Tethocyathus virgatus (Alcock, 1902)

Trochocyathus (Tethocyathus) virgatus Alcock, v*1902a: 98-99; v.1902c: 16-17, pl. 2, fig. 13.
Tethocyathus virgatus - CAIRNS, 1995: 65-66, pl. 16, figs c-f, map 11 (synonymy). — CAIRNS & ZIBROWIUS, 1997: 114-115.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 1 (MNHN). — Stn 522, 1 (USNM 98652).
Vanuatu. MUSORSTOM 8: stn 973, 7 (USNM 98650). — Stn 977, 5 (MNHN). — Stn 978, 2 (MNHN). — Stn 982, 2 (MNHN). — Stn 1015, 1 (MNHN). — Stn 1026, 1 (MNHN). — Stn 1095, 1 (MNHN). — Stn 1108, 3 (MNHN).

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 nontrabecular 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 nontrabecular 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 acrothoracican 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 acrothoracican cirripede borings in the corallum of living specimens.

DISTRIBUTION. — Wallis and Futuna; 450-650 m. Vanuatu region: Tanna, Efaté, 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

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 494, 1 holotype (MNHN). — Stn 496, 2 paratypes (MNHN). — Stn 499, 1 paratype (USNM 98654). — Stn 504, 7 paratypes (MNHN), 3 paratypes (USNM 98653). — Stn 509, 3 paratypes (MNHN). — Stn 513, 1 paratype (MNHN). — Stn 516, 1 paratype (MNHN).
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 *octuplus*, 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 octamerally arranged 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 P_2. When quaternary septa occur in a sector, the flanked tertiary septum bears a palus of equal size to the P_2, but slightly recessed from the columella and also rising slightly higher than the P_2. 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 veroni Wells, v*1984: 213-214, pl. 3, figs 7-18.
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

(USNM 98707). — Stn 514, 13 (USNM 98706). — Stn 516, 5 (USNM 98705). — Stn 556, 2 (MNHN). — Stn 569, 3 (MNHN). — Stn 585, 5 including 3 anthocauli (USNM 98710). — Stn 586, 2 (MNHN). — Stn 591, 1 (MNHN). — Stn 594, 2 (MNHN). — Stn 595, 1 (MNHN). — Stn 604, 13 including 3 anthocauli and SEM stub 878 (USNM 98711). — Stn 605, 8 (USNM 98711). — Stn 608, 5 (USNM 98709). — Stn 610, 14 including 1 anthocaulus (MNHN). — Stn 618, 3 anthocauli (MNHN).

Vanuatu. MUSORSTOM 8: stn 963, 2 cemented to *Xenophora* shell (MNHN). — Stn 969, 1 (MNHN). — Stn 1018, 1 cemented to *Xenophora* shell (MNHN). — Stn 1023, 1 cemented to *Xenophora* shell (MNHN). — Stn 1061, 1 (MNHN). — Stn 1087, 2 cemented to *Xenophora* shells (MNHN). — Stn 1097, 11 cemented to *Xenophora* shells (MNHN). — Stn 1106, 10 cemented to *Xenophora* shells (MNHN).

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

REMARKS. — The anthocyathus of *B. stellulatus* 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 S_4 in each system. Because the costal spines are associated with the C_1, they are symmetrically distributed around the perimeter of the corallum (Fig. 10 d). However, about 20% of the examined coralla lack one to three pairs of S_4, 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 coralla that have a well-developed basal scar, lack spines, often have less than 36 septa, and appear to have a primitive epithecal 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; Tuscarora, Waterwitch, and Field Banks; 240-566 m. Vanuatu region: Anatom, Efaté, Malakula, and Espiritu Santo; 280-458 m [Pleistocene of Espiritu 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 *STEPHANOCYATHUS* Seguenza, 1864

Subgenus *STEPHANOCYATHUS (STEPHANOCYATHUS)* Seguenza, 1864

Stephanocyathus (S.) regius Cairns & Zibrowius, 1997

Figs 10 h, 11 a-c

Stephanocyathus (S.) regius Cairns & Zibrowius, *1997: 117-118, figs 14a-c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 564, 68 (MNHN). — Stn 565, 8 (USNM 98659). — Stn 567, 14 (MNHN). — Stn 621, 5 (MNHN). — Stn 623, 2 (MNHN). — Stn 635, 24 (MNHN). — Stn 636, 14 (MNHN). — Stn 637, 14 (USNM 98660).

Vanuatu. MUSORSTOM 8: stn 990, 1 (MNHN). — Stn 992, 5 (USNM 98655). — Stn 996, 2 (MNHN). — Stn 1007, 2 (MNHN). — Stn 1036, 11 (MNHN). — Stn 1109, 5 (USNM 98656). — Stn 1110, 1 (MNHN). — Stn 1125, 1 (USNM 98658). — Stn 1127, 1 (MNHN). — Stn 1129, 8, including SEM stub 882 (USNM 98657).

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, Efaté, 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 synonymy**).
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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 621, 3 (MNHN). — Stn 622, 4 (MNHN). — Stn 623, 7 (USNM 98661).
Vanuatu. MUSORSTOM 8: stn 956, 2 (MNHN). — Stn 1125, 1 (MNHN).

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)

Stephanotrochus weberianus Alcock, v*1902a: 101-102; v.1902c: 25, pl. 3, figs 22, 22a.
Stephanotrochus sibogae Alcock, v*1902a: 101-102; v.1902c: 25-26, pl. 3, figs 23, 23a.
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)

Stephanotrochus spiniger Marenzeller, *1888b: 20-21.
Odontocyathus spiniger - YABE & EGUCHI, 1942: 124-125, pl. 10, figs 26-28 (synonymy).
Stephanocyathus (O.) spiniger - WELLS, v.1984: 209, pl. 2, figs 10-13. — CAIRNS & PARKER, 1992: 26-27, pl. 7, figs g-i (synonymy). — CAIRNS, 1994: 57, pl. 25, figs a-c (synonymy); 1995: 67-68, pl. 17, figs d-f, pl. 18, fig. c (synonymy); 1998: 381. — CAIRNS & ZIBROWIUS, 1997: 118-119, figs 13f, 14d.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 585, 1 (MNHN). — Stn 604, 1 (MNHN). — Stn 606, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 963, 8 (MNHN). — Stn 1003, 1 (MNHN). — Stn 1004, 2 (USNM 98664). — Stn 1058, 1 (MNHN). — Stn 1087, 1 (USNM 98665). — Stn 1092, 1 (USNM 98663).

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

REMARKS. — This commonly collected, distinctive species, characterised by having six elongate costal spines (C_1) and highly exsert S_1, 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, Erromango, 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

Vaughanella concinna Gravier, v*1915: 10. — ZIBROWIUS, v.1980: 104-105, pl. 52, figs A-K, pl. 53, figs A-L (synonymy).
Vaughanella oreophila - CAIRNS, 1995: 70, pl. 18, figs d-e (Not *V. oreophila* Keller, *1981).

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 S_5). 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 P_3, 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

Deltocyathus magnificus Moseley, v*1876: 552-553; v.1881: 147-148, pl. 4, figs 1-2. — CAIRNS & PARKER, 1992: 27-28, pl. 7, figs j-l, pl. 8, fig. a. — CAIRNS, 1994: 56, pl. 24, figs d-e, g-h (synonymy); 1998: 381-382, fig. 4a. — GUERRIERO *et al.*, 1996: 986. — CAIRNS & ZIBROWIUS, 1997: 126-127.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 963, 12: 8 (MNHN), 4 (USNM 98666). — Stn 964, 1 (MNHN). — Stn 980, 1 (MNHN).

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 S_5 lacking from each half-system adjacent to an S_2. 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: Anatom 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.
Deltocyathus rotulus - CAIRNS, 1994: 55-56, pl. 24, figs j-k. — CAIRNS & ZIBROWIUS, 1997: 125-126, figs 16 a-c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 621, 3 (MNHN). — Stn 622, 3 (MNHN). — Stn 623, 2 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1125, 5 (USNM 98667). — Stn 1127, 1 (MNHN). — Stn 1129, 11 (USNM 98668).

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 S_4 and adjacent pair of S_5 projecting beyond the S_{1-3}; a large, undercut papillose columella; and a prominent crown of large P_4. 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 S_4 solidly attached to the S_3, 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 magnificus var. *suluensis* Alcock, v*1902c: 20-21.
Deltocyathus formosus Cairns, *1995: 73-74, pl. 19, figs f-g.
Deltocyathus suluensis - CAIRNS & ZIBROWIUS, 1997: 125, fig. 16d. — CAIRNS, 1998: 382.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 1 (MNHN). — Stn 529, 2 (USNM 98672). — Stn 530, 4 (MNHN). — Stn 532, 3 (MNHN). — Stn 534, 17 (USNM 98674). — Stn 535, 14 (USNM 98671). — Stn 540, 74 (MNHN). — Stn 541, 3 (MNHN). — Stn 546, 1 (MNHN). — Stn 557, 1 (MNHN). — Stn 575, 1 (MNHN). — Stn 578, 1 (MNHN). — Stn 590, 6 (MNHN). — Stn 594, 2 (MNHN). — Stn 595, 3 (USNM 98673). — Stn 631, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 975, 7 (USNM 98669). — Stn 1028, 3 (USNM 98670).

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., S_{1-3}) projecting beyond the higher cycle septa (e.g., S_{4-5}); 5 cycles of septa (96) above a CD of 18 mm; and rudimentary S_5, joined to adjacent S_4 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 Bayonnaise Banks; 400-650 m. Vanuatu region: Tanna and Efaté; 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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 522, 11 (MNHN). — Stn 523, 1 (MNHN). — Stn 525, 1 (MNHN). — Stn 529, 12 (USNM 98680). — Stn 535, 1 (MNHN). — Stn 537, 1 (MNHN). — Stn 540, 5 (MNHN). — Stn 541, 2 (MNHN). — Stn 542, 6 (USNM 98679). — Stn 546, 4 (MNHN). — Stn 555, 5 (MNHN). — Stn 556, 10 (MNHN). — Stn 557, 1 (MNHN). — Stn 560, 1 (MNHN). — Stn 585, 1 (MNHN). — Stn 589, 4 (USNM 98678). — Stn 590, 9 (USNM 98675). — Stn 591, 22 (MNHN). — Stn 594, 19 (USNM 98677). — Stn 597, 9 (USNM 98676).

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: $S_{1-2}>S_3>S_4>S_5$. Between a CD of about 6.5-7.0 mm, pairs of S_5 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 S_5 (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 S_5 pairs are inserted, some half-systems in the same corallum having 2 pairs, 1 pair, or no S_5. S_{1-2} 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 P_1 associated with the principal septa are noticeably smaller, only about 0.9 mm wide. S_3 about 0.7 mm exsert and half the width of the S_{1-2}, each bordered by a P_3 about 1.4 mm wide that is slightly recessed from the columella, its axial edge strongly fused to its adjacent P_2. S_4 dimorphic in size. If unflanked by S_5, S_4 are rudimentary, well developed only at the calicular edge and represented by discontinuous spines within the theca, joining to their adjacent S_3 by 4 or 5 thin (0.15 mm in diameter) processes well below the S_3-P_3 notch (Fig. 12 b). However, if S_4 are flanked by a pair of S_5, they are 2/3 the width of an S_3 and bear pali (P_4) of equal size to the P_3, the axial edges of which are strongly fused to the P_3 and recessed slightly more from the columella than the P_3. In this case the S_5 resemble the unflanked S_4 as described above. All septal and palar faces are covered with spinose granulations. Fossa shallow, containing a papillose 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, 1932

Deltocyathus vaughani Yabe & Eguchi, *1932a: 388-389. — CAIRNS, 1994: 54-55, pl. 23, figs i-j, pl. 24, figs a-c, f (synonymy). — 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

(1997). Although coarsely dentate costae are diagnostic for the species, it is interesting to note that the specimen from MUSORSTOM 8 stn 1006 (CD = 20.4 mm) has finely granular costae.

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

Deltocyathus crassiseptum sp. nov.

Figs 12 c-f

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 2 paratypes (MNHN). — Stn 523, 6 paratypes (MNHN). — Stn 529, 13 paratypes (USNM 98683). — Stn 537, 38 paratypes (MNHN). — Stn 570, 3 paratypes (MNHN). — Stn 585, 8 paratypes (USNM 98684). — Stn 586, 1 paratype (MNHN). — Stn 597, 1 paratype (MNHN). — Stn 604, 5 paratypes (MNHN). — Stn 608, 2 paratypes (MNHN). — Stn 618, 1 paratype (MNHN).

Vanuatu. MUSORSTOM 8: stn 958, 9 paratypes (USNM 98682). — Stn 959, 14 paratypes (MNHN). — Stn 977, 2 paratypes (USNM 98681). — Stn 978, 3 paratypes (MNHN). — Stn 980, holotype (MNHN). — Stn 983, 5 paratypes (USNM 98686). — Stn 1061, 2 paratypes (MNHN). — Stn 1068, 2 paratypes (USNM 98685).

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 S_{1-2}. 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 ($S_1>S_2>S_3>S_4$), for a total of 48 septa; however, the holotype is missing one half-system, resulting in 11 major septa and a total of only 44 septa. S_1 about 2 mm exsert, extend about half way to the columella, having straight, vertical to slightly concave axial edges. S_1 can be remarkably thick, up to 1.0 mm at the calicular edge. S_2 only slightly smaller than S_1 and equally thick. S_3 about half as exsert and wide as S_{1-2}, and of normal thickness (i.e., 0.4 mm). S_4 rudimentary in small coralla, but up to 3/4 exsertness and width of an S_3 in larger coralla. Lower axial edges fuse to adjacent S_4 low in fossa adjacent to columella through 3 or 4 slender processes. P_{1-3} all about 1 mm wide, the 6 P_1 being the only independent pali, forming a crown low in the fossa encircling the columella. The 6 P_2 rise slightly higher in the fossa, and the 12 P_3 higher still and are recessed from the columella, the axial edges of each pair of P_3 fusing to its adjacent P_2 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 S_{1-2}. 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 petrarcid ascothoracidan gall beneath its columella, a symbiosis previously reported in this genus by ZIBROWIUS & GRYGIER (1985), GRYGIER (1991), and GRYGIER & NOJIMA (1995).

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

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 520, 2 paratypes (MNHN). — Stn 530, 1 paratype (MNHN). — Stn 537, 1 paratype (MNHN). — Stn 541, 1 paratype (MNHN). — Stn 542, 4 paratypes (USNM 98688). — Stn 546, 1 paratype (MNHN). — Stn 552, 1 paratype (USNM 98690). — Stn 555, 1 paratype (MNHN). — Stn 557, 3 paratypes (USNM 98691). — Stn 560, 1 paratype (USNM 98687). — Stn 567, 1 paratype (MNHN). — Stn 569, 1 paratype (USNM 98689). — Stn 578, 2 paratypes (MNHN). — Stn 589, 2 paratypes (MNHN). — Stn 597, 1 paratype (MNHN). — Stn 635, 18 paratypes (MNHN). — Stn 636, 3 paratypes (MNHN).
Vanuatu. MUSORSTOM 8: stn 956, 4 paratypes (USNM 98693). — Stn 992, 1 paratype (USNM 98692). — Stn 1007, holotype (MNHN). — Stn 1036, 4 paratypes (MNHN). — Stn 1061, 1 paratype (MNHN).

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 S_4-P_3 and P_2-P_3 fusions.

DESCRIPTION. — Corallum 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 CS_3 and adjacent pairs of CS_4 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 coralla uniformly white, but some (e.g., the holotype) are a light reddish-brown in the palar region.

Septa hexamerally arranged in 4 complete cycles (S_1>S_2>S_4>S_3). In a large well-preserved corallum, S_1 are about 1.6 mm exsert, extending about half distance to columella; S_2 similar in shape and exsertness but only slightly less wide. S_3 about 1.3 mm exsert and half the width of an S_1. S_4, although less exsert than the S_3 (about 1.0 mm), are slightly wider than the S_3, the axial edges of each S_4 pair solidly fused as a thick lamella to the outer edge of the adjacent P_3. This fusion reaches as high as the S_3-P_3 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 (P_{1-3}) uniform in width (about 1.2 mm) and separated from their corresponding septa by wide notches (about 0.8 mm). Axial edges of P_1 and P_2 solidly fused to the columella, although P_2 rise slightly higher in the fossa. Axial edges of each pair of P_3 solidly fused to their adjacent P_2, this fusion being imperforate and reaching as high as the S_3-P_3 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 coralla ornately sculptured (Fig. 13 a).

REMARKS. — The well-developed lamellar fusions of the S_4 to P_3 and P_3 to P_2 serve to differentiate this species from all others, as well as subdivide the corallum into 24 elliptical compartments, or chambers. In each system there are 2 small chambers formed by each pair of S_4, bisected by the S_3; 1 slightly larger compartment formed between each S_3, bisected by the S_2; and an elongate compartment between each system, bisected by an S_1. 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 S_4-P_3/P_3-P_2 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 petrarcid 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

Deltocyathus stella Cairns & Zibrowius, *1997: 123-124, figs 15 f-h.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 509, 6 (USNM 98695). — Stn 510, 1 (MNHN). — Stn 511, 1 (MNHN). — Stn 512, 41 (MNHN). — Stn 513, 22 (MNHN). — Stn 514, 4 (MNHN). — Stn 516, 5 (MNHN). — Stn 523, 11 (USNM 98694). — Stn 537, 1 (MNHN). — Stn 541, 1 (MNHN). — Stn 556, 4 (MNHN). — Stn 569, 6 (USNM 98696). — Stn 585, 1 (USNM 98697). — Stn 594, 1 (MNHN). — Stn 605, 16 (USNM 98698). — Stn 610, 6 (MNHN). — Stn 626, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 967, 3 (USNM 98700). — Stn 969, 4 (MNHN). — Stn 1097, 1 cemented to *Xenophora* shell (MNHN). — Stn 1106, 1 (MNHN).

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*.

	D. stella Cairns & Zibrowius, 1997	*D. heteroclitus* Wells, 1984	*D. ornatus* Gardiner, 1899	*D. corrugatus* sp. nov.	*D. calcar* Pourtalès, 1874
Calicular Margin	Lancetted	Polygonal, asymmetric hexagonal	Circular	Prominently lancetted	Serrate
Maximum Calicular Diameter, Exclusive of Spines (mm)	12.3	5.4	10.4	12.0	14.8
Costal Spines: Number; Length; Shape	12 C_3; short (1.2 mm); stubby, thick	6-8 C_3; short (1.5 mm); wide-based, circular in cross section, attenuate	12 C_3; short (1.6 mm); slender, circular in cross section, flattened	12 C_3; long (3.5 mm); slender, circular in cross section	6 C_1; long (4.0 mm); slender, attenuate, circular in cross section
Corallum Shape	Shallow bowl	Shallow bowl	Discoidal (flat base)	Discoidal (flat base)	Patellate
Costae: Relative Width; Granules/ Costal Width	C_3>$C_{1-2, 4}$; 2 granules/costa	All costae equal; 1 granule/costa	C_3>$C_{1-2, 4}$; several granules/costa	C_3>$C_{1-2, 4}$ (C_3 prominent); 1 granule/costa	C_3>$C_{1-2, 4}$ (C_3 prominent); 2-3 granules/costa;
Number of Septa	48	40	48	48	48
Height and Nature of S_4-P_3 Junction	Just below S_3-P_3 notch, 4-5 slender processes	At S_3-P_3 notch, slender processes	Slightly below S_3-P_3 notch, thick processes	At S_3-P_3 notch, slender processes	Just below S_3-P_3 notch, 5-6 slender processes
Pali: Relative Width; P_1 Size Dimorphism	P_3>P_{1-2} (axial edges sinuous and dentate); P_1 dimorphic	P_3>P_{1-2}; not dimorphic	All palar cycles equal sized, but P_1 dimorphic	All palar cycles equal sized, but P_1 dimorphic	P_3>P_{1-2}; not dimorphic
Distribution; Depth	Philippines, Indonesia, Wallis and Futuna, Vanuatu; 206-597 m	Futuna, Vanuatu; 208-335 m	Wallis and Futuna, Vanuatu, Loyalty Islands; 73-360 m	Norfolk Ridge, Lord Howe Rise; 280-390 m	W. Atlantic; 81-675 m

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 P_3, and occasionally the P_1 and P_2, are dentate. *Deltocyathus stella* is most easily distinguished from other spined *Deltocyathus* (Table 6), by having short, thick, stubby costal spines, and large, sinuous, dentate P_3.

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).

Deltocyathus heteroclitus Wells, 1984

Figs 13 d-g, Fig. A

Deltocyathus heteroclitus Wells, v*1984: 210, figs 3, 1-6. — CAIRNS & ZIBROWIUS, 1997: 124 (mentioned).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 514, 16: 12 (MNHN), 4 (USNM 98701).

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

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

DESCRIPTION. — Corallum 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 (C_3) project up to 1.5 mm from the calicular edge, spines forming only in half-systems in which the CS_3 is flanked by a pair of CS_4 (see Remarks). Costal spines thick at base, circular in cross section, attenuate at the tip, and coarsely granular. Corallum 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 S_4 occurs in each system, resulting in 36 septa (Fig. A, but see Remarks). S_1 only independent septa, each bordered axially by a slender (0.4 mm wide) palus. S_2 about 2/3 width of the S_1, each bearing a similarly sized palus, but rising higher in the fossa. S_3 dimorphic in size: S_3 unflanked by S_4 about 3/4 width of the S_2, their axial edges fused to the adjacent P_2, and often bear a small paliform lobe. S_3 flanked by S_4 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. P_3 wide (0.6 mm), sinuous, highly granular, and are the tallest and most recessed pali from the fossa. S_4 slightly wider than flanked S_3, have a dentate distal margin, a peripheral margin that borders the costal spine, and an axial margin that fuses to the adjacent P_3 at the level of the S_3-P_3 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 S_4 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 corallum being poorly preserved, the other with the additional costal spines in half-systems VI and VII (Fig. 13 g).

DISTRIBUTION. — Wallis and Futuna region: Futuna; 349-355 m. Vanuatu region: Espiritu Santo; 208-210 m and Late Pleistocene of Espiritu Santo (WELLS, 1984).

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).
Vanuatu. MUSORSTOM 8: stn 964, 2 (USNM 98703). — Stn 967, 1 (MNHN). — Stn 1017, 1 (MNHN). — Stn 1018, 1 (USNM 98702). — Stn 1094, 2 (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 (C_3), dimorphic P_1, and an S_4-P_3 junction slightly below the S_3-P_3 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; C_3 so prominent that they give the base of the corallum a corrugated aspect; much longer costal spines; a higher S_4-P_3 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, Efaté, 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.
Heterocyathus sulcatus - HOEKSEMA & BEST, 1991: 231-233, figs 19-23 (synonymy).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 494, 4 (USNM 98717). — Stn 495, 16 (USNM 98716). — Stn 496, 1 + (3) (USNM 98715). — Stn 509, 5 (USNM 98713). — Stn 510, 1 (MNHN). — Stn 512, 19 + (6) (MNHN). — Stn 513, 70 + (3): 60 + (3) (MNHN), 10 and SEM stubs 886-888 (USNM 98712). — Stn 514, 2 (MNHN). — Stn 516, 2 + (2) (MNHN). — Stn 556, 1 (MNHN). — Stn 570, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 969, 1 (MNHN). — Stn 976, 17 + (2) (USNM 98714). — Stn 1069, 10 (USNM 98718). — Stn 1094, 1 (MNHN). — Stn 1097, 2 (MNHN).

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 porcellaneous 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. C_{1-3} light brown to chocolate-brown in colour, alternating with the white C_4; however, only the S_{1-2} are similarly coloured, the pigment of the C_3 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 S_4 resulting in 36 to 46 septa: $S_1>S_2>S_4>S_3$. S_1 about 1.1 mm exsert, extend about half way to columella, and bordered by 1 or 2 narrow paliform lobes. S_2 0.7 mm exsert, about 3/4 width of the S_1, and also bear 1 or 2 paliform lobes. S_3 that are flanked by a pair of S_4 are the smallest septa, only 0.5 mm exsert and half the size of the S_2, but if not flanked by S_4, an S_3 is as wide as an S_2 and often considerably thicker. S_4 also dimorphic in size, those adjacent to S_1 as wide as an S_2 and fused to its adjacent S_1 in a lancet. S_4 adjacent to S_2 are smaller, only slightly wider than an S_3. Both S_3 and S_4 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 papillose 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.

DISTRIBUTION. — Wallis and Futuna region: Futuna; Tuscarora and Waterwitch Banks; live specimens from 110-260 (dead specimens found to 550 m). Vanuatu region: Anatom, Tanna, and Espiritu Santo; 182-312 m (live specimens). Elsewhere: See HOEKSEMA & BEST (1991).

Heterocyathus alternatus Verrill, 1865

Figs 14 e-f

Heterocyathus alternatus Verrill, v*1865: 149. — HOEKSEMA & BEST, 1991: 230-231, figs 12-18 (synonymy). — CAIRNS, 1998: 384, figs 3d-e.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1004, 1 (MNHN). — Stn 1018, 4 (USNM 98719).

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 ($S_1>S_2>S_4>S_3$), although HOEKSEMA and BEST (1991: fig. 17) show that this species may sometimes attain a full fifth cycle. S_1 highly exsert (3.7 mm), forming tall lancets with their adjacent S_4, and axially bordered with 2 or 3 slender paliform lobes. S_2 about 2.5 mm exsert, also forming lancets with their adjacent S_4. S_3 bear only 1 or 2 paliform lobes, whereas the larger S_4 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 S_1 and S_2, nonridged paliform lobes, a deeper fossa, and finer columellar elements.

DISTRIBUTION. — Vanuatu region: Erromango and Efaté; 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)

Ceratotrochus (Conotrochus) funicolumna Alcock, v*1902a: 93; v.1902c: 11-12, pl. 1, figs 6, 6a.
Conotrochus funicolumna - CAIRNS, 1994: 58-59, pl. 24, fig. i, pl. 25, figs g-l (synonymy). — CAIRNS & ZIBROWIUS, 1997: 127. — CAIRNS, 1998: 385.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 6 (MNHN). — Stn 522, 1 (MNHN). — Stn 523, 5 (MNHN). — Stn 525, 2 (MNHN). — Stn 532, 1 (MNHN). — Stn 535, 1 (MNHN). — Stn 537, 1 (MNHN). — Stn 540, 4 (MNHN). — Stn 541, 1 (MNHN). — Stn 542, 1 (MNHN). — Stn 555, 1 (USNM 98721). — Stn 556, 3 (MNHN). — Stn 557, 4 (USNM 98720). — Stn 560, 1 (MNHN). — Stn 570, 12 (MNHN). — Stn 571, 2 (MNHN). — Stn 585, 3 (USNM 98724). — Stn 604, 3 (MNHN). — Stn 618, 40 (USNM 98722). — Stn 619, 14 (USNM 98723).

Vanuatu. MUSORSTOM 8: stn 1059, 1 (USNM 98728). — Stn 1060, 1 (MNHN). — Stn 1065, 8 (USNM 98726). — Stn 1072, 3 (MNHN). — Stn 1087, 8 (USNM 98729). — Stn 1088, 1 (USNM 98725). — Stn 1091, 1 (MNHN). — Stn 1107, 1 (USNM 98727). — Stn 1113, 1 (MNHN).

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 ($S_1>S_2>S_3>S_4$), a full fourth cycle complete in some coralla at a CD of 4.6 mm, but larger specimens sometimes lacking several pairs of S_4. 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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 511, 1 (USNM 98734). — Stn 513, 1 (MNHN). — Stn 525, 1 (MNHN). — Stn 530, 1 (USNM 98731). — Stn 546, 1 (MNHN). — Stn 586, 1 (MNHN). — Stn 590, 1 (MNHN). — Stn 591, 1 (MNHN). — Stn 597, 1 (MNHN). — Stn 625, 1 (USNM 98730).
Vanuatu. MUSORSTOM 8: stn 959, 2 (USNM 98732). — Stn 977, 1 (MNHN). — Stn 1006, 1 (MNHN). — Stn 1089, 1 (MNHN). — Stn 1090, 1 (USNM 98733). — Stn 1092, 1 cemented to a *Xenophora* shell (MNHN).

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

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 495, 3 paratypes and SEM stub 890 (USNM 98735). — Stn 496, 1 holotype (MNHN). — Stn 504, 6 paratypes (MNHN). — Stn 509, 10 paratypes (USNM 98736). — Stn 512, 3 paratypes (MNHN). — Stn 513, 6 paratypes (MNHN). — Stn 516, 3 paratypes (MNHN). — Stn 586, 1 paratype (MNHN). — Stn 610, 1 paratype (MNHN).
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 eversions. 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 hexamerally 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 columella. 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 columella 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: Efaté and Espiritu Santo; 288-294 m.

Genus *LOCHMAEOTROCHUS* Alcock, 1902

Lochmaeotrochus gardineri sp. nov.

Figs 15 f-g

MATERIAL EXAMINED/TYPES. — MUSORSTOM 7: stn 539, 17 paratypes (MNHN). — Stn 548, 1 paratype (MNHN). — Stn 557, 1 paratype (MNHN). — Stn 560, 1 paratype (USNM 98739).

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 (Efaté), 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: $S_1>S_2>S_3>S_4$. Most coralla have 1 pair of S_4 in each system, resulting in 36 septa; however, the holotype has 40 septa, and a smaller specimen (CD 9.4 mm) has 42 septa. S_1 nonexsert, extend about 3/4 distance to the columella, having straight, vertical axial edges. Rarely (e.g., the holotype) the S_1 bear a small (0.6 mm wide), lamellar P_1, separated from its septum by a deep, narrow notch. S_2 about 3/4 width of the S_1. S_3 dimorphic in size: S_3 unflanked by S_4 about half the size of the S_2, but those flanked by S_4 are only slightly less wide than the S_2 and usually bear a broad (1.2 mm wide), lamellar palus. The position of the P_3 is variable. Although it is usually aligned with the S_3, it is sometimes aligned between the S_3 and adjacent S_2, or may be absent. Even when aligned with the S_3, lower in the fossa the P_3 is usually connected to the adjacent S_2. Also, in some systems having a full complement of 2 pairs of S_4, only one palus is present before the S_2, but this palus having connections to the 2 adjacent S_3 lower in the fossa. S_4 about half width of a flanked S_3. Axial edges of S_{2-4} 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 gardineri* is similar to but differs from the only other species described in this genus, *L. oculeus* 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. oculeus* have 48 septa); wider and better developed pali; and a deeper fossa. It is also known from greater depths than *L. oculeus*.

Lochmaeotrochus gardineri is also similar to *Conotrochus funicolumna*, particularly in corallum size and thecal granulation; these species also co-occur at one station. *L. gardineri* is distinguished by having at least 6 lamellar pali (P_3), which are different in shape from its cylindrical columellar elements, *C. funicolumna* only having swirled, interconnected (labyrinthiform) lamellar columellar elements and no pali. *L. gardineri* also has a narrower basal attachment, a deeper fossa, fewer septa at a corresponding CD, and a greater disparity between the width of its S_1 and S_2. *L. gardineri* 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 Efaté; 750-1175 m.

Genus ***AULOCYATHUS*** Marenzeller, 1904

Aulocyathus recidivus (Dennant, 1906)

Ceratotrochus recidivus Dennant, *1906: 159-160, pl. 6, figs 1-2.
Aulocyathus recidivus - CAIRNS, 1982: 25-26, pl. 7, figs 7-9, pl. 8, fig. 1 (synonymy); 1994: 59-60, pl. 26, fig. a-b. — CAIRNS & PARKER, 1992: 22-24, pl. 6, figs d-e, g-h (synonymy). — CAIRNS & ZIBROWIUS, 1997: 129-130.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 564, 4 (USNM 98741). — Stn 567, 1 (MNHN). — Stn 620, 1 (MNHN). — Stn 622, 1 (MNHN). — Stn 623, 2 (MNHN).

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*.

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

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

Aulocyathus juvenescens Marenzeller, v*1904: 301-302, pl. 18, fig. 17. — ZIBROWIUS, 1980: 107. — CAIRNS & KELLER, 1993: 247. — CAIRNS, 1994: pl. 26, figs h-i. — CAIRNS & ZIBROWIUS, 1997: 130 (mentioned).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 87, 1 juvenile (USNM 97653).
Vanuatu. MUSORSTOM 8: stn 976, 2 (MNHN). — Stn 1070, 1 (USNM 98740).

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 $S_1>S_2>S_3>S_4$; however, the size difference between the S_2 and the flanking S_3 is slight. The lower axial edges of S_1 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 *DESMOPHYLLUM* 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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 637, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1088, 8 (MNHN). — Stn 1089, 1 (MNHN). — Stn 1128, 1 (USNM 98742).

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).

Genus ***THALAMOPHYLLIA*** Duchassaing, 1870

Thalamophyllia tenuescens (Gardiner, 1899)

Desmophyllum tenuescens Gardiner, v*1899a: 161-162, pl. 19, figs 1a-b.
Desmophyllum delicatum - WELLS, v.1954: 470 (Not *Desmophyllum delicatum* Yabe & Eguchi, 1942).
Thalamophyllia tenuescens - CAIRNS, 1995: 78, pl. 21, figs g-i, map 19; 1998: 386. — CAIRNS & ZIBROWIUS, 1997: 133, figs 17d-e.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 496, 1 (MNHN). — Stn 499, 1 (MNHN). — Stn 504, 2 (MNHN). — Stn 509, 2 (MNHN). — Stn 512, 3 (USNM 98744). — Stn 513, 1 (MNHN). — Stn 514, 1 (USNM 98743).
Lord Howe Island. NZOI: stn P115, 2 colonies (USNM 94363).

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

REMARKS. — This species was rently 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 S_5 (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).

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

Lophelia pertusa (Linnaeus, 1758)

Madrepora pertusa Linnaeus, *1758: 797.
Madrepora prolifera Pallas, *1766: 307.
Lophelia prolifera - CAIRNS, 1979: 125-127, pl. 24, figs 1-5 (synonymy); 1991a: 17-18, pl. 6, fig. j.
Lophelia pertusa - ZIBROWIUS, v.1980: 126-130, pl. 66, figs A-L (synonymy). — CAIRNS, 1995: 27-28, pl. 9, figs e-i (synonymy).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 530, 19 fragments: 15 (MNHN), 4 (USNM 98745). — Stn 572, 1 (MNHN).

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, v*1899a: 168, pl. 19, figs 7a-e.
Dactylotrochus cervicornis - WELLS, v.1954: 470-471, pl. 178, figs 1-3. — CAIRNS & ZIBROWIUS, 1997: 131.

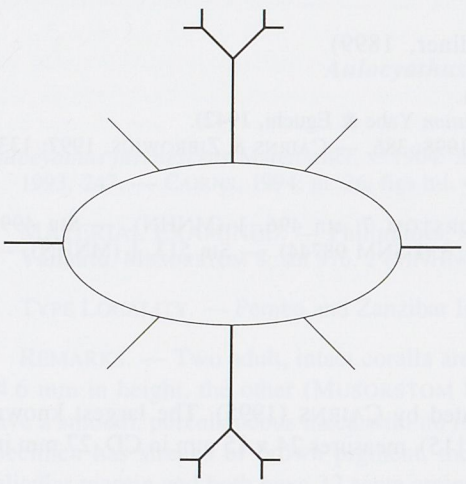


FIG. B. — Diagrammatic representation of the calice of *Dactylotrochus cervicornis*, showing the placement, length, and orientation of the calicular extensions. Thick lines represent a vertical extension; thin lines represent a horizontal to oblique extension. Length of extensions drawn in proportion to calicular diameter.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 499, 1 (MNHN). — Stn 504, 1 (MNHN). — Stn 512, 2 (MNHN). — Stn 513, 1 (MNHN). — Stn 514, 4 (MNHN) and SEM stub 889 (USNM 98746). — Stn 515, 1 (USNM 98747). — Stn 584, 1 (MNHN). — Stn 589, 1 (MNHN). — Stn 605, 3 (MNHN).

Vanuatu. MUSORSTOM 8: stn 988, 3 (USNM 98749). — Stn 1095, 1 (USNM 98748).

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

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).

Genus ***RHIZOSMILIA*** Cairns, 1978

Rhizosmilia robusta Cairns, 1993

Rhizosmilia robusta Cairns in CAIRNS & KELLER, *1993: 250-253, pl. 6, figs F-I. — CAIRNS & ZIBROWIUS, 1997: 133-134.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 509, 2 (MNHN). — Stn 524, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 961, 2 (MNHN). — Stn 964, 1 (MNHN). — Stn 971, 1 (MNHN). — Stn 1021, 1 (USNM 98752). — Stn 1071, 1 (USNM 98750). — Stn 1077, 3 (USNM 98751). — Stn 1078, 1 (MNHN). — Stn 1084, 1 (MNHN).

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).

Genus ***ASTEROSMILIA*** Duncan, 1867

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

Figs 16 g-i, 17 a-b

Caryophyllia gigas van der Horst, v*1931: 4-5, pl. 2, figs 1, 4. — ZIBROWIUS, 1980: 70.
Rhizosmilia gigas - CAIRNS & KELLER, 1993: 251-252.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 510, 1 (MNHN). — Stn 515, 16: 10 (MNHN), 6 (USNM 98754). — Stn 523, 4 (MNHN). — Stn 535, 2 (USNM 98753). — Stn 537, 2 (MNHN). — Stn 586, 1 (MNHN).

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. C_{1-3} expressed as low, rounded ridges; in some coralla C_{4-5} 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 ($S_1>S_2>S_3>S_4>S_5$); however, it is not unusual for even large coralla to lack several pairs of S_5 resulting in less than 96 septa, or for some coralla to have additional pairs of S_6. The holotype, for example, has 5 pairs of S_6 for a total of 100 septa. S_1 up to 3.5 mm exsert, having straight vertical axial edges. S_{2-4} progressively and gradually narrower; however, S_5 only half width of S_4. Triangular lancets corresponding to S_1 and S_2 form at calicular margin. Wide (2.5-3.0 mm), thin paliform lobes (P_4) usually border every S_4 that is flanked by a pair of S_5, the P_4 appearing as pairs in those half-systems containing both pairs of S_5; however, occasionally a paliform lobe occurs before an S_3, even though pairs of S_5 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)

Platytrochus 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.1902c: 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).
"Cryptotrochus" venustus - CAIRNS & ZIROWIUS, 1997: 142-143.
Pleotrochus venustus - CAIRNS, 1997: 14 , pl. 1, fig. b, pl. 4, fig. b.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1114, 1 (MNHN).

TYPE LOCALITY. — *"Siboga"* 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).

DISTRIBUTION. — Vanuatu region: Espiritu Santo; 647 m. Elsewhere: Banda Sea, Indonesia: 200-397 m (CAIRNS & ZIBROWIUS, 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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 637, 1 (MNHN).
Vanuatu. MUSORSTOM 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.

DISTRIBUTION. — Wallis and Futuna region: Rotumah Bank; 820-830 m. Vanuatu region: Espiritu Santo; 700-736 m. Elsewhere: Three Kings Ridge, New Zealand; 1137-1150 m.

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

Tropidocyathus lessonii (Michelin, 1842)

Fig. 17 c

Flabellum Lessonii Michelin, *1842: 119.
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: Efaté; 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

"Tropidocyathus" labidus Cairns & Zibrowius, 1997: 148, figs 20 a-g. — CAIRNS, 1998: 392.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 8: stn 963, 1 cemented to a *Xenophora* shell (MNHN). — Stn 1026, 1 (MNHN). — Stn 1065, 1 (MNHN). — Stn 1068, 2 (USNM 98758).

TYPE LOCALITY. — KARUBAR stn 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, Efaté, 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 herdmani* Bourne, *1905: 193, pl. 1, figs 2, 2a.
Tropidocyathus pileus - CAIRNS, 1989a: 34-35, pl. 17, figs a-h (synonymy); 1994: 68, pl. 29, figs d-e; 1995: 91, pl. 28, figs a-c, map 11. — CAIRNS & ZIBROWIUS, 1997: 147-148, figs 19 h-i.
Cyathotrochus pileus - CAIRNS, 1997: 16, pl. 1, figs f-g, pl. 4, fig. f; 1998: 392.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 958, 2 (USNM 98760). — Stn 959, 1 (MNHN). — Stn 980, 1 (MNHN). — Stn 1016, 1 (MNHN).

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 Efaté; 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 orientalis - WELLS, v.1984: 214.
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, v*1870].
Deltocyathoides orientalis - CAIRNS & ZIBROWIUS, 1997: 144. — CAIRNS, 1997: 17, pl. 1, fig. h, pl. 7, fig. f; 1998: 392.

MATERIAL EXAMINED. — MUSORSTOM 7: stn 512, 1 (MNHN). — Stn 523, 1 (MNHN).

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.
Not *Citharocyathus conicus* - WELLS, v.1984: 214, figs 4, 2-5 [= ?*Notocyathus venustus* (Alcock, 1902)].

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: Efaté 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 (MNHN). — Stn 1113, 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 (P_2) 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. C_{1-2} independent in origin, but C_4 originate by trifurcation of C_3 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): $S_1>S_2>S_3>S_4$, 48 septa. S_1 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. S_2 about 1.2 mm exsert and 2/3 with of the S_1, each bearing a prominent palus (P_2). S_3 about 0.9 mm exsert and 3/4 width of the S_2, their lower axial edges strongly fused to the peripheral edge of the P_2 lower in fossa, but easily visible in calicular view. In fact, in some specimens it would appear that each S_3 bears a palus, a pair of which unite before their common S_2 to form a V-shaped P_2 (as in the case of *Notocyathus*); however, each P_2 in this species rises higher in the fossa (usually just above the level of the columella) as a single slender structure. S_4 about 0.7 mm exsert, 2/3 width of the S_3, 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 S_4; however, differs in having serrate costae (not granular), S_3 fused to the peripheral edge of P_2, and in having less prominent P_2. *C. brevipalus* resembles *C. carolinensis* Cairns, 1988 (western Atlantic, 320-338 m) in having serrate costae and S_3 that fuse with the P_2, but differs in having a larger and more open corallum (higher basal angle), independent S_4, and pointed P_2 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 S_3 that fuse to the peripheral edge of the P_2. 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 P_2.

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. l; 1998: 390. — CAIRNS & ZIBROWIUS, 1997: 148-149.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 509, 6 (MNHN). — Stn 512, 1 (USNM 98764). — Stn 513, 1 (MNHN).

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 ***PEPONOCYATHUS*** Gravier, 1915

Peponocyathus folliculus (Pourtalès, 1868)

Figs 18 a-b

Stephanophyllia folliculus Pourtalès, 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.
Peponocyathus folliculus - CAIRNS, 1979: 113-115, pl. 22, figs 1-4; 1989a: 32-33 (in part: pl. 16, figs a-c); 1994: 66-67, pl. 28, figs g-k (synonymy and description); 1997: 30, pl. 3, fig. k, pl. 6, figs h-j. — ZIBROWIUS, v.1980: 113-115, pl. 58, figs A-L, pl. 59, figs A-K (synonymy). — CAIRNS & ZIBROWIUS, 1997: 146.

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

Guynia annulata Duncan, v*1872: 32, pl. 1, figs 1-8. — ZIBROWIUS, v.1980: 161-162, pl. 83, figs A-Q (synonymy). — CAIRNS, 1989a: 42-43, pl. 21, fig. f, pl. 22, figs a-e; 1998: 392. — CAIRNS & PARKER, 1992: 42-43, pl. 14, figs g-h. — CAIRNS & ZIBROWIUS, 1997: 150 (synonymy).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 504, 4 attached to theca of ?dead corallum of *Conotrochus asymmetros* (MNHN). — Stn 513, 1 attached to theca of dead corallum of *Heterocyathus* cf. *sulcatus* (MNHN). — Stn 569, 1 attached to theca of dead corallum of *Flabellum arcuatile*, n. sp. (MNHN).

Vanuatu. MUSORSTOM 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).

DISTRIBUTION. — Wallis and Futuna region: Futuna; Waterwitch Bank; 260-300 m. Vanuatu region: Efaté and Espiritu Santo; 288-300 m. Elsewhere: cosmopolitan in tropical and warm temperate regions; 28-653 m (CAIRNS & ZIBROWIUS, 1997).

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**. MUSORSTOM 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: $S_{1-2}>>S_3$.

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**. MUSORSTOM 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 S_{1-2}. 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.

DISTRIBUTION. — Vanuatu region: Anatom and Efaté; 321-400 m. Elsewhere: Kermadec Ridge; 366-402 m.

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, v*1831: 2. — CAIRNS, 1989a: 46-50, pl. 23, figs g-l, pl. 24, figs a-d, g-h (synonymy); 1994: 70-71, pl. 30, figs g-i, pl. 31, figs a-c. — CAIRNS & ZIBROWIUS, 1997: 150-151, fig. 20h.
Flabellum coalitum Marenzeller, v*1888a: 48-49. — CAIRNS, 1989a: 46, 47, 50, pl. 24, figs e-f, i-l.
Flabellum sp. - CAIRNS, 1989a: 24, pl. 24, figs e-f.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 504, 1 (MNHN). — Stn 513, 2 (MNHN). — Stn 516, 2 (MNHN). — Stn 523, 4 (MNHN). — Stn 538, 3 (USNM 98767). — Stn 569, 3 (MNHN). — Stn 605, 4 (MNHN). — Stn 610, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 962, 1 (MNHN). — Stn 963, 12 (USNM 98871). — Stn 964, 3 (USNM 98874). — Stn 971, 1 (USNM 98873). — Stn 976, 7 (MNHN). — Stn 988, 2 (MNHN). — Stn 1004, 1 (MNHN). — Stn 1005, 1 (MNHN). — Stn 1016, 2 (USNM 98770). — Stn 1017, 1 (MNHN). — Stn 1018, 4 (USNM 98768). — Stn 1065, 5 (USNM 98769). — Stn 1070, 1 (MNHN). — Stn 1071, 2 (MNHN). — Stn 1084, 4 (MNHN). — Stn 1085, 125 (MNHN). — Stn 1086, 6 (MNHN). — Stn 1087, 1 (USNM 98872). — Stn 1091, 3, including 1 cemented to a *Xenophora* shell (MNHN). — Stn 1102, 1 (MNHN). — Stn 1103, 15: 12 (MNHN), 3 (USNM 98875). — Stn 1132, 3 (MNHN). — Stn 1134, 3 (MNHN). — Stn 1135, 2 (MNHN).

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 S_{1-3}.

Septa hexamerally arranged in 5 cycles and often part of a sixth cycle ($S_{1-3}>S_4>S_5>S_6$) in larger coralla, pairs of S_6 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 S_{1-3} nonexsert, separated from thecal edge by a low notch or slight concavity, then projecting into fossa as a prominent lobe; midaxial edges of S_{1-3} often slightly concave, and lower axial edges thickened and very sinuous. The two principal S_1 aligned with the GCD are smaller than the other 4 S_1. Distal edges of S_4 not lobate and thus much narrower than S_{1-3}, but lower in fossa almost 3/4 width of the S_{1-3}; axial edges straight. S_5 about 1/3 width of an S_4. When pairs of S_6 are present, the S_5 they flank widen to 2/3 the width of an S_4 and the S_6 are the size of a typical S_5. Fossa deep and elongate; lower axial edges of S_{1-3} 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, Efaté, 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].

MATERIAL EXAMINED/TYPES. — **Wallis and Futuna region**. MUSORSTOM 7: stn 524, 2 paratypes (MNHN). — Stn 530, 3 paratypes (MNHN). — Stn 534, 1 paratype (MNHN). — Stn 535, 2 paratypes (MNHN). — Stn 542, 1 paratype (USNM 98876). — Stn 546, 2 paratypes (USNM 98877). — Stn 578, 1 paratype (USNM 98878). — Stn 589, 1 paratype (MNHN).

New Zealand region. NZOI: stn I92, 9 paratypes (USNM 94322). — Stn I97, 35: 20 paratypes (NZOI), holotype (NZOI H688), 14 paratypes (USNM 94323). — Stn U599, 1 paratype (NZOI).

TYPE LOCALITY. — NZOI stn I97: 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 I97, 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 S_7: $S_{1-4}>S_5>S_6>S_7$. Axial edges of S_{1-4} 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

Flabellum deludens Marenzeller, *1904: 269-272, pl. 17, figs 10, 10a. — CAIRNS, 1989a: 55-56, pl. 29, figs a-f (synonymy); 1994: 73, pl. 32, figs d-e; 1998: 395. — CAIRNS & ZIBROWIUS, 1997: 154-156.

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 S_5 flanking each S_3. This specimen is unusual in that its C_{1-2} 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

Flabellum aotearoa Squires, v*1964: 7-9, pl. 2, figs 15-18. — CAIRNS, 1995: 102-103, pl. 33, figs d-f, i, Map 16 (synonymy).
Flabellum sp. cf. *F. deludens* - WELLS, v.1984: 215, pl. 4, figs 8-10 [Not *Flabellum deludens* Marenzeller, *1904].

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn *959, 3 (MNHN). — Stn 963, 25, including 1 cemented to a *Xenophora* shell (USNM 98882). — Stn *964, 4 (MNHN). — Stn *977, 1 (MNHN). — Stn *1004, 1 (MNHN). — Stn 1005, 2 (MNHN). — Stn *1016, 30 (MNHN). — Stn *1017, 6 (USNM 98880). — Stn *1018, 148 (MNHN). — Stn *1023, 2 (MNHN). — Stn 1060, 1 (MNHN). — Stn 1065, 1 (USNM 98881). — Stn 1091, 4 (USNM 98879). — Stn *1134, 1 (MNHN).

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 S_{1-4} 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, Efaté, 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.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 956, 7 (USNM 98883). — Stn 1037, 8 (MNHN). — Stn 1129, 1 (MNHN).

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 Efaté; 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

Flabellum (U.) hoffmeisteri Cairns & Parker, *1992: 47-48, pl. 16, figs d-f (synonymy). — CAIRNS, 1995: 103-104, pl. 33, figs g-h, map 22; 1998: 394-395. — CAIRNS & ZIBROWIUS, 1997: 157-158.

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: Efaté; 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 apertum Moseley, v*1876: 556 (in part: *"Challenger"* stn 145); v.1881: 167-168 (in part: pl. 6, figs 7a-c). — CAIRNS, 1982: 44-46, pl. 13, figs 8-11, pl. 14, figs 1-4 (synonymy).
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).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 551, 49 (MNHN). — Stn 552, 53 (USNM 98884). — Stn 564, 30 (MNHN). — Stn 565, 53 (USNM 98885). — Stn 567, 6 (MNHN). — Stn 620, 1 (MNHN). — Stn 621, 1 (MNHN). — Stn 623, 1 (MNHN).

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

Flabellum stabile Marenzeller, *1904: 273-274, pl. 17, figs 12a-b. — ZIBROWIUS, 1980: 150.
Truncatoflabellum stabile - CAIRNS, 1989a: 61. — ZIBROWIUS & GILI, 1990: 39.
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. — **Vanuatu**. MUSORSTOM 8: stn 996, 1 (MNHN). — Stn 1036, 1 (MNHN). — Stn 1037, 1 (USNM 98887). — Stn 1125, 2 (including an anthocaulus) (MNHN). — Stn 1127, 1 (MNHN).
Madeira Islands. CANCAP III: stn 3.053, 4 (USNM 98886).

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 C_{1-2} 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: $S_{1-2}>S_3>S_4>S_5$, the base of an anthocyathus having only 3 cycles plus several pairs of S_4 (24-32 septa), and a full fourth cycle present by a GCD of 11 mm. S_{1-2} only slightly wider than S_3, whereas S_3 are twice the width of the S_4, and S_5 are only about 1/3 the width of the S_4. Axial edges of all septa straight and vertical, those of the S_{1-3} 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. trapezoideum* (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. trapezoideum* 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 Efaté; Guyot Bougainville; 786-1160 m. Elsewhere: Cape Verde, Selvagems, and Madeira Islands; Mozambique; Ryukyu Islands; 964-3010 m (ZIBROWIUS & GILI, 1990).

Truncatoflabellum dens (Alcock, 1902)

Figs 19 g-h

Flabellum dens Alcock, v*1902a: 106-107; v.1902c: 32, pl. 4, figs 30, 30a. — CAIRNS, 1989a: 54, pl. 28, figs g-k. *Truncatoflabellum dens* - CAIRNS, 1995: 114-115 (in part: pl. 37, fig. g). — CAIRNS & ZIBROWIUS, 1997: 170.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 546, 1 (MNHN). — Stn 569, 8 (USNM 98889). — Stn 585, 2 (MNHN). — Stn 597, 1 (MNHN). — Stn 605, 4 (USNM 98890). — Stn 610, 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 965, 3 (MNHN). — Stn 977, 1 (MNHN). — Stn 988, 3 (USNM 98888). — Stn 1015, 1 (MNHN). — Stn 1060, 1 (MNHN).

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 ($S_{1-2}>S_3>>S_4$); however, pairs of S_4 often lacking in lateral half-systems, resulting in 40-44 total septa. Large coralla may have additional pairs of S_5 in the end half-systems, but may also be lacking pairs of S_4 in the lateral half-systems. Axial edges of S_{1-2} 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, Efaté, Malakula, and Espiritu Santo; 314-410 m. Elsewhere: Philippines; Indonesia; Kermadec and Norfolk Ridges; New Caledonia; 300-555 m (CAIRNS & ZIBROWIUS, 1997).

Truncatoflabellum pusillum Cairns, 1989

Fig. 20 a

Truncatoflabellum pusillum Cairns, *1989a: 71-72, pl. 37, figs a-e. — CAIRNS & KELLER, 1993: 265, pl. 11, fig. E. — CAIRNS & ZIBROWIUS, 1997: 170.

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 ($S_{1-2}>S_3$), larger specimen having pairs of S_4 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).

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].
Truncatoflabellum angustum Cairns & Zibrowius, *1997: 172-173, figs 23c-f.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 501, 1 (MNHN). — Stn 502, 2 (MNHN).
Vanuatu. MUSORSTOM 8: stn 1016, 5 (USNM 98894). — Stn 1017, 1 (MNHN). — Stn 1018, 11 (MNHN). — Stn 1065, 3 (MNHN). — Stn 1087, 1 (MNHN). — Stn 1091, 1 (USNM 98893). — Stn 1135, 3 (USNM 98895).

TYPE LOCALITY. — MUSORSTOM 3 stn 143: 11°28.3'N, 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 S_{1-3}.

DISTRIBUTION. — Futuna; 516-530 m. Vanuatu region: Efaté, 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.
Truncatoflabellum phoenix Cairns, *1995: 115-116, pl. 37, fig. i, pl. 38, figs a-f. — CAIRNS & ZIBROWIUS, 1997: 171.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 495, 1 (USNM 98896). — Stn 509, 7 (MNHN). — Stn 512, 11 (USNM 98897). — Stn 513, 4 (MNHN). — Stn 514, 1 (MNHN). — Stn 516, 1 (MNHN). — Stn 538, 1 (MNHN).

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,

2 paratypes (MNHN). — Stn 1097, 5 paratypes (MNHN). — Stn 1098, holotype (MNHN) and 4 paratypes (USNM 98898). — Stn 1106, 9 paratypes (MNHN). — Stn 1113, 1 paratype (MNHN).

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 decamerally 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.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 523, 5 anthocauli (MNHN). — Stn 585, 1 anthocaulus (MNHN). — Stn 601, 4 anthocauli (MNHN).

Vanuatu. MUSORSTOM 8: stn 963, 1 anthocaulus (MNHN). — Stn 964, 1 anthocaulus (MNHN). — Stn 967, 5 anthocauli and 2 anthocyathi (MNHN). — Stn 969, 5 anthocauli (MNHN). — Stn 970, 1 anthocaulus (USNM 98901). — Stn 971, 3 anthocauli (USNM 98902). — Stn 1065, 2 anthocauli (MNHN). — Stn 1070, 1 anthocyathus (MNHN). — Stn 1071, 1 anthocaulus and 1 anthocyathus (MNHN). — Stn 1077, 1 anthocaulus (MNHN). — Stn 1102, 2 anthocauli and 1 anthocyathus (USNM 98903). — Stn 1103, 3 anthocauli and 30 anthocyathi (USNM 98904). — Stn 1134, 1 anthocaulus and 1 anthocyathus (MNHN).

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.

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

Truncatoflabellum vanuatu (Wells, 1984)

Flabellum vanuatu Wells, v*1984: 215, figs 4 (11-12), 5 (1).
Truncatoflabellum vanuatu - CAIRNS, 1989a: 63, 69, pl. 36, fig. c.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 499, 1 (MNHN). — Stn 505, 1 (MNHN). — Stn 509, 6 (MNHN). — Stn 524, 4 (MNHN). — Stn 605, 1 (USNM 98906).

TYPE LOCALITY. — Kere River (Late Pleistocene), Espiritu 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 Espiritu Santo (WELLS, 1984).

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

Flabellum aculeatum H. Milne Edwards & Haime, v*1848a: 272, pl. 8, figs 3, 3a.
Truncatoflabellum aculeatum - CAIRNS, 1989a: 61, 64, table 6, pl. 31, figs h-l, pl. 32, figs a-c (synonymy); 1998: 399-400, table 4. — CAIRNS & ZIBROWIUS, 1997: 166-167.

MATERIAL EXAMINED. — **Vanuatu**. South Santo Island, coll. J.N. CARNEY, stn SDC-5, 30-50 m, II 1975, 2 (USNM 98905).

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

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

Flabellum candeanum H. Milne Edwards & Haime, *1848a: 278, pl. 8, fig. 13.
Truncatoflabellum candeanum - CAIRNS, 1989a: 70-71, table 6, pl. 36, figs d-h (synonymy, neotype designation); 1994; 76-77, pl. 33, figs e-f. — CAIRNS & ZIBROWIUS, 1997: 167.

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.
Flabellum paripavoninum - WELLS, v.1984: 214-215 (in part: USGS 25715, fig. 4 (6-7)) [Not *F. paripavoninum* Alcock, 1894].
Truncatoflabellum martensii - CAIRNS, 1989a: 61.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1085, 13: 10 (MNHN), 3 (USNM 98908). — Stn 1086, 4 (MNHN).

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 S_{1-3}. 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 S_6 in half-systems adjacent to the principal septa (See Remarks). Septa formula: $S_{1-3}>S_4>S_5>S_6$. Axial edges of S_{1-3} highly sinuous, their lower axial edges fusing into a columellar structure low in centre of fossa. S_{4-6} 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 S_6, 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 S_6 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)

Desmophyllum lamprotichum Moseley, v*1880: 41-42, figs 1-2.

Javania lamprotichum - CAIRNS, 1984: 21, pl. 4, figs D-E; 1995: 112, pl. 37, figs b-c, map 20; 1998: 403, figs 8j, m. — CAIRNS & ZIBROWIUS, 1997: 164 (synonymy).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 520 or 521 (confusion on label), 1 (MNHN).
Vanuatu. MUSORSTOM 8: stn 974, 1 (USNM 98909). — Stn 975, 1 (MNHN). — Stn 988, 1 (MNHN). — Stn 1014, 1 (USNM 98910).

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 Efaté; 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 pachytheca CAIRNS, *1995: 112-113, pl. 36, figs j-l, pl. 37, fig. a, map 17. — CAIRNS & ZIBROWIUS, 1997: 165, figs 21i, 22a.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 525, 1 (USNM 98913). — Stn 530, 2 (MNHN). — Stn 540, 1 (MNHN). — Stn 578, 3 (MNHN). — Stn 592, 1 (USNM 98912).
Vanuatu. MUSORSTOM 8: stn 959, 1 (MNHN). — Stn 965, 3 (USNM 98911). — Stn 982, 1 (MNHN). — Stn 988, 3 (MNHN). — Stn 1097, 2 (MNHN). — Stn 1106, 1 (MNHN). — Stn 1114, 2 (USNM 98914). — Stn 1128, 20 (MNHN).

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 S_{1-3}, 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 S_{1-2}. Septa hexamerally arranged in 4 complete cycles: $S_{1-2}>S_3>>S_4$ (48 septa). S_{1-2} 1.2-1.5 mm exsert, having slightly sinuous axial edges. S_3 up to 0.5 mm exsert and only 1/2-2/3 width of the S_{1-2}, having moderately sinuous axial edges. S_4 nonexsert, in fact, their distal edges often several mm below the calicular edge. S_4 only 1/5-1/4 width of the S_3, 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

Desmophyllum sp. cf. *D. crista-galli* - WELLS, 1954: 470 [Not *Desmophyllum cristagalli* H. Milne Edwards and Haime, 1848].

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

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 30, 2 paratypes (USNM 98919). — Stn 44, holotype (MNHN). — Stn 49, 2 paratype fragments (USNM 97498). — Stn 86, 1 paratype (MNHN).

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

Wallis and Futuna region. MUSORSTOM 7: stn 499, 1 paratype (USNM 98916). — Stn 513, 2 paratypes (MNHN). — Stn 514, 1 paratype (MNHN). — Stn 523, 2 paratypes (MNHN). — Stn 537, 1 paratype (USNM 98915). — Stn 538, 1 paratype (MNHN). — Stn 569, 1 paratype (MNHN).

Vanuatu. MUSORSTOM 8: stn 962, 1 paratype (MNHN). — Stn 964, 1 paratype (MNHN). — Stn 978, 1 paratype (USNM 98918). — Stn 1021, 5 paratypes (USNM 98917). — Stn 1030, 8 paratypes (MNHN). — Stn 1042, 2 paratypes (MNHN). — Stn 1060, 3 paratypes (MNHN). — Stn 1085, 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 S_{1-2} 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 S_{1-2}. Calicular edge between S_{1-2} 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 S_3. Theca porcellaneous and usually white; however, specimens from KARUBAR stations pigmented a light purple-grey. Ridged C_{1-2} sometimes expressed within 0-3 mm of calicular edge.

Septa hexamerally arranged in 4 complete cycles (48 septa): $S_1>S_2>>S_3>S_4$. S_1 extremely exsert, in the holotype as much as 6.5 mm, but even in coralla of moderate size, 3-4 mm. Axial edges of S_1 straight and vertical, the 4 lateral S_1 almost meeting in centre of fossa. S_2 also quite exsert but only 1/2-2/3 that of the S_1, about 3/4 width of the S_1, and also less thick than the S_1. S_3 not exsert: rudimentary or absent near calicular edge,

increasing to about 3/4 width of S_2 lower in fossa. S_4 also nonexsert, 1/3-1/2 width of the S_3. Axial edges of S_{1-2} 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 S_1 being larger than its S_2, and its S_{3-4} 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, Efaté, 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. 22 a

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.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1021, 1 (USNM 98920). — Stn 1078, 1 (MNHN). — Stn 1131, 1 (MNHN).

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: Efaté, 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, v*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.
"Rhizotrochus" flabelliformis - CAIRNS & ZIBROWIUS, 1997: 161-162.

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

Polymyces wellsi Cairns, *1991a: 22, pl. 8, figs f, i, pl. 9, figs a-b; 1995: 108-109, pl. 35, figs d-f, map 10. — CAIRNS & ZIBROWIUS, 1997: 160-161. — CAIRNS, 1998: 403-404.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 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 VOLZEIOIDEA Melnikova, 1974

Family GARDINERIIDAE Stolarski, 1996

Genus *GARDINERIA* Vaughan, 1907

Gardineria hawaiiensis Vaughan, 1907

Gardineria hawaiiensis Vaughan, v*1907: 65-66, pl. 4, fig. 1. — CAIRNS, 1984: 23; 1995: 110-111, map 13, pl. 36, figs c-f, i; 1998: 404. — STOLARSKI, v.1996: 348-350, figs 2F-G, 4A-I, 8A-C.
Gardineria musorstomica Cairns, v*1989a: 82-83, pl. 42, figs c, e-g.

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1006, 1 (USNM 98921). — Stn 1011, 1 (MNHN). — Stn 1014, 1 (MNHN). — Stn 1067, 1 (MNHN).

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 P_2 and a rudimentary columella. *G. hawaiiensis* is best described and figured by STOLARSKI (1996).

DISTRIBUTION. — Vanuatu region: Erromango, Efaté, 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 (Pourtalès, 1868)

Fig. 22 b

Haplophyllia paradoxa Pourtalès, v*1868: 140-141.
Gardineria paradoxa - CAIRNS, 1979: 160-161, map 46, pl. 31, figs 4-6, 10 (synonymy). — STOLARSKI, v.1996: 348-350, figs 2C-E, 5A-G. — CAIRNS & ZIBROWIUS, 1997: 163, figs 21g-h.

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: Efaté; 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 desmophyllioides Vaughan, 1907

Fig. 22 c

Balanophyllia desmophyllioides Vaughan, v*1907: 149-150, pl. 45, fig. 1. — CAIRNS & ZIBROWIUS, 1997: 177-178, figs 23g-h.
Balanophyllia desmophylloides - CAIRNS, 1984: 26.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 496, 2 (MNHN). — Stn 500, 4 (MNHN). — Stn 502, 1 (MNHN). — Stn 509, 17 (USNM 98924). — Stn 512, 5 (MNHN). — Stn 524, 2 (MNHN). — Stn 538, 1 (MNHN). — Stn 589, 1 (MNHN). — Stn 601, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 964, 2 (MNHN). — Stn 969, 3 (USNM 98926). — Stn 988, 1 (USNM 98922). — Stn 1030, 1 (MNHN). — Stn 1065, 1 (USNM 98925). — Stn 1098, 4: 3 (MNHN), 1 (USNM 98923).
Lord Howe seamount chain. NZOI: stn I741, 9 (USNM 94366).

TYPE LOCALITY. — *"Albatross"* stn 4061: Hawaii, 44-152 m.

DIAGNOSIS. — Corallum straight, firmly attached, and flared distally. Calice elongate; calicular edge arched and constricted in centre, in some cases (Fig. 22 c) producing a division of the fossa. Costae well defined; thin epitheca often present basally. Septa hexamerally arranged in 5 cycles, coralla of GCD 11-12 having a complete fifth cycle; additional half-systems of septa may occur in elongate specimens (e.g., the holotype). S_{1-3} equal in size, pairs of S_5 fusing high in fossa before their flanking S_4. Lower axial edges of $S_{1-3, 5}$ coarsely dentate. Fossa deep; papillose columella small, elongate, and low.

REMARKS. — The species was recently redescribed and illustrated by CAIRNS & ZIBROWIUS (1997).

DISTRIBUTION. — Wallis and Futuna region: Wallis and Futuna; Waterwitch and Field Banks; 240-516 m. Vanuatu region: Anatom, Tanna, Efaté, Malakula, and Espiritu Santo; 190-372 m. Elsewhere: Hawaiian Islands; Philippines; Indonesia; Chesterfield Islands (reported herein); 95-658 m (CAIRNS & ZIBROWIUS, 1997).

Balanophyllia laysanensis Vaughan, 1907

Figs 22 d-e

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

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 962, 2 (MNHN). — Stn 963, 1 (MNHN). — Stn 965, 1 (USNM 98927).

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 C_{1-2} are prominent. Septa are arranged in 4 complete cycles, pairs of S_4 bending toward but not quite fusing before their enclosed S_3 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

Balanophyllia rediviva Moseley, v*1881: 193-194, pl. 15, figs 10-12. — CAIRNS & ZIBROWIUS, 1997: 181-182, figs 25d-f (synonymy).

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 (C_{1-3}) 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).

MATERIAL EXAMINED. — **Vanuatu**. MUSORSTOM 8: stn 1009, 2 (MNHN). — Stn 1015, 7: 5 (MNHN), 2 (USNM 98930). — Stn 1019, 2 (USNM 98929).

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 epitheca that covers most of the theca; low, equal costae; and a shallow fossa containing a discrete, swirled columella.

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

Balanophyllia gigas Moseley, 1881

Balanophyllia gigas Moseley, v*1881: 193. — WELLS, v.1984: 217, figs 5 (2-3). — CAIRNS, 1994: 83, pl. 35, figs j-l (synonymy); 1995: 119-120, pl. 40, figs f-h, map 7 (synonymy); 1998: 404. — CAIRNS & ZIBROWIUS, 1997: 182.

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 S_6 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

Endopachys grayi H. Milne Edwards & Haime, *1848b: 82-83, pl. 1, figs 2, 2a. — ZIBROWIUS & GRYGIER, 1985: 137 (New Caledonia). — CAIRNS, 1994: 84-85, pl. 36, figs e, h, pl. 37, fig. i (synonymy); 1995: 121-122, pl. 41, figs c-h, map 13 (synonymy); 1998: 405. — CAIRNS & ZIBROWIUS, 1997: 185-186.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 499, 1 (MNHN). — Stn 504, 1 (MNHN). — Stn 507, 1 (MNHN). — Stn 516, 1 (MNHN).

Vanuatu. MUSORSTOM 8: stn 967, 2 (USNM 98932). — Stn 969, 1 (MNHN). — Stn 976, 17 (MNHN). — Stn 1005, 1 (MNHN). — Stn 1016, 2 (MNHN). — Stn 1017, 1 cemented to a *Xenophora* shell (MNHN). — Stn 1018, 6 (MNHN). — Stn 1071, 3 (MNHN). — Stn 1085, 1 (USNM 98933). — Stn 1086, 6 (USNM 98934). — Stn 1134, 2 (USNM 98931).

TYPE LOCALITY. — Unknown.

REMARKS. — Most specimens of this commonly collected species are easily distinguished by having unattached, cuneiform-shaped coralla with prominent edge crests; asexual 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 crests. 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, Efaté, 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.

Heteropsammia cochlea - VERON & PICHON, 1980: 416-420, in part: figs 727, 729 (synonymy and description). — HOEKSEMA & BEST, 1991: 234-237, figs 24-28 (synonymy!). — CAIRNS, 1998: 406-408.

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 494, 83 (MNHN). — Stn 495, 9 (USNM 98937). — Stn 496, 30 (USNM 98935). — Stn 504, 10 (MNHN). — Stn 509, 11 (USNM 98936). — Stn 512, 3 (MNHN). — Stn 516, 9 (MNHN).

Vanuatu. MUSORSTOM 8: stn 961, 1 (MNHN). — Stn 967, 1 (MNHN). — Stn 969, 1 (MNHN). — Stn 976, 1 (MNHN). — Stn 1072, 1 (MNHN).

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 zooxanthellate, 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 ijimai Yabe & Eguchi, *1934b: 2026. — EGUCHI, 1965: 294, 2 figs; 1968: C65 (in part: pl. C16, figs 1-2, pl. C22, fig. 1)(synonymy). — CAIRNS & KELLER, 1993: 280, fig. 13G. — CAIRNS, 1995: 89, pl. 38, figs c, f (synonymy).

?Dendrophyllia subcornigera cylindrica Eguchi, *1968: C64-65, pl. C32, figs 1-2 [Not *D. subcornigera subcornigera* Eguchi, 1968].

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. arbuscula* van der Horst, 1922 (see CAIRNS, 1995). *D. ijimai* was recently redescribed and figured by CAIRNS (1995).

DISTRIBUTION. — Vanuatu region: Pleistocene of Espiritu Santo (WELLS, 1984). Elsewhere: southwestern Indian Ocean to Japan; 10-366 m (CAIRNS, 1995).

Dendrophyllia arbuscula van der Horst, 1922

Dendrophyllia arbuscula van der Horst, v*1922: 53 (in part: *"Siboga"* stn 277, pl. 8, fig. 6). — CAIRNS, 1994: 90-91, pl. 38, figs i-l (synonymy); 1995: 125-126, pl. 43, figs e-f, map 15; 1998: 408-409. — CAIRNS & ZIBROWIUS, 1997: 192-193, figs 29a-c (lectotype designated).

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 columella that is often constricted into three lobes. It was recently redescribed and figured by CAIRNS (1994, 1995).

DISTRIBUTION. — Vanuatu region: Efaté and Malakula; 130-319 m. Elsewhere: Indo-West Pacific from southwestern Indian Ocean to Japan; 2-353 m (CAIRNS, 1998).

Dendrophyllia alcocki (Wells, 1954)

Sclerhelia alcocki Wells, v*1954: 465-466, pl. 177, figs 1-2.
Dendrophyllia alcocki - ZIBROWIUS, v.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).
Vanuatu. MUSORSTOM 8: stn 971, 4 colonies (MNHN). — Stn 977, 1 colony (MNHN). — Stn 978, 1 branch (MNHN). — Stn 980, 1 branch (MNHN). — Stn 982, 4 branches (MNHN). — Stn 983, 1 colony and 2 branches (USNM 98940). — Stn 988, 4 branches (USNM 98942). — Stn 1015, 2 branches (USNM 98939). — Stn 1019, 1 branch (USNM 98941). — Stn 1023, 2 branches (MNHN). — Stn 1095, 1 branch (MNHN). — Stn 1108, 1 branch (MNHN).

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 P_2. It was recently redescribed and illustrated by CAIRNS (1995).

DISTRIBUTION. — Wallis and Futuna region: Futuna; 355-400 m. Vanuatu region: Anatom, Tanna, Efaté, 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.
Dendrophyllia amphelioides Alcock, v*1902a: 112-113.
Enallopsammia rostrata - ZIBROWIUS, 1973: 44-45, pl. 2, figs 14-15. — CAIRNS, 1982: 57, pl. 18, figs 1-4 (synonymy); 1994: 92-93, pl. 39, figs d-f (synonymy); 1995: 127-128, pl. 44, figs c-f, map 5. — CAIRNS & ZIBROWIUS, 1997: 195.
Enallopsammia amphelioides - ZIBROWIUS, 1973: 45-46 (Tuamotu Archipelago).

MATERIAL EXAMINED. — **Wallis and Futuna region**. MUSORSTOM 7: stn 501, 5 nonrostrate branches (MNHN). — Stn 520, 2 rostrate branches (MNHN). — Stn 522, 3 rostrate branches (USNM 98947). — Stn 530, 1 nonrostrate branch (MNHN). — Stn 574, 2 rostrate colonies (MNHN).
Vanuatu. MUSORSTOM 8: stn 959, 4 nonrostrate branches (USNM 98945). — Stn 974, 3 nonrostrate branches (MNHN). — Stn 977, 3 nonrostrate colonies and 3 branches (MNHN). — Stn 1006, 2 nonrostrate branches (USNM 98946). — Stn 1015, 4 nonrostrate branches (MNHN). — Stn 1024, 1 nonrostrate colony and 2 branches (USNM 98944).

TYPE LOCALITY. — *"Blake"* stn 2: 23°14'N, 82°25'W (Straits 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

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 Efaté; 370-574 m. Elsewhere: cosmopolitan, except for eastern Pacific and off continental Antarctica; 110-2165 m (CAIRNS & ZIBROWIUS, 1997).

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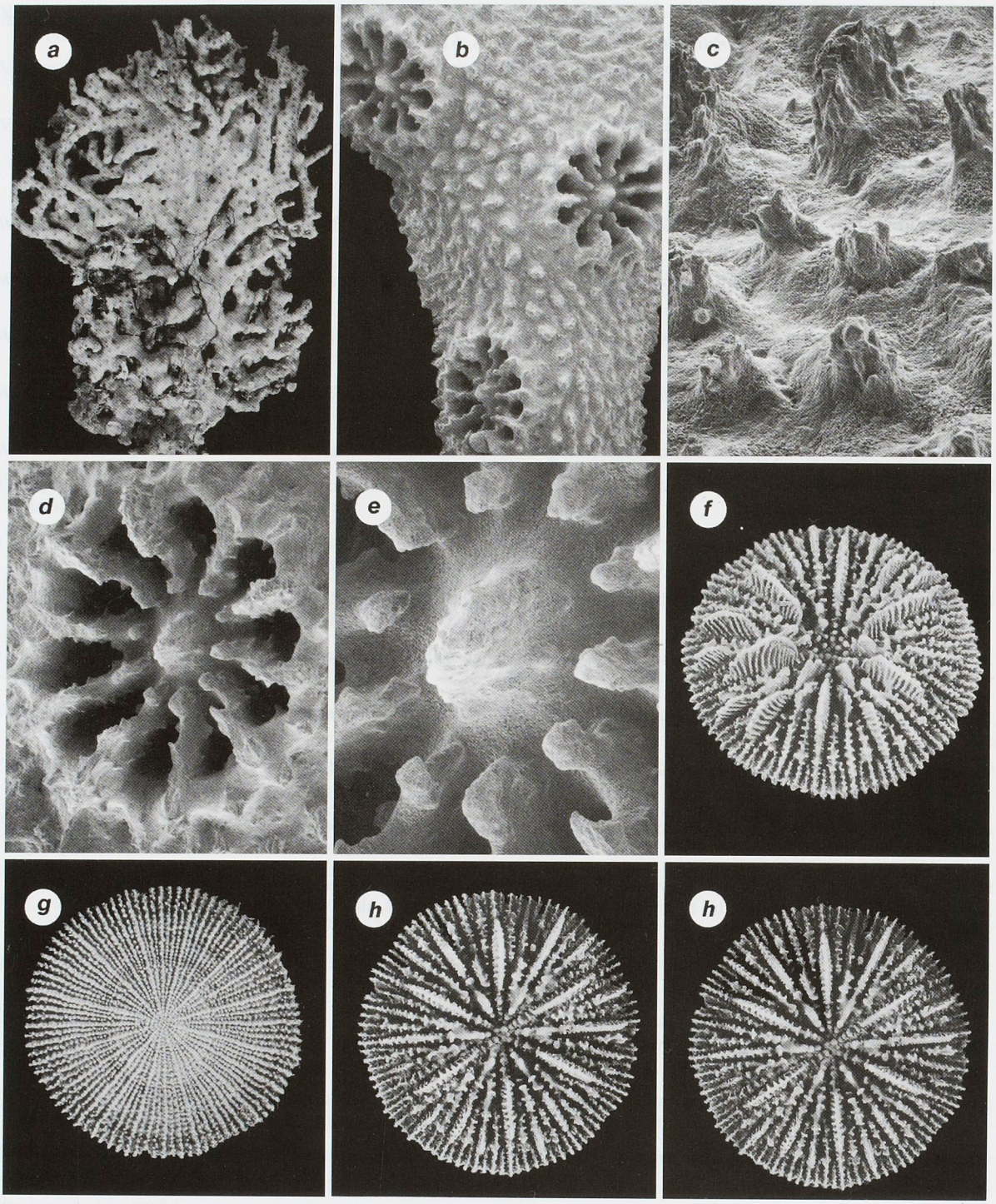


FIG. 1 a-e. — *Madracis kauaiensis*: **a**, MUSORSTOM 7 stn 509 (MNHN): a large colony, x 0.46. — **b-e**, MUSORSTOM 7 stn 509 (USNM 98541): **b**, branch with 3 corallites, x 15; **c**, coenosteal spines, x 115; **d**, calice, x 38; **e**, close up of columella and paliform lobes, x 100.

FIG. 1 f-h. — *Fungiacyathus sandoi*, holotype, MUSORSTOM 7 stn 538 (MNHN), oblique, basal, and stereo calicular views, all x 3.0.

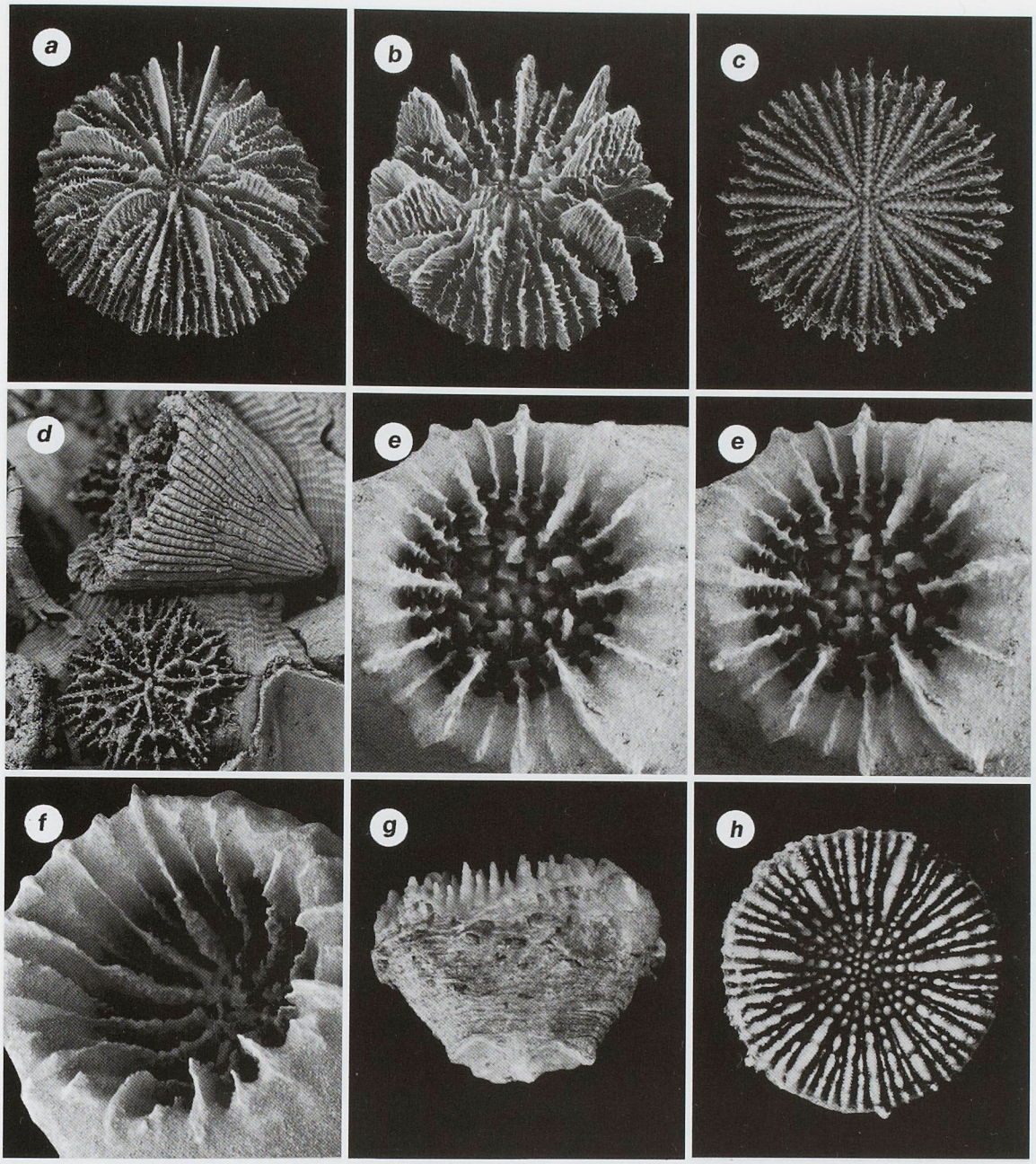


FIG. 2 a. — *Fungiacyathus paliferus*, MUSORSTOM 8 stn 1003 (MNHN), oblique calicular view, x 3.3.

FIG. 2 b-c. — *Fungiacyathus margaretae*: **b**, MUSORSTOM 7 stn 567 (MNHN), oblique calicular view, x 3.3. — **c**, MUSORSTOM 7 stn 565 (MNHN), granular base, x 3.1.

FIG. 2 d. — *Fungiacyathus variegatus*, MUSORSTOM 9 stn 963 (MNHN), corallum cemented to a *Xenophora* shell, along with a corallum of *Tropidocyathus labidus*, x 6.6

FIG. 2 e. — *Madrepora oculata* forma *formosa*, MUSORSTOM 7 stn 609 (USNM 98580), stereo view of a calice with asymmetrically arranged paliform lobes, x 23.

FIG. 2 f. — *Madrepora oculata* forma *tenuis*, MUSORSTOM 7 stn 552 (USNM 98548), calice lacking paliform lobes and columella, x 16.5.

FIG. 2 g-h. — *Anthemiphyllia pacifica*, MUSORSTOM 8 stn 1031 (MNHN), side and calicular views of a pedicellate corallum, x 3.9, x 4.3, respectively.

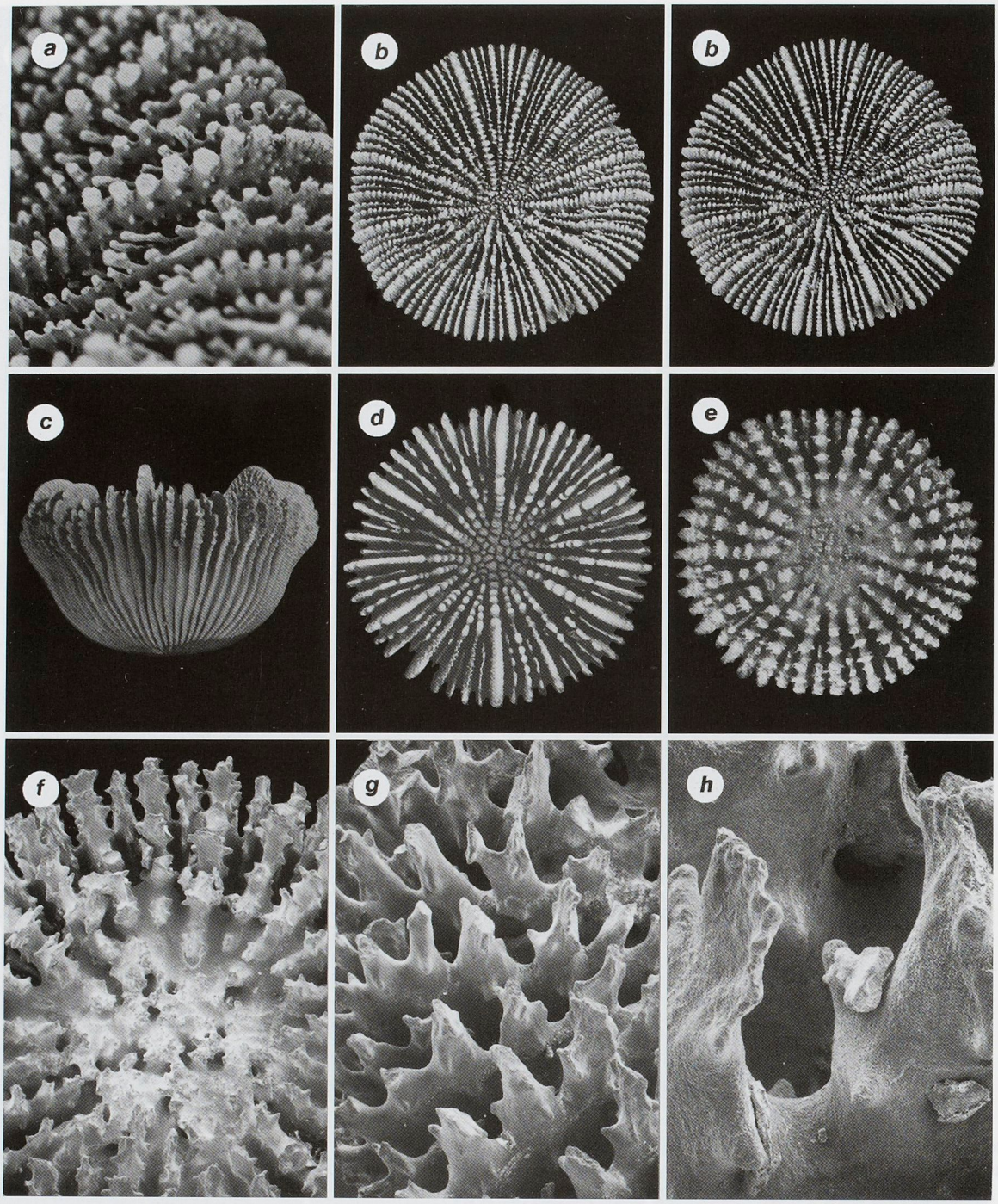


FIG. 3 a-b. — *Anthemiphyllia multidentata*, holotype, Cronulla (USNM 83010), detail of septal edge dentition and stereo calicular view, x 6.3, x 2.0, respectively.

FIG. 3 c-d. — *Anthemiphyllia macrolobata*, holotype, *Townsend Cromwell* stn 81-01-14 (USNM 60559), side and calicular views, both x 3.1.

FIG. 3 e-h. — *Anthemiphyllia patera costata*: **e**, MUSORSTOM 7 stn 586 (MNHN), calicular view of holotype, x 5.6. — **f-h**, paratype, MUSORSTOM 7 stn 594 (USNM 98555), calice and details of septal spines, x 11, x 24, x 75, respectively.

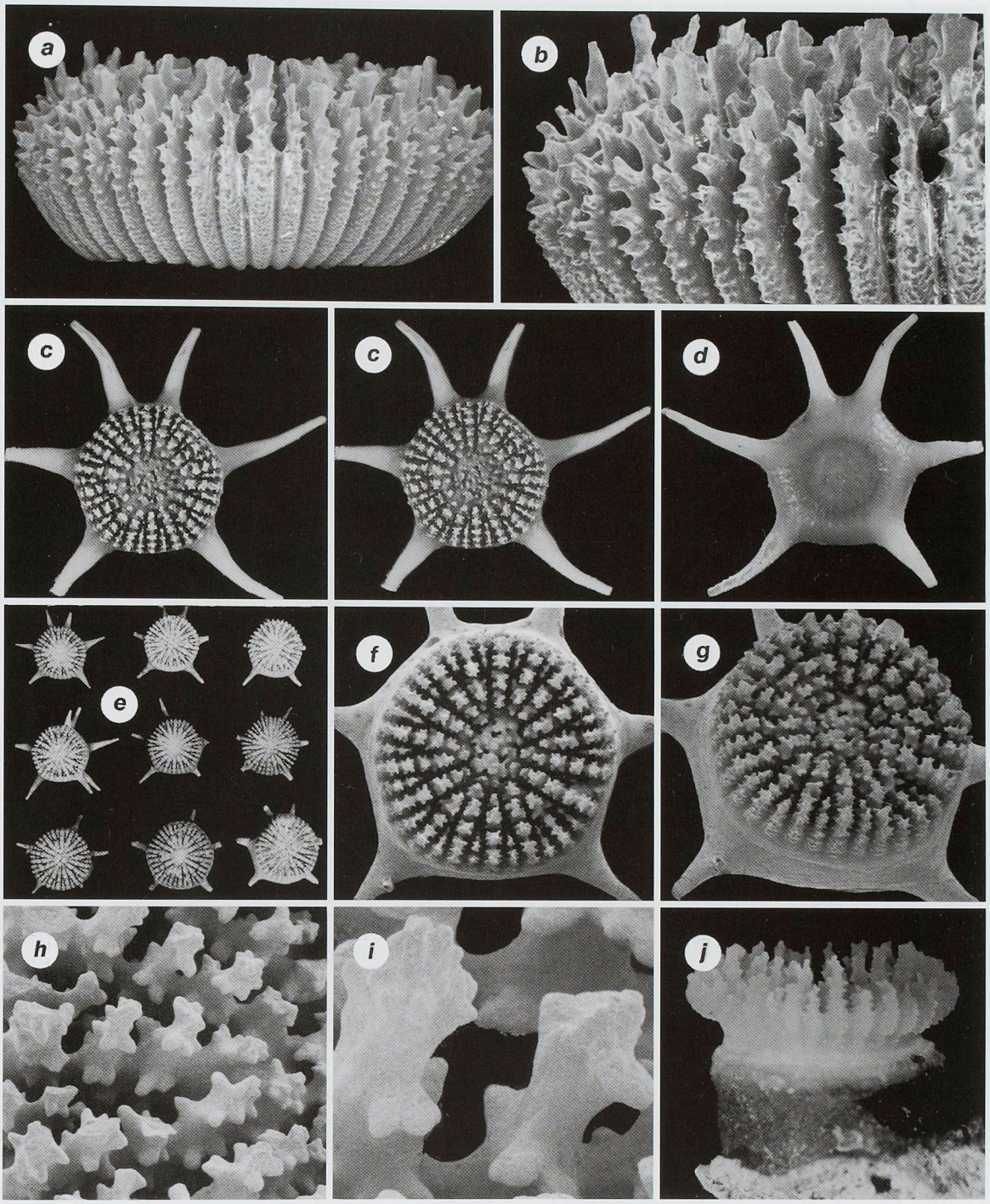


FIG. 4 a-b. — *Anthemiphyllia patera costata*, paratype, MUSORSTOM 7 stn 594 (USNM 98555), edge views of costal granulation, x 8.5, x 17.5, respectively.

FIG. 4 c-j. — *Anthemiphyllia spinifera*: **c-e**, MUSORSTOM 7 stn 605 (MNHN): **c-d**, stereo calicular and basal views of holotype, both x 5.0; **e**, 9 paratypes, x 2.0. — **f-i**, paratypes, MUSORSTOM 7 stn 610 (USNM 98570): **f-g**, calicular views, x 5.8, x 6.6, respectively; **h-i**, paratypes, septal spines, x 27, x 75, respectively. — **j**, paratype, MUSORSTOM 8 stn 1014 (MNHN), anthocyathus attached to its anthocaulus, x 9.5.

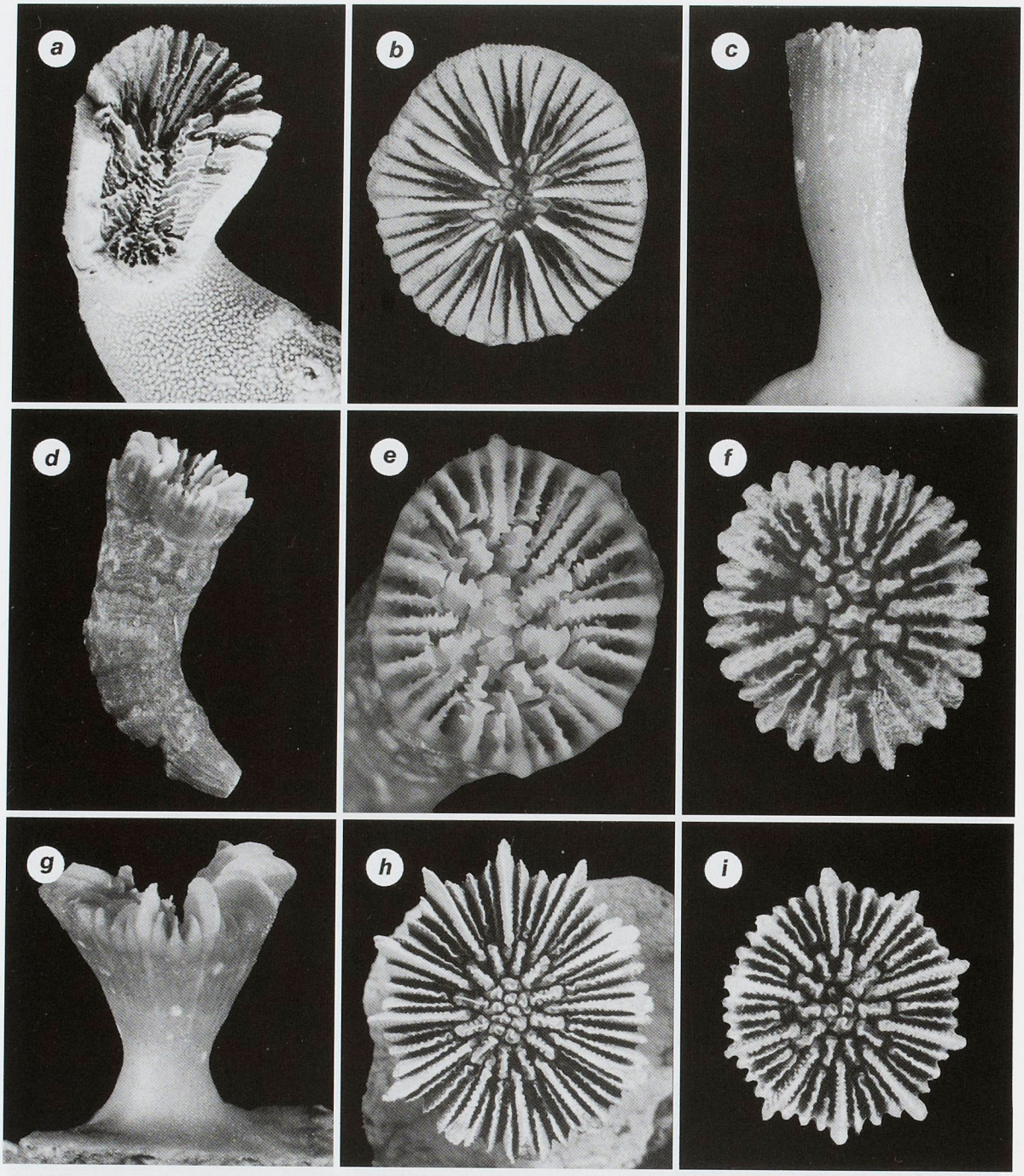


FIG. 5 a-b. — *Caryophyllia crosnieri*: **a**, MUSORSTOM 8 stn 974 (MNHN), broken corallum revealing ridged pali and deep fossa, x 6.7. — **b**, MUSORSTOM 8 stn 973 (MNHN), calice, x 5.0.

FIG. 5 c, f. — *Caryophyllia marmorea*, MUSORSTOM 7 stn 525 (MNHN), side and calicular views, x 6.7, x 15.2, respectively.

FIG. 5 d-e. — *Caryophyllia abrupta*, holotype, MUSORSTOM 7 stn 535 (MNHN), side and calicular views, x 2.6, x 6.6, respectively.

FIG. 5 g-i. — *Caryophyllia* sp. cf. *C. calveri*, MUSORSTOM 8 stn 1056 (MNHN): **g-h**, side and calicular views of corallum with 12 pali, x 4.1, x 5.0, respectively; **i**, calicular view of corallum with 10 pali, x 6.8.

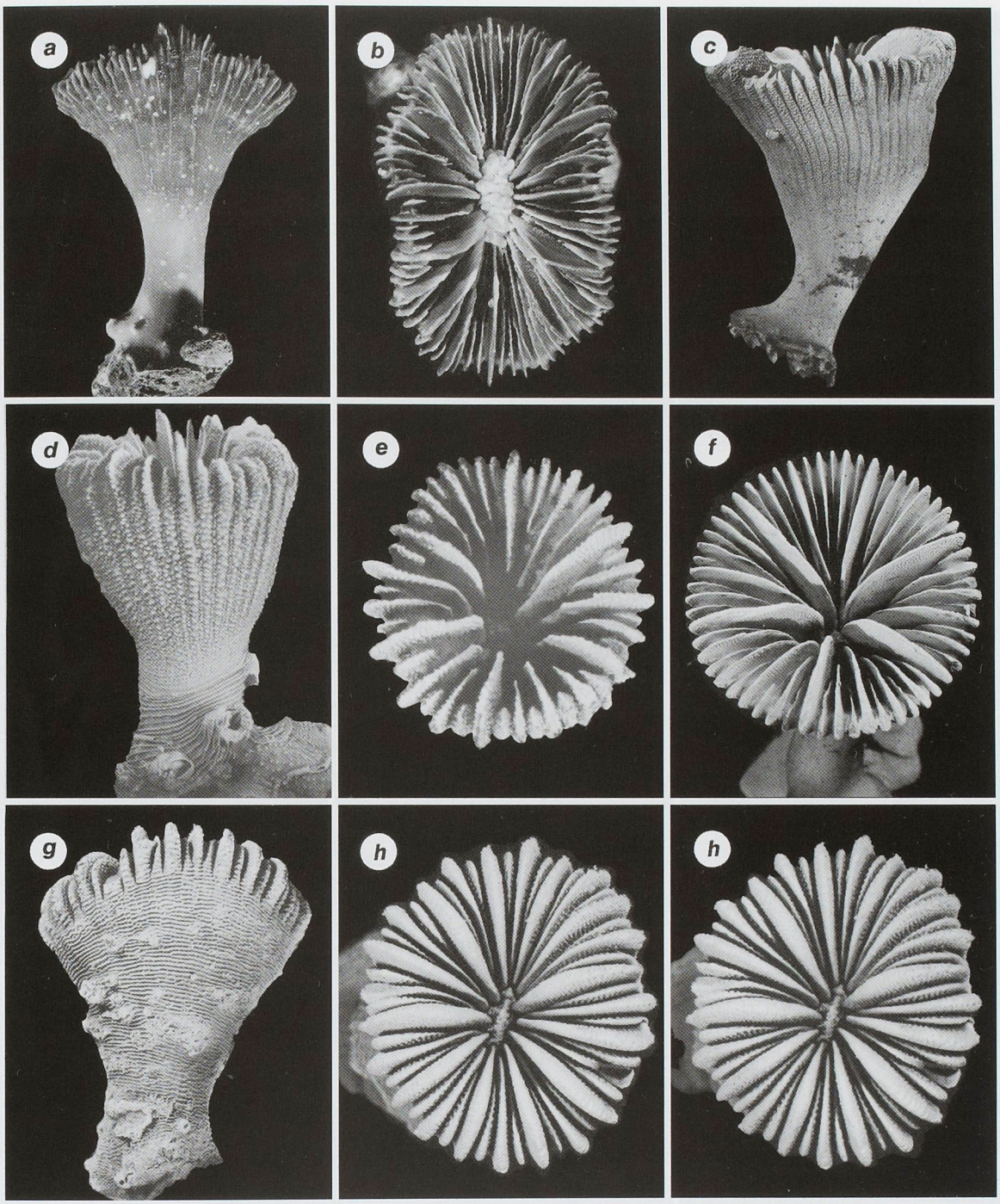


FIG. 6 a-b. — *Crispatotrochus rugosus*, MUSORSTOM 8 stn 1043 (MNHN), side and calicular views, x 1.4, x 2.0, respectively.

FIG. 6 c, f. — *Oxysmilia circularis*, MUSORSTOM 8 stn 977 (NMNH), side and calicular views, x 1.7, x 1.9, respectively.

FIG. 6 d-e. — *Oxysmilia epithecata*, holotype, MUSORSTOM 8 stn 1018 (MNHN), side and calicular views, x 5.3, x 6.3, respectively.

FIG. 6 g-h. — *Oxysmilia corrugata*, holotype, MUSORSTOM 8 stn 1030 (MNHN), side and stereo calicular views, x 4.1, x 4.9, respectively.

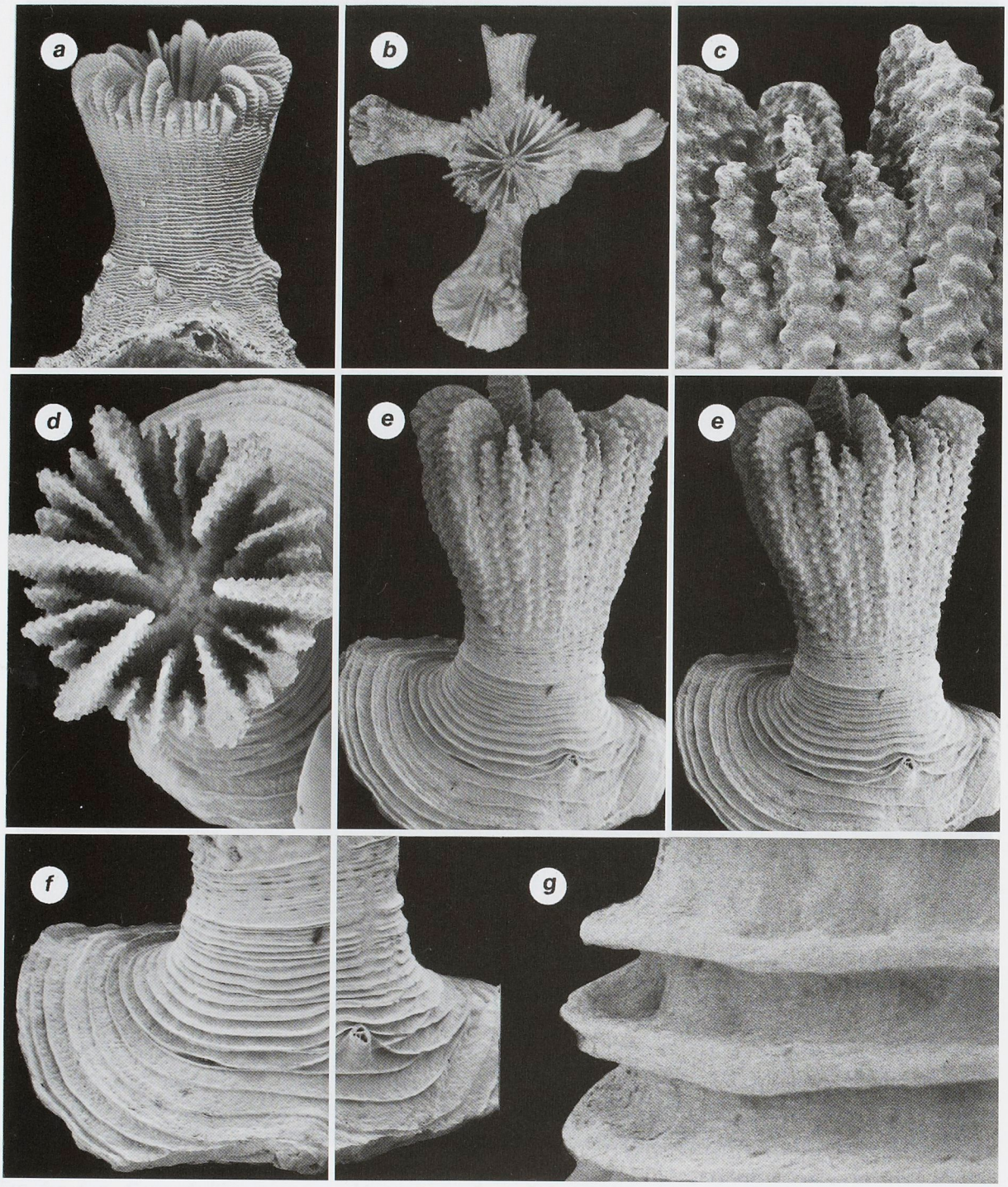


FIG. 7 a. — *Oxysmilia corrugata*, paratype, MUSORSTOM 8 stn 1030 (MNHN), side view showing thecal ridges, x 4.1.
FIG. 7 b-g. — *Oxysmilia epithecata*: **b**, paratype, MUSORSTOM 8 stn 1023 (NMNH), cluster of 5 corallites. — **c-g**, paratypes, MUSORSTOM 7 stn 496 (USNM 98626): **c**, costal granules near calice, x 41; **d-e**, calicular and stereo side views of same specimen, x 20, x 14.5, respectively; **f-g**, epithecal ridges on base of corallum, x 22, x 450, respectively.

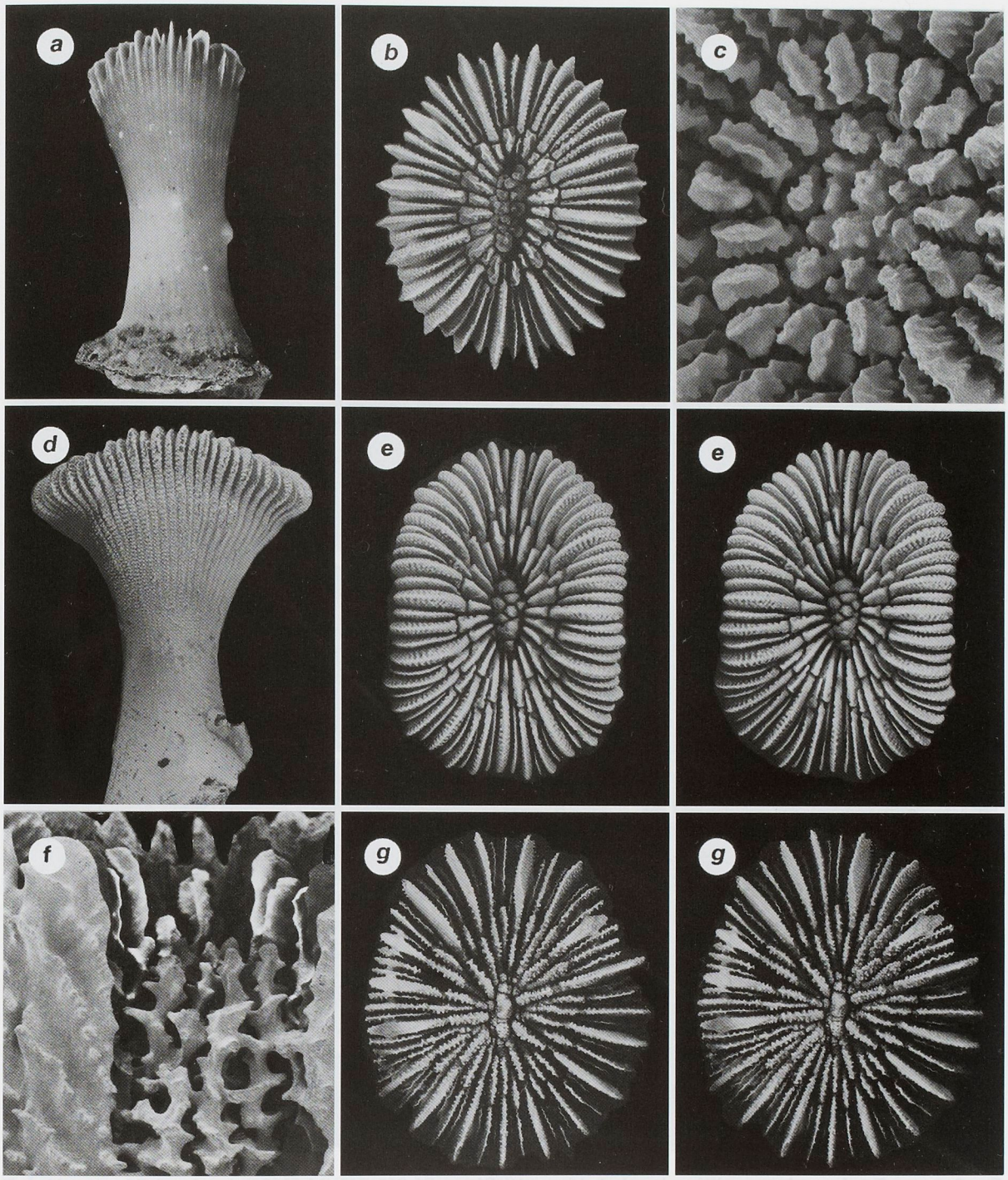


FIG. 8 a-b, f. — *Trochocyathus vasiformis*, MUSORSTOM 8 stn 977 (MNHN): **a-b**: side and calicular views, x 1.9, x 4.1, respectively; **c**, fracture revealing menianes on pali and twisted columellar elements, x 15.

FIG. 8 c. — *Bourneotrochus stellulatus*, MUSORSTOM 7 stn 509 (USNM 98708), palar ring and columella, x 25.

FIG. 8 d-e. — *Trochocyathus efateensis*, holotype, MUSORSTOM 8 stn 1019 (MNHN), side and stereo calicular views, x 2.8, x 3.4, respectively.

FIG. 8 g. — *Trochocyathus patelliformis*, holotype, HURL stn P5-063 (USNM 83026), stereo calicular view, x 2.4.

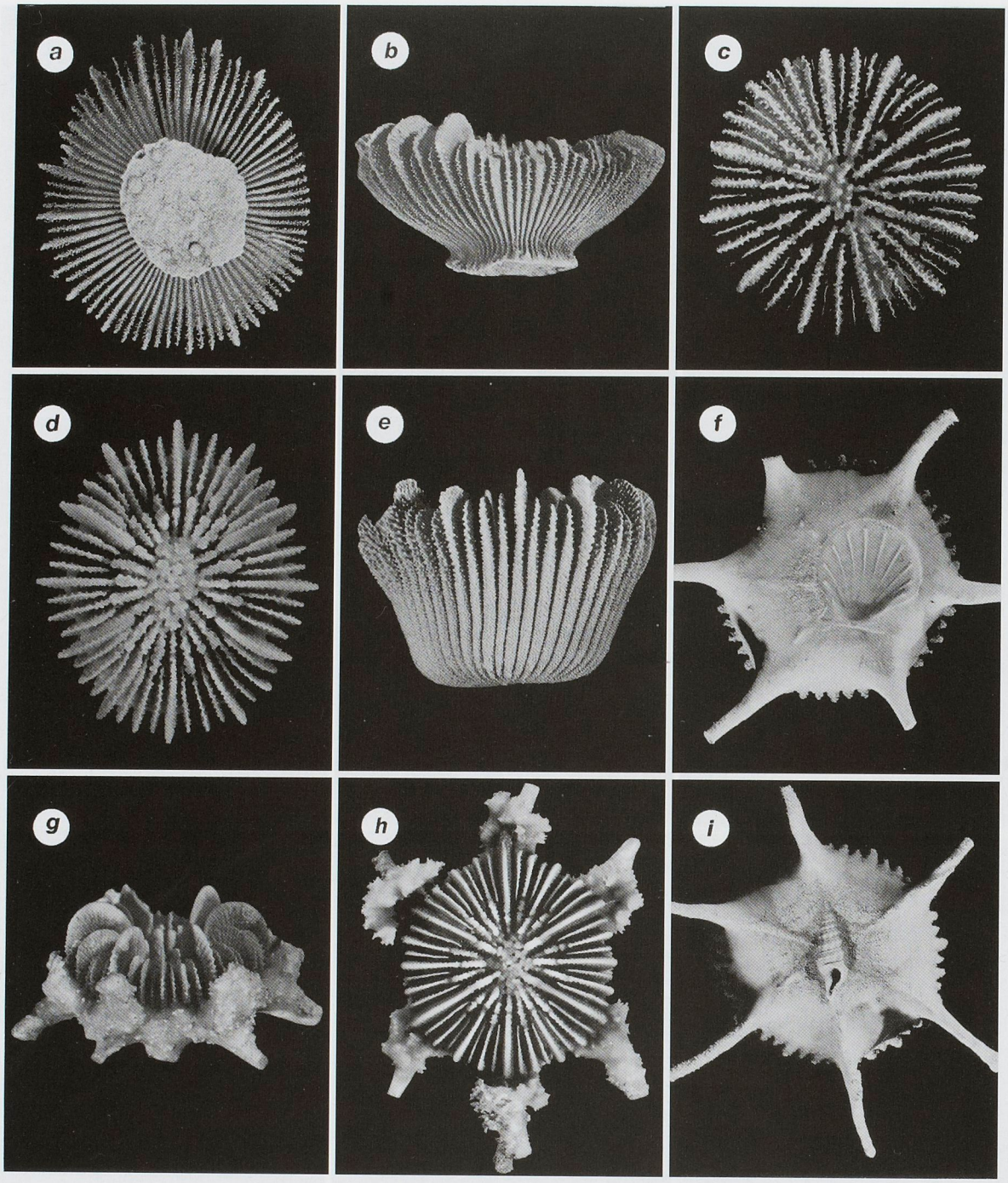


FIG. 9 a-c. — *Trochocyathus patelliformis*: **a-b**, holotype, HURL stn P5-063 (USNM 83026), basal and side views, x 2.4, x 2.2, respectively. — **c**, paratype, MUSORSTOM 8 stn 1111 (MNHN), juvenile calice, x 4.4.

FIG. 9 d-e. — *Trochocyathus discus*, MUSORSTOM 8 stn 1089 (MNHN), calicular and side views, x 3.8, x 3.4, respectively.

FIG. 9 f-i. — *Trochocyathus brevispina*: **f**, **i**, MUSORSTOM 8 stn 963 (MNHN), bases of coralla that were originally attached to a bivalve and a gastropod, x 2.7, x 3.0, respectively. — **g**, MUSORSTOM 8 stn 1004 (MNHN), side view of nodular proliferations on costal spines, x 2.9. — **h**, MUSORSTOM 8 stn 1003 (MNHN), calicular view of nodular proliferations on costal spines, x 2.8.

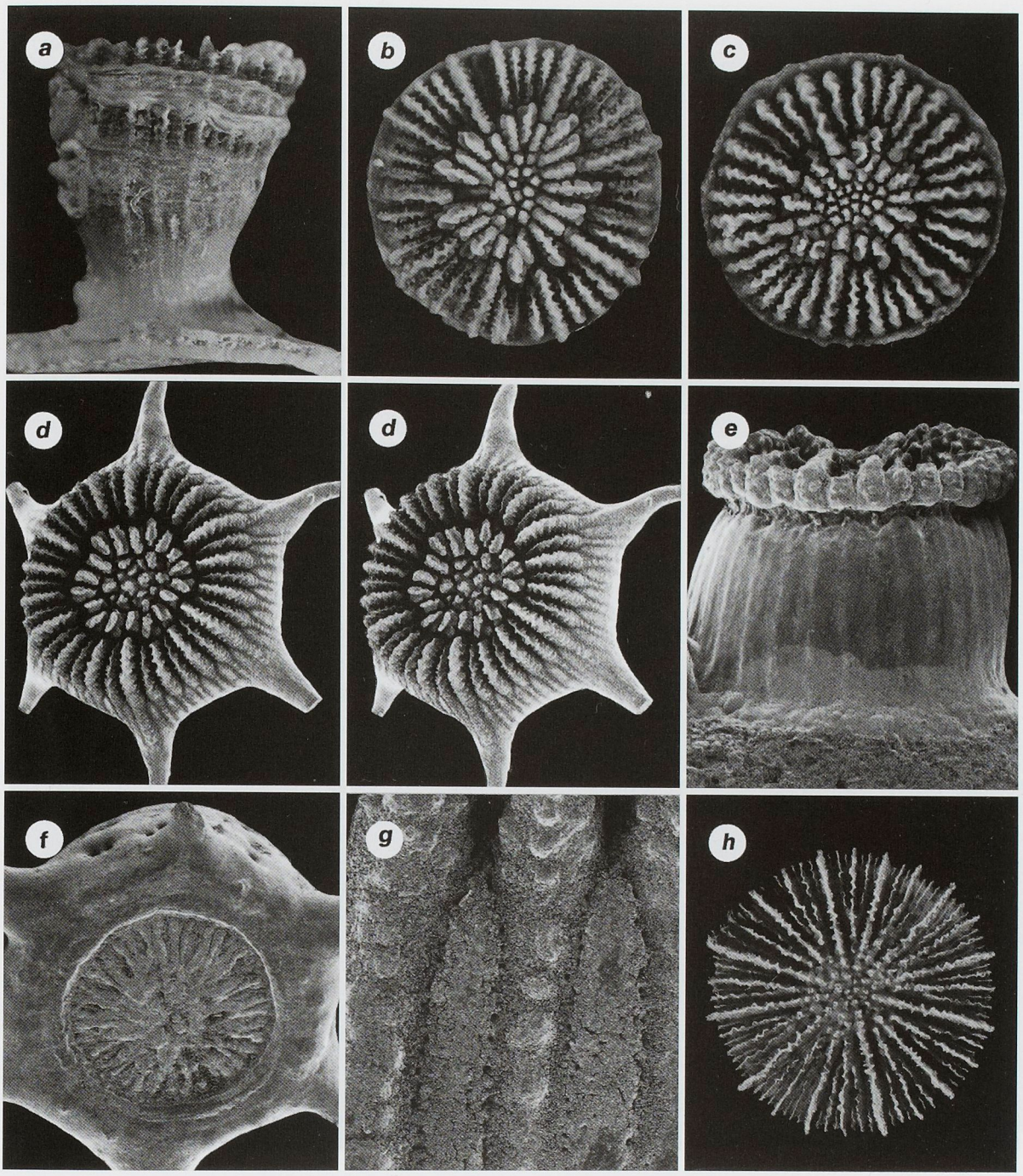


FIG. 10 a-c. — *Polycyathus octuplus*: **a-b**, holotype, MUSORSTOM 7 stn 494 (MNHN), side and calicular views, x 6.0, x 7.5, respectively. — **c**, paratype, MUSORSTOM 7 stn 504 (MNHN), calice of septamerally symmetrical corallum, x 7.5.

FIG. 10 d-g. — *Bourneotrochus stellulatus*: **d-e**, MUSORSTOM 7 stn 509 (USNM 98708): **d**, stereo oblique calicular view, x 6.5; **e**, anthocaulus with incipient anthocyathus attached, x 16. — **f-g**, MUSORSTOM 7 stn 511 (USNM 98704): **f**, basal scar resulting from transverse division, x 11; **g**, costae at calicular edge, x 54.

FIG. 10 h. — *Stephanocyathus regius*, MUSORSTOM 7 stn 509 (MNHN), juvenile corallum with 96 septa, x 2.9.

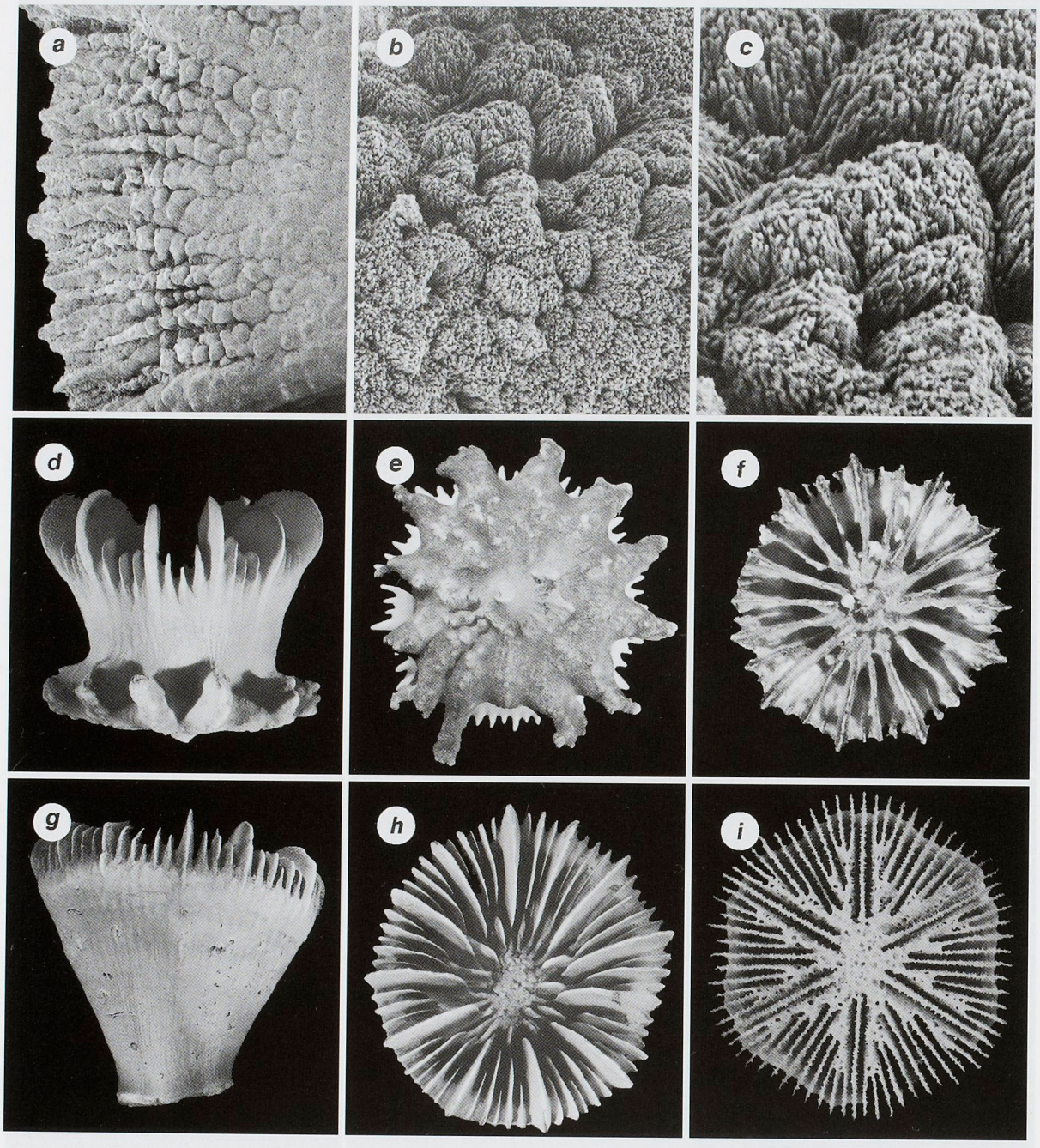


FIG. 11 a-c. — *Stephanocyathus regius*, MUSORSTOM 8 stn 1129 (USNM 98657), base of rapidly growing corallum showing progressive magnifications of tufts of fibres, x 20, x 580, x 1450, respectively.

FIG. 11 d-f. — *Stephanocyathus coronatus*: **d-e**, MUSORSTOM 8 stn 1125 (MNHN), side and basal views, both x 1.2. — **f**, MUSORSTOM 7 stn 622 (MNHN), juvenile "*flatiliseptis*" stage, x 3.8.

FIG. 11 g-h. — *Vaughanella concinna*, MUSORSTOM 7 stn 572 (MNHN), side and calicular views, x 1.6, x 1.7, respectively.

FIG. 11 i. — *Deltocyathus magnificus*, MUSORSTOM 8 stn 963 (MNHN), corallum with hexagonal outline, x 2.2.

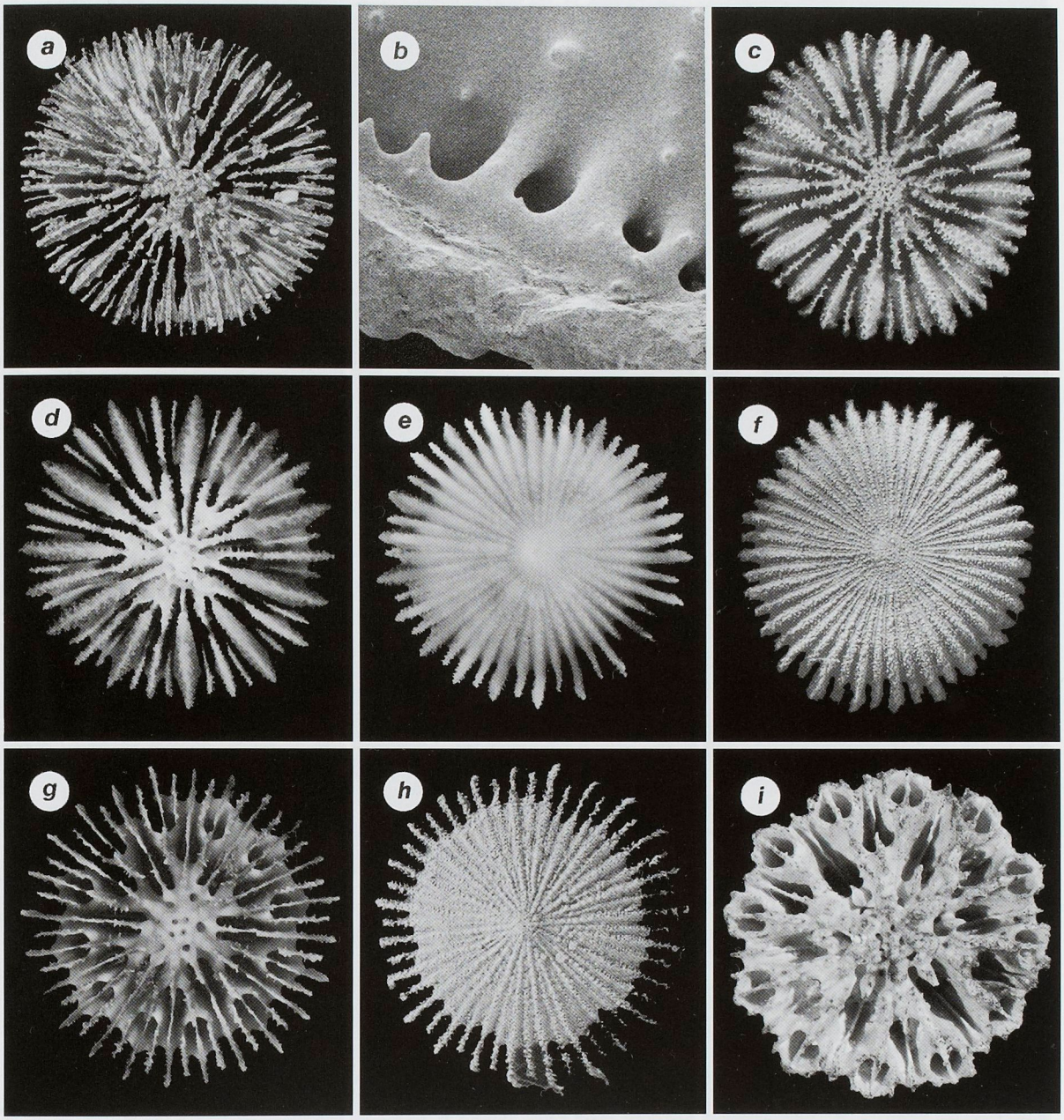


FIG. 12 a-b. — *Deltocyathus taiwanicus*: **a**, MUSORSTOM 7 stn 541 (MNHN), calicular view, x 3.2. — **b**, MUSORSTOM 7 stn 589 (USNM 98678), processes uniting S_4 to adjacent S_3, x 40.

FIG. 12 c-f. — *Deltocyathus crassiseptum*: **c**, **f**, paratype, MUSORSTOM 8 stn 978, calicular and basal views, both x 3.5. — **d-e**, holotype, MUSORSTOM 8 stn 980 (MNHN), calicular and basal views, both x 3.3.

FIG. 12 g-i. — *Deltocyathus cameratus*, MUSORSTOM 8 stn 1007 (MNHN): **g-h**, holotype, calicular and basal views, both x 3.5; **i**, paratype, worn corallum showing calicular chambers, x 4.6.

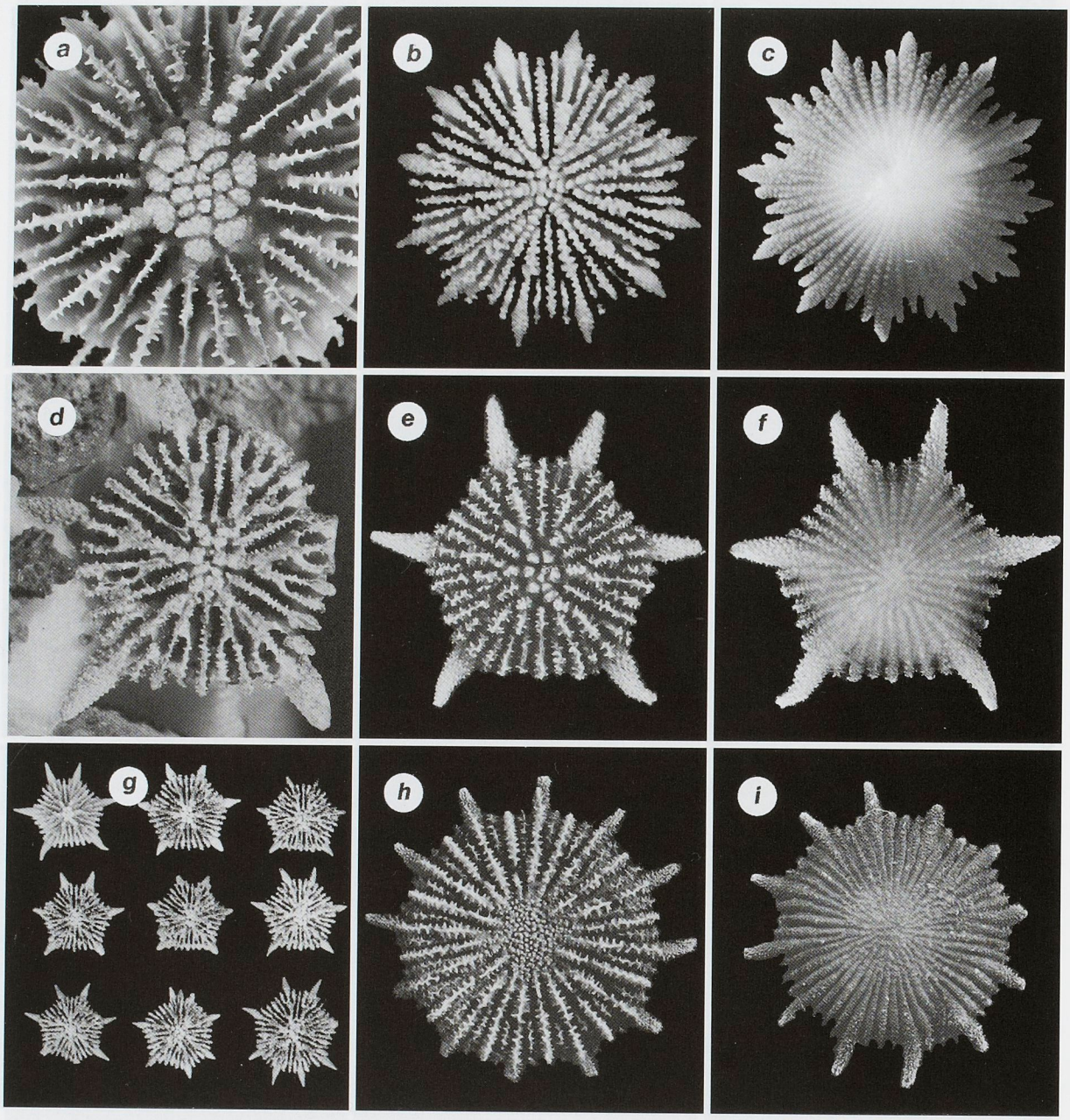


FIG. 13 a. — *Deltocyathus cameratus*, paratype, MUSORSTOM 8 stn 1036 (MNHN), specimen with ornately sculptured columella, x 5.5.

FIG. 13 b-c. — *Deltocyathus stella*, MUSORSTOM 7 stn 513 (MNHN), calicular and basal views, both x 4.7.

FIG.13 d-g. — *Deltocyathus heteroclitus*: **d**, MUSORSTOM 8 stn 1106 (MNHN), corallum cemented to a *Xenophora* shell, x 7.1. — **e-g**, MUSORSTOM 7 stn 514 (MNHN): **e-f**, calicular and basal views, both x 7.0; **g**, series of 9 specimens, those in lower row having 7 or 8 costal spines, x 2.3.

FIG. 13 h-i. — *Deltocyathus ornatus*, holotype, Lifu (Cambridge), calicular and basal views, both x 4.0.

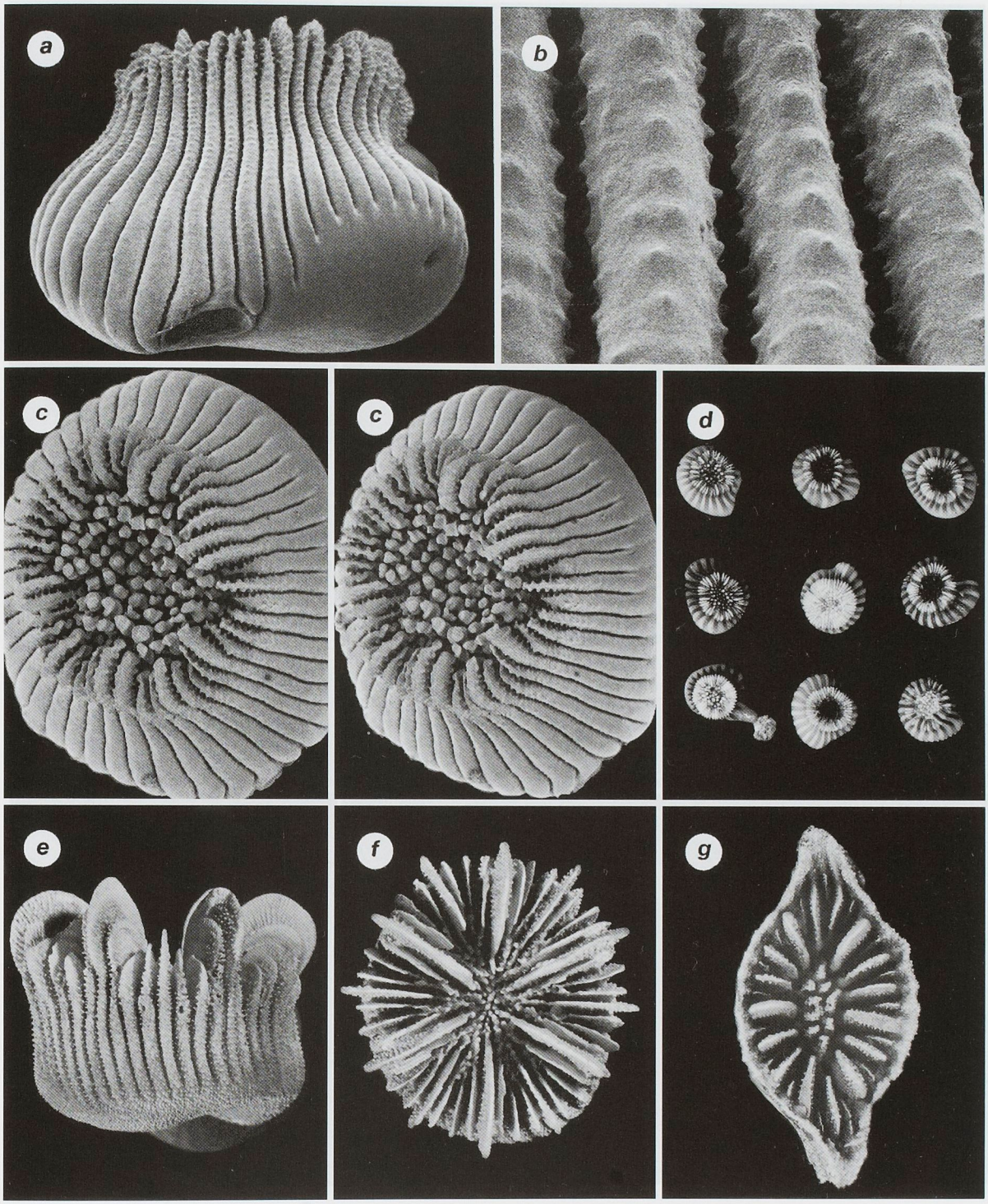


FIG. 14 a-d. — *Heterocyathus* sp. cf. *H. sulcatus*, MUSORSTOM 7 stn 513 (USNM 98712): **a**, side view showing sipunculid efferent pore, x 14; **b**, granules of costae, x 105; **c**, stereo calicular view, x 11; **d**, series of 9 coralla (MNHN), x 2.0.
FIG. 14 e-f. — *Heterocyathus alternatus*, MUSORSTOM 8 stn 1004 (MNHN), side and calicular views, both x 4.8.
FIG. 14 g. — *Conotrochus asymmetros*, holotype, MUSORSTOM 7 stn 496 (MNHN), calicular view, x 6.5.

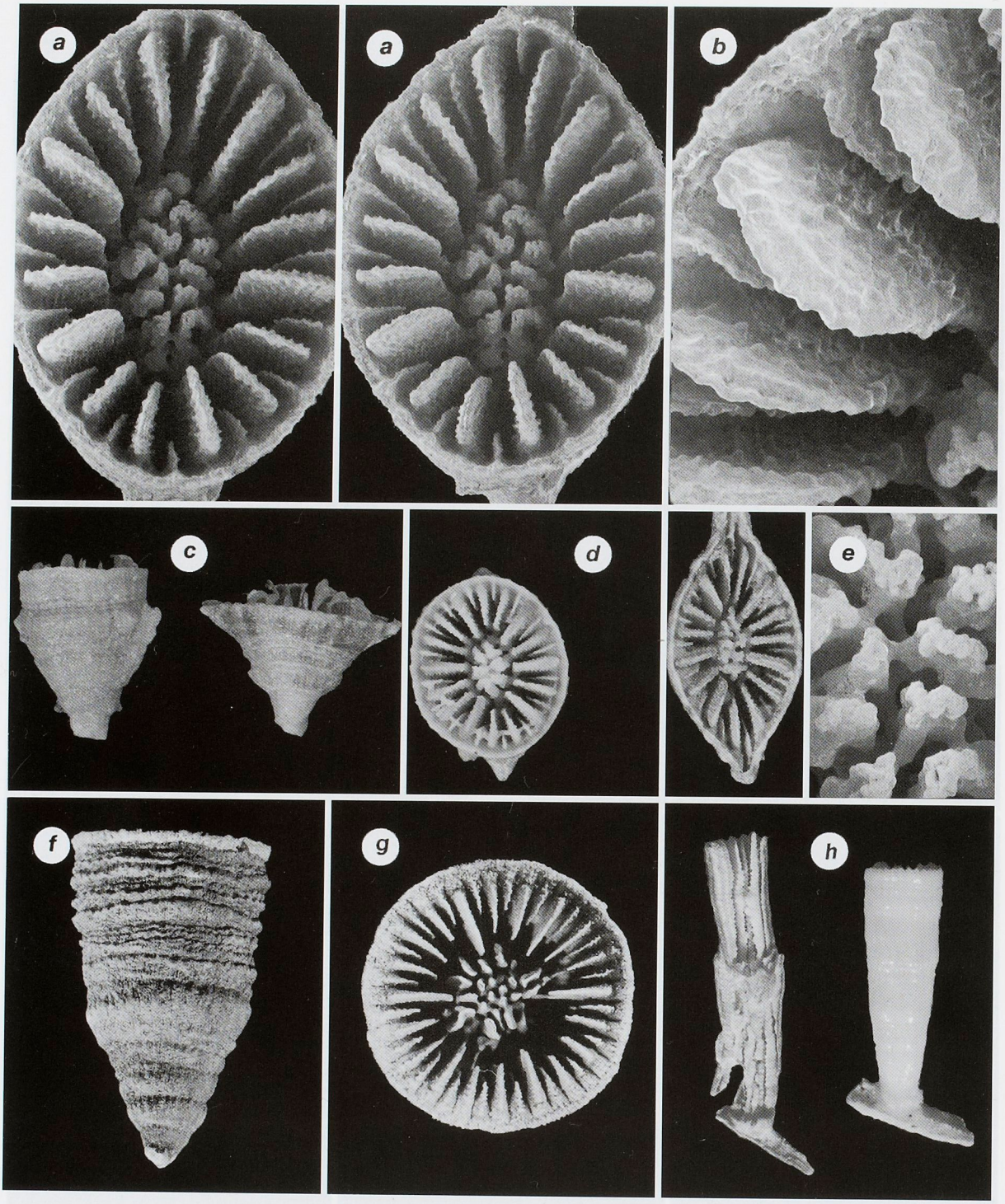


FIG. 15 a-e. — *Conotrochus asymmetros*, paratypes: **a-b**, **e**, MUSORSTOM 7 stn 495 (USNM 98735): **a**, stereo calicular view, x 14; **b**, inner calicular edge, x 37; **e**, columellar elements, x 35. — **c-d**, MUSORSTOM 7 stn 513 (MNHN), side and calicular views of coralla with and elliptical and an elongate calice, x 4.3, x 6.3, respectively.

FIG. 15 f-g. — *Lochmaeotrochus gardineri*, holotype, MUSORSTOM 8 stn 1036 (MNHN), side and calicular views, x 3.0, x 4.1, respectively.

FIG. 15 h. — *Aulocyathus juvenescens*, MUSORSTOM 8 stn 976 (MNHN), a longitudinally fractured and an intact specimen, x 3.3.

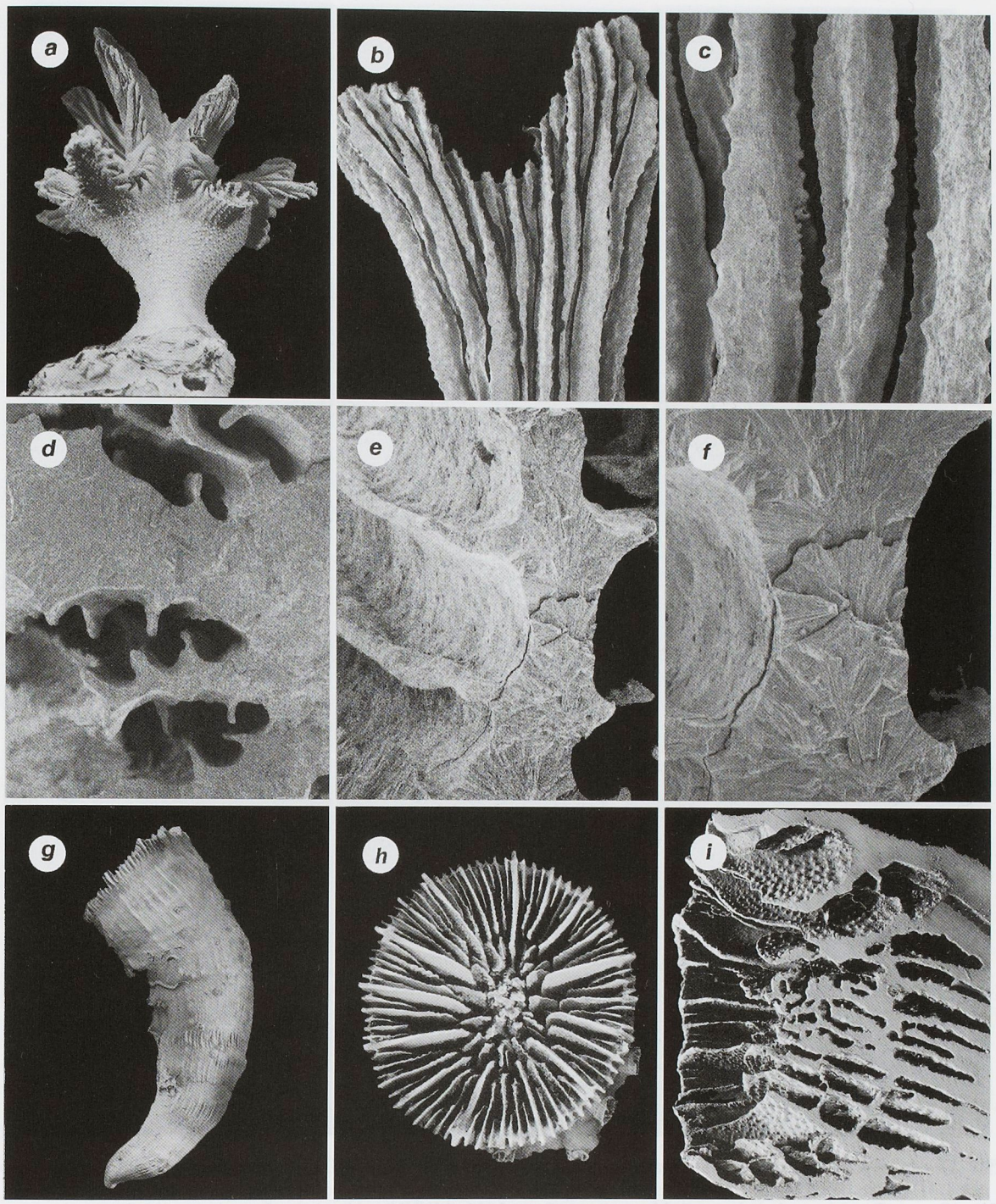


FIG. 16 a-f. — *Dactylotrochus cervicornis*, MUSORSTOM 7 stn 514: **a**, side view of corallum (MNHN), x 3.2; **b-e**, USNM 98746: **b**, bifurcated extension, x 11.8; **c**, 3 septa viewed from above, x 51; **d**, cross section of several septa showing alternation of adjacent menianes, x 74; **e-f**, higher magnification of menianes and fibre arrangement on broken surface, x 150, x 300, respectively.

FIG. 16 g-i. — *Asterosmilia gigas*, MUSORSTOM 7 stn 515 (MNHN): **g-h**, side and calicular views, x 0.8, x 1.7, respectively; **i**, longitudinal section revealing dissepiments in upper corallum, x 2.5.

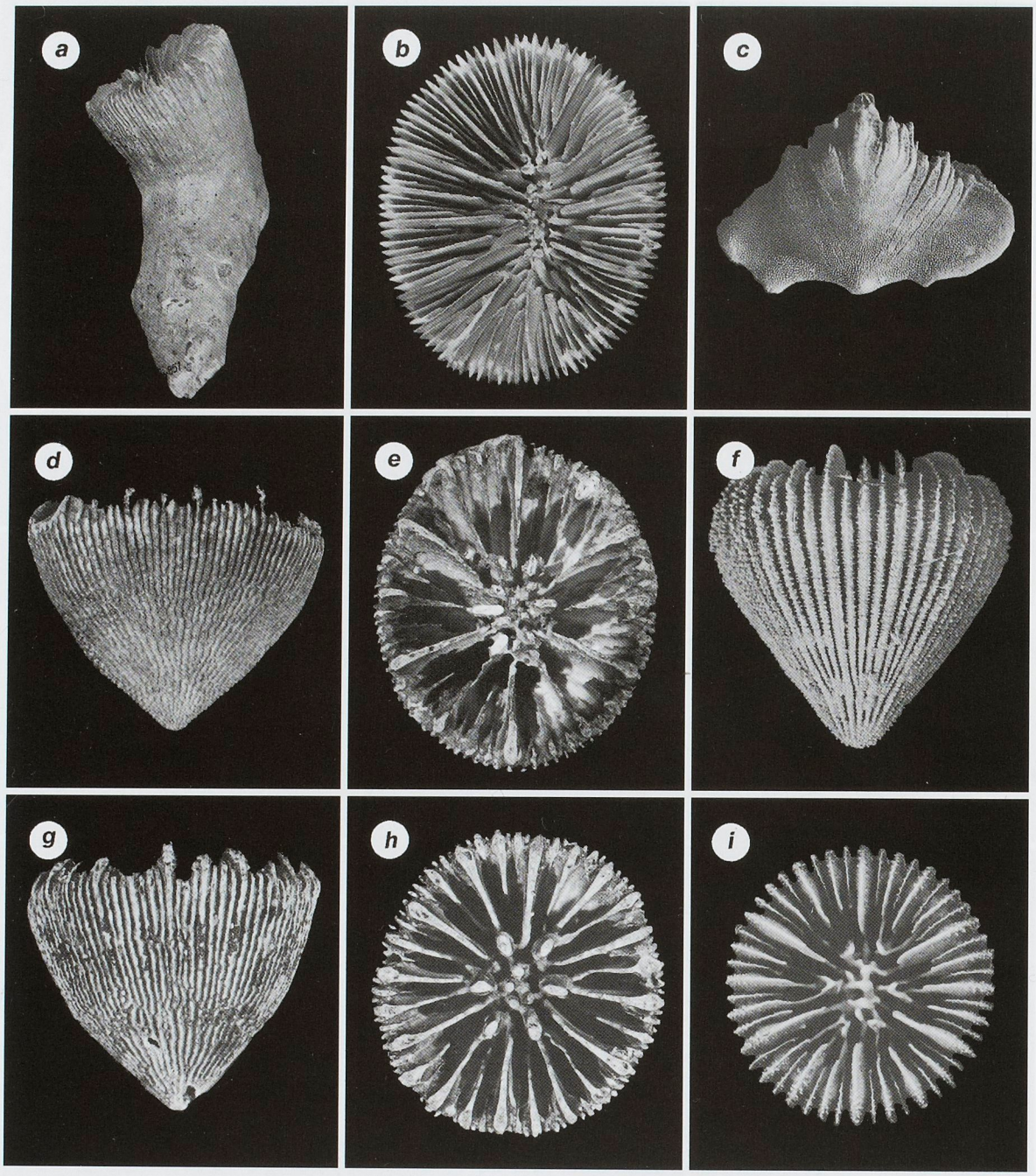


FIG. 17 a-b. — *Caryophyllia (= Asterosmilia) gigas*, holotype (BM 1939.7.20.851), side and calicular views, x 0.65, x 1.4, respectively.

FIG. 17 c. — *Tropidocyathus lessonii*, MUSORSTOM 8 stn 1016 (MNHN), side view of specimen with large edge crests, x 2.7.

FIG. 17 d-e. — *Pleotrochus venustus*, MUSORSTOM 8 stn 1114 (MNHN), side and calicular views, x 3.5, x 4.0, respectively.

FIG. 17 f, i. — *Cryptotrochus brevipalus*, holotype, MUSORSTOM 8 stn 1034 (MNHN), side and calicular views, x 4.5, x 4.3, respectively.

FIG. 17 g-h. — *Pleotrochus zibrowii*, MUSORSTOM 7 stn 637 (MNHN), side and calicular views, x 3.5, x 3.6, respectively.

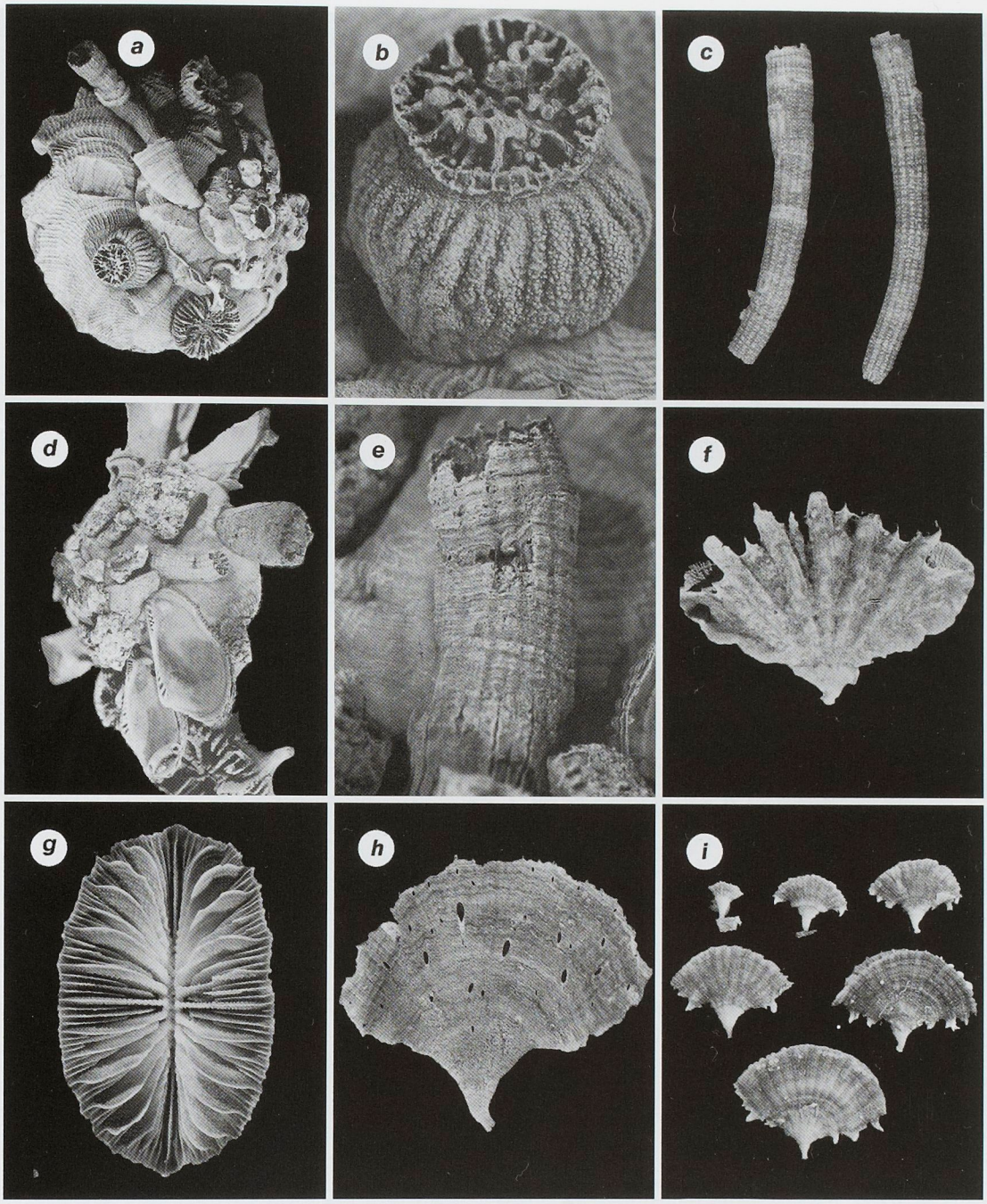


FIG. 18 a-b. — *Peponocyathus folliculus*, MUSORSTOM 8 stn 1088 (MNHN): **a**, specimen cemented to a *Xenophora* shell (*Trochocyathus discus* also attached on lower shell), x 1.5; **b**, oblique calicular view, x 9.5.

FIG. 18 c. — *Truncatoguynia irregularis*, MUSORSTOM 8 stn 967 (MNHN), 2 coralla, x 2.2.

FIG. 18 d-e. — *Temnotrochus kermadecensis*, MUSORSTOM 8 stn 963 (MNHN): **d**, specimen cemented to a *Xenophora* shell, x 1.8; **e**, side view, x 12.1.

FIG. 18 f. — *Flabellum deludens*, MUSORSTOM 7 stn 532 (MNHN), side view, x 1.4.

FIG. 18 g-i. — *Flabellum pavoninum* forma *coalitum* (MNHN): **g**, MUSORSTOM 8 stn 1102, calicular view, x 1.6; **h**, MUSORSTOM 8 stn 1004, side view showing acrothoracican burrows, x 2.2; **i**, series of 6 coralla showing ontogenetic development of edge spines, x 0.75.

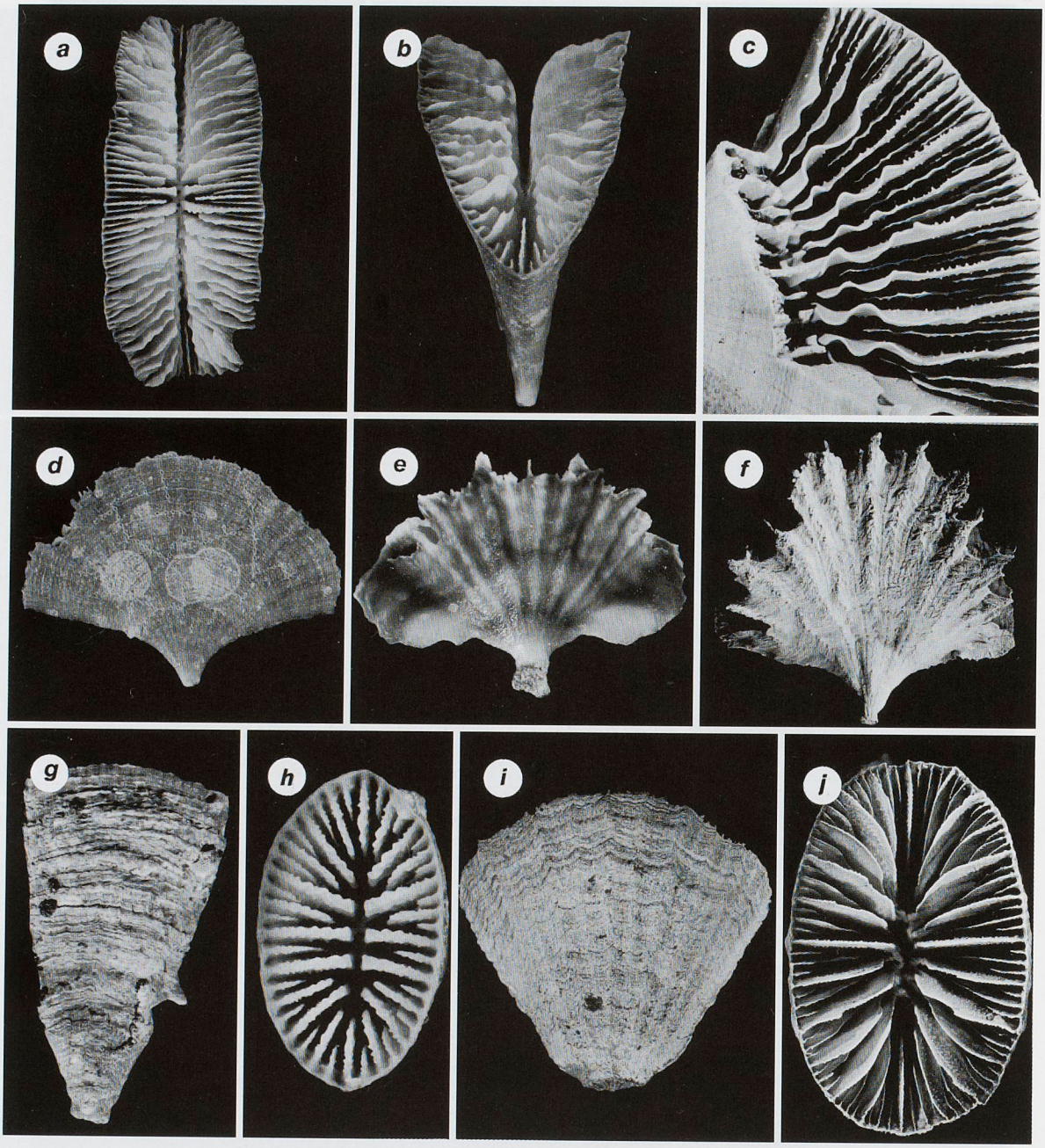


FIG. 19 a-d. — *Flabellum arcuatile*: **a-b**, **d**, holotype, NZOI stn I97 (NZOI H688), calicular edge, and side views, x 1.5, x 2.2, x 1.3, respectively. — **c**, paratype, MUSORSTOM 7 stn 535 (MNHN), broken corallum showing sinuosity of septal edges, x 2.5.

FIG. 19 e. — *Flabellum aotearoa*, MUSORSTOM 8 stn 1018 (MNHN), side view of juvenile corallum having large edge crests, x 3.0.

FIG. 19 f. — *Flabellum marcus*, MUSORSTOM 8 stn 1037 (MNHN), side view, x 1.3.

FIG. 19 g-h. — *Truncatoflabellum dens*, MUSORSTOM 8 stn 1060 (MNHN), side and calicular views, x 3.8, x 5.8, respectively.

FIG. 19 i-j. — *Truncatoflabellum stabile*, MUSORSTOM 8 stn 996 (MNHN), side and calicular views, x 1.7, x 2.1, respectively.

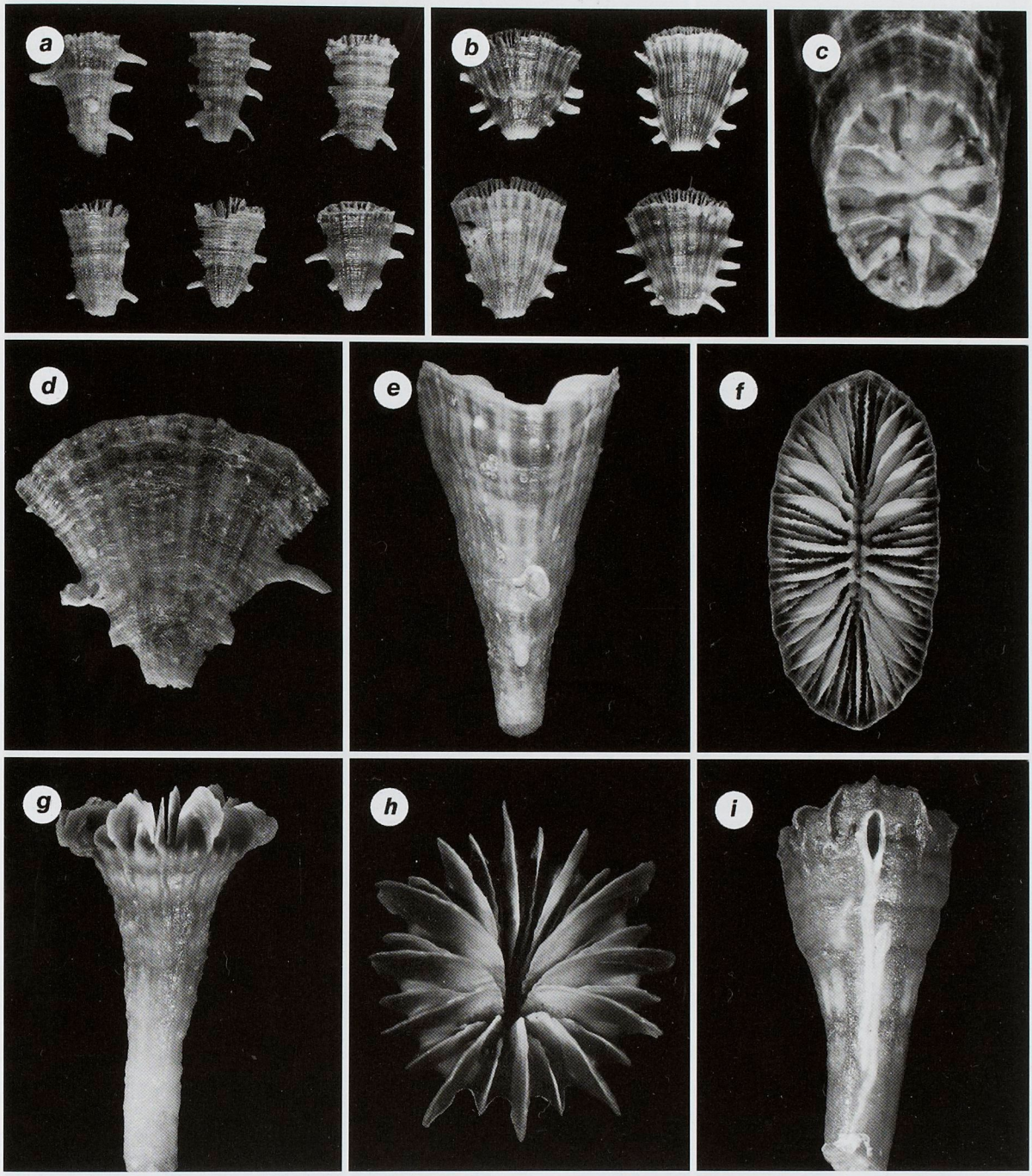


FIG. 20 a. — *Truncatoflabellum pusillum*, MUSORSTOM 8 stn 1097 (MNHN), series of 6 coralla, x 2.2.

FIG. 20 b. — *Truncatoflabellum angustum*, MUSORSTOM 8 stn 1018 (MNHN), series of 4 coralla, x 1.6.

FIG. 20 c-f. — *Truncatoflabellum vigintifarium* (MNHN): **c**, paratype, MUSORSTOM 8 stn 1106, basal scar of anthocyathus, x 9.0. — **d-f**, holotype, MUSORSTOM 8 stn 1098 (MNHN), side, edge, and calicular views, x 2.4, x 3.4, x 2.7, respectively.

FIG. 20 g-i. — *Javania fusca* (MNHN): **g-h**, MUSORSTOM 8 stn 1128 (MNHN), side and calicular views, x 2.9, x 4.2, respectively. — **i**, MUSORSTOM 8 stn 988 (MNHN), corallum with an acrothoracican burrow, x 4.6.

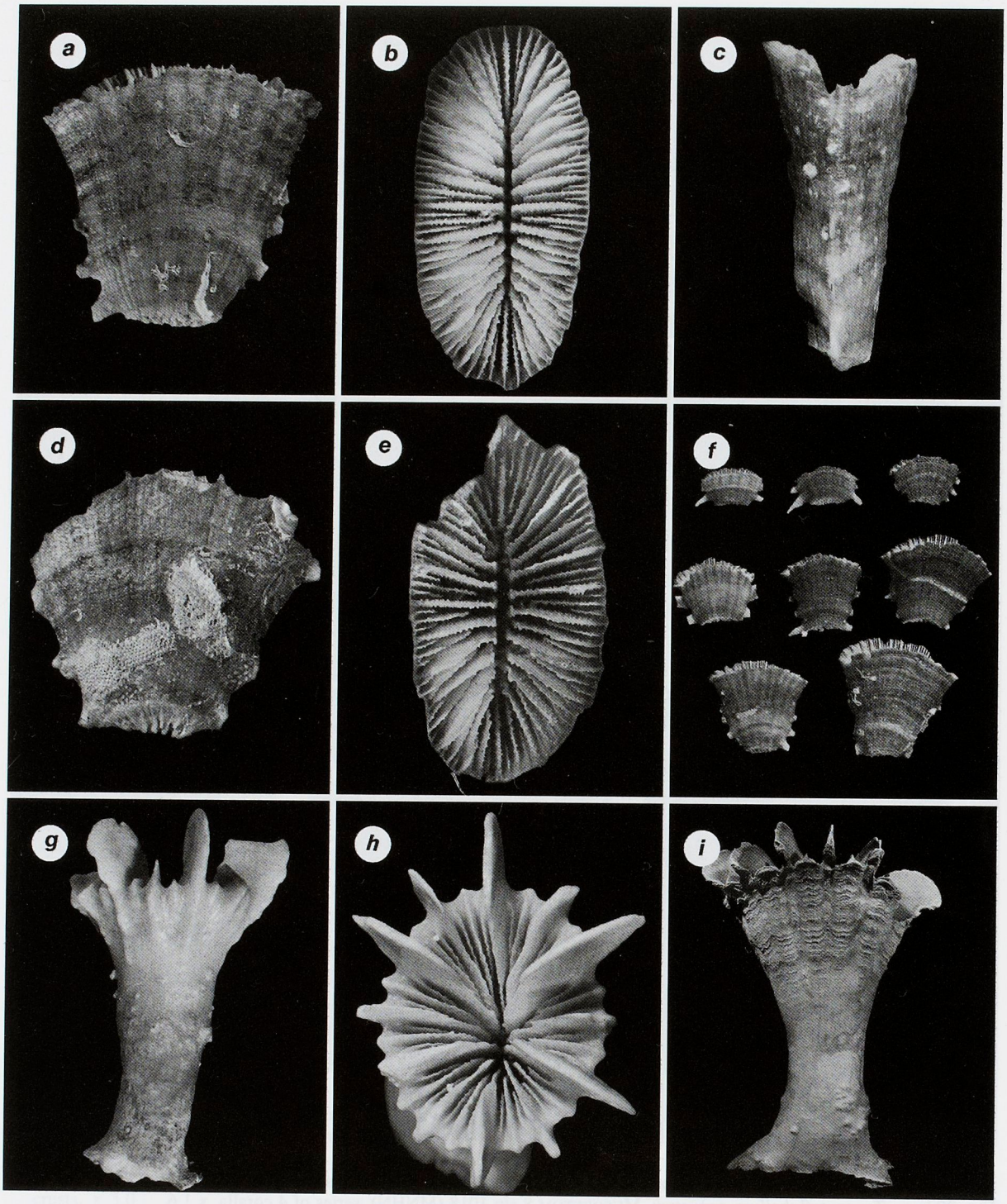


FIG. 21 a-f. — *Truncatoflabellum martensii*: **a-c**, **f**, MUSORSTOM 8 stn 1085 (MNHN): **a-c**, side, calicular, and edge views, x 2.2, x 2.9, x 2.4, respectively; **f**, series of 8 coralla showing ontogeny of anthocyathus, x 0.8. — **d-e**, holotype, Gazelle stn 40 (ZMB 1798), side and calicular views, x 2.2, x 2.8, respectively.

FIG. 21 g-i. — *Javania exserta* (MNHN): **g-h**, holotype, KARUBAR stn 44 (MNHN), side and calicular views, x 2.4, x 3.4, respectively. — **i**, paratype, MUSORSTOM 1 stn 65 (MNHN), side view, x 1.5.

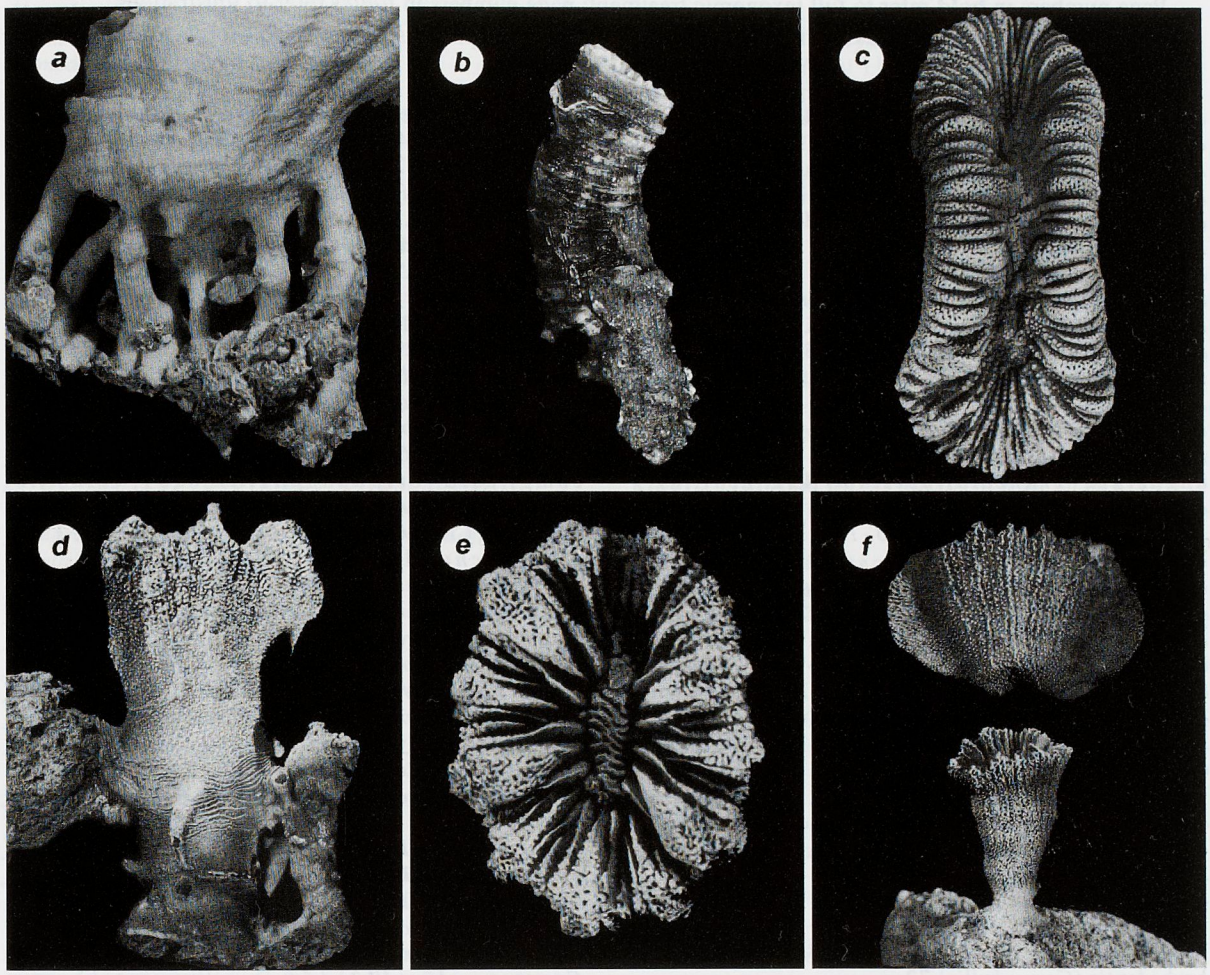


FIG. 22 a. — *Rhizotrochus typus*, MUSORSTOM 8 stn 1131 (MNHN), basal rootlets, x 2.2.
FIG. 22 b. — *Gardineria paradoxa*, MUSORSTOM 8 stn 1014 (MNHN), side view, x 1.6.
FIG. 22 c. — *Balanophyllia desmophyllioides*, MUSORSTOM 8 stn 1098 (MNHN), calice about to undergo intratentacular division, x 3.0.
FIG. 22 d-e. — *Balanophyllia laysanensis*, MUSORSTOM 8 stn 963 (MNHN), side and calicular views, x 3.7, x 5.3, respectively.
FIG. 22 f. — *Endopachys grayi*, MUSORSTOM 8 stn 976 (MNHN), anthocaulus and anthocyathus, x 2.8.

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Generic and subgeneric names used herein in combination with specific or subspecific names, or in citation, are given in parentheses. A slash (/) separates variant spellings; spellings retained herein in first position.

Taxa of generic and species level that receive full taxonomic treatment herein are in **bold**.

Page numbers in **bold** refer to full taxonomic treatment; page numbers in *italics* refer to illustrations.

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