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Cnidaria Anthozoa: Azooxanthellate Scleractinia from the Philippine and Indonesian Regions

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ABSTRACT

A total of 206 species of azooxanthellate Scleractinia are listed from the Philippine-Indonesian region, 176 of which are reported as new records. The newly reported specimens originate primarily from the MUSORSTOM 1-3 and KARUBAR expeditions, but also include specimens collected by the *"Albatross"*, Danish Expedition to the Kei Islands, SNELLIUS 2 Expedition, *"Galathea"*, Mortensen's Java-South Africa Expedition, *"Hakuho Maru"*, *"Siboga"*, CORINDON 2, and ESTASE 2 expeditions as well as some others. In all, approximately 15,600 specimens from some 640 stations are reported, the new records including the description of 26 new species and 3 new genera. Also, 4 new combinations and 1 new name are proposed (*Caryophyllia crosnieri* for *C. elongata* Cairns, 1993, non Duncan, 1873).

The distribution and bathymetric ranges of the 206 species known from the combined Philippine-Indonesian region are tabulated. 157 azooxanthellate species are now known from the Philippine Islands, with highest local diversities off Lubang Island (69 species) and the Sulu Archipelago (66 species). 174 species are known from the Indonesian region, the region with the highest diversity being the Banda Sea (138 species), specifically the Kai Islands (125 species). To a large degree, these high levels of diversity reflect the intensity of sampling effort. 65 (or 31.5%) of the Philippine-Indonesian species also occur in the Indian Ocean; 77 species (or 37%) off Japan; 67 species (or 32.5%) in the Australia and New Zealand region; and 47 species (or 23%) among the other western Pacific Islands. Only 11 of these species (or 5.3%) occur as far east as continental eastern Pacific, and 11 also occur in the Atlantic Ocean. These corals occur from 0 to 2570 m, the deepest being *Flabellum conuis*. The highest diversity of species (123 species) has been found in the 200-400 m depth range.

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The first example of sweeper tentacles in a deep-water coral is reported for *Madrepora arbuscula*. Examples of commensal/symbiotic relationships are reported to occur with petrarcid ascothoracidan crustaceans (6 coral hosts), acrothoracican cirripede crustaceans (4 coral hosts), eunicid polychaetes (4 coral hosts), and lumbrinerid polychaetes (11 coral hosts). Several cases of epifauna living on live corals are the brachiopod *Discradisca stella* and the gastropod *Malluvium* sp. attached to *Truncatoflabellum mortenseni*, and a stalked suberitid sponge growing on *Truncatoflabellum paripavoninum*.

RÉSUMÉ

Cnidaria Anthozoa : Scléractiniaires sans zooxanthelles des Philippines et d'Indonésie.

206 espèces de scléractiniaires sans zooxanthelles sont recensées dans la région des Philippines et de l'Indonésie. Pour 176 d'entre elles, des données nouvelles sont apportées. Le matériel étudié provient principalement des campagnes MUSORSTOM 1 à 3 (1976, 1980, 1985) aux Philippines et KARUBAR (1991) dans l'est de l'Indonésie. Diverses autres collections sont également prises en compte, dont notamment: *"Challenger "* (1874), *"Siboga"* (1899-1900), *"Albatross"* (1908-1909), expédition danoise aux îles Kei (1922), expédition de Th. MORTENSEN à Java (1929), *"Galathea"* (1951), *"Hakuho-Maru "* (1972, 1973, 1985), SNELLIUS 2 (1984), campagnes CORINDON 2 (1980) et ESTASE 2 (1984). Les échantillons étudiés sont au nombre de 15.600 et proviennent d'environ 640 stations.

Trois genres nouveaux sont décrits (*Confluphyllia, Ericiocyathus, Sympodangia*) et 26 espèces nouvelles (*Balanophyllia crassiseptum, B. generatrix, B. serrata, Caryophyllia cornulum, C. karubarica, C. octonaria, C. secta, C. unicristata, Confluphyllia juncta, Deltocyathus philippinensis, D. stella, Endopachys bulbosa, Ericiocyathus echinatus, Fungiacyathus fissidiscus, Madrepora minutiseptum, Rhizosmilia elata, Stephanocyathus regius, Sympodangia albatrossi, Trochocyathus apertus, T. brevispina, T. discus, T. longispina, T. semperi, "Tropidocyathus" labidus, Truncatoflabellum angustum, T. mortenseni*). Un nom nouveau est introduit (*Caryophyllia crosnieri*, nomen novum) et 4 combinaisons nouvelles résultent de transferts dans un autre genre (*Colangia moseleyi, Premocyathus dentiformis, Trochocyathus burchae, Deltocyathoides orientalis*). Une espèce étrange, aux affinités incertaines (*incertae sedis*), est présentée, mais non décrite formellement.

Un tableau résume la répartition géographique et bathymétrique des 206 espèces recensées dans la région des Philippines et de l'Indonésie. Aux Philippines (157 espèces), la diversité est la plus élévée autour de l'île Lubang (69 espèces) et dans l'archipel de Sulu (66 espèces). En Indonésie (174 espèces), elle est la plus élévée dans la mer de Banda (138 espèces) et plus spécialement aux îles Kai (125 espèces). Ces remarquables richesses en espèces reflètent aussi une prospection particulièrement intense dans les secteurs en question. 65 des 206 espèces inventoriées dans la région des Philippines et de l'Indonésie vivent aussi dans l'océan Indien tropical, 77 au Japon, 67 autour de l'Australie ou au nord de la Nouvelle-Zélande, et 47 autour d'autres îles du Pacifique occidental. Mais seulement 11 de ces espèces sont connues dans le Pacifique oriental et 11 espèces également dans l'océan Atlantique. La répartition en profondeur des espèces étudiées s'étale entre 0 et 2700 m, *Flabellum conuis* étant l'espèce qui atteint la plus grande profondeur. L'intervalle de 200-400 m est habité par environ les 2/3 des espèces. Le genre *Leptopenus*, au squelette extrêmement fragile, a été reconnu pour la première fois dans des fonds de 300 m seulement.

De nombreuses espèces présentent un mode de multiplication asexuée: division transversale, fractionnement suivi de régénération, détachement de bourgeons. Pour la première fois des tentacules spéciaux, particulièrement allongés ("sweeper tentacles"), ont été reconnus chez un scléractiniaire bathyal (*Madrepora arbuscula*); auparavant ce type de tentacule était connu seulement chez divers scléractiniaires récifaux. Divers types d'associations symbiotiques plus ou moins spécialisées ont été reconnus. Les partenaires sont les suivants: crabes Cryptochiridae (avec *Phyllangia papuensis*), crustacés ascothoracides causant des galles (dans *Madrepora oculata, Balanophyllia carinata, Balanophyllia* sp., *Deltocyathoides orientalis, Dendrophyllia* sp. cf. *D. ijimai, Flabellum lamellulosum*); cirripèdes acrothoraciques perforants (dans *Balanophyllia crassiseptum, Balanophyllia* sp., *Javania lamprotichum, Tethocyathus virgatus*); polychètes Eunicidae liés aux déformations de colonies de *Madrepora* et de *Neohelia*, leurs tubes y étant incorporés; polychète *Lumbrineris flabellicola* corrodant la surface du squelette (de *Balanophyllia* sp., *Caryophyllia grayi, C. spinicarens, C. spinigera, C. transversalis, Conotrochus brunneus, Flabellum lamellulosum, F. patens, Flabellum* sp., *Rhizotrochus typus,* Dendrophylliidae).

Des cas plus remarquables d'épifaune installée sur des coraux vivants, mais n'en dépendant probablement pas, sont le brachiopode *Discradisca stella* et le gastropode *Malluvium* sp. sur *Truncatoflabellum mortenseni*, et un spongiaire Suberitidae pédonculé sur *Truncatoflabellum paripavoninum*.

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INTRODUCTION

This work may be considered as the concluding part 2 of the partial revision by CAIRNS (1989a) of the azooxanthellate Scleractinia of the Philippines and adjacent waters. Whereas CAIRNS included only 58 Philippine species from 5 families, this work lists 206 species in 11 families from the Philippine-Indonesian region, including additional records of most species reported in Part 1. This work differs conceptually from Part 1 (CAIRNS, 1989a) in that it covers a larger geographic region, including most of Indonesia, and was based on a much larger and varied collection.

LIST OF ABBREVIATIONS

MUSEUMS:

AMS Australian Museum, Sydney.
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**].
NMW Naturhistorisches Museum, Wien.
NNM Nationaal Natuurhistorisch Museum, Leiden (formerly the Rijksmuseum van Natuurlijke Historie: **RMNH**).
NMNH National Museum of Natural History, Smithsonian, Washington, D. C. (formerly the United States National Museum: **USNM**).
NZOI New Zealand Oceanographic Institute, Wellington.

ORI Ocean Research Institute, Tokyo.
POLIPI Puslitbang Oseanologi (National Institute of Oceanology), Jakarta.
ZMA Zöologisch Museum, Amsterdam.
ZMB Zoologisches Museum, Berlin.
ZMUC Zoologisk Museum, København.

EXPEDITIONS AND VESSELS:

CORINDON 2 French-Indonesian expedition (1980) that collected mainly in the Makassar Strait.
DEKI Danish Expedition to the Kei Islands (1922).
ESTASE 2 French expedition (1984) that collected in the Philippines.
KARUBAR French-Indonesian expedition (1991) that collected in the southeastern Banda Sea. Named for the **Kai**, **Aru**, and Tanim**bar** Islands.
MUSORSTOM Cruises organized jointly by the **Muséum** National d'Histoire Naturelle and 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**).
SIPHILEXP Smithsonian Institution Philippine Expedition (1978).
TM R/V *"Tansei Maru."*

MORPHOLOGICAL TERMS:

D:H Ratio of diameter to height of a solitary corallum.
GCD Greater calicular diameter.
GCD:H Ratio of greater calicular diameter to height of a solitary corallum.
GCD:LCD Ratio of greater calicular diameter to lesser calicular diameter.
H:D Ratio of height to diameter of a solitary corallum.
LCD Lesser calicular diameter.
LEL:H Ratio of lateral edge length to height of a solitary corallum, *i.e.*, of a *Flabellum*.
PD:GCD Ratio of pedicel diameter to greater calicular diameter of a solitary corallum.
SCI Septal concavity index: ratio of distance from thecal edge to point of greatest septal inflection to length of thecal face along that septum.
SEM Scanning Electron Microscopy.
SSI Septal sinuosity index: ratio of amplitude of sinuosity of lower inner edge of a major septum to the thickness of same septum (see CAIRNS, 1989b).
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 wider than septa of cycle y.

COMBINED LIST OF STATIONS AND OF SPECIES OBTAINED PER STATION

This list provides the data of all stations mentioned in this report (ships, respectively cruises, in alphabetical order) and of those stations of the *"ALBATROSS"* Philippines Expedition and of cruises MUSORSTOM 1, 2, 3 (Philippines) and CORINDON 2 (Indonesia) that were previously mentioned by CAIRNS (1989a). For some of the stations previously mentioned by CAIRNS (1989a) the data are herein corrected.

The following abbreviations are used and placed after the species names:

CSD: (= confused station data) species found labeled as from this station, but certainly from another station because of the unlikely depth;

C89: already reported by CAIRNS (1989a);

C89*: reported by CAIRNS (1989a), but under another name (see synonymy, remarks).

"Acheron" New Zealand National Museum (= NZNM),

Stn BS441. — 28.10.1975, Kermadec Isl., Raoul Isl., 3.7 km off Nugent Isl., 366-402 m: *Truncatoflabellum angustum.*

"Akademik Oparin"

Stn 18. — 3.12.1990, 13°56.1'S, 140°57.4'E, 36 m, Gulf of Carpentaria: *Truncatoflabellum spheniscus.*

"Albatross" Philippines Expedition

Stn 5106. — 9.1.1908, 14°23'55"N, 120°32'33"E, 68 m, SW Luzon: *Placotrochus laevis* C89.

Stn 5107. — 9.1.1908, 14°24'30"N, 120°33'40"E, 51 m, SW Luzon: *Placotrochus laevis* C89.

Stn 5110. — 15.1.1908, 13°59'20"N, 120°15'45"E, 247 m, 15.0°C, SW Luzon: *Balanophyllia cornu, Deltocyathus vaughani, Flabellum (U.) deludens* C89, *Fungiacyathus (F.) stephanus* C89.

Stn 5113. — 17.1.1908, 13°51'30"N, 120°50'30"E, 291 m, SW Luzon: *Fungiacyathus (B.) variegatus* C89.

Stn 5116. — 20.1.1908, 13°41'00"N, 120°47'05"E, 366 m, 10.1°C, SW Luzon: *Caryophyllia (C.) secta, Flabellum (F.) lamellulosum* C89, *Flabellum (F.) magnificum* C89.

Stn 5117. — 21.1.1908, 13°52'22"N, 120°46'22"E, 216 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum* C89, *Flabellum (U.) deludens* C89.

Stn 5118. — 21.1.1908, 13°48'45"N, 120°41'51"E, 291 m, SW Luzon: *Caryophyllia (A.) spinicarens, Flabellum (F.) magnificum* C89, *Flabellum (U.) deludens* C89.

Stn 5123. — 2.2.1908, 13°12'45"N, 121°38'45"E, 518 m, E Mindoro: *Madrepora oculata.*

Stn 5124. — 2.2.1908, 12°52'00"N, 121°48'30"E, 514 m, E Mindoro: *Flabellum (U.) japonicum* C89, *Madrepora oculata.*

Stn 5130. — 5.2.1908, 7°35'00"N, 122°04'45"E, 187 m, 15.1°C, W Mindanao: *Leptopsammia crassa.*

Stn 5133. — 6.2.1908, 7°41'00"N, 122°01'00"E, 70 m, W Mindanao: *Asterosmilia marchadi, Balanophyllia imperialis, Balanophyllia stimpsonii, Deltocyathoides orientalis* C89* (ex *P. australiensis*) CSD?, *Endocyathopora laticostata* C89, *Endopachys grayi, Flabellum (F.) politum* C89 CSD?, *Notocyathus venustus* C89 CSD?, *Placotrochus laevis* C89, *Trochocyathus (T.) burchae, Trochocyathus (T.) cooperi, Trochocyathus (T.) semperi, Tropidocyathus lessonii* C89.

Stn 5134. — 7.2.1908, 6°44'45"N, 121°48'00"E, 46 m, Jolo: *Balanophyllia carinata, Cyathelia axillaris, Endocyathopora laticostata* C89, *Placotrochus laevis* C89.

Stn 5135. — 7.2.1908, 6°11'50"N, 121°08'20"E, 294 m, Jolo: *Balanophyllia gemma, Deltocyathus magnificus.*

Stn 5136. — 14.2.1908, 6°04'20"N, 120°59'20"E, 40 m, Jolo: *Flabellum (F.) politum* C89 CSD, *Flabellum (U.) deludens* C89 CSD, *Trochocyathus (T.) cooperi.*

Stn 5137. — 14.2.1908, 6°04'25"N, 120°58'30"E, 37 m, Jolo: *Balanophyllia stimpsonii, Deltocyathoides orientalis* CSD, *Trochocyathus (T.) cooperi, Truncatoflabellum incrustatum* C89* (ex *T. formosum*).

Stn 5139. — 14.2.1908, 6°06'00"N, 121°02'30"E, 37 m, Jolo: *Balanophyllia carinata.*

Stn 5141. — 15.2.1908, 6°09'00"N, 120°58'00"E, 53 m, Jolo: *Truncatoflabellum aculeatum.*

Stn 5142. — 15.2.1908, 6°06'10"N, 121°02'40"E, 38 m, Jolo: *Trochocyathus (T.) cooperi, Trochocyathus (T.) semperi.*

Stn 5143. — 15.2.1908, 6°05'50"N, 121°02'15"E, 35 m, Jolo: *Balanophyllia stimpsonii, Trochocyathus (T.) cooperi.*

Stn 5144. — 15.2.1908, 6°05'50"N, 121°02'15"E, 35 m, Jolo: *Placotrochus laevis* C89, *Trochocyathus (T.) cooperi.*

Stn 5145. — 15.2.1908, 6°04'30"N, 120°59'30"E, 42 m, Jolo: *Sphenotrochus (S.) hancocki* C89, *Truncatoflabellum irregulare* C89.

Stn 5146. — 16.2.1908, 5°46'40"N, 120°48'50"E, 44 m, Siasi: *Balanophyllia imperialis, Deltocyathoides orientalis* C89* (ex *P. australiensis*) CSD, *Truncatoflabellum phoenix, Trochocyathus (T.) cooperi.*

Stn 5147. — 16.2.1908, 5°41'40"N, 120°47'10"E, 38 m, Siasi: *Trochocyathus (T.) cooperi, Truncatoflabellum phoenix.*

Stn 5151. — 18.2.1908, 5°24'40"N, 120°27'15"E, 44 m, Tawitawi group: *Balanophyllia carinata, Premocyathus dentiformis, Trochocyathus (T.) cooperi.*

Stn 5152. — 18.2.1908, 5°22'55"N, 120°15'45"E, 62 m, Tawitawi group: *Asterosmilia marchadi, Balanophyllia carinata, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Notocyathus conicus* C89.

Stn 5153. — 19.2.1908, 5°18'10"N, 120°02'55"E, 90 m, Tawitawi group: *Fungiacyathus (B.) paliferus* C89.

Stn 5155. — 19.2.1908, 5°13'40"N, 119°57'20"E, 22 m, Tawitawi group: *Premocyathus dentiformis*.

Stn 5156. — 21.2.1908, 5°12'50"N, 119°55'55"E, 33 m, Tawitawi group: *Asterosmilia marchadi, Balanophyllia carinata, Balanophyllia stimpsonii, Trochocyathus (T.) apertus, Truncatoflabellum aculeatum* C89.

Stn 5159. — 21.2.1908, 5°11'50"N, 119°54'00"E, 18 m, Tawitawi group: *Truncatoflabellum phoenix*.

Stn 5161. — 22.2.1908, 5°10'15"N, 119°53'00"E, 29 m, Tawitawi group: *Truncatoflabellum aculeatum* C89.

Stn 5162. — 22.2.1908, 5°10'00"N, 119°47'30"E, 421 m, 11.6°C, Tawitawi group: *Anthemiphyllia dentata, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Fungiacyathus (B.) paliferus* C89, *Idiotrochus kikutii* C89, *Madracis cf. pharensis*, *Notocyathus conicus* C89, *Tropidocyathus lessonii* C89, *Truncatoflabellum formosum* C89, *Truncatoflabellum phoenix, Truncatoflabellum pusillum, Truncatoflabellum sp.* C89* (ex *T. formosum*).

Stn 5164. — 24.2.1908, 5°01'40"N, 119°52'20"E, 33 m, Tawitawi group: *Asterosmilia marchadi, Balanophyllia carinata, Balanophyllia stimpsonii, Paracyathus rotundatus, Trochocyathus (T.) apertus, Truncatoflabellum aculeatum* C89.

Stn 5171. — 28.2.1908, 5°05'00"N, 119°28'00"E, 458 m, 11.9°C, Sulu Sea: *Conotrochus brunneus*.

Stn 5172. — 5.3.1908, 6°03'15"N, 120°35'30"E, 582 m, Jolo: *Caryophyllia (C.) rugosa, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Idiotrochus kikutii* C89, *Peponocyathus minimus* C89* (ex *P. folliculus*).

Stn 5173. — 5.3.1908, 6°02'55"N, 120°53'00"E, 340 m, Jolo: *Flabellum (F.) patens* C89.

Stn 5174. — 5.3.1908, 6°03'45"N, 120°57'00"E, 37 m, Jolo: *Balanophyllia imperialis*.

Stn 5178. — 25.3.1908, 12°43'00"N, 122°06'15"E, 143 m, Romblon: *Anthemiphyllia dentata, Asterosmilia marchadi, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) politum* C89, *Fungiacyathus (B.) paliferus* C89, *Idiotrochus kikutii* C89, *Letepsammia formosissima* C89, *Notocyathus conicus* C89, *Stephanophyllia neglecta* C89, *Tropidocyathus lessonii* C89, *"Tropidocyathus" pileus* C89, *Trochocyathus (T.) philippinensis, Truncatoflabellum pusillum* C89.

Stn 5179. — 25.3.1908, 12°38'15"N, 122°12'30"E, 68 m, 24.3°C, Romblon: *Incertae sedis, Tropidocyathus lessonii* C89, *Truncatoflabellum phoenix*.

Stn 5197. — 9.4.1908, 9°52'30"N, 123°40'45"E, 318 m, 12.4°C, W Bohol: *Flabellum (U.) deludens* C89.

Stn 5198. — 9.4.1908, 9°40'50"N, 123°39'45"E, 403 m, 12.2°C, W Bohol: *Caryophyllia (A.) spinicarens, Deltocyathus magnificus, Deltocyathus vaughani, Flabellum (U.) japonicum* C89, *Fungiacyathus (F.) stephanus* C89.

Stn 5201. — 10.4.1908, 10°10'00"N, 125°04'15"E, 1014 m, 11.6°C, S Leyte: *Madrepora oculata*.

Stn 5202. — 10.4.1908, 10°12'00"N, 125°04'10"E, 919 m, S Leyte: *Flabellum (U.) deludens, Madrepora oculata, Trochocyathus (T.) cooperi* CSD.

Stn 5212. — 24.4.1908, 12°04'15"N, 124°04'36"E, 198 m, 15.5°C, E Masbate: *Flabellum (F.) lamellulosum* C89, *Flabellum (F.) politum* C89.

Stn 5213. — 20.4.1908, 12°15'00"N, 123°57'30"E, 146 m, E Masbate: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Stephanophyllia neglecta* C89, *Trochocyathus (T.) philippinensis, Truncatoflabellum candeanum* C89.

Stn 5217. — 22.4.1908, 13°20'00"N, 123°14'15"E, 192 m, 17.3°C, between Luzon and Burias: *Caryophyllia (C.) rugosa, Conotrochus brunneus, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) politum* C89, *Gardineria philippinensis* C89, *Letepsammia formosissima* C89, *Madracis* sp. A, *Peponocyathus minimus* C89* (ex *P. folliculus*), *Premocyathus dentiformis*, *Thrypticotrochus multilobatus* C89, *Trochocyathus (T.) philippinensis*.

Stn 5221. — 24.4.1908, 13°38'15"N, 121°48'15"E, 353 m, 16.9°C, between Luzon and Marinduque: *Flabellum (U.) japonicum* C89.

Stn 5222. — 24.4.1908, 13°38'30"N, 121°42'45"E, 357 m, 17.1°C, between Luzon and Marinduque: *Flabellum (U.) japonicum* C89.

Stn 5236. — 11.5.1908, 8°50'45"N, 126°26'52"E, 903 m, 5.1°C, NE Mindanao: *Peponocyathus minimus*.

Stn 5244. — 14.5.1908, 6°52'05"N, 126°14'15"E, 313 m, SE Mindanao: *Rhizosmilia elata*.

Stn 5248. — 18.5.1908, 7°07'05"N, 125°40'24"E, 33 m, SE Mindanao, Gulf of Davao: *Eguchipsammia wellsi.*

Stn 5249. — 18.5.1908, 7°06'06"N, 125°40'08"E, 42 m, SE Minanao, Gulf of Davao: *Eguchipsammia gaditana, Eguchipsammia wellsi, Truncatoflabellum formosum* C89, *Truncatoflabellum incrustatum* C89.

Stn 5250. — 18.5.1908, 7°05'07"N, 125°39'45"E, 42 m, SE Mindanao, Gulf of Davao: *Truncatoflabellum incrustatum* C89.

Stn 5251. — 18.5.1908, 7°05'12"N, 125°39'35"E, 37 m, SE Mindanao, Gulf of Davao: *Truncatoflabellum incrustatum* C89.

Stn 5253. — 18.5.1908, 7°04'48"N, 125°39'38"E, 51 m, SE Mindanao, Gulf of Davao: *Truncatoflabellum aculeatum, Truncatoflabellum incrustatum* C89.

Stn 5255. — 18.5.1908, 7°03'00"N, 125°39'00"E, 183 m, SE Mindanao, Gulf of Davao: *Cyathelia axilllaris, Javania insignis* C89, *Rhizosmilia sagamiensis, Thalamophyllia tenuescens.*

Stn 5256. — 22.5.1908, 7°21'45"N, 124°07'15"E, 289 m, S Mindanao, Illana Bay: *Caryophyllia (A.) spinicarens, Flabellum (U.) deludens* C89.

Stn 5260. — 3.6.1908, 12°25'35"N, 121°31'35"E, 428 m, 10.8°C, SE Mindoro: *Caryophyllia (A.) spinicarens, Fungiacyathus (B.) granulosus* C89.

Stn 5265. — 6.6.1908, 13°41'15"N, 120°00'50"E, 247 m, SW Luzon: *Caryophyllia (C.) secta, Flabellum (U.) marenzelleri* C89, *Truncatoflabellum formosum* C89, *Truncatoflabellum incrustatum* C89.

Stn 5268. — 8.6.1908, 13°42'00"N, 120°57'15"E, 311 m, SW Luzon: *Balanophyllia cornu, Cyathelia axillaris, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Endopachys grayi, Flabellum (U.) marenzelleri* C89, *Madracis cf. pharensis.*

Stn 5272. — 14.7.1908, 14°00'00"N, 120°22'30"E, 216 m, 14.1°C, SW Luzon: *Notocyathus conicus* C89.

Stn 5273. — 14.7.1908, 13°58'45"N, 120°21'35"E, 209 m, SW Luzon: *Caryophyllia (A.) spinigera, Deltocyathus andamanicus, Flabellum (F.) lamellulosum* C89, *Flabellum (U.) deludens* C89, *Stephanocyathus (A.) spiniger.*

Stn 5277. — 17.7.1908, 13°56'55"N, 120°13'45"E, 146 m, 14.8°C, SW Luzon: *Asterosmilia marchadi, Conotrochus brunneus, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Madracis asanoi, Notocyathus conicus* C89, *Peponocyathus folliculus* C89, *"Tropidocyathus" pileus* C89, *Truncatoflabellum pusillum* C89.

Stn 5278. — 17.7.1908, 14°00'10"N, 120°17'15"E, 187 m, 15.3°C, SW Luzon: *Caryophyllia (A.) spinigera, Fungiacyathus (B.) variegatus* C89, *Flabellum (U.) deludens* C89, *Letepsammia formosissima* C89.

Stn 5279. — 17.7.1908, 13°57'30"N, 120°22'15"E, 214 m, SW Luzon: *Dendrophyllia arbuscula.*

Stn 5280. — 17.7.1908, 13°55'20"N, 120°25'55"E, 353 m, 9.8°C, SW Luzon: *Balanophyllia cornu, Dendrophyllia arbuscula, Flabellum (F.) magnificum* C89.

Stn 5281. — 18.7.1908, 13°52'45"N, 120°25'00"E, 368 m, 10.2°C, SW Luzon: *Balanophyllia cornu, Flabellum (F.) magnificum* C89, *Flabellum (U.) messum* C89.

Stn 5282. — 18.7.1908, 13°53'00"N, 120°26'45"E, 454 m, 8.6°C, SW Luzon: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Fungiacyathus (B.) granulosus* C89.

Stn 5283. — 18.7.1908, 13°48'30"N, 120°28'40"E, 512 m, 8.2°C, SW Luzon: *Fungiacyathus (B.) granulosus* C89, *Rhombopsammia niphada* C89, *Truncatoflabellum paripavoninum* C89.

Stn 5284. — 18.7.1908, 13°42'05"N, 120°30'45"E, 772 m, 5.7°C, SW Luzon: *Flabellum (U.) sexcostatum* C89, *Truncatoflabellum paripavoninum* C89.

Stn 5289. — 22.7.1908, 13°41'50"N, 120°58'30"E, 315 m, SW Luzon: *Flabellum (F.) patens* C89, *Flabellum (U.) marenzelleri* C89, *Truncatoflabellum formosum* C89, *Truncatoflabellum incrustatum* C89.

Stn 5297. — 24.7.1908, 13°41'20"N, 120°58'00"E, 362 m, SW Luzon: *Flabellum (U.) deludens* C89.

Stn 5298. — 24.7.1908, 13°43'25"N, 120°57'40"E, 256 m, SW Luzon: *Flabellum (U.) deludens* C89, *Flabellum (U.) marenzelleri* C89.

Stn 5301. — 8.8.1908, 20°37'00"N, 115°43'00"E, 381 m, 10.3°C, South China Sea, SE Hong Kong: *Caryophyllia (A.) spinicarens, Conotrochus brunneus, Flabellum (F.) patens* C89, *Thrypticotrochus multilobatus* C89.

Stn 5310. — 4.11.1908, 21°33'00"N, 116°13'00"E, 183 m, 18.6°C, South China Sea, SE Hong Kong: *Balanophyllia parvula, Caryophyllia (C.) hawaiiensis.*

Stn 5311. — 4.11.1908, 21°33'00"N, 116°15'00"E, 161 m, South China Sea, SE Hong Kong: *Asterosmilia marchadi, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Dendrophyllia alcocki, Flabellum (F.) politum* C89, *Idiotrochus kikutii* C89, *Madracis sp. A, Notocyathus venustus* C89, *Peponocyathus minimus* C89*

(ex *P. folliculus*), *Sphenotrochus (S.) hancocki* C89, *Stephanophyllia fungulus* C89, *Trochocyathus (T.) philippinensis, Tropidocyathus lessonii* C89, *Truncatoflabellum candeanum* C89, *Truncatoguynia irregularis* C89.

Stn 5312. — 4.11.1908, 21°30'00"N, 116°32'00"E, 256 m, 14.2°C, South China Sea, SE Hong Kong: *Conotrochus funicolumna, Deltocyathoides orientalis* C89, *Flabellum (F.) pavoninum* C89, *Flabellum (F.) politum* C89 (not 5212), *Notocyathus venustus* C89, *Peponocyathus minimus, Sphenotrochus (S.) hancocki* C89, *Stephanophyllia fungulus* C89, *"Tropidocyathus" pileus* C89, *Truncatoflabellum carinatum* C89.

Stn 5313. — 4.11.1908, 21°30'00"N, 116°43'00"E, 274 m, 12.0°C, South China Sea, SE Hong Kong: *Anthemiphyllia frustum, Caryophyllia (C.) quadragenaria, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) politum, Peponocyathus minimus, Sphenotrochus (S.) hancocki* C89, *Truncatoflabellum carinatum* C89.

Stn 5314. — 5.11.1908, 21°41'00"N, 116°46'00"E, 223 m, 15.3°C, South China Sea, SE Hong Kong: *Caryophyllia (A.) spinicarens, Deltocyathoides orientalis* C89, *Deltocyathus magnificus, Fungiacyathus (B.) variegatus* C89, *Madrepora oculata, Trochocyathus (T.) philippinensis, Truncatoflabellum candeanum* C89, *Truncatoflabellum carinatum* C89.

Stn 5315. — 5.11.1908, 21°40'00"N, 116°58'00"E, 271 m, 12.4°C, South China Sea, SE Hong Kong: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Peponocyathus minimus, Sphenotrochus (S.) hancocki* C89.

Stn 5317. — 5.11.1908, 21°36'00"N, 117°27'00"E, 421 m, 10.3°C, South China Sea, SE Hong Kong: *Caryophyllia (C.) diomedeae, Caryophyllia (C.) quadragenaria, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Enallopsammia marenzelleri, Madrepora oculata, "Tropidocyathus" pileus* C89.

Stn 5318. — 5.11.1908, 21°32'00"N, 117°46'00"E, 622 m, South China Sea, SE Hong Kong: *Conotrochus funicolumna, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Fungiacyathus (B.) turbinolioides* C89.

Stn 5327. — 12.11.1908, 18°31'30"N, 122°03'00"E, 362 m, N Luzon: *Madrepora oculata.*

Stn 5331. — 22.11.1908, 15°36'45"N, 119°47'45"E, 326 m, 12.6°C, W Luzon: *Trochocyathus (A.) longispina.*

Stn 5336. — 18.12.1908, 11°37'45"N, 119°46'E, 84 m, Linapacan Strait: *Dactylotrochus cervicornis* (fide Wells, 1954).

Stn 5348. — 27.12.1908, 10°57'45"N, 118°38'15"E, 686 m, 13.6°C, NW Palawan: *Caryophyllia (C.) scobinosa, Fungiacyathus (F.) stephanus* C89, *Madrepora oculata, Rhombopsammia niphada* C89, *Stephanocyathus (O.) weberianus.*

Stn 5349. — 27.12.1908, 10°54'00"N, 118°26'20"E, 1336 m, 4.8°C, NW Palawan: *Fungiacyathus (F.) stephanus* C89, *Madrepora oculata, Stephanocyathus (O.) weberianus.*

Stn 5353. — 1.1.1909, 7°50'45"N, 116°43'15"E, 271 m, S Balabac: *Caryophyllia (A.) spinigera.*

Stn 5355. — 5.1.1909, 8°08'10"N, 117°19'15"E, 81 m, N Balabac: *Trochocyathus (T.) cooperi.*

Stn 5357. — 5.1.1909, 8°06'00"N, 117°17'10"E, 124 m, N Balabac: *Asterosmilia marchadi, Eguchipsammia wellsi, Javania insignis* C89, *Endopachys grayi, Rhizotrochus typus* C89.

Stn 5367. — 22.2.1909, 13°34'37"N, 121°07'30"E, 329 m, SW Luzon: *Balanophyllia cornu, Cyathelia axillaris.*

Stn 5369. — 24.2.1909, 13°48'00"N, 121°43'00"E, 194 m, Marinduque: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens* C89, *Letepsammia formosissima* C89, *Stephanocyathus (A.) spiniger, Truncatoflabellum candeanum* C89.

Stn 5371. — 24.2.1909, 13°49'40"N, 121°40'15"E, 152 m, Marinduque: *Caryophyllia (A.) spinigera, Letepsammia formosissima* C89, *Stephanocyathus (A.) spiniger, Truncatoflabellum candeanum* C89.

Stn 5372. — 24.2.1909, 13°49'12"N, 121°36'09"E, 274 m, Marinduque: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens* C89 (not 5392), *Stephanocyathus (A.) spiniger.*

Stn 5373. — 2.3.1909, 13°40'00"N, 121°31'10"E, 619 m, 11.0°C, Marinduque: *Flabellum (U.) japonicum* C89, *Madrepora oculata.*

Stn 5374. — 2.3.1909, 13°46'45"N, 121°35'08"E, 348 m, Marinduque: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Deltocyathus magnificus, Flabellum (U.) deludens* C89.

Stn 5376. — 2.3.1909, 13°42'50"N, 121°51'30"E, 165 m, Marinduque: *Caryophyllia (A.) spinigera, Letepsammia formosissima* C89, *Truncatoflabellum candeanum* C89.

Stn 5378. — 4.3.1909, 13°17'45"N, 122°22'00"E, 723 m, 10.2°C, Marinduque: *Madrepora oculata.*

Stn 5380. — 4.3.1909, 13°02'45"N, 122°29'00"E, depth?, Marinduque: *Notocyathus venustus* C89, CSD (net lost).

Stn 5381. — 6.3.1909, 13°14'15"N, 122°44'45"E, 161 m, S Luzon, Gulf of Ragai: *Caryophyllia (A.) grayi, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Madracis asanoi, Madrepora oculata, Trochocyathus (T.) philippinensis*.

Stn 5387. — 11.3.1909, 12°54'40"N, 123°20'30"E, 382 m, 11.3°C, between Luzon and Burias: *Flabellum (U.) deludens* C89.

Stn 5391. — 13.3.1909, 12°13'15"N, 124°05'03"E, 216 m, between Masbate and Samar: *Balanophyllia cornu, Flabellum (F.) lamellulosum* C89, *Flabellum (F.) politum* C89, *Truncatoflabellum candeanum* C89.

Stn 5392. — 13.3.1909, 12°13'35"N, 124°02'48"E, 247 m, between Masbate and Samar: *Balanophyllia cornu, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) lamellulosum* C89, *Flabellum (F.) politum* C89.

Stn 5393. — 13.3.1909, 12°03'30"N, 124°03'36"E, 249 m, between Masbate and Samar: *Balanophyllia cornu, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) lamellulosum* C89, *Flabellum (F) politum* C89, *Truncatoflabellum candeanum* C89.

Stn 5398. — 15.3.1909, 11°35'12"N, 124°13'48"E, 209 m, between Masbate and Leyte: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Letepsammia formosissima* C89, *Madracis sp. A, Sympodangia albatrossi*.

Stn 5403. — 16.3.1909, 11°10'00"N, 124°17'15"E, 333 m, 13.2°C, between Cebu and Leyte: *Caryophyllia (A.) spinicarens, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Deltocyathus andamanicus, Flabellum (U.) deludens* C89, *Fungiacyathus (B.) variegatus* C89, *Madrepora oculata, Notocyathus conicus* C89.

Stn 5405. — 17.3.1909, 10°49'20"N, 124°24'23"E, 479 m, W Leyte: *Madrepora oculata.*

Stn 5406. — 17.3.1909, 10°49'03"N, 124°22'30"E, 545 m, W Leyte: *Madrepora oculata.*

Stn 5407. — 17.3.1909, 10°51'38"N, 124°20'54"E, 640 m, W Leyte: *Madrepora oculata.*

Stn 5408. — 18.3.1909, 10°40'15"N, 124°15'00"E, 291 m, 13.0°C, between Cebu and Leyte: *Caryophyllia (A.) spinicarens, Flabellum (U.) deludens* C89, *Madrepora oculata.*

Stn 5411. — 23.3.1909, 10°10'30"N, 123°51'15"E, 265 m, 12.9°C, between Cebu and Bohol: *Caryophyllia (A.) spinicarens, Flabellum (U.) deludens* C89, *Madrepora oculata.*

Stn 5412. — 23.3.1909, 10°09'15"N, 123°52'00"E, 296 m, 12.7°C, between Cebu and Bohol: *Caryophyllia (A.) spinicarens, Deltocyathus andamanicus, Flabellum (F.) magnificum* C89, *Flabellum (U.) deludens* C89.

Stn 5417. — 25.3.1909, 10°10'00"N, 123°53'15"E, 302 m, 12.4°C, between Cebu and Bohol: *Caryophyllia (A.) spinicarens, Deltocyathus andamanicus, Flabellum (U.) deludens* C89, *Madrepora oculata.*

Stn 5418. — 25.3.1909, 10°08'50"N, 123°52'30"E, 291 m, 12.4°C, between Cebu and Bohol: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Flabellum (U.) deludens* C89, *Madrepora oculata.*

Stn 5419. — 25.3.1909, 9°58'30"N, 123°46'00"E, 320 m, 12.5°C, between Cebu and Bohol: *Flabellum (U.) deludens* C89.

Stn 5423. — 31.3.1909, 9°38'30"N, 121°11'00"E, 930 m, 9.9°C, Sulu Sea, Cagayan Isl.: *Deltocyathus rotulus, Madrepora oculata, Ericiocyathus echinatus, Rhombopsammia squiresi* C89.

Stn 5424. — 31.3.1909, 9°37'50"N, 121°12'37"E, 622 m, 10.2°C, Sulu Sea, Cagayan Isl.: *Fungiacyathus (B.) turbinolioides, Madrepora oculata, Peponocyathus minimus, Rhombopsammia squiresi* C89.

Stn 5425. — 31.3.1909, 9°37'45"N, 121°11'00"E, 906 m, 9.7°C, Sulu Sea, Cagayan Isl.: *Deltocyathus rotulus, Fungiacyathus (F.) stephanus* C89, *Madrepora oculata, Ericiocyathus echinatus.*

Stn 5426. — 3.4.1909, 9°12'00"N, 118°28'00"E, 49 m, SE Palawan: *Stephanophyllia neglecta* C89.

Stn 5428. — 3.4.1909, 9°13'00"N, 118°51'15"E, 2022 m, 9.8°C, SE Palawan: *Enallopsammia rostrata, Flabellum (U.) ?conuis* C89, *Madrepora oculata.*

Stn 5429. — 5.4.1909, 9°41'30"N, 118°50'22"E, 1402 m, E Palawan: *Deltocyathus rotulus, Ericiocyathus echinatus, Rhombopsammia squiresi* C89 (not 5425).

Stn 5438. — 8.5.1909, 15°54'42"N, 119°44'42"E, 544 m, 7.9°C, W Luzon: *Deltocyathus rotulus.*

Stn 5439. — 9.5.1909, 15°58'15"N, 119°40'20"E, 1720 m, 2.6°C, W Luzon: *Deltocyathus rotulus.*

Stn 5440. — 10.5.1909, 16°33'52"N, 119°52'54"E, 315 m, 11.8°C, W Luzon: *Stephanocyathus (A.) spiniger.*

Stn 5444. — 3.6.1909, 12°43'51"N, 124°50'50"E, 564 m, 7.4°C, N Samar: *Caryophyllia (C.) scobinosa, Deltocyathus magnificus, Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn 5445. — 3.6.1909, 12°44'42"N, 124°59'50"E, 701 m, 6.8°C, N Samar: *Caryophyllia (C.) scobinosa, Deltocyathus rotulus, Fungiacyathus (F.) stephanus* C89, *Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn 5447. — 4.6.1909, 13°28'00"N, 123°46'18"E, 567 m, 7.4°C, SE Luzon: *Caryophyllia (C.) scobinosa, Deltocyathus rotulus, Stephanocyathus (S.) regius.*

Stn 5453. — 7.6.1909, 13°12'00"N, 123°49'18"E, 267 m, SE Luzon: *Flabellum (U.) deludens* C89.

Stn 5454. — 7.6.1909, 13°12'00"N, 123°50'30"E, 280 m, SE Luzon: *Flabellum (U.) deludens* C89.

Stn 5483. — 30.7.1909, 10°27'30"N, 125°19'15"E, 135 m, E Leyte: *Truncatoflabellum sp.* C89* (ex *T. formosum*).

Stn 5484. — 30.7.1909, 10°28'00"N, 125°20'00"E, 139 m, E Leyte: *Truncatoflabellum incrustatum* C89* (ex *T. formosum*).

Stn 5487. — 31.7.1909, 10°02'45"N, 125°05'33"E, 1340 m, 11.3°C, SE Leyte: *Ericiocyathus echinatus.*

Stn 5499. — 4.8.1909, 8°41'30"N, 124°35'40"E, 1014 m, 11.8°C, N Mindanao: *Enallopsammia rostrata.*

Stn 5505. — 5.8.1909, 8°37'15"N, 124°36'00"E, 403 m, N Mindanao: *Caryophyllia (A.) spinicarens, Deltocyathus philippinensis, Flabellum (F.) lamellulosum* C89, *Flabellum (U.) japonicum* C89.

Stn 5506. — 5.8.1909, 8°40'00"N, 124°31'45"E, 479 m, 11.8°C, N Mindanao: *Deltocyathus magnificus, Deltocyathus philippinensis, Flabellum (U.) deludens* C89, *Trochocyathus (A.) longispina, "Tropidocyathus" pileus* C89.

Stn 5508. — 5.8.1909, 8°17'24"N, 124°11'42"E, 494 m, 11.8°C, N Mindanao: *Caryophyllia (A.) spinicarens, Deltocyathus magnificus, Flabellum (U.) deludens* C89, *Gardineria philippinensis* C89, *"Tropidocyathus" pileus* C89.

Stn 5510. — 7.8.1909, 8°16'00"N, 124°03'50"E, 774 m, 11.7°C, N Mindanao: *Fungiacyathus (F.) stephanus* C89.

Stn 5512. — 7.8.1909, 8°16'02"N, 123°58'26"E, 814 m, 11.6°C, N Mindanao: *Ericiocyathus echinatus.*

Stn 5513. — 7.8.1909, 8°16'45"N, 124°02'48"E, 924 m, 11.6°C, N Mindanao: *Madrepora oculata, Notocyathus conicus* C89, *Ericiocyathus echinatus, Rhombopsammia squiresi* C89.

Stn 5516. — 9.8.1909, 8°46'00"N, 123°32'30"E, 320 m, 12.4°C, NW Mindanao: *Madrepora oculata.*

Stn 5519. — 9.8.1909, 8°47'00"N, 123°31'15"E, 333 m, 12.4°C, NW Mindanao: *Crispatotrochus rubescens.*

Stn 5523. — 10.8.1909, 8°48'44"N, 123°27'35"E, depth?, NW Mindanao: *Flabellum (F.) magnificum* C89, *Flabellum (U.) marenzelleri.*

Stn 5527. — 11.8.1909, 9°22'30"N, 123°42'40"E, 717 m, 11.8°C, between Bohol and Siquijor: *Caryophyllia (A.) spinicarens, Caryophyllia (C.) octonaria, Deltocyathus magnificus, Deltocyathus rotulus, Flabellum (F.) politum* C89, *Flabellum (U.) japonicum* C89, *Madrepora oculata, Truncatoflabellum paripavoninum* C89.

Stn 5528. — 11.8.1909, 9°24'45"N, 123°39'15"E, 803 m, 11.7°C, between Bohol and Siquijor: *Truncatoflabellum paripavoninum* C89.

Stn 5529. — 11.8.1909, 9°23'45"N, 123°39'30"E, 807 m, 11.7°C, between Bohol and Siquijor: *Madrepora oculata, Deltocyathus vaughani, Truncatoflabellum paripavoninum* C89.

Stn 5535. — 19.8.1909, 9°20'30"N, 123°23'45"E, 567 m, 11.8°C, between Negros and Siquijor: *Caryophyllia (A.) spinicarens, Flabellum (U.) japonicum* C89.

Stn 5536. — 19.8.1909, 9°15'45"N, 123°22'00"E, 511 m, 11.9°C, between Negros and Siquijor: *Caryophyllia (A.) spinicarens, Deltocyathus magnificus, Deltocyathus vaughani, Flabellum (U.) deludens* C89, *Flabellum (U.) japonicum* C89.

Stn 5537. — 19.8.1909, 9°11'00"N, 123°23'00"E, 465 m, 11.9°C, between Negros and Siquijor: *Caryophyllia (A.) spinicarens, Flabellum (U.) japonicum* C89, *Trochocyathus (A.) longispina.*

Stn 5538. — 19.8.1909, 9°08'15"N, 123°23'20"E, 468 m, 11.8°C, between Negros and Siquijor: *Caryophyllia (A.) spinicarens, Deltocyathus philippinensis, Flabellum (U.) japonicum* C89.

Stn 5541. — 20.8.1909, 8°49'38"N, 123°34'30"E, 401 m, 11.8°C, NW Mindanao: *Caryophyllia (A.) spinicarens, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Madrepora oculata, Stephanocyathus (A.) spiniger.*

Stn 5543. — 20.8.1909, 8°47'15"N, 123°35'00"E, 296 m, 12.5°C, NW Mindanao: *Balanophyllia generatrix, Coenosmilia arbuscula, Madrepora oculata.*

Stn 5545. — 15.9.1909, 6°04'45"N, 121°20'20"E, 209 m, 14.6°C, Jolo: *Stephanocyathus (A.) spiniger.*

Stn 5551. — 17.9.1909, 5°54'48"N, 120°44'24"E, 353 m, 11.8°C, Jolo: *Caryophyllia (C.) scobinosa, Conotrochus funicolumna.*

Stn 5554. — 18.9.1909, 5°52'27"N, 120°52'18"E, 46 m, Jolo: *Tubastraea micranthus.*

Stn 5564. — 20.9.1909, 5°50'00"N, 120°31'00"E, 432 m, 11.3°C, between Jolo and Tawitawi: *Caryophyllia (C.) scobinosa, Flabellum (U.) japonicum* C89.

Stn 5565. — 21.9.1909, 5°51'42"N, 120°30'30"E, 445 m, 11.3°C, between Jolo and Tawitawi: *Caryophyllia (A.) spinicarens, Caryophyllia (C.) scobinosa, Deltocyathoides orientalis.*

Stn 5567. — 21.9.1909, 5°48'00"N, 120°33'45"E, 490 m, 11.1°C, between Jolo and Tawitawi: *Caryophyllia (C.) secta, Conotrochus funicolumna, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Deltocyathus magnificus, Flabellum (U.) deludens* C89, *Notocyathus venustus* C89, *Trochocyathus (T.) gardineri, "Tropidocyathus" pileus* C89, *Truncatoflabellum angustum.*

Stn 5569. — 22.9.1909, 5°33'15"N, 120°15'30"E, 554 m, 11.3°C, N Tawitawi: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Notocyathus venustus* C89, *Stephanophyllia neglecta* C89.

Stn 5574. — 23.9.1909, 5°30'45"N, 120°07'57"E, 622 m, N Tawitawi: *Madrepora oculata.*

Stn 5576. — 23.9.1909, 5°25'56"N, 120°03'39"E, 507 m, 11.8°C, N Tawitawi: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Notocyathus venustus* C89, *Thrypticotrochus multilobatus* C89.

Stn 5577. — 23.9.1909, 5°20'36"N, 119°58'51"E, 439 m, 12.4°C, N Tawitawi: *Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Flabellum (F.) patens* C89, *Fungiacyathus (B.) paliferus* C89, *Peponocyathus folliculus* C89.

Stn 5579. — 25.9.1909, 4°54'15"N, 119°09'52"E, 320 m, 12.9°C, NE Borneo, Sabah: *Fungiacyathus (B.) paliferus* C89, *Notocyathus venustus, Peponocyathus minimus.*

Stn 5580. — 25.9.1909, 4°52'45"N, 119°06'45"E, 296 m, 13.2°C, NE Borneo, Sabah: *Javania insignis* C89, *Rhizotrochus typus* C89.

Stn 5582. — 26.9.1909, 4°19'54"N, 118°58'38"E, 1629 m, 3.5°C, NE Borneo, Sabah: *Deltocyathus rotulus, Fungiacyathus (F.) stephanus* C89, *Placotrochides scaphula* C89.

Stn 5584. — 27.9.1909, 4°17'40"N, 118°57'42"E, 534 m, 6.8°C, NE Borneo, Sabah: *Anthemiphyllia dentata, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Idiotrochus kikutii* C89, *Javania pachytheca, Madrepora arbuscula, Peponocyathus folliculus* C89.

Stn 5585. — 28.9.1909, 4°07'00"N, 118°49'54"E, 871 m, 5.1°C, NE Borneo, Sabah: *Aulocyathus recidivus, Deltocyathus rotulus, Flabellum (U.) messum* C89, *Leptopenus sp. A* C89, *Stephanocyathus (S.) regius.*

Stn 5586. — 28.9.1909, 4°06'50"N, 118°47'20"E, 635 m, 6.7°C, NE Borneo, Sabah: *Aulocyathus recidivus, Conotrochus funicolumna, Crispatotrochus rugosus, Deltocyathus rotulus, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Dendrophyllia alcocki, Flabellum (F.) magnificum* C89, *Fungiacyathus (B.) turbinolioides* C89, *Goniocorella dumosa, Idiotrochus kikutii* C89, *Lochmaeotrochus oculeus, Madrepora oculata, Notocyathus sp.* C89 (ex *N. conicus*), *Peponocyathus minimus, Placotrochides scaphula* C89, *Stephanocyathus (O.) weberianus, Stephanophyllia fungulus* C89, *Sympodangia albatrossi, Truncatoflabellum paripavoninum* C89.

Stn 5587. — 28.9.1909, 4°10'35"N, 118°37'12"E, 759 m, 6.7°C, NE Borneo, Sabah: *Fungiacyathus (F.) stephanus* C89, *Stephanocyathus (O.) weberianus.*

Stn 5589. — 29.9.1909, 4°12'10"N, 118°38'08"E, 366 m, 7.6°C, NE Borneo, Sabah: *Caryophyllia (C.) grandis, Flabellum (U.) messum* C89, *Fungiacyathus (B.) granulosus* C89, *Paraconotrochus zeidleri, Placotrochides scaphula* C89, *Stephanocyathus (A.) explanans, Truncatoflabellum paripavoninum* C89.

Stn 5590. — 29.9.1909, 4°10'50"N, 118°39'35"E, 567 m, 6.8°C, NE Borneo, Sabah: *Caryophyllia (C.) grandis, Flabellum (F.) magnificum* C89, *Fungiacyathus (B.) granulosus* C89, *Paraconotrochus zeidleri, Truncatoflabellum paripavoninum* C89.

Stn 5591. — 29.9.1909, 4°11'48"N, 118°38'20"E, 476 m, NE Borneo, Sabah: *Deltocyathus rotulus, Flabellum (U.) messum* C89, *Placotrochides scaphula* C89.

Stn 5592. — 29.9.1909, 4°12'44"N, 118°27'44"E, 558 m, 6.3°C, NE Borneo, Sabah: *Caryophyllia (C.) grandis, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Fungiacyathus (B.) granulosus* C89, *Lochmaeotrochus oculeus, Paraconotrochus zeidleri, Trochocyathus (A.) longispina, Truncatoflabellum aculeatum.*

Stn 5593. — 29.9.1909, 4°02'40"N, 118°11'20"E, 70 m, NE Borneo, Sabah: *Caryophyllia (A.) grayi, Endopachys grayi, Rhizotrochus typus* C89, *Truncatoflabellum candeanum* C89.

Stn 5601. — 13.11.1909, 1°13'10"N, 125°17'05"E, 1400 m, NE Celebes, Moluccan Sea: *Deltocyathus rotulus, Stephanocyathus (O.) weberianus.*

Stn 5605. — 16.11.1909, 0°21'33"N, 121°34'10"E, 1184 m, Celebes, Gulf of Tomini: *Fungiacyathus (F.) stephanus* C89.

Stn 5606. — 17.11.1909, 0°16'28"N, 121°33'30"E, 1526 m, Celebes, Gulf of Tomini: *Caryophyllia (C.) cornulum.*

Stn 5618. — 27.11.1909, 0°37'00"N, 127°15'00"E, 763 m, Molucca Passage: *Fungiacyathus (B.) sibogae* C89, *Fungiacyathus (F.) stephanus* C89.

Stn 5619. — 27.11.1909, 0°35'00"N, 127°14'40"E, 796 m, Molucca Passage. *Fungiacyathus (B.) sibogae* C89, *Fungiacyathus (F.) stephanus* C89.

Stn 5622. — 29.11.1909, 0°19'20"N, 127°28'30"E, 503 m, Makian: *Caryophyllia (A.) spinicarens.*

Stn 5625. — 29.11.1909, 0°07'00"N, 127°28'00"E, 421 m, Kayoa: *Caryophyllia (A.) spinicarens, Madrepora oculata.*

Stn 5626. — 29.11.1909, 0°07'30"N, 127°29'00"E, 485 m, Kayoa: *Caryophyllia (A.) spinicarens.*

Stn 5630. — 2.12.1909, 0°56'30"S, 128°05'00"E, 1041 m, S Patiente Strait, Doworra: *Fungiacyathus (F.) stephanus* C89.

Stn 5634. — 3.12.1909, 1°54'00"S, 127°36'00"E, 602 m, Pitt Passage, Gomomo: *Caryophyllia (C.) diomedeae, Javania pachytheca.*

Stn 5636. — 3.12.1909, 1°55'00"S, 127°42'30"E, 2309 m, Pitt Passage, Gomomo: *Caryophyllia (C.) diomedeae.*

Stn 5645. — 16.12.1909, 5°29'06"S, 122°36'06"E, 377 m, Butung Strait: *Madrepora oculata.*

Stn 5647. — 16.12.1909, 5°34'00"S, 122°18'15"E, 950 m, Butung Strait: *Flabellum (U.) messum* C89.

Stn 5648. — 16.12.1909, 5°35'00"S, 122°20'00"E, 1023 m, 4.0°C, Butung Strait: *Fungiacyathus (B.) sibogae* C89, *Fungiacyathus (F.) stephanus* C89, *Deltocyathus rotulus, Stephanocyathus (O.) weberianus, Truncatoflabellum paripavoninum* C89.

Stn 5650. — 17.12.1909, 4°53'45"S, 121°29'00"E, 988 m, 4.5°C, S Celebes, Gulf of Boni: *Caryophyllia (C.) scobinosa, Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn 5656. — 19.12.1909, 3°17'40"S, 120°36'45"E, 886 m, 5.1°C, S Celebes, Gulf of Boni: *Caryophyllia (C.) diomedeae, Truncatoflabellum paripavoninum* C89.

Stn 5658. — 19.12.1909, 3°32'40"S, 120°31'30"E, 933 m, 5.1°C, S Celebes, Gulf of Boni: *Truncatoflabellum formosum* C89, *Truncatoflabellum paripavoninum* C89.

Stn 5668. — 29.12.1909, 2°28'15"S, 118°49'00"E, 1649 m, 3.4°C, Macassar Strait: *Deltocyathus rotulus, Fungiacyathus (F.) stephanus* C89.

Stn 5670. — 30.12.1909, 1°19'00"S, 118°43'00"E, 2161 m, 3.4°C, Macassar Strait: *Caryophyllia (C.) cornulum, Fungiacyathus (F.) stephanus* C89, *Stephanocyathus (S.) regius.*

Stn 5671. — 30.12.1909, 1°05'00"S, 118°56'00"E, 1647 m, 3.4°C, Macassar Strait: *Stephanocyathus (O.) weberianus.*

"Alpha Helix"

Stn 1769. — date?, 4°32'S, 129°52'E, 25 m, Banda: *Tubastraea micranthus.*

Stn 79-M21. — 7.6.1979, 8°45.0'S, 144°05.8'E, 55 m, Gulf of Papua: *Paracyathus rotundatus.*

Stn 79-M26. — 10.6.1979, 9°29.7'S, 147°06.6'E, 1 m, Papua-New Guinea, Port Moresby: *Endopsammia philippensis.*

Stn 79-M48. — 18.6.1979, 6°41.7'S 147°53.1'E, 0-8 m, Papua-New Guinea, Cape Cretin: *Endopsammia philippensis.*

Stn 79-M59. — 21.6.1979, 3°23.8'S, 143°40.7'E, 1-6 m, Papua-New Guinea, Schouten Isl.: *Endopsammia philippensis.*

Stn 79-M122. — 15.7.1979, 1°40.9'N, 127°32.2'E, 0-3 m, NW Halmahera: *Tubastraea micranthus.*

Stn 79-M140. — 23.7.1979, 9°36.5'N, 123°53'E, 14-20 m, SW Bohol: *Culicia stellata.*

"Challenger"

Stn 174. — 3.8.1874, Fiji, Kandavu, 384 m: *Caryophyllia (A.) dentata.*

Stn 190. — 12.9.1874, 8°56'S, 136°05'E, 90 m, Arafura Sea: *Paracyathus* sp.

Stn 192. — 26.9.1874, 5°42'S, 132°25'E, 236 m, Kai Isl.: *Balanophyllia cornu, Balanophyllia rediviva, Caryophyllia (C.) transversalis.*

Stn 194. — 29.9.1874, 4°33'S, 129°58'E, 366 m or 659 m, Banda: *Madrepora arbuscula.*
Stn 201. — 26.10.1874, Philippines, Basilan Strait, 187 m: *Balanophyllia gemma, Balanophyllia parvula.*
Stn 219. — 10.3.1874, 1°50'S, 146°42'E, 274 m, Admiralty Isl.: *Paraconotrochus zeidleri.*

CORINDON 2, *"CORIOLIS"*

Stn 208. — 31.10.1980, 0°14.6'S, 117°52.0'E, 150 m, W Makassar Strait: *Caryophyllia (A.) grayi.*
Stn 210. — 31.10.1980, 0°12.6'S, 117°53.5'E, 338 m, W Makassar Stait: *Fungiacyathus (F.) paliferus, Peponocyathus minimus.*
Stn 216. — 1.11.1980, 0°40.1'N(!), 117°51.4'E, 96 m, W Makassar Strait: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Flabellum (F.) pavoninum, Truncatoflabellum formosum.*
Stn 220. — 2.11.1980, 0°13.6'S, 118°12.3'E, 2350 m, W Makassar Strait: *Caryophyllia (C.) cornulum.*
Stn 235. — 4.11.1980, 0°04.7'S, 119°48.4'E, 1110 m, E Makassar Strait: *Madrepora minutiseptum* CSD, *Notocyathus conicus* C89, *Peponocyathus minimus.*
Stn 240. — 5.11.1980, 0°37.6'S, 119°33.5'E, 675 m, E Makassar Strait: *Caryophyllia (C.) ambrosia ambrosia, Caryophyllia (C.) scobinosa, Rhombopsammia squiresi.*
Stn 241. — 6.11.1980, 0°57.7'S, 119°15.3'E, 1525-1550 m, E Makassar Strait: *Caryophyllia (C.) cornulum, Deltocyathus rotulus, Stephanocyathus (S.) regius.*
Stn 248. — 6.11.1980, 0°54.2'S, 119°28.7'E, 170 m, E Makassar Strait: *Balanophyllia imperialis, Balanophyllia rediviva, Caryophyllia (C.) hawaiiensis, Cyathohelia axillaris, Deltocyathoides orientalis, Javania insignis, Madracis sp. A, Madrepora minutiseptum, Neohelia cf. porcellana, Rhizosmilia sagamiensis, Thalamophyllia tenuescens, Trochocyathus (T.) philippinensis, Truncatoflabellum pusillum.*
Stn 251. — 6.11.1980, 0°53.7'S, 119°29.6'E, 65 m, E Makassar Strait: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Trochocyathus (T.) semperi.*
Stn 260. — 6.11.1980, 1°56.9'S, 119°17.6'E, 15-50 m, E Makassar Strait: *Truncatoflabellum aculeatum.*
Stn 261. — 6.11.1980, 1°56.8'S, 119°16.8'E, 60 m, E Makassar Strait: *Asterosmilia marchadi, Caryophyllia (A.) grayi.*
Stn 263. — 6.11.1980, 1°56.8'S, 119°16.7'E, 80 m, E Makassar Strait: *Asterosmilia marchadi.*
Stn 266. — 7.11.1980, 1°56.6'S, 119°15.8'E, 95 m, E Makassar Strait: *Asterosmilia marchadi, Balanophyllia desmophyllioides.*
Stn 275. — 7.11.1980, 1°53.9'S, 119°13.7'E, 530 m, E Makassar Strait: *Fungiacyathus (F.) paliferus.*
Stn 286. — 9.11.1980, 2°04.4'S, 118°46.9'E, 1710-1730 m, E Makassar Strait: *Caryophyllia (C.) cornulum, Deltocyathus rotulus, Fungiacyathus (F.) stephanus.*
Stn 292. — 10.11.1980, 2°37.2'S, 117°53.0'E, 46 m, Central Makassar Strait: *Balanophyllia carinata, Truncatoflabellum aculeatum.*

DANISH EXPEDITION TO THE KEI ISLANDS (= DEKI)

Stn unnumbered. — 22.2.1922, Bay of Amboina, 91 m: *Neohelia cf. porcellana.*
Stn unnumbered. — 3.3.1922, Bay of Amboina, 91 m: *Endocyathopora laticostata.*
Stn unnumbered. — 3.6.1922, Banda, Komkir, 75-90 m: *Balanophyllia carinata.*
Stn unnumbered. — 3.6.1922, Banda, Waling Bezar, 30 m: *Incertae sedis.*
Stn unnumbered. — Between Neira and Lontor, Banda Isl., 70-90 m: *Caryophyllia (A.) dentata.*
Stn 1. — 30.3.1922, 5°34'S, 132°50'E, 370 m, Kai Isl.: *Enallopsammia pusilla.*
Stn 2. — 31.3.1922, 5°32'S, 132°27'E, 180-222 m, Kai Isl.: *Caryophyllia (A.) dentata, Fungiacyathus (F.) paliferus, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*
Stn 3. — 31.3.1922, 5°32'S, 132°36'E, 245 m, Kai Isl.: *Caryophyllia (A.) dentata, Caryophyllia (C.) crosnieri, Caryophyllia (C.) rugosa, Caryophyllia (C.) transversalis, Conotrochus brunneus, Crispatotrochus rubescens, Deltocyathus magnificus, Dendrophyllia arbuscula, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (F.) politum, Fungiacyathus (F.) paliferus, Letepsammia formosissima, Rhombopsammia niphada, Stephanocyathus (A.) spiniger, Truncatoflabellum pusillum.*
Stn 4. — 3.4.1922, 5°31'40"S, 132°26'E, 250 m, Kai Isl.: *Caryophyllia (A.) grayi, Conotrochus brunneus, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Tubastraea micranthus* CSD.

Stn 5. — 4.4.1922, 5°31'30"S, 132°38'E, 90-250 m, Kai Isl.: *Conotrochus brunneus, Fungiacyathus (F.) paliferus, Rhizotrochus typus, Stephanocyathus (A.) spiniger.*

Stn 6. — 4.4.1922, 5°32'S, 132°36'30"E, 210 m, Kai Isl.: *Asterosmilia marchadi, Caryophyllia (A.) dentata, Caryophyllia (A.) grayi, Caryophyllia (C.) transversalis, Conotrochus brunneus, Deltocyathoides orientalis, Deltocyathus magnificus, Deltocyathus rotulus, Fungiacyathus (F.) paliferus, Notocyathus conicus, Stephanophyllia complicata, Stephanophyllia fungulus, Trochocyathus (T.) philippinensis, Trochocyathus (T.) semperi, Stephanocyathus (A.) spiniger.*

Stn 7. — 5.4.1922, 5°38'30"S, 132°26'E, 196 m, Kai Isl.: *Balanophyllia cornu, Balanophyllia crassiseptum, Deltocyathoides orientalis, Dendrophyllia arbuscula, Trochocyathus (T.) caryophylloides.*

Stn 8. — 5.4.1922, 5°39'S, 132°26'E, 300 m, Kai Isl.: *Trochocyathus (T.) rhombocolumna.*

Stn 10. — 6.4.1922, off Doelah, 50 m, Kai Isl.: *Asterosmilia marchadi, Balanophyllia carinata, Balanophyllia stimpsonii, Peponocyathus folliculus, Placotrochus laevis, Trochocyathus (T.) burchae, Trochocyathus (T.) apertus, Tubastraea micranthus.*

Stn 12. — 9.4.1922, 5°30'S, 132°35'E, 325 m, Kai Isl.: *Balanophyllia generatrix, Caryophyllia (C.) crosnieri, Deltocyathus magnificus, Enallopsammia pusilla, Flabellum magnificum, Trochocyathus (A.) brevispina.*

Stn 13. — 9.4.1922, 5°31'S, 132°36'30"E, 275 m, Kai Isl.: *Trochocyathus (A.) brevispina.*

Stn 14. — 10.4.1922, S of Doe Roa, 40 m, Kai Isl.: *Balanophyllia carinata, Balanophyllia stimpsonii, Truncatoflabellum aculeatum.*

Stn 15. — 10.4.1922, S of Doe Roa, ca. 5-20 m, Kai Isl.: *Trochocyathus (T.) cooperi.*

Stn 17. — 12.4.1922, 5°34'40"S, 132°35'E, 100 m, Kai Isl.: *Trochocyathus (T.) cooperi.*

Stn 18. — Doe Roa Strait, 40 m, Kai Isl.: *Balanophyllia carinata, Balanophyllia stimpsonii, Placotrochus laevis.*

Stn 20. — 14.4.1922, Doe Roa Bassin, 50 m, Kai Isl.: *Balanophyllia carinata.*

Stn 22. — 15.4.1922, 5°30'40"S, 132°51'E, 340 m, Kai Isl.: *Madrepora oculata, Stephanocyathus (A.) spiniger.*

Stn 24. — 15.4.1922, 5°37'S, 132°56'E, 100 m, Kai Isl.: *Balanophyllia carinata, Caryophyllia (C.) lamellifera, Cyathelia axillaris, Deltocyathoides orientalis, Dendrophyllia arbuscula, Fungiacyathus (B.) variegatus, Fungiacyathus (F.) paliferus, Javania insignis, Madracis cf. pharensis, Notocyathus venustus, Phyllangia papuensis, Rhizotrochus typus, Trochocyathus (T.) cooperi, Trochocyathus (T.) philippinensis.*

Stn 25. — 16.4.1922, 5°34'20"S, 132°55'E, 85 m, Kai Isl.: *Caryophyllia (A.) grayi, Caryophyllia (C.) hawaiiensis, Rhizotrochus typus.*

Stn 26. — 16.4.1922, 5°38'S, 132°55'20"E, 90 m, Kai Isl.: *Deltocyathoides orientalis, Rhizotrochus typus.*

Stn 27. — 17.4.1922, 2 miles N of Elat, 60-70 m, Kai Isl.: *Rhizosmilia elata, Rhizotrochus typus.*

Stn 30. — 18.4.1922, between Doe Roa and Kai Doelah, 40 m, Kai Isl.: *Balanophyllia stimpsonii.*

Stn 31. — 18.4.1922, Doe Roa Bassin, 50 m, Kai Isl.: *Balanophyllia carinata.*

Stn 32. — 22.4.1922, 5°32'20"S, 132°34'E, 260 m, Kai Isl.: *Caryophyllia (C.) transversalis.*

Stn 33. — 22.4.1922, 5°31'S, 132°34'E, 285 m, Kai Isl.: *Madrepora oculata.*

Stn 35. — 23.4.1922, Bay N of Noehoe Roa, 32 m, Kai Isl.: *Asterosmilia marchadi.*

Stn 38. — 24.4.1922, NE of Doe Roa, 35 m, Kai Isl.: *Balanophyllia carinata.*

Stn 41. — 25.4.1922, 5°28'40"S, 132°28'E, 245 m, Kai Isl.: *Caryophyllia (C.) transversalis, Deltocyathus magnificus, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Trochocyathus (A.) brevispina.*

Stn 42. — 26.4.1922, 5°35'S, 132°29'E, 225 m, Kai Isl.: *Caryophyllia (A.) spinigera, Caryophyllia (C.) transversalis, Conotrochus brunneus, Flabellum (F.) magnificum, Fungiacyathus (F.) paliferus, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 44. — 30.4.1922, 5°39'S, 132°23'E, 268 m, Kai Isl.: *Alatotrochus rubescens, Caryophyllia (A.) grayi, Caryophyllia (C.) transversalis, Conotrochus funicolumna, Deltocyathoides orientalis, Deltocyathus magnificus, Deltocyathus suluensis, Letepsammia formosissima, Notocyathus venustus, Placotrochides laevis, Trochocyathus (T.) philippinensis.*

Stn 45. — 1.5.1922, 5°48'30"S, 132°14'E, 270 m, Kai Isl.: *Madrepora oculata.*

Stn 46. — 2.5.1922, 5°47'20"S, 132°13'E, 300 m, Kai Isl.: *Balanophyllia gemma, Balanophyllia parvula, Caryophyllia (C.) quadragenaria, Caryophyllia (C.) transversalis, Conotrochus brunneus, Deltocyathoides orientalis, Deltocyathus magnificus, Flabellum (U.) deludens, Idiotrochus kikutii, Letepsammia formosissima, Thrypticotrochus multilobatus, Truncatoflabellum pusillum.*

Stn 48. — 3.5.1922, 5°40'10"S, 130°21'E, 263 m, Kai Isl.: *Balanophyllia cornu, Bourneotrochus stellulatus, Caryophyllia (A.) dentata, Caryophyllia (C.) transversalis, Conotrochus brunneus, Crispatotrochus rubescens, Fungiacyathus (B.) variegatus, Rhizotrochus flabelliformis.*

Stn 49. — 3.5.1922, 5°37'10"S, 132°23'E, 245 m, Kai Isl.: *Alatotrochus rubescens, Balanophyllia cornu, Caryophyllia (A.) grayi, Deltocyathoides orientalis, Endopachys grayi, Flabellum (U.) deludens, Fungiacyathus (F.) paliferus, Fungiacyathus (F.) stephanus, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Stephanophyllia fungulus, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii, "Tropidocyathus" pileus.*

Stn 50. — 4.5.1922, 5°34'S, 132°25'40"E, 233 m, Kai Isl.: *Balanophyllia gigas, Caryophyllia (C.) transversalis, Flabellum (F.) lamellulosum, Fungiacyathus (B.) sibogae, Fungiacyathus (B.) variegatus, Madrepora oculata, Notocyathus venustus, Stephanocyathus (A.) spiniger, Stephanophyllia complicata, Stephanophyllia neglecta.*

Stn 51. — 7.5.1922, 5°46'30"S, 132°51'E, 348 m, Kai Isl.: *Deltocyathus magnificus, Deltocyathus suluensis.*

Stn 52. — 7.5.1922, 5°46'S, 132°49'35"E, 352 m, Kai Isl.: *Conotrochus funicolumna, Deltocyathus suluensis, Flabellum (F.) lamellulosum, Flabellum (U.) marenzelleri, Lochmaeotrochus oculeus, Madrepora oculata, Paraconotrochus zeidleri, Stephanocyathus (A.) spiniger, Stephanophyllia complicata, Stephanophyllia fungulus, "Tropidocyathus" labidus.*

Stn 53. — 9.5.1922, 5°36'S, 132°55'E, 85 m, Kai Isl.: *Caryophyllia (A.) grayi, Caryophyllia (C.) hawaiiiensis, Deltocyathoides orientalis, Flabellum (F.) politum, Rhizotrochus typus, Trochocyathus (T.) cooperi, Trochocyathus (T.) semperi, Tropidocyathus lessonii, Truncatoflabellum pusillum.*

Stn 54. — 9.5.1922, 5°34'S, 132°55'E, 85 m, Kai Isl.: *Flabellum (F.) politum, Rhizotrochus typus, Thalamophyllia tenuescens, Truncatoflabellum candeanum.*

Stn 56. — 10.5.1922, 5°30'20"S, 132°51'E, 345 m, Kai Isl.: *Flabellum (U.) hoffmeisteri, Lochmaeotrochus oculeus, Rhizotrochus flabelliformis.*

Stn 57. — 10.5.1922, 5°32'S, 132°49'25"E, ca. 200 m, Kai Isl.: *"Cryptotrochus" venustus, Deltocyathus suluensis, Fungiacyathus (B.) sibogae.*

Stn 58. — 12.5.1922, 5°29'S, 132°37'E, 290 m, Kai Isl.: *Balanophyllia generatrix, "Cryptotrochus" venustus, Conotrochus brunneus, Deltocyathus rotulus, Deltocyathus suluensis, Fungiacyathus (F.) paliferus, Letepsammia formosissima, Madrepora oculata, Truncatoflabellum candeanum.*

Stn 59. — 12.5.1922, 5°28'S, 132°36'E, 385 m, Kai Isl.: *Balanophyllia gemma, Caryophyllia (C.) quadragenaria, Crispatotrochus rubescens, Confluphyllia juncta, Deltocyathus andamanicus, Enallopsammia pusilla, Madrepora oculata, Polymyces wellsi, Rhizotrochus flabelliformis, Trochocyathus (T.) rhombocolumna.*

Stn 60. — 14.5.1922, S of Doe Roa, 25 m, Kai Isl.: *Truncatoflabellum aculeatum.*

Stn 61. — 14.5.1922, between Doe Roa and Kai Doelah, 50 m, Kai Isl.: *Enallopsammia pusilla.*

Stn 62. — 15.5.1922, 5°29'25"S, 132°50'E, 290 m, Kai Isl.: *Caryophyllia (A.) spinicarens, Caryophyllia (C.) transversalis, Deltocyathus suluensis, Deltocyathus vaughani, Notocyathus venustus.*

Stn 63. — 16.5.1922, 5°32'S, 132°36'25"E, ca. 250 m, Kai Isl.: *Balanophyllia crassiseptum, Caryophyllia (A.) dentata, Caryophyllia (C.) transversalis, Conotrochus brunneus, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Fungiacyathus (B.) variegatus, Fungiacyathus (F.) paliferus, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Truncatoflabellum pusillum.*

Stn 64. — 26.7.1922, 5°51'S, 106°22'E, 35 m, Java Sea: *Balanophyllia carinata, Balanophyllia stimpsonii, Placotrochus laevis.*

Stn 65. — 27.7.1922, 5°52'05"S, 106°17'E, 25 m, Java Sea: *Placotrochus laevis.*

Stn 66. — 27.7.1922, 5°54'S, 106°12'E, 24 m, Java Sea: *Placotrochus laevis.*

Stn 67. — 27.7.1922, 5°48'S, 106°12'E, 38 m, Java Sea: *Placotrochus laevis, Truncatoflabellum spheniscus.*

Stn 68. — 27.7.1922, 5°47'S, 106°14'E, 55 m, Java Sea: *Balanophyllia stimpsonii, Paracyathus rotundatus.*

Stn 69. — 27.7.1922, 5°47'S, 106°17'E, 50 m, Java Sea: *Placotrochus laevis.*

Stn 70. — 28.7.1922, 5°40'S, 106°21'E, 35m, Java Sea: *Balanophyllia carinata.*

Stn 71. — 28.7.1922, 5°40'S, 106°08'E, 54 m, Java Sea: *Paracyathus rotundatus, Truncatoflabellum spheniscus.*

Stn 73. — 28.7.1922, 5°57'S, 105°57'E, 30 m, Sunda Strait: *Eguchipsammia gaditana.*

Stn 74. — 29.7.1922, 6°03'S, 105°54'E, 30 m, Sunda Strait: *Rhizopsammia nuda, Truncatoflabellum spheniscus.*

Stn 82. — 30.7.1922, 6°38'S, 105°21'E, 35 m, Sunda Strait: *Balanophyllia carinata, Balanophyllia stimpsonii, Paracyathus rotundatus, Trochocyathus (T.) burchae, Truncatoflabellum aculeatum.*

Stn 84. — 31.7.1922, 5°55'S, 105°31'E, 38 m, Sunda Strait: *Balanophyllia carinata, Balanophyllia stimpsonii, Truncatoflabellum aculeatum.*

Stn 89. — 31.7.1922, 5°55'S, 105°31'E, 38 m, Sunda Strait: *Placotrochus laevis, Truncatoflabellum aculeatum.*

Stn 90. — 1.8.1922, 5°55'S, 105°30'E, 36 m, Sunda Strait: *Trochocyathus (T.) cooperi, Truncatoflabellum aculeatum, Truncatoflabellum spheniscus.*

Stn 91. — 1.8.1922, 5°53'S, 105°27'E, 42 m, Sunda Strait: *Placotrochus laevis.*

Stn 92. — 1.8.1922, 5°49'S, 105°29'E, 32 m, Sunda Strait: *Truncatoflabellum aculeatum.*

Stn 95. — 1.8.1922, 5°44'S, 105°20'E, 25 m, Sunda Strait: *Trochocyathus (T.) cooperi.*

Stn 100. — 3.8.1922, 5°49'S, 105°25'E, 54 m, Sunda Strait: *Balanophyllia stimpsonii.*

Stn 103. — 4.8.1922, 5°52'S, 106°05'E, 52 m, Sunda Strait: *Trochocyathus (T.) cooperi, Truncatoflabellum spheniscus.*

Stn 104. — 4.8.1922, 5°52'S, 105°04'E, 38 m, Java Sea: *Cyathelia axillaris, Rhizopsammia nuda.*

Stn 105. — 5.8.1922, 5°56'S, 106°07'E, 13 m, Java Sea: *Cyathelia axillaris.*

Stn 106. — 5.8.1922, 5°50'S, 106°16'E, 32 m, Java Sea: *Truncatoflabellum spheniscus.*

Stn 110. — 5.8.1922, 5°25'S, 105°53'E, 12 m, Java Sea: *Placotrochus laevis.*

Stn 116. — 7.8.1922, 5°57'S, 106°34'E, 22 m, Java Sea: *Placotrochus laevis.*

ESTASE 2, *"JEAN CHARCOT"*

Stn 42/CP6. — 5.12.1984, 4°38.00'N, 119°49.00'E, 2570 m, S Sibutu: *Flabellum (U.) conuis.*

"GALATHEA"

Stn 330. — 15.5.1951, 4 miles SE Singapore, 40 m: *Truncatoflabellum spheniscus.*

Stn 423. — 25.7.1951, 10°27'N, 124°18'E, 750 m, E Cebu: *Caryophyllia (A.) spinicarens.*

Stn 436. — 9.8.1951. — 10°12'N, 124°14'E, 710 m, E Cebu: *Caryophyllia (A.) spinicarens, Deltocyathus magnificus, Flabellum (U.) japonicum, Madrepora oculata.*

Stn 443. — 16.8.1951, 8°48'N, 124°09'E, 1500 m, N Mindanao: *Madrepora oculata.*

Stn 476. — 11.9.1951, 9°04'S, 114°43'E, 1555 m, S Bali: *Deltocyathus rotulus.*

Stn 477. — 9°01'N, 114°48'E, 780 m, S Bali: *Peponocyathus minimus.*

Stn 480. — 19.9.1951, 8°49'S, 115°00'E, 440 m, S Bali: *Fungiacyathus (F.) variegatus.*

Stn 485. — 12.9.1951, 8°48'S, 115°16'E, 62 m, S Bali: *Blastotrochus nutrix.*

Stn 488. — 12.9.1951, 8°49'S, 115°19'E, 202 m, S Bali: *Balanophyllia desmophyllioides.*

Stn 489. — 13.9.1951, 7°38'S, 116°08'E, 1160 m, N Lombok: *Flabellum (U.) conuis.*

Stn 490. — 14.9.1951, 5°25'S, 117°03'E, 570-545 m, SW Sulawesi: *Cryptotrochus javanus* (see CAIRNS, 1988), *Fungiacyathus (B.) turbinolioides, Madrepora oculata, Premocyathus dentiformis.*

Stn 500. — 25.9.1951, 7°34'N, 132°44'E, 390 m, Arafura Sea, E Tanimbar Isl.: *Balanophyllia cornu, Conotrochus funicolumna, Deltocyathoides orientalis, Paraconotrochus zeidleri, Deltocyathus suluensis, Rhizotrochus flabelliformis, "Tropidocyathus" labidus.*

Stn 501. — 27.9.1851, 10°43'S, 139°17'E, 54 m, Arafura Sea: *Truncatoflabellum spheniscus.*

"GAZELLE"

Stn 37. — 25.8.1875, 6°29.5'S, 154°45'E, 88 m, Bougainville Isl.: *Phyllangia papuensis.*

"HAKUHO MARU"

Stn KH72-1-8. — 25.5.1972, 8°44.6'N, 119°05.4'E, 2030 m, Sulu Sea: *Flabellum (U.) conuis.*

Stn KH72-1-20. — 10.6.1972, 5°40.9'N, 119°46.3'E, 460-514 m, Sulu Sea, Sibutu Passage: *Alatotrochus rubescens, Anthemiphyllia dentata, Conotrochus brunneus, Conotrochus funicolumna, Deltocyathoides orientalis, Deltocyathus magnificus, Enallopsammia pusilla, Fungiacyathus (F.) turbinolioides, Madrepora oculata, Notocyathus conicus, Stephanophyllia fungulus, "Tropidocyathus" pileus.*

Stn KH72-1-26. — 18-19.6.1972, 9°27.0'S, 127°58.6'E, 610-690 m, SE Timor: *Caryophyllia (C.) ambrosia ambrosia, Fungiacyathus (F.) stephanus, Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn KH72-1-28. — 19.6.1972, 9°34.4'S, 128°06.0'E, 295-296 m, SE Timor: *Balanophyllia cornu, Conotrochus funicolumna, Deltocyathus magnificus, Flabellum (F.) lamellulosum, Flabellum (F.) patens, Flabellum (U.) marenzelleri, Madrepora oculata, Letepsammia formosissima.*

Stn KH72-1-29. — ?.6.1972, 12°17.3'S, 129°40.9'E, 49-52 m, NW Australia, Beagle Gulf: *Truncatoflabellum aculeatum, Truncatoflabellum spheniscus.*

Stn KH72-1-30. — 25.6.1972, 12°24.8'S, 128°00.1'E, 115 m, NW Australia, Beagle Gulf: *Balanophyllia imperialis, Truncatoflabellum aculeatum, Truncatoflabellum spheniscus.*

Stn KH72-1-50. — 10-11.7.1972, 6°51.6'N, 108°47.2'S, 132-137 m, South China Sea: *Caryophyllia (A.) grayi, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn KH72-1-52. — 11.7.1972, 7°26.3'N, 109°14.9'E, 265-286 m, South China Sea: *Caryophyllia (A.) spinicarens, Conotrochus brunneus, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Madrepora oculata.*

Stn KH73-2-44-2. — 18.3.1973, 21°42.1'N, 117°36.8'E, 412-430 m, South China Sea: *Crispatotrochus rubescens, Dendrophyllia alcocki, Desmophyllum dianthus, Enallopsammia pusilla, Goniocorella dumosa, Lochmaeotrochus oculeus, Madrepora oculata.*

Stn KH85-1-A1. — 12.2.1985, 5°47.3'S, 119°35.4'E, 250-285 m, S Celebes: *Flabellum (U.) marenzelleri.*

Stn KH85-1-A2. — 12.2.1985, 5°47.1'S, 119°35.5'E, 250-285 m, S Celebes: *Balanophyllia cornu, Balanophyllia desmophyllioides, Conotrochus brunneus, Flabellum (U.) marenzelleri.*

KARUBAR, *"BARUNA JAYA 1"*

Stn 1. — 22.10.1991, 5°46'45"S, 132°11'10"E, 156-305 m, Kai Isl.: *Anthemiphyllia dentata, Caryophyllia (C.) hawaiiensis, Conotrochus brunneus, Deltocyathus stella, Flabellum (F.) pavoninum, Letepsammia superstes, Stephanophyllia neglecta, Tropidocyathus lessonii, Truncatoflabellum formosum, Truncatoflabellum mortenseni.*

Stn 2. — 22.10.1991, 5°47'00"S, 132°11'35"E, 209-300 m, Kai Isl.: *Alatocyathus rubescens, Anthemiphyllia frustum, Caryophyllia (C.) quadragenaria, Caryophyllia (C.) transversalis, Conotrochus brunneus, "Cryptotrochus" venustus, Deltocyathoides orientalis, Deltocyathus rotulus, Deltocyathus stella, Deltocyathus suluensis, Endopachys grayi, Flabellum (F.) politum, Flabellum (U.) marenzelleri, Guynia annulata, Idiotrochus kikutii, Letepsammia formosissima, Notocyathus conicus, Notocyathus venustus, Peponocyathus minimus, Stephanophyllia complicata, Thrypticotrochus multilobatus, Trochocyathus (A.) brevispina, Trochocyathus (T.) discus, Trochocyathus (T.) philippinensis, "Tropidocyathus" labidus, Tropidocyathus lessonii, "Tropidocyathus" pileus, Truncatoflabellum angustum, Truncatoflabellum dens.*

Stn 3. — 22.10.1991, 5°47'40"S, 132°12'11"E, 278-300 m, Kai Isl.: *Alatocyathus rubescens, Bourneotrochus stellulatus, Caryophyllia (C.) diomedae, Caryophyllia (C.) quadragenaria, Caryophyllia (C.) secta, Conotrochus brunneus, "Cryptotrochus" venustus, Deltocyathoides orientalis, Deltocyathus magnificus, Deltocyathus suluensis, Fungiacyathus (B.) fissidiscus, Fungiacyathus (B.) granulosus, Fungiacyathus (F.) ?paliferus* (irregular), *Guynia annulata, Idiotrochus kikutii, Leptopenus sp., Letepsammia formosissima, Notocyathus venustus, Peponocyathus minimus, Stephanophyllia complicata, Thrypticotrochus multilobatus, Trochocyathus (A.) brevispina, Trochocyathus (T.) discus, Trochocyathus philippinensis, "Tropidocyathus" labidus, "Tropidocyathus" pileus, Truncatoflabellum angustum, Truncatoflabellum formosum.*

Stn 5. — 22.10.1991, 5°46'39"S, 132°20'04"E, 285-323 m, Kai Isl.: *Caryophyllia crosnieri, Flabellum (F.) patens, Gardineria paradoxa, Stephanophyllia complicata.*

Stn 7. — 22.10.1991, 5°47'35"S, 132°20'39"E, 282-287 m, Kai Isl.: *Balanophyllia cornu, Bourneotrochus stellulatus, Caryophyllia (C.) transversalis, Conotrochus brunneus, "Cryptotrochus" venustus, Deltocyathoides orientalis, Deltocyathus magnificus, Deltocyathus suluensis, Fungiacyathus (B.) granulosus, Fungiacyathus (B.) fissidiscus, Fungiacyathus (F.) ?paliferus* (irregular), *Guynia annulata, Idiotrochus kikutii, Leptopenus sp. A, Letepsammia formosissima, Letepsammia superstes, Notocyathus venustus, Peponocyathus minimus, Stephanophyllia complicata, Thrypticotrochus multilobatus, Trochocyathus (A.) brevispina, "Tropidocyathus" labidus, "Tropidocyathus" pileus, Truncatoflabellum phoenix.*

Stn 9. — 23.10.1991, 5°19'21"S, 132°30'35"E, 361-389 m, Kai Isl.: *Flabellum (U.) hoffmeisteri, Madrepora oculata.*

Stn 10. — 23.10.1991, 5°26'11"S, 132°27'37"E, 329-389 m, Kai Isl.: *Caryophyllia (A.) karubarica, Flabellum (U.) hoffmeisteri.*

Stn 12. — 23.10.1991, 5°25'23"S, 132°36'59"E, 412-434 m, Kai Isl.: *Caryophyllia (A.) karubarica, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) hoffmeisteri, Fungiacyathus (F.) stephanus.*

Stn 13. — 24.10.1991, 5°26'27"S, 132°37'37"E, 393-417 m, Kai Isl.: *Balanophyllia desmophyllioides, Balanophyllia gigas, Caryophyllia (A.) karubarica, Deltocyathoides orientalis, Enallopsammia rostrata, Flabellum (U.) hoffmeisteri, Lochmaeotrochus oculeus, Madrepora oculata, Polymyces wellsi.*

Stn 15. — 24.10.1991, 5°17'38"S, 132°40'51"E, 214-221 m, Kai Isl.: *Anthemiphyllia frustum, Caryophyllia (P.) dentiformis, Conotrochus brunneus, Deltocyathoides orientalis, Flabellum (F.) politum, Fungiacyathus (F.) ?paliferus* (irregular), *Guynia annulata, Idiotrochus kikutii, Leptopenus sp., Notocyathus conicus, Notocyathus venustus, Peponocyathus folliculus, Peponocyathus minimus, Stephanophyllia complicata, Trochocyathus philippinensis, "Tropidocyathus" labidus, Truncatoflabellum pusillum.*

Stn 16. — 24.10.1991, 5°17'06"S, 132°51'19"E, 315-348 m, Kai Isl.: *Balanophyllia cornu, Balanophyllia generatrix, Crispatotrochus rubescens, Madrepora oculata, Tethocyathus virgatus.*

Stn 18. — 24.10.1991, 5°17'49"S, 133°00'51"E, 205-212 m, Kai Isl.: *Balanophyllia cornu, Balanophyllia desmophyllioides, Balanophyllia parvula, Bourneotrochus stellulatus, Caryophyllia (C.) lamellifera, Caryophyllia (C.) rugosa, Conotrochus brunneus, Dactylotrochus cervicornis, Deltocyathoides orientalis, Deltocyathus stella, Deltocyathus suluensis, Dendrophyllia alcocki, Eguchipsammia gaditana, Fungiacyathus (F.) paliferus, Idiotrochus kikutii, Letepsammia superstes, Madrepora arbuscula, Madrepora minutiseptum, Notocyathus conicus, Peponocyathus minimus, Premocyathus dentiformis, Sympodangia albatrossi, Thrypticotrochus multilobatus, Trochocyathus (T.) philippinensis, Truncatoflabellum angustum, Truncatoflabellum pusillum.*

Stn 19. — 25.10.1991, 5°15'52"S, 133°00'01"E, 576-604 m, Kai Isl.: *Madrepora oculata.*

Stn 20. — 25.10.1991, 5°16'30"S, 132°58'20"E, 768-810 m, Kai Isl.: *Fungiacyathus (F.) stephanus, Rhombopsammia niphada, Stephanocyathus (O.) weberianus.*

Stn 21. — 25.10.1991, 5°16'25"S, 132°59'03"E, 688-694 m, Kai Isl.: *Caryophyllia (C.) hawaiiensis, Deltocyathus rotulus, Fungiacyathus (F.) stephanus, Rhombopsammia niphada.*

Stn 22. — 25.10.1991, 5°16'23"S, 133°00'23"E, 85-124 m, Kai Isl.: *Balanophyllia rediviva, Caryophyllia (C.) hawaiiensis, Cyathelia axillaris, Deltocyathoides orientalis, Guynia annulata, Idiotrochus kikutii, Javania insignis, Madracis sp. A, Notocyathus venustus, Peponocyathus minimus, Thalamophyllia tenuescens, Truncatoflabellum phoenix.*

Stn 25. — 26.10.1991, 5°31'30"S, 132°50'40"E, 318-352 m, Kai Isl.: *Enallopsammia pusilla, Confluphyllia juncta.*

Stn 27. — 26.10.1991, 5°34'22"S, 132°51'29"E, 304-314 m, Kai Isl.: *Tethocyathus virgatus, Trochocyathus (T.) rhombocolumna.*

Stn 28. — 26.10.1991, 5°31'27"S, 132°54'07"E, 448-468 m, Kai Isl.: *Deltocyathoides orientalis, Deltocyathus vaughani, Fungiacyathus (F.) ?paliferus* (irregular), *Guynia annulata.*

Stn 29. — 26.10.1991, 5°35'49"S, 132°55'44"E, 181-184 m, Kai Isl.: *Deltocyathoides orientalis, Guynia annulata, Madracis sp. A.*

Stn 30. — 26.10.1991, 5°37'34"S, 132°55'34"E, 111-116 m, Kai Isl.: *Caryophyllia lamellifera, Cyathelia axillaris, Dendrophyllia cf. ijimai, Flabellum (F.) pavoninum, Thalamophyllia tenuescens, Truncatoflabellum mortenseni.*

Stn 31. — 26.10.1991, 5°39'39"S, 132°50'41"E, 288-289 m, Kai Isl.: *Caryophyllia (C.) crosnieri, Conotrochus brunneus, Deltocyathus magnificus, Deltocyathus suluensis, Flabellum (F.) patens, Flabellum (F.) politum, Fungiacyathus (B.) variegatus, Notocyathus venustus, Truncatoflabellum angustum.*

Stn 32. — 26.10.1991, 5°46'31"S, 132°50'42"E, 170-206 m, Kai Isl.: *Balanophyllia desmophyllioides, Caryophyllia (C.) crosnieri, Conotrochus brunneus, Deltocyathus stella, Javania insignis, Madrepora arbuscula, Notocyathus conicus, Trochocyathus (T.) caryophylloides, Trochocyathus (T.) philippinensis, "Tropidocyathus" labidus.*

Stn 35. — 27.10.1991, 6°07'22"S, 132°43'45"E, 390-502 m, Kai Isl.: *Deltocyathus suluensis, Flabellum (U.) marenzelleri, Flabellum (U.) hoffmeisteri, Fungiacyathus (F.) stephanus, Letepsammia formosissima, Madrepora oculata, Stephanocyathus (A.) explanans, "Tropidocyathus" pileus.*

Stn 36. — 27.10.1991, 6°05'50"S, 132°44'29"E, 210-268 m, Kai Isl.: *Conotrochus brunneus, Deltocyathus suluensis, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) marenzelleri, Fungiacyathus (F.) stephanus, Labyrinthocyathus sp. A, Letepsammia formosissima, "Tropidocyathus" pileus.*

Stn 39. — 28.10.1991, 7°45'43"S, 132°28'22"E, 466-477 m, Tanimbar Isl.: *Caryophyllia (A.) karubarica, Caryophyllia (A.) unicristata, Caryophyllia (C.) grandis, Deltocyathus vaughani, Flabellum (U.) hoffmeisteri, Fungiacyathus (F.) stephanus, Madrepora oculata, Rhombopsammia niphada, Stephanocyathus (A.) explanans, Truncatoflabellum paripavoninum.*

Stn 40. — 28.10.1991, 7°47'53"S, 132°28'19"E, 442-468 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Caryophyllia (C.) ambrosia ambrosia, Caryophyllia (C.) grandis, Deltocyathus vaughani, Flabellum (U.) hoffmeisteri, Fungiacyathus (B.) granulosus, Rhombopsammia niphada, Stephanocyathus (A.) explanans.*

Stn 42. — 28.10.1991, 7°49'48"S, 132°43'29"E, 350-353 m, Tanimbar Isl.: *Madrepora oculata.*

Stn 44. — 29.10.1991, 7°52'27"S, 132°48'24"E, 291-295 m, Tanimbar Isl.: *Conocyathus zelandiae, Deltocyathoides orientalis, Javania sp., Peponocyathus minimus, Tethocyathus virgatus, Truncatoflabellum angustum, Truncatoflabellum phoenix, Truncatoflabellum pusillum.*

Stn 49. — 29.10.1991, 7°59'51"S, 132°58'50"E, 206-209 m, Tanimbar Isl.: *Balanophyllia gemma, Balanophyllia desmophyllioides, Balanophyllia crassiseptum, Balanophyllia parvula, Caryophyllia (A.) dentata, Deltocyathoides orientalis, Fungiacyathus (F.) ?paliferus* (irregular), *Idiotrochus kikutii, Javania sp., Notocyathus venustus, Peponocyathus minimus, Trochocyathus (T.) caryophylloides, Trochocyathus (T.) rhombocolumna.*

Stn 50. — 29.10.1991, 7°59'09"S, 133°01'56"E, 184-185 m, Tanimbar Isl.: *Balanophyllia gemma, Balanophyllia crassiseptum, Letepsammia superstes, Notocyathus venustus, Trochocyathus (T.) caryophylloides.*

Stn 56. — 31.10.1991, 8°12'39"S, 132°01'15"E, 549-552 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Deltocyathus rotulus, Deltocyathus vaughani, Flabellum (U.) messum, Fungiacyathus (B.) granulosus, Fungiacyathus (F.) stephanus, Madrepora oculata, Truncatoflabellum paripavoninum.*

Stn 57. — 31.10.1991, 8°15'39"S, 131°56'38"E, 603-622 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Flabellum (U.) messum, Truncatoflabellum paripavoninum.*

Stn 58. — 31.10.1991, 8°21'47"S, 132°00'55"E, 457-461 m, Tanimbar Isl.: *Caryophyllia (A.) karubarica, Caryophyllia (A.) unicristata, Fungiacyathus (B.) granulosus, Stephanocyathus (A.) explanans.*

Stn 59. — 31.10.1991, 8°20'01"S, 132°09'32"E, 399-405 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Caryophyllia (C.) grandis, Conotrochus funicolumna, Deltocyathus magnificus, Deltocyathus vaughani, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) deludens, Flabellum (U.) hoffmeisteri, Fungiacyathus (B.) granulosus, Fungiacyathus (F.) stephanus, Madrepora oculata, Paraconotrochus zeidleri, Rhombopsammia niphada, Stephanocyathus (A.) explanans.*

Stn 61. — 1.11.1991, 9°05'09"S, 132°44'35"E, 235 m, Tanimbar Isl.: *Balanophyllia cornu, Deltocyathoides orientalis, Peponocyathus minimus, Stephanocyathus (A.) spiniger, Trochocyathus (T.) caryophylloides.*

Stn 62. — 1.11.1991, 9°02'10"S, 132°43'05"E, 245-251 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Caryophyllia (A.) spinigera, Caryophyllia (C.) grandis, Endopachys bulbosa, Flabellum (U.) deludens, Fungiacyathus (F.) stephanus, "Tropidocyathus" pileus.*

Stn 63. — 1.11.1991, 8°59'59"S, 132°56'40"E, 213-214 m, Tanimbar Isl.: *Flabellum (U.) deludens.*

Stn 65. — 1.11.1991, 9°14'01"S, 132°28'28"E, 174-176 m, Tanimbar Isl.: *Caryophyllia (A.) dentata, Flabellum (F.) politum, Flabellum (U.) deludens, Placotrochus laevis, Truncatoflabellum spheniscus.*

Stn 67. — 1.11.1991, 8°58'59"S, 132°07'20"E, 233-246 m, Tanimbar Isl.: *Caryophyllia (C.) transversalis, Crispatotrochus rubescens, Deltocyathus suluensis, Endopachys bulbosa, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Letepsammia formosissima, "Tropidocyathus" pileus.*

Stn 68. — 1.11.1991, 8°55'09"S, 132°03'13"E, 280-296 m, Tanimbar Isl.: *Caryophyllia (C.) transversalis.*

Stn 69. — 2.11.1991, 8°45'17"S, 131°51'35"E, 356-367 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Conotrochus brunneus, Deltocyathus magnificus, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) hoffmeisteri, Madrepora oculata, Paraconotrochus zeidleri.*

Stn 70. — 2.11.1991, 8°39'14"S, 131°49'16"E, 410-411 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Caryophyllia (C.) grandis, Deltocyathus magnificus, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) hoffmeisteri, Rhombopsammia niphada, Stephanocyathus (A.) explanans, Truncatoflabellum paripavoninum.*

Stn 71. — 2.11.1991, 8°39'39"S, 131°42'29"E, 477-480 m, Tanimbar Isl.: *Caryophyllia (A.) karubarica, Caryophyllia (A.) unicristata, Caryophyllia (C.) grandis, Conotrochus brunneus, Deltocyathus magnificus, Deltocyathus vaughani, Flabellum (U.) hoffmeisteri, Rhombopsammia niphada, Stephanocyathus explanans, Truncatoflabellum paripavoninum.*

Stn 72. — 2.11.1991, 8°33'19"S, 131°35'10"E, 676-699 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Flabellum (U.) messum, Stephanocyathus (A.) explanans.*

Stn 75. — 3.11.1991, 8°46'52"S, 131°33'37"E, 451 m, Tanimbar Isl.: *Caryophyllia (C.) grandis, Flabellum (U.) hoffmeisteri, Rhombopsammia niphada, Stephanocyathus (A.) explanans.*

Stn 76. — 3.11.1991, 8°49'08"S, 131°35'36"E, 400 m, Tanimbar Isl.: *Caryophyllia (A.) unicristata, Deltocyathus magnificus, Deltocyathus vaughani, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus.*

Stn 77. — 3.11.1991, 8°55'38"S, 131°29'12"E, 347-351 m, Tanimbar Isl.: *Conotrochus brunneus, Deltocyathus suluensis, Flabellum (F.) lamellulosum, Flabellum (F.) magnificum, Flabellum (U.) hoffmeisteri, Madrepora oculata, Paraconotrochus zeidleri.*

Stn 79. — 3.11.1991, 9°13'34"S, 131°22'35"E, 239-250 m, Tanimbar Isl.: *Caryophyllia (A.) spinigera, Caryophyllia (C.) transversalis, Endopachys bulbosa, Flabellum (F.) lamellulosum, Flabellum (U.) deludens.*

Stn 82. — 4.11.1991, 9°30'00"S, 131°02'41"E, 215-218 m, Tanimbar Isl.: *Balanophyllia generatrix.*

Stn 84. — 4.11.1991, 9°22'41"S, 131°07'17"E, 246-275 m, Tanimbar Isl.: *Caryophyllia (C.) transversalis.*

Stn 85. — 4.11.1991, 9°22'51"S, 131°12'04"E, 239-244 m, Tanimbar Isl.: *Flabellum (F.) magnificum, Letepsammia formosissima, "Tropidocyathus" pileus.*

Stn 86. — 4.11.1991, 9°23'59"S, 131°14'29"E, 222-226 m, Tanimbar Isl.: *Cladopsammia echinata, Conocyathus zelandiae, Crispatotrochus rubescens, Dendrophyllia arbuscula, Gardineria philippinensis, Javania sp., Letepsammia formosissima, Rhizosmilia elata, Stephanocyathus (A.) spiniger, Trochocyathus (T.) caryophylloides, Trochocyathus (T.) rhombocolumna.*

Stn 87. — 5.11.1991, 8°48'13"S, 130°46'37"E, 1016-1024 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Deltocyathus rotulus, Rhombopsammia squiresi, Stephanocyathus (A.) explanans, Truncatoflabellum paripavoninum.*

Stn 89. — 5.11.1991, 8°39'41"S, 131°05'25"E, 1048-1084 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Deltocyathus rotulus, Rhombopsammia squiresi, Stephanocyathus (O.) weberianus.*

Stn 91. — 5.11.1991, 8°44'54"S, 131°03'10"E, 884-890 m, Tanimbar Isl.: *Caryophyllia (C.) ambrosia ambrosia, Caryophyllia (C.) scobinosa, Deltocyathus rotulus, Flabellum (U.) messum, Stephanocyathus (O.) weberianus, Truncatoflabellum paripavoninum.*

MORTENSEN'S JAVA (-SOUTH AFRICA) EXPEDITION

Stn 1. — 3.4.1929, 7°34'S, 114°18'E, 100 m, N Bali: *Caryophyllia (A.) grayi.*

Stn 2. — 3.4.1929, 7°33'S, 114°36'E, 200 m, N Bali: *Caryophyllia (A.) spinigera.*

Stn 5. — 5.4.1929, 8°23'S, 114°29'E, 70 m, Bali Strait: *Asterosmilia marchadi, Balanophyllia carinata, Balanophyllia stimpsonii, Caryophyllia (A.) grayi, Endopachys grayi, Stephanophyllia neglecta, Tropidocyathus lessonii, Trochocyathus (T.) burchae, Truncatoflabellum mortenseni.*

Stn 6. — 5.4.1929, 8°26'S, 114°29'E, 70 m, Bali Strait: *Asterosmilia marchadi, Balanophyllia carinata, Caryophyllia (A.) grayi, Endopachys grayi, Stephanophyllia neglecta, Truncatoflabellum mortenseni.*

Stn 8. — 6.4.1929, 8°23'S, 114°24'E, 50 m, Bali Strait: *Asterosmilia marchadi, Balanophyllia carinata, Balanophyllia stimpsonii, Caryophyllia (A.) grayi, Endopachys grayi, Stephanophyllia neglecta, Tropidocyathus lessonii, Truncatoflabellum mortenseni.*

Stn 9. — 6.4.1929, 8°30-35'S, 114°28'E, 70-150 m, Bali Strait: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Endocyathopora laticostata, Trochocyathus (T.) burchae, Trochocyathus (T.) apertus, Truncatoflabellum mortenseni.*

Stn 15. — 10.4.1929, 7°29'S, 114°49'E, 240 m, N Bali: *Balanophyllia cornu, Caryophyllia (C.) secta, Deltocyathus suluensis, Lochmaeotrochus oculeus, Tethocyathus virgatus.*

Stn 18. — 11.4.1929, 7°15'S, 114°45'E, 100 m, N Bali: *Notocyathus venustus, Truncatoflabellum mortenseni.*

MORTENSEN'S PACIFIC EXPEDITION

Stn unnumbered. — 14.3.1914, W Mindanao, Zamboanga Peninsula, 301-373 m: *Caryophyllia (C.) secta.*
Stn unnumbered. — 19.3.1914, Sulu Archipelago, Jolo, 46 m: *Leptopsammia stokesiana.*

MUSORSTOM 1, *"VAUBAN"*

Stn 2. — 19.3.1976, 14°02.8'N, 120°18.8'E, 182-187 m, SW Luzon: *Letepsammia formosissima, Stephanocyathus (A.) spiniger.*
Stn 3. — 19.3.1976, 14°01.7'N, 120°16.0'E, 183-185 m, SW Luzon: *Balanophyllia cornu, Balanophyllia desmophyllioides, Balanophyllia rediviva.*
Stn 4. — 19.3.1976, 14°01.8'N, 120°17.2'E, 182-194 m, SW Luzon: *Letepsammia formosissima.*
Stn 5. — 19.3.1976, 14°01.5'N, 120°23.5'E, 200-215 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens.*
Stn 9. — 19.3.1976, 14°01.8'N, 120°17.6'E, 180-194 m, SW Luzon: *Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima.*
Stn 10. — 19.3.1976, 13°59.8'N, 120°18.2'E, 187-205 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens, Letepsammia formosissima.*
Stn 11. — 20.3.1976, 13°59.8'N, 120°23.7'E, 217-230 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens.*
Stn 12. — 20.3.1976, 14°00.8'N, 120°20.5'E, 187-210 m, SW Luzon: *Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima.*
Stn 13. — 20.3.1976, 14°00.5'N, 120°17.0'E, 190 m, SW Luzon: *Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Trochocyathus (T.) philippinensis, "Tropidocyathus" pileus.*
Stn 14. — 20.3.1976, 14°00.2'N, 120°17.2'E, 190 m, SW Luzon: *Balanophyllia cornu, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Trochocyathus (T.) philippinensis.*
Stn 15. — 20.3.1976, 14°00.3'N, 120°18.0'E, 188-192 m, SW Luzon: *Flabellum (U.) deludens, Fungiacyathus (B.) variegatus.*
Stn 20. — 21.3.1976, 13°59.2'N, 120°20.3'E, 208-222 m, SW Luzon: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Flabellum (U.) deludens, Letepsammia formosissima.*
Stn 24. — 22.3.1976, 14°00.0'N, 120°18.0'E, 189-209 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima.*
Stn 25. — 22.3.1976, 14°02.7'N, 120°20.3'E, 191-200 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*
Stn 27. — 22.3.1976, 13°59.8'N, 120°18.6'E, 188-192 m, SW Luzon: *Balanophyllia serrata, Flabellum (F.) lamellulosum.*
Stn 31. — 22.2.1976, 14°00.0'W, 120°16.0'E, 187-195 m, SW Luzon: *Flabellum (F.) lamellulosum.*
Stn 32. — 23.2.1976, 14°02.2'W, 120°17.7'E, 184-193m, SW Luzon: *Asterosmilia marchadi, Balanophyllia crassisepta, Flabellum (F.) lamellulosum, Tethocyathus virgatus.*
Stn 35. — 23.3.1976, 13°59.0'N, 120°18.5'E, 186-187 m, SW Luzon: *Letepsammia formosissima, Trochocyathus (T.) philippinensis.*
Stn 40. — 24.3.1976, 13°57.4'N, 120°27.8'E, 265-287 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Flabellum (U.) marenzelleri, "Tropidocyathus" pileus.*
Stn 42. — 24.3.1976, 13°55.1'N, 120°28.6'E, 379-407 m, SW Luzon: *"Tropidocyathus" pileus.*
Stn 43. — 24.3.1976, 13°50.5'N, 120°28.0'E, 448-484 m, SW Luzon: *Fungiacyathus (B.) granulosus.*
Stn 44. — 24.3.1976, 13°46.9'N, 120°29.5'E, 592-610 m, SW Luzon: *Caryophyllia (C.) scobinosa, Fungiacyathus (B.) granulosus, Truncatoflabellum paripavoninum.*
Stn 45. — 24.3.1976, 13°46.0'N, 120°23.8'E, 100-180 m, SW Luzon: *Caryophyllia (A.) grayi.*
Stn 47. — 25.3.1976, 13°40.7'N, 120°30.0'E, 685-757 m, SW Luzon: *Caryophyllia (C.) scobinosa, Flabellum (U.) sexcostatum, Rhombopsammia niphada, Truncatoflabellum paripavoninum.*

Stn 49. — 25.3.1976, 13°49.1'N, 119°59.8'E, 750-925 m, SW Luzon: *Caryophyllia (C.) ambrosia ambrosia, Caryophyllia (C.) diomedeae, Fungiacyathus (F.) stephanus, Madrepora oculata, Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn 50. — 25.3.1976, 13°49.2'N, 120°01.8'E, 415-510 m, SW Luzon: *Fungiacyathus (B.) granulosus, Trochocyathus (A.) longispina.*

Stn 54. — 26.3.1976, 13°54.2'N, 119°57.9'E, 975-1125 m, SW Luzon: *Caryophyllia (C.) ambrosia ambrosia, Deltocyathus rotulus, Fungiacyathus (F.) stephanus, Stephanocyathus (O.) weberianus, Stephanocyathus (S.) regius.*

Stn 55. — 26.3.1976, 13°55.0'N, 120°12.5'E, 194-200 m, SW Luzon: *Flabellum (F.) lamellulosum, "Tropidocyathus" pileus.*

Stn 56. — 26.3.1976, 13°53.1'N, 120°08.9'E, 129-134 m, SW Luzon: *Caryophyllia (A.) grayi, Truncatoflabellum candeanum.*

Stn 57. — 26.3.1976, 13°53.1'N, 120°13.2'E, 96-107m, SW Luzon: *Asterosmilia marchadi, Balanophyllia rediviva, Endopachys grayi, Trochocyathus (T.) cooperi.*

Stn 58. — 26.3.1976, 13°58.0'N, 120°13.7'E, 143-178 m, SW Luzon: *"Tropidocyathus" pileus.*

Stn 61. — 27.3.1976, 14°02.2'N, 120°18.1'E, 184-202 m, SW Luzon: *Balanophyllia cornu, Balanophyllia* sp., *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 62. — 27.3.1976, 13°59.5'N, 120°15.6'E, 179-194 m, SW Luzon: *Javania lamprotichum, "Tropidocyathus" pileus, Truncatoflabellum candeanum.*

Stn 63. — 27.3.1976, 14°00.8'N, 120°15.8'E, 191-195 m, SW Luzon: *Balanophyllia cornu, Balanophyllia desmophyllioides, Balanophyllia serrata, Gardineria philippinensis, Javania lamprotichum, Stephanocyathus (A.) spiniger, Tethocyathus virgatus, Trochocyathus (T.) caryophylloides.*

Stn 64. — 27.3.1976, 14°00.5'N, 120°16.3'E, 194-195 m, SW Luzon: *Balanophyllia desmophyllioides, Caryophyllia (C.) octonaria, Letepsammia formosissima, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii, Truncatoflabellum angustum, Truncatoflabellum candeanum.*

Stn 65. — 27°3.1976, 14°00.0'N, 120°19.2'E, 194-202 m, SW Luzon: *Balanophyllia desmophyllioides, Balanophyllia serrata, Javania lamprotichum, Rhizosmilia robusta, Stephanocyathus (A.) spiniger.*

Stn 68. — 27.3.1976, 14°00.8'N, 120°17.4'E, 183-199 m, SW Luzon: *Flabellum (F.) lamellulosum, Flabellum (U.) deludens.*

Stn 69. — 27.3.1976, 13°58.8'N, 120°17.3'E, 187-199 m, SW Luzon: *Balanophyllia serrata.*

Stn 71. — 28.3.1976, 14°09.3'N, 120°26.2'E, 174-204m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum.*

Stn 72. — 28.3.1976, 14°11.8'N, 120°28.7'E, 122-127 m, SW Luzon: *Caryophyllia (A.) grayi, Caryophyllia (A.) spinigera, Trochocyathus (T.) philippinensis, Truncatoflabellum candeanum.*

Stn 73. — 28.3.1976, 14°15.0'N, 120°31.2'E, 70-76 m, SW Luzon: *Asterosmilia marchadi.*

MUSORSTOM 2, *"CORIOLIS"*

Stn 1. — 20.11.1980, 14°00.3'N, 120°19.3'E, 188-198 m, SW Luzon: *Balanophyllia gigas, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima.*

Stn 2. — 20.11.1980, 14°01.0'N, 120°17.1'E, 184-186 m, SW Luzon: *Alatotrochus rubescens, Balanophyllia gigas, Caryophyllia (C.) octonaria, Flabellum (F.) politum, Letepsammia formosissima, Tethocyathus virgatus, Trochocyathus (T.) caryophylloides, Truncatoflabellum candeanum, Truncatoflabellum formosum.*

Stn 4. — 20.11.1980, 14°01.2'N, 120°18.4'E, 183-190 m, SW Luzon: *Caryophyllia (A.) spinigera, Fungiacyathus (B.) variegatus, Letepsammia formosissima.*

Stn 6. — 20.11.1980, 13°56.5'N, 120°20.7'E, 136-152 m, SW Luzon: *Flabellum (F.) politum, Letepsammia formosissima, Trochocyathus (T.) philippinensis, "Tropidocyathus" pileus, Truncatoflabellum candeanum.*

Stn 8. — 21.11.1980, 13°55.0'N, 120°20.0'E, 85-90 m, SW Luzon: *Asterosmilia marchadi.*

Stn 9. — 21.11.1980, 13°53.4'N, 120°20.7'E, 66 m, SW Luzon: *Balanophyllia stimpsonii, Paracyathus rotundatus.*

Stn 10. — 21.11.1980, 14°00.1'N, 120°18.5'E, 188-195 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Trochocyathus (T.) philippinensis, "Tropidocyathus" pileus, Truncatoflabellum candeanum.*

Stn 11. — 21.11.1980, 14°00.4'N, 120°19.7'E, 194-196 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens, Letepsammia formosissima, Notocyathus conicus* C89.

Stn 12. — 21.11.1980, 14°01.0'N, 120°19.7'E, 197-210 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 13. — 21.11.1980, 14°00.5'N, 120°20.7'E, 193-200 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens, Letepsammia formosissima.*

Stn 15. — 21.11.1980, 13°55.1'N, 120°28.4'E, 326-330 m, SW Luzon: *Balanophyllia cornu, Caryophyllia (C.) crosnieri, Caryophyllia (C.) diomedeae, Crispatotrochus rubescens, Flabellum (F.) magnificum, Flabellum (U.) deludens, Letepsammia formosissima.*

Stn 17. — 22.11.1980, 14°00.0'N, 120°17.1'E, 174-193 m, SW Luzon: *Balanophyllia desmophyllioides, Trochocyathus (T.) philippinensis.*

Stn 18. — 22.11.1980, 14°00.0'N, 120°18.6'E, 188-195 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 19. — 22.11.1980, 14°00.5'N, 120°16.5'E, 189-192 m, SW Luzon: *Flabellum (F.) lamellulosum.*

Stn 20. — 22.11.1980, 14°00.9'N, 120°18.1'E, 185-192m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens.*

Stn 21. — 22.11.1980, 14°00.2'N, 120°17.8'E, 191-192 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Stephanocyathus (A.) spiniger.*

Stn 24. — 23.11.1980, 13°37.2'N, 120°42.3'E, 640-647 m, SW Luzon: *Fungiacyathus (F.) stephanus.*

Stn 25. — 23.11.1980, 13°39.0'N, 120°42.6'E, 520-550 m, SW Luzon: *Caryophyllia (C.) scobinosa, Fungiacyathus (B.) granulosus, Fungiacyathus (F.) stephanus, Placotrochides scaphula C89, Rhombopsammia niphada, Truncatoflabellum paripavoninum.*

Stn 26. — 23.11.1980, 13°49.6'N, 120°51.0'E, 299-300 m, SW Luzon: *Flabellum (F.) lamellulosum, Stephanocyathus (A.) spiniger.*

Stn 27. — 23.11.1980, 13°41.5'N, 120°50.1'E, 95-100 m, SW Luzon: *Balanophyllia gigas.*

Stn 29. — 23.11.1980, 13°42.1'N, 120°50.1'E, 119-204 m, SW Luzon: *Caryophyllia (A.) grayi, Endopachys grayi, Tropidocyathus lessonii.*

Stn 32. — 24.11.1980, 13°40.5'N, 120°53.9'E, 192-220 m, SW Luzon: *Balanophyllia cornu, Balanophyllia parvula, Balanophyllia* sp., *Caryophyllia (C.) secta, Conotrochus brunneus, Crispatotrochus rugosus, Gardineria musorstomica* C89, *Idiotrochus kikutii C89, Javania insignis, Letepsammia superstes, Trochocyathus (T.) caryophylloides, Truncatoflabellum formosum.*

Stn 33. — 24.11.1980, 13°32.3'N, 121°07.5'E, 130-137 m, S Luzon: *Anthemiphyllia dentata, Balanophyllia desmophyllioides, Balanophyllia gemma, Balanophyllia rediviva, Balanophyllia* sp., *Caryophyllia (C.) hawaiiensis, Caryophyllia (C.) rugosa, Conotrochus brunneus, Deltocyathoides orientalis* C89* (ex *P. australiensis*), *Deltocyathus stella, Dendrophyllia cf. ijimai, Dendrophylliidae (colonial), Guynia annulata* C89, *Idiotrochus kikutii* C89, *Javania insignis, Letepsammia formosissima, Notocyathus conicus* C89, *Stephanophyllia neglecta, Tethocyathus virgatus, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii* C89, *Thrypticotrochus multilobatus* C89, *Truncatoflabellum mortenseni, Truncatoflabellum pusillum.*

Stn 34. — 24.11.1980, 13°27.9'N, 121°12.0'E, 155-167 m, N Mindoro: *Balanophyllia sp.*

Stn 36. — 24.11.1980, 13°31.4'N, 121°23.9'E, 569-595 m, S Luzon: *Flabellum (U.) japonicum, Madrepora oculata.*

Stn 39. — 25.11.1980, 13°02.8'N, 122°37.1'E, 1030-1190 m, S Luzon: *Madrepora oculata.*

Stn 40. — 25.11.1980, 13°07.7'N, 122°39.1'E, 280-440 m, S Luzon: *Flabellum (U.) deludens, Flabellum (U.) japonicum.*

Stn 44. — 26.11.1980, 13°23.2'N, 122°20.7'E, 760-820 m, S Luzon: *Flabellum (U.) japonicum, Trochocyathus (A.) longispina.*

Stn 45. — 26.11.1980, 13°26.8'N, 122°18.5'E, 447-500 m, S Luzon: *Caryophyllia (A.) spinicarens.*

Stn 46. — 26.11.1980, 13°25.7'N, 122°17.0'E, 445-520 m, S Luzon: *Flabellum (U.) deludens, Caryophyllia (A.) spinicarens.*

Stn 47. — 26.11.1980, 13°33.0'N, 122°10.1'E, 81-84 m, S Luzon: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Phyllangia papuensis, Trochocyathus (T.) cooperi.*

Stn 49. — 26.11.1980, 13°38.4'N, 121°44.1'E, 416-425 m, S Luzon: *Flabellum (U.) japonicum, Madrepora oculata.*

Stn 53. — 27.11.1980, 13°59.2'N, 120°18.3'E, 215-216m, SW Luzon: *Javania lamprotichum.*

Stn 62. — 29.11.1980, 14°00.4'N, 120°17.0'E, 186-189 m, SW Luzon: *Caryophyllia (A.) spinigera, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 63. — 29.11.1980, 14°07.3'N, 120°15.0'E, 215-230 m, SW Luzon: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Conotrochus brunneus, Deltocyathus andamanicus, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima, "Tropidocyathus" pileus, Truncatoflabellum angustum.*

Stn 64. — 29.11.1980, 14°01.5'N, 120°18.9'E, 191-195 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Fungiacyathus (B.) variegatus, Flabellum (U.) deludens, Letepsammia formosissima.*

Stn 66. — 29.11.1980, 14°00.6'N, 120°20.3'E, 192-209 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens C89, Fungiacyathus (B.) variegatus, Letepsammia formosissima.*

Stn 68. — 29.11.1980, 14°01.9'N, 120°18.8'E, 195-199 m, SW Luzon: *Balanophyllia cornu, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Letepsammia formosissima, Truncatoflabellum candeanum.*

Stn 75. — 1.12.1980, 13°50.5'N, 120°30.3'E, 300-330 m, SW Luzon: *Flabellum (F.) lamellulosum, Flabellum (F.) magnificum.*

Stn 77. — 1.12.1980, 13°48.8'N, 120°30.3'E, 529-552 m, SW Luzon: *Truncatoflabellum paripavoninum.*

Stn 78. — 1.12.1980, 13°49.1'N, 120°28.0'E, 441-550 m, SW Luzon: *Flabellum (F.) magnificum, Flabellum (U.) sp.*

Stn 82. — 2.12.1980, 13°46.1'N, 120°28.4'E, 550 m, SW Luzon: *Fungiacyathus (B.) granulosus.*

Stn 83. — 2.12.1980, 13°55.2'N, 120°30.5'E, 318-320 m, SW Luzon: *Caryophyllia (A.) spinicarens, Deltocyathus magnificus, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, "Tropidocyathus" pileus.*

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Stn 86. — 31.5.1985, 14°00.4'N, 120°17.8'E, 187-192 m, SW Luzon: *Alatotrochus rubescens, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Letepsammia formosissima.*

Stn 87. — 31.5.1985, 14°00.6'N, 120°19.6'E, 191-197 m, SW Luzon: *Aulocyathus ?juvenescens, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Guynia annulata, Letepsammia formosissima, Truncatoflabellum pusillum.*

Stn 88. — 31.5.1985, 14°00.5'N, 120°17.4'E, 183-187 m, SW Luzon: *Alatotrochus rubescens, Balanophyllia cornu, Caryophyllia (C.) octonaria, Caryophyllia (A.) spinigera, Deltocyathus andamanicus, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Javania lamprotichum, Letepsammia formosissima, Rhizosmilia sagamiensis, Trochocyathus (T.) caryophylloides, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii C89, "Tropidocyathus" pileus, Truncatoflabellum candeanum, Stephanocyathus (A.) spiniger.*

Stn 89. — 31.5.1985, 14°01.0'N, 120°17.1'E, 187-191 m, SW Luzon: *Madrepora oculata.*

Stn 90. — 31.5.1985, 14°00.1'N, 120°18.6'E, 195 m, SW Luzon: *Caryophyllia (C.) octonaria, Caryophyllia (A.) spinigera, Letepsammia formosissima, Truncatoflabellum candeanum.*

Stn 91. — 31.5.1985, 14°00.1'N, 120°17.8'E, 190-203 m, SW Luzon: *Alatotrochus rubescens, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima, Stephanophyllia neglecta* C89, *Truncatoflabellum candeanum.*

Stn 92. — 31.5.1985, 14°03.0'N, 120°11.5'E, 224 m, SW Luzon: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Conotrochus brunneus, Deltocyathus andamanicus, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Letepsammia formosissima, "Tropidocyathus" pileus, Truncatoflabellum angustum, Truncatoflabellum candeanum.*

Stn 93. — 1.6.1985, 13°48.6'N, 120°02.4'E, 540 m, SW Luzon: *Deltocyathus suluensis.*

Stn 94. — 1.6.1985, 13°47.4'N, 120°03.4'E, 842 m, SW Luzon: *Caryophyllia (C.) ambrosia ambrosia, Deltocyathus rotulus, Javania lamprotichum, Polymyces wellsi.*

Stn 95. — 1.6.1985, 13°55.8'N, 119°59.3'E, 865 m, SW Luzon: *Caryophyllia (C.) diomedeae, Flabellum (U.) japonicum, Fungiacyathus (B.) variegatus.*

Stn 96. — 1.6.1985, 14°00.3'N, 120°17.3'E, 190-194 m, SW Luzon: *Alatotrochus rubescens, Balanophyllia cornu, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima* C89, *Stephanocyathus (A.) spiniger, Trochocyathus (T.) philippinensis, "Tropidocyathus" pileus, Truncatoflabellum candeanum, Truncatoflabellum pusillum.*

Stn 97. — 1.6.1985, 14°00.7'N, 120°18.8'E, 189-194 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 98. — 1.6.1985, 14°00.2'N, 120°17.9'E, 194-205 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Trochocyathus (T.) philippinensis.*

Stn 99. — 1.6.1985, 14°01.0'N, 120°19.5'E, 196-204 m, SW Luzon: *Caryophyllia (A.) grayi, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Stephanocyathus (A.) spiniger, "Tropidocyathus" pileus, Truncatoflabellum candeanum.*

Stn 100. — 1.6.1985, 14°00.0'N, 120°17.6'E, 189-199 m, SW Luzon: *Balanophyllia cornu, Caryophyllia (C.) octonaria, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima, Thrypticotrochus multilobatus.*

Stn 101. — 1.6.1985, 14°00.1'N, 120°19.2'E, 194-196 m, SW Luzon: *Caryophyllia (C.) octonaria, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Guynia annulata, Letepsammia formosissima.*

Stn 102. — 1.6.1985, 14°00.8'N, 120°17.8'E, 192 m, SW Luzon: *Alatotrochus rubescens, Asterosmilia marchadi, Balanophyllia cornu, Caryophyllia (C.) octonaria, Caryophyllia (A.) spinigera, Conotrochus brunneus, Deltocyathoides orientalis, Endopachys grayi, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Fungiacyathus (F.) paliferus, Fungiacyathus (B.) variegatus, Guynia annulata, Idiotrochus kikutii, Letepsammia formosissima, Notocyathus conicus* C89, *Stephanocyathus (A.) spiniger, Stephanophyllia neglecta* C89, *Trochocyathus (T.) philippinensis, Truncatoflabellum candeanum, Truncatoflabellum pusillum.*

Stn 103. — 1.6.1985, 14°00.4'N, 120°18.1'E, 193-200 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (U.) deludens, Letepsammia formosissima, Stephanocyathus (A.) spiniger.*

Stn 105. — 1.6.1985, 13°52.6'N, 120°29.6'E, 398-417 m, SW Luzon: *Balanophyllia cornu, Madrepora oculata.*

Stn 106. — 2.6.1985, 13°47.0'N, 120°30.3'E, 640-668 m, SW Luzon: *Fungiacyathus (B.) granulosus, Madrepora oculata, Notocyathus conicus, Truncatoflabellum paripavoninum.*

Stn 107. — 2.6.1985, 14°01.9'N, 120°27.9'E, 111-115 m, SW Luzon: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Flabellum (F.) politum, Letepsammia formosissima, Truncatoflabellum candeanum.*

Stn 108. — 2.6.1985, 14°01.1'N, 120°17.9'E, 188-195 m, SW Luzon: *Anthemiphyllia dentata, Balanophyllia cornu, Balanophyllia serrata, Balanophyllia parvula, Caryophyllia (A.) grayi, Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima C89, Tethocyathus virgatus, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii, "Tropidocyathus" pileus, Truncatoflabellum candeanum.*

Stn 109. — 2.6.1985, 14°00.2'N, 120°17.6'E, 188-190 m, SW Luzon: *Caryophyllia (A.) spinigera, Conotrochus brunneus, Flabellum (F.) lamellulosum, Flabellum (F.) politum, Flabellum (U.) deludens, Letepsammia formosissima* C89, *Stephanocyathus (A.) spiniger, "Tropidocyathus" pileus, Truncatoflabellum candeanum, Truncatoflabellum pusillum.*

Stn 110. — 2.6.1985, 13°59.5'S, 120°18.2'E, 187-193 m, SW Luzon: *Flabellum (F.) politum, Letepsammia formosissima, Truncatoflabellum candeanum.*

Stn 111. — 2.6.1985, 14°00.1'N, 120°17.5'E, 193-205 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima.*

Stn 112. — 2.6.1985, 14°00.2'N, 120°19.2'E, 187-199 m, SW Luzon: *Caryophyllia (A.) spinigera, Flabellum (F.) lamellulosum, Flabellum (U.) deludens, Fungiacyathus (B.) variegatus, Letepsammia formosissima.*

Stn 116. — 3.6.1985, 12°32.2'N, 120°46.4'E, 804-812 m, SW Mindoro: *Fungiacyathus (F.) stephanus, Rhombopsammia niphada.*

Stn 117. — 3.6.1985, 12°31.2'N, 120°39.3'E, 92-97 m, SW Mindoro: *Balanophyllia rediviva, Caryophyllia (C.) hawaiiensis, Conotrochus brunneus, Deltocyathoides orientalis, Dendrophyllia* cf. *ijimai, Guynia annulata, Idiotrochus kikutii, Madracis* cf. *pharensis, Rhizosmilia sagamiensis.*

Stn 119. — 3.6.1985, 11°59.7'N, 121°12.7'E, 320-327 m, S Mindoro: *Caryophyllia (A.) spinicarens.*

Stn 120. — 3.6.1985, 12°05.6'N, 121°15.6'E, 219-220 m, S Mindoro: *Balanophyllia cornu, Caryophyllia (A.) spinigera, Deltocyathus magnificus, Flabellum (U.) deludens, Stephanocyathus (A.) spiniger.*

Stn 121. — 3.6.1985, 12°08.3'N, 121°17.3'E, 73-84 m, S Mindoro: *Fungiacyathus (B.) variegatus.*

Stn 122. — 4.6.1985, 12°20.0'N, 121°41.6'E, 673-675m, SE Mindoro: *Flabellum (U.) japonicum, Madrepora oculata.*

Stn 123. — 4.6.1985, 12°10.6'N, 121°45.5'E, 700-702 m, NW Panay: *Flabellum (U.) japonicum, Madrepora oculata.*

Stn 124. — 4.6.1985, 12°02.6'N, 121°35.3'E, 120-123 m, between Panay and Mindoro: *Caryophyllia (A.) grayi, Letepsammia formosissima, Trochocyathus (T.) philippinensis, "Tropidocyathus" pileus, Truncatoflabellum mortenseni.*

Stn 125. — 4.6.1985, 11°57.7'N, 121°28.5'E, 388-404 m, between Panay and Mindoro: *Caryophyllia (A.) spinicarens.*

Stn 126. — 4.6.1985, 11°49.2'N, 121°22.1'E, 266 m, between Panay and Mindoro: *Anthemiphyllia dentata, Balanophyllia cornu, Confluphyllia juncta, Conotrochus brunneus, Caryophyllia (C.) secta, Deltocyathus andamanicus, Flabellum (F.) patens, Letepsammia formosissima, Madrepora arbuscula, Truncatoflabellum angustum.*

Stn 128. — 5.6.1985, 11°49.7'N, 121°41.2'E, 815-821 m, NW Panay: *Flabellum (U.) japonicum, Madrepora oculata.*

Stn 130. — 5.6.1985, 11°36.7'N, 121°43.5'E, 178-195 m, NW Panay: *Anthemiphyllia dentata, Deltocyathus andamanicus, Flabellum (F.) lamellulosum, Fungiacyathus (F.) paliferus, Truncatoflabellum angustum.*

Stn 131. — 5.6.1985, 11°36.6'N, 121°43.0'E, 120-122 m, NW Panay: *Anthemiphyllia dentata, Asterosmilia marchadi, Balanophyllia sp., Caryophyllia (A.) grayi, Caryophyllia (C.) lamellifera, Cyathelia axillaris, Dendrophyllia arbuscula, Endopachys grayi, Flabellum (F.) pavoninum, Fungiacyathus (F.) paliferus, Guynia annulata, Javania insignis, Letepsammia formosissima, Madracis cf. pharensis, Rhizosmilia sagamiensis, Rhizotrochus typus, Stephanophyllia neglecta* C89, *Thalamophyllia tenuescens, Trochocyathus (T.) philippinensis, Tropidocyathus lessonii* C89, *Truncatoflabellum mortenseni, Truncatoflabellum formosum.*

Stn 133. — 5.6.1985, 11°57.8'N, 121°52.25'E, 334-390 m, NW Panay: *Balanophyllia cornu, Flabellum (F.)* sp.

Stn 134. — 5.6.1985, 12°01.1'N, 121°57.3'E, 92-95 m, N Panay: *Caryophyllia (C.) lamellifera, Madracis* cf. *pharensis, Rhizosmilia sagamiensis, Trochocyathus (T.) maculatus.*

Stn 135. — 5.6.1985, 11°58.6'N, 122°01.8'E, 486-551 m, N Panay: *Flabellum (F.) lamellulosum, Flabellum (F.) magnificum.*

Stn 137. — 6.6.1985, 12°03.5'N, 122°05.8'E, 56 m, N Panay: *Eguchipsammia wellsi, Trochocyathus (T.) cooperi, Truncatoflabellum phoenix.*

Stn 138. — 6.6.1985, 11°53.8'N, 122°15.9'E, 252-370 m, N Panay: *Deltocyathus andamanicus, Caryophyllia (A.) spinicarens.*

Stn 139. — 6.6.1985, 11°52.9'N, 122°14.7'E, 240-267 m, N Panay: *Caryophyllia (A.) spinicarens, Caryophyllia (A.) spinigera, Conotrochus brunneus, Deltocyathoides orientalis, Deltocyathus andamanicus, Flabellum (U.) deludens, Letepsammia formosissima, Madrepora oculata.*

Stn 140. — 6.6.1985, 11°42.6'N, 122°34.5'E, 93-99 m, N Panay: *Asterosmilia marchadi, Caryophyllia (A.) grayi, Fungiacyathus (B.) variegatus, Guynia annulata, Trochocyathus (T.) semperi.*

Stn 142. — 6.6.1985, 11°47.3'N, 123°01.5'E, 26-27 m, N Panay: *Balanophyllia imperialis, Eguchipsammia wellsi, Truncatoflabellum aculeatum.*

Stn 143. — 7.6.1985, 11°28.3'N, 124°11.6'E, 205-214 m, NW Leyte: *Flabellum (F.) lamellulosum, Flabellum (F.) politum, Letepsammia formosissima, Stephanocyathus (A.) spiniger, Truncatoflabellum angustum, Truncatoflabellum candeanum.*

Stn 145. — 7.6.1985, 11°01.6'N, 124°04.2'E, 214-246 m, NE Cebu: *Caryophyllia (A.) spinicarens, Flabellum (U.) deludens.*

"SIBOGA"

Stn 12. — 14.3.1899, 7°15'S, 115°15.6'E, 289 m, Bali Sea, S Kangeang Isl., Bali Sea: *Caryophyllia (C.) transversalis, Madrepora arbuscula.*

Stn 41. — 3.4.1899, 7°25'S, 117°50.5'E, 96 m, Pulau Tenga (= Paternoster) Isl.: *Balanophyllia generatrix.*

Stn 49a. — 14.4.1899, 8°23.5'S, 119°04.6'E, 69 m, E Sumbawa, Sapeh Strait: *Fungiacyathus (F.) paliferus, Truncatoflabellum sp.*

Stn 52. — 20.4.1899, 9°03.4'S, 119°56.7'E, 959 m, SW Flores: *Sabinotrochus bipatella* (= *Stephanocyathus*).

Stn 59. — 26.4.1899, 10°22.7'S, 123°16.5'E, 390 m, W entrance Samau Strait: *Caryophyllia (C.) diomedeae, Premocyathus dentiformis.*

Stn 91. — 22.6.1899, E Borneo, Moeras reef, max. 54 m: *Placotrochus laevis.*

Stn 95. — 26.6.1899, 5°43.5'N, 119°40'E, 522 m, Sulu Isl.: *Balanophyllia gemma, Caryophyllia (C.) diomedeae, Deltocyathus philippinensis, Flabellum (U.) japonicum, Fungiacyathus (F.) stephanus, Madrepora oculata, Truncatoflabellum dens.*

Stn 100. — 29.6.1899, 6°11'N, 120°37.5'E, 450 m, Sulu Isl.: *Deltocyathus philippinensis.*

Stn 102. — 1.7.1899, 6°04.1'N, 120°44'E, 535 m, Sulu Isl., "dredge full of fine yellow sand, nearly no animals : *Balanophyllia generatrix* CSD?, *Thrypticotrochus multilobatus* CSD?

Stn 105. — 4.7.1899, 6°08'N, 121°19'E, 275 m, Sulu Isl.: *Crispatotrochus rubescens, Javania ?lamprotichum.*

Stn 116. — 12.7.1899, 0°58.5'N, 122°42.5'E, 72 m, N Sulawesi, W Kwandang Bay entrance: *Placotrochus laevis.*

Stn 133. — 25-27.7.1899, Talaut Isl., Salibabu Isl., Lirung, anchorage, max. 36 m: *Placotrochus laevis.*

Stn 150. — 11.7.1899, 0°06'N, 129°07.2'E, 1089 m, E Halmahera: *Conotrochus brunneus* CSD?

Stn 156. — 15.8.1899, 0°29.2'S, 130°05.3'E, 469 m, SW Waigeu: *Madrepora oculata.*

Stn 159. — 16.8.1899, 0°59.1'S, 129°48.8'E, 411 m, SE Halmahera: *Lochmaeotrochus oculeus.*

Stn 204. — 20.9.1899, 4°20'S, 122°58'E, 75-94 m, N entrance Buton Strait: *Caryophyllia (A.) grayi, Flabellum (F.) politum.*

Stn 211. — 25.9.1899, 5°40.7'S, 120°45.5'E, 1158 m, NE Saleyer: *Sabinotrochus flatiliseptis* (= *Stephanocyathus*).

Stn 212. — 26.9.1899, 5°54.5'S, 120°19.2'E, 462 m, Saleyer: *Flabellum (U.) hoffmeisteri, Placotrochides scaphula.*

Stn 231. — 14-18.11.1899, Ambon, anchorage, 40 m: *Tubastraea coccinea.*

Stn 240. — 22.11.-1.12.1899, Banda, anchorage, 9-45 m: *Blastotrochus nutrix, Tubastraea micranthus.*

Stn 251. — 8.12.1899, 5°28.4'S, 132°00.2'E, 204 m, Kai Isl.: *Balanophyllia parvula, Deltocyathus suluensis, Flabellum (F.) patens.*

Stn 253. — 10.12.1899, 5°48.2'S, 132°13'E, 304 m, Kai Isl.: *Truncatoflabellum sp.*

Stn 256. — 11.12.1899, 5°26.6'S, 132°32.5'E, 397 m, Kai Isl.: *Caryophyllia (C.) transversalis, Paracyathus sp.*

Stn 258. — 12-16.12.1899, Kai Isl.., Tual anchorage, 22 m: *Leptopsammia crassa.*

Stn 259. — 16.12.1899, 5°29.2'S, 132°52.5'E, 487 m, Kai Isl.: *Desmophyllum dianthus, Lochmaeotrochus oculeus, Madrepora oculata.*

Stn 260. — 16.12.1899, 5°36.5'S, 132°55.2'E, 90 m, Kai Isl.: *Cyathelia axillaris, Flabellum (F.) politum, Rhizotrochus typus.*

Stn 262. — 18.12.1899, 5°53.8'S, 132°48.8'E, 560 m, Kai Isl.: *Trochocyathus (T.) brevispina.*

Stn 266. — 19.12.1899, 5°56.5'S, 132°47.7'E, 595 m, Kai Isl.: *Enallopsammia pusilla.*

Stn 273. — 23-26.12.1899, NE Aru Isl., Pulu Jedan, anchorage, 13 m: *Placotrochus laevis.*

Stn 274. — 26.12.1899, 5°28.2'S, 134°53.9'E, 57 m, NE Aru Isl.: *Truncatoflabellum formosum.*

Stn 277. — 9-11.1.1900, Banda Sea, Dammer Isl., Kullewatti (Sollot) Bay, 45 m: *Dendrophyllia arbuscula.*

Stn 279. — 11-13.1.1900, Banda Sea, Roma Isl., Rumah-Kuda Bay, 36 m: *Placotrochus laevis.*

Stn 289. — 20.1.1900, 9°00.3'S, 126°24.5'E, 112 m, S Timor: *Caryophyllia (A.) grayi, Neohelia cf. porcellana.*

Stn 297. — 27.1.1900, 10°39'S, 123°40'E, 520 m, E Rotti Isl.: *Balanophyllia cornu, Placotrochides scaphula.*

Stn 299. — 27-29.1.1900, 10°52.4'S, 123°01.1'E, max. 34 m (dive), S Rotti Isl., Boeka or Cyrus Bay: *Truncatoflabellum spheniscus*.

Stn 303. — 2-5.1.1900, Samau Isl., Haingsisi, max. 36 m: *Truncatoflabellum incrustatum, Truncatoflabellum irregulare*.

Stn 305. — 8.2.1900, mid-channel in Solor Strait off Kampong Menanga, 113 m: *Neohelia cf. porcellana*.

Stn 310. — 12.2.1900, 8°30'S, 119°07.5'E, 73 m, E Sumbawa: *Cyathelia axillaris, Eguchipsammia gaditana*.

Stn 315. — 17-18.2.1900, Pulau Tenga (Paternoster) Isl., anchorage east of Sailus Besar, max. 36 m: *Blastotrochus nutrix*.

SMITHSONIAN INSTITUTION MARQUESAS EXPEDITION, *"PELE"*

Stn TH1. — 28.9.1967, 10°S, 139°10'W, 75-79 m, Marquesas: *Trochocyathus (T.) cooperi*.

SMITHSONIAN INSTITUTION PHILIPPINE EXPEDITION (= SIPHILEXP), *"STING RAY"* (mainly)

Stn 78-CAC189. — 7.5.1978, Cebu, Tanon Strait, Pescador Isl., 12-18 m: *Tubastraea micranthus*.

Stn 78-CAC194. — 11.5.1978, 9°04'15"N, 123°16'10"E, 1-6 m, SE Negros: *Tubastraea coccinea*.

Stn 78-SP1-1. — 8.5.1978, 9°25'15"N, 123°18'10"E, 1-5 m, SE Negros: *Tubastraea diaphana*.

Stn 78-SP40. — 11.6.1978, 9°31'14"N, 123°40'00"W, depth? (bought), Bohol Strait: *Stephanocyathus (A.) spiniger*.

Stn 78-T10. — 6.6.1978, 11°35'46"N, 123°55'32"E, 75 m, Visayan Sea: *Asterosmilia marchadi*.

Stn 78-T14 . — 6.6.1978, 11°34'45"N, 123°52'08"E, 84 m, Visayan Sea: *Balanophyllia carinata*.

SNELLIUS 2 EXPEDITION, *"TYRO"* (mainly)

Stn 81.2. — 28.8.1984, 6°59'S, 131°30'E, 340 m, Tanimbar Isl.: *Anthemiphyllia frustum, Bourneotrochus stellulatus, Caryophyllia (C.) quadragenaria, Deltocyathoides orientalis, Javania pachytheca, Notocyathus venustus, Peponocyathus minimus*.

Stn D2. — 3.3.1985, 6°57.9'S, 131°39.7'E, 91 m, Tanimbar Isl.: *Deltocyathoides orientalis, Idiotrochus kikutii, Notocyathus venustus, Truncatoflabellum phoenix*.

Stn 4.019. — 9.9.1984, 5°57.5'S, 123°46.5'E, 285-305 m, Tukang Besi Isl., S Karang Kaledupa: *Fungiacyathus (F.) paliferus, Stephanophyllia fungulus*.

Stn 4.032. — 10.9.1984, 5°52.5'S, 123°58.5'E, ca. 385 m, Tukang Besi Isl., NW Binongko: *Truncatoflabellum dens*.

Stn 4.033. — 10.9.1984, 5°52.5'S, 123°58.5'E, 250-290 m, Tukang Besi Isl., NW Binongko: *Anthemiphyllia dentata, Fungiacyathus (F.) paliferus*.

Stn 4.034. — 10.9.1984, 5°52.5'S, 123°58.5'E, 280 m, Tukang Besi Isl., NW Binongko: *Anthemiphyllia dentata, Deltocyathus stella, Fungiacyathus (F.) paliferus*.

Stn 4.039. — 10.9.1984, 5°54'S, 123°57.7'E, ca. 525 m, Tukang Besi Isl., NW Binongko: *Stephanophyllia neglecta*.

Stn 4.056. — 14.9.1984, 9°54'S, 120°44.8'E, 125 m, NE Sumba, E Melolo: *Conocyathus zelandiae*.

Stn 4.057. — 14.9.1984, 9°52.8'S, 120°44.7'E, 154 m, NE Sumba, E Melolo: *Letepsammia formosissima*.

Stn 4.066. — 16.9.1984, 9°53'S, 120°53'E, 295 m, NE Sumba: *Crispatotrochus rubescens*.

Stn 4.070. — 17.9.1984, 8°36'S, 119°31.2'E, rocky shore, E Komodo, Teluk Slawi: *Endopsammia philippensis*.

Stn 4.099. — 19.9.1984, 8°29'S, 119°38.2'E, 81 m, E Komodo: *Truncatoflabellum aculeatum*.

Stn 4.100. — 19.9.1984, 8°28.6'S, 119°37.3'E, 91 m, E Komodo: *Javania insignis, Rhizopsammia nuda*.

Stn 4.104. — 20.9.1984, 8°25.3'S, 119°36.2'E, 140-150 m, NE Komodo: *Neohelia cf. porcellana*.

Stn 4.105. — 20.9.1984, 8°25.7'S, 119°37.8'E, 105-120 m, NE Komodo: *Neohelia cf. porcellana*.

Stn 4.106. — 20.9.1984, 8°26.9'S, 119°37.9'E, 80 m, NE Komodo: *Cyathelia axillaris, Rhizotrochus typus*.

Stn 4.115. — 21.9.1984, 8°19.4'S, 118°15.3'E, 60-75 m, N Sumbawa, Bay of Sanggar: *Rhizotrochus typus*.

Stn 4.130. — 23.9.1984, 8°17.9'S, 118°17.8'E, 700-730 m, N Sumbawa, Bay of Sanggar: *Deltocyathus rotulus*.

Stn 4.134. — 25.9.1984, 6°31'S, 121°08.2'E, 53-59 m, NE Taka Bone Rate (Tiger Isl.), SE Tarupa Kecil: *Truncatoflabellum aculeatum*.

Stn 4.144. — 26.9.1984, 6°26.7'S, 121°10'E, 730-850 m, NE Taka Bone Rate (Tiger Isl.), NE Tarupa Besar: *Enallopsammia pusilla, Madrepora oculata.*

Stn 4.173. — 1.10.1984, 6°28.5'S, 120°24.3'E, 300-340 m, SW Salayer, NW Pulau Bahuluang: *Deltocyathus andamanicus.*

Stn 4.174. — 1.10.1984, 6°28.1'S, 120°24.2'E, 330 m, SW Salayer, NW of Pulau Bahuluang: *Fungiacyathus (F.) variegatus.*

Stn 4.196. — 9.10.1984, 6°23.0'S, 120°26.5'E, 150-200 m, SW Salayer, off Tanjung Batu Kerapo: *Madrepora minutiseptum.*

Stn 4.226. — 17.10.1984, 6°32'S, 121°10.5'E, NE Taka Bone Rate (Tiger Isl.), N Pulau Tinanja, scuba diving along reef edge: *Thalamophyllia tenuescens* CSD?

Stn 4.228. — 15.10.1984, 6°32.1'S, 121°07.5'E, 60 m, NE Taka Bone Rate (Tiger Isl.), N Pulau Tarupa Kecil: *Balanophyllia carinata, Balanophyllia stimpsonii, Truncatoflabellum aculeatum.*

Stn 4.232. — 16.10.1984, 6°32.1'S, 121°09.0'E, 59 m, NE Taka Bone Rate (Tiger Isl.), S Pulau Tarupa Kecil: *Balanophyllia stimpsonii, Placotrochides laevis, Truncatoflabellum aculeatum.*

Stn 4.234. — 17.10.1984, 6°31.6'S, 121°07.5'E, 58 m, NE Taka Bone Rate (Tiger Isl.), S Pulau Tarupa Kecil: *Balanophyllia carinata, Balanophyllia stimpsonii, Placotrochides laevis, Trochocyathus (T.) cooperi, Truncatoflabellum aculeatum.*

Stn 4.235. — 18.10.1984, 6°32.7'S, 121°08.7'E, 53-57 m, NE Taka Bone Rate (Tiger Isl.), S Pulau Tarupa Kecil : *Asterosmilia marchadi, Balanophyllia stimpsonii, Placotrochides laevis.*

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

Stn G3. — 27.9.1966, 26°25.0'S, 167°15.0'E, 710 m, Norfolk Ridge: *Flabellum (U.) sp.*

Stn K858. — 30.7.1974, 30°34.2'S, 178°29.8'W, 465 m, Kermadec Isl.: *Truncatoflabellum angustum.*

Stn Q47. — 24.5.1978, 33°06'S, 156°11'E, 135 m, Tasman Sea, Taupo Seamount: *Dendrophyllia cf. ijimai.*

Stn T243. — 24.3.1982, 30°05.0'S, 178°15.0'W, 1035 m, Kermadec Isl.: *Stephanocyathus (S.) regius.*

Stn U582. — 5.2.1988, 31°52.0'S, 172°26.5'E, 988-1058 m, Three Kings Ridge: *Flabellum (U.) sp.*

"Tansei Maru"

Stn KT86-16-F. — 3.11.1986, 31°55.3'N, 133°23.9'E, 2576-2603 m, S Shikoku: *Caryophyllia (C.) cornulum, Flabellum (U.) conuis.*

Stn KT90-13-T6. — 3.9.1990, 32°14.23'N, 134°01.3'E, 2547-2565 m, S Shikoku: *Caryophyllia (C.) cornulum.*

Stn KT93-09-AM6. — 22.6.1993, 28°20.48'N, 129°40.18'E, 107-108 m, Ryukyu, Amami: *Trochocyathus (T.) philippinensis.*

Stn KT93-09-AM7. — 22.6.1993, 28°17.07'N, 129°40.15'E, 191-196 m, Ryukyu, Amami: *Guynia annulata, Trochocyathus (T.) philippinensis.*

Stn KT93-09-AM8. — 25.6.1993, 28°11'N, 129°43'E, 422-425 m, Ryukyu, Amami: *"Tropidocyathus" labidus.*

"Te Vega"

Stn 1-54. — 25.9.1963, 1°08.6'N, 128°01'E, 46-55 m, Halmahera: *Balanophyllia imperialis, Balanophyllia stimpsonii.*

HISTORICAL REVIEW (INDONESIAN REGION)

Perhaps the earliest azooxanthellate corals reported from the Indonesian region were those collected by the *H. M. S. "Challenger"* at stations 191-198 and 214, as reported by Moseley (1876, 1881). Sixteen species were described, including 11 from one station (*"Challenger"* stn 192) at the Kai Islands at 256 m, 9 of those new species. The *"Challenger"* specimens are deposited at the BMNH and were examined by both authors.

The historically most significant collection of Indonesian deep-water corals, reported in at least 8 publications, was that of the *"Siboga"* expedition of 1899-1900, which made 323 stations throughout the Indonesian region and Sulu Archipelago (WEBER, 1902; TYDEMAN, 1902). ALCOCK (1902a, b, July) published 2 preliminary accounts in which he described 45 new species of deep-water corals from this expedition. Although the descriptions are adequate, he did not include illustrations of these species or station numbers for the specimens. Just one month later (ALCOCK, 1902c, August) his report on the deep-water (*i.e.*, over 100 fathoms, 183 m) corals of the *"Siboga"* Expedition (*"Siboga"* Report 16a) appeared, in which he published *verbatim* the description of 37 of the 45 species he described the previous month, 3 additional new species (*Paracyathus pruinosus, Flabellum laciniatum* var. *messum*, and *Pourtalosmilia dumosa*), 26 previously described species, and 7 lots identified only to the generic level (a total of 73 azooxanthellate species). Illustrations and station data were included for all taxa in the *"Siboga"* report, and, although ALCOCK (1902c: 2) noted that most of the new species had been published in a "preliminary communication ... of the Journal of the Netherland Zoological Society", the 2 earlier publications were largely forgotten until 1991 (HOEKSEMA & BEST, 1991). It is unknown why ALCOCK omitted 8 species from his *Siboga* report that were included in his preliminary accounts. These species were shallow water (0-183 m) azooxanthellates, on which he perhaps intended to write a separate *"Siboga"* report (ALCOCK, 1902c: 2); nonetheless, 2 of these 8 species were later redescribed by VAN DER HORST (1922) inadvertently as new species using ALCOCK's original names: *Dendrophyllia florulenta* and *Leptopsammia poculum* (the latter described as *Endopsammia poculum* by ALCOCK, 1902a). Even VAN DER HORST (1922) was apparently unaware of ALCOCK's preliminary papers. Only one of the other 6 species was ever cited; *Flabellum weberi*, a junior synonym of *Javania insignis* was cited by CAIRNS (1989a, 1994), based on a collection label, not the ALCOCK publication. The remaining 5 species: *Trochocyathus weberi (= ? T. cooperi), T. cavatus, Endopachys weberi (= E. grayi), Heteropsammia pisum*, and *Rhodopsammia (= Balanophyllia) corniculans*, all described in ALCOCK (1902a), were not subsequently reported. Aside from the 2 species redescribed by VAN DER HORST, the types of only 2 of the other 6 species are now known to exist at the ZMA: *Flabellum weberi* and *Endopachys weberi*.

In a paper describing the shallow-water fungiids collected by the *"Siboga"*, VAN DER HORST (1921, *"Siboga"* Report 16b) also reported 2 specimens of *Bathyactis (= Fungiacyathus) palifera*; and in a paper dedicated to the study of *Fungia patella*, BOSCHMA (1923, *"Siboga"* Report 16d) also described a new Indonesian species, *Stephanophyllia neglecta*, from a *"Siboga"* station off the Kai Islands. Another paper on *"Siboga"* azooxanthellates (VAN DER HORST, 1922, *"Siboga"* Report 16c) was an account of the dendrophylliids of the expedition, which included 36 species from Indonesian waters, 11 of these new; however, as mentioned above, 2 of these 11 new species were previously described by ALCOCK (1902a). Most *"Siboga"* specimens are deposited at the ZMA (see VAN SOEST, 1979 for type deposition) and have been examined by the authors.

Two more papers include reidentifications of *"Siboga"* specimens: ZIBROWIUS (1973) reidentified the *"Siboga" Dendrophyllia* reported by ALCOCK (1902c) in the context of a revision of the genus *Enallopsammia*; and ZIBROWIUS & GRYGIER (1985) reidentified two lots of *Balanophyllia* reported by VAN DER HORST (1922).

BEDOT (1907) reported *Cyathelia axillaris* from the Ceram Sea (depth unknown), a species previously reported by MOSELEY (1881) from the adjacent Molucca Sea.

Azooxanthellate Scleractinia collected on the Danish Expedition to the Kai Islands (DEKI) in 1922 have been reported in 3 publications. BOSCHMA (1923) listed 1 species, *Stephanophyllia formosissima*; VAN DER HORST (1926) reported 5 dendrophylliid species, including the new species *Rhizopsammia nuda*; and BOSCHMA (1953) reported *Tubastraea aurea (= T. coccinea* and *T. faulkneri*) from the Kai Islands and Ambon. However, the bulk of the specimens from that expedition are reported herein and are deposited at the NNM and ZMK (see Material).

More recent reports of Indonesian azooxanthellates from miscellaneous sources include: *Polycyathus furanaensis* from Sulawesi (VERHEIJ & BEST, 1987); *Anthemiphyllia dentata* from the Banda Sea (BEST & HOEKSEMA, 1987); *Cryptotrochus javanus* from the Java Sea (CAIRNS, 1988); and a revision of *Heterocyathus* and *Heteropsammia* from the Indonesian region (HOEKSEMA & BEST, 1991).

A common theme in previous expedition reports has been a high diversity of deep-water species from the Kai Islands, and the Indonesian region in general, as evidenced by the collections of the *"Challenger", "Siboga"*, and the Danish Expedition to the Kai Islands (DEKI). This is confirmed herein on the basis of collections from the SNELLIUS 2 and KARUBAR expeditions. ALCOCK (1902c: 3) alluded to the Kai Islands as second only to the Sulu

Archipelago in coral biodiversity; however, as a result of this study, 122 species are known from the Kai Islands, and only 65 from the Sulu Archipelago.

Works containing references to fossil azooxanthellates from the Indonesian region include: GERTH (1921), Miocene of Java; UMBGROVE (1938), Pleistocene of Talaud; UMBGROVE (1950), Pleistocene of Java; and BOEKSCHOTEN *et al.* (1989), Pliocene-Pleistocene of Nias.

A review of previous records of azooxanthellate Scleractinia from the Philippines can be found in CAIRNS (1989a).

MATERIAL

This study is based on the examination of approximately 15,600 coral specimens collected throughout the Philippine-Indonesian region from some 640 stations. A specimen equates to an individual solitary corallum or a colony or branch of a colonial species. Many of the new specimens were collected by the French and French-Indonesian expeditions: MUSORSTOM cruises 1-3 (1976, 1980, 1986, respectively), which concentrated on southwestern Luzon (vicinity of Lubang Island and Verde Island Passage), and also did some collecting near southern Luzon (Mindoro and Panay) (FOREST, 1981, 1985, 1989); CORINDON 2 (1980), on the R.V. *Coriolis*, which collected in Makassar Strait (MOOSA, 1984); and KARUBAR (1991) on the R.V. *Baruna Jaya 1*, which made extensive deep-water collections in the Banda Sea (Kai Islands) and Arafura Sea (southeast of Tanimbar Islands) (CROSNIER, RICHER DE FORGES & BOUCHET, 1997). Many of the MUSORSTOM 1 stations were made in a small area north of Lubang Island near *"Albatross"* stn 5278 (the type locality of *Neoglyphea inopinata*), a "living fossil" decapod crustacean. The French collections are divided among the MNHN, NMNH, and Puslitbang Oseanologi, Jakarta. Many additional specimens from the Philippines and Banda Sea also came from the *"Albatross"* expedition (1906-1909; see ANONYMOUS, 1910 for a history and station list of the expedition), and are deposited at the NMNH. A remarkably large and diverse collection of azooxanthellates was also made available from the Danish Expedition to the Kei Islands made in 1922 by Th. MORTENSEN and H. BOSCHMA. This expedition collected not only near the Kai Islands but also in the Java Sea (MORTENSEN, 1923). Specimens are deposited primarily in the NNM and to a lesser extent at the ZMK. Few specimens of shallow water azooxanthellates were found at the NNM from the *"Snellius"* expedition to Indonesia in 1930, but many upper slope specimens were available for study at the NNM from the SNELLIUS 2 (R/V *Tyro*) expedition of 1984, which made deep-water stations throughout the Indonesian region (VAN DER LAND & SUKARNO, 1986). Specimens from the following expeditions were also examined: *"Galathea"* expedition (1950-1952), throughout the Philippine and Indonesian region (see BRUUN, 1957; WOLFF, 1964), deposited at the ZMK; Mortensen's Java-South African Expedition (1929-1930), primarily from the Bali Strait, deposited at the ZMK; stations made by the *"Hakuho Maru"* (1972-1985) in the South China Sea, Philippine, and Indonesian waters (see NISHIWAKI, 1974; HORIKOSHI *et al.*, 1983; HORIKOSHI & OHTA, 1987), deposited at the ORI and NMNH; and specimens from *"Siboga"* stations (1899-1900) in Indonesian waters that were not previously reported (see TYDEMAN, 1902).

In addition to the newly reported specimens listed above, all previously reported specimens from the *"Siboga"* Expedition (ALCOCK, 1902a-c; HORST, 1921, 1922; BOSCHMA, 1923) and specimens from the Indonesian and Philippine stations of the *"Challenger"* Expedition (stations 191-213) were re-examined by the first author in 1994 and by the second author on various occasions. SEMPER's (1872) Philippine specimens were examined by the second author.

Although not politically part of Indonesia or the Philippines, specimens from the eastern coast of Sabah, Malaysia (*e.g.*, Darvel Bay, Celebes Sea) were included in this study, and their depth ranges included with those of the Indonesian region.

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 the remaining species for which new material is reported, with an indication as to where to find a more complete description. New material was collected

of 176 (85%) of the 206 species known from the Philippine-Indonesian region, the remaining 30 species being indicated in Table 1 by an asterisk but not discussed in the text. Most of these 30 are rarely collected species, indeterminable species (*e.g.*, those described but not illustrated by ALCOCK, 1902a, b), or probable junior synonyms of species better known under other names (*e.g.*, *Balanophyllia dubia, B. ovalis, B. parallela*). Although some species of *Heterocyathus* and *Heteropsammia* occur in this region and are acknowledged to be azooxanthellate, they are not included in this report.

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 Philippine-Indonesian region. When possible, all historical records were verified, but when material was unavailable and the published account unclear, the synonymy entry and corresponding distribution record are queried.

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, as well as Puslitbang Oseanologi - LIPI, Indonesia, in the case of KARUBAR material. Essentially, only new material is reported in the Material Examined sections, not types or previously reported specimens.

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 it most likely was collected.

The SEM and most conventional photography was done by the first author, the former on a Cambridge Stereoscan 100 in the SEM Laboratory of the NMNH.

COMMENSAL RELATIONSHIPS

Several types of specialized coral symbionts (other than simple epibionts) have been found associated with various members of the species-rich fauna of the Philippines and Indonesia studied here.

Lumbrinerid polychaete eroding the coral skeleton. — This association has been described in detail by ZIBROWIUS *et al.* (1975) on the basis of material from the northeastern Atlantic and the southwestern Indian Ocean (South Africa), with additional records from Madagascar, the China Sea, and Japan. The coral-skeleton-eroding polychaete *Lumbrineris flabellicola* (Fage, 1936) inhabits a soft tube exteriorly attached to the host, and causes a superficial to deep erosion of the coral skeleton. The worm itself is easily lost by the mechanical constraints of dredging and the subsequent manipulations, but frequently empty tube fragments remain attached to the coral, or a corrosion trace can be detected on the coral even after the worm and tube have disappeared. This association occurs in the Philippines and Indonesia. Worms obtained during cruise MUSORSTOM 2 in the Philippines have been compared by T. MIURA with *Lumbrineris flabellicola* from the northeastern Atlantic and Japan and have been found to be the same species (*L. flabellicola*) in these widely distant areas (T. MIURA, *in litt.*, 1989).

The following species have been found to be the coral partner of this association, specimens still bearing the worm (WO), or still having empty tubes fragments attached (ET), or showing only a characteristic erosion trace left over (TR):

Caryophyllia (C.) transversalis: DEKI stn 32 (WO).

Caryophyllia (A.) grayi: MUSORSTOM 2 stn 29 (ET); MUSORSTOM 3 stn 131 (ET, TR).

Caryophyllia (A.) spinigera: MUSORSTOM 2 stn 63 (WO).

Caryophyllia (A.) spinicarens: *"Albatross"* stn 5256 (ET), stn 5418 (TR), stn 5535 (ET), stn 5536 (TR), stn 5538 (TR); MUSORSTOM 1 stn 20 (TR?); MUSORSTOM 2 stn 63 (ET).

Conotrochus brunneus: MUSORSTOM 3 stn 92 (ET, TR).

Flabellum (F.) patens: KARUBAR stn 31 (TR).

Flabellum (F.) lamellulosum: MUSORSTOM 1 stn 27 (TR?), stn 31 (TR); MUSORSTOM 2 stn 63 (ET); MUSORSTOM 3 stn 86 (WO), stn 92 (WO, TR).

Flabellum (F.) sp.: MUSORSTOM 3 stn 133 (ET).
Rhizotrochus typus: MUSORSTOM 3 stn 131 (ET).
Balanophyllia sp.: MUSORSTOM 2 stn 33 (WO).
Dendrophylliidae, colonial: MUSORSTOM 2 stn 33 (WO).

Eunicid polychaete causing deformation of the coral colony. — Some colonies of *Madrepora oculata* from Indonesia (*"Albatross"* stn 5645; KARUBAR stn 56) show deformations similar to those found in colonies of *Madrepora oculata*, *Lophelia pertusa*, and *Solenosmilia variabilis* from the northeastern Atlantic, in which the parchment-like tube of *Eunice norvegica* (Linnaeus, 1767) is overgrown by the coral coenosteum and incorporated into the colony (ZIBROWIUS, 1980). We have no information whether the deformations of Indonesian *M. oculata* is caused by the same *Eunice* species. Similar deformations characterize all colonies of *Madrepora arbuscula* and of *Madrepora minutiseptum* studied here. Even though no overgrown soft tube has been formally identified in this material and no worm been extracted, it is presumed that the commensal organism is an eunicid polychaete. Overgrown parchment-like *Eunice* tubes have also been found in some colonies of *Neohelia* sp. cf. *N. porcellana*.

Acrothoracican cirripede crustacean boring the coral skeleton. — Acrothoracican cirripeds may bore the skeleton of live corals and when penetrating through the wall cause the polyp to deposit additional wall material that is intended to seal off the borer. The orifice of the burrow may migrate upward along the growing coral (GRYGIER & NEWMAN, 1985). Orifice motility is particularly marked in a specimen of *Javania lamprotichum* (MUSORSTOM 2 stn 53) bored by 4 large acrothoracids. Other species bored alive are *Tethocyathus virgatus* (MUSORSTOM 3 stn 108), *Balanophyllia crassiseptum* (KARUBAR stn 50) and *Balanophyllia* sp. (MUSORSTOM 1 stn. 61; MUSORSTOM 2 stn 32; MUSORSTOM 3 stn 131).

Ascothoracidan crustacean inducing a skeleton gall. — The most common aspect of this association has been described in detail by ZIBROWIUS & GRYGIER (1985), who already reported some examples from the Philippines and Indonesia: "internal galls" are recognizable as a spongy proliferation of the columella that covers the underlying cavity occupied by the parasite. The list from the Philippines and Indonesia now includes : *Deltocyathoides orientalis* (*"Albatross"* stn 5178, 5313, 5314, 5315, 5317, 5403, 5569); *Flabellum lamellulosum* (MUSORSTOM 2 stn 83); *Balanophyllia carinata* (*"Siboga"* stn 240); *Balanophyllia* sp. (MUSORSTOM 2 stn 34); *Balanophyllia* sp. (MUSORSTOM 3 stn 131); and *Dendrophyllia* sp. cf. *D. ijimai* (MUSORSTOM 2 stn 33). A newly recognized expression (GRYGIER & CAIRNS, 1996) of ascothoracidan gall induction are abnormally hypertrophied corallites in *Madrepora oculata* (*"Albatross"* stn 5529; DEKI stn 50; *"Hakuho Maru"* stn KH-73-2-44-2; KARUBAR stn 9, 13, 19, 77).

Cryptochirid crab inhabiting a crypt in the coral skeleton. — Cryptochirid (formerly hapalocarcinid) crabs are obligate symbionts of scleractinians. The crypts (or in some cases cage-like galls) they inhabit are due to dissolution of the coral skeleton and to induced modified coral growth (ZIBROWIUS, 1982; ZIBROWIUS & GILI, 1990). Previous to these authors, cryptochirids had always been considered as typical of the reef fauna, but new deep-water species continue to be discovered. *Zibrovia galea* Kropp & Manning, 1995, has thus been found on *Phyllangia papuensis* from the Philippines (MUSORSTOM 2 stn 47) and from Madagascar.

DISTRIBUTION

Regional Diversity. — VAUGHAN & WELLS (1943), ALCOCK (1902c), and CAIRNS (1989a) have all suggested that the highest diversity of deep-water corals (azooxanthellates) occurs in the Philippine-Indonesian region. ALCOCK mentioned the Sulu Archipelago and the Kai Islands as areas with a particularly diversified fauna. With the possible exception of the New Caledonia-Chesterfield Islands region, which even though a much smaller region, may have more species, the Philippine-Indonesian region does have the highest recorded number of azooxanthellate species, *i.e.*, 206 species (Table 1).

TABLE 1. — Geographic distribution and bathymetric ranges of all azooxanthellate species known from the Philippine-Indonesian region.

Key to areas: 1 = Japan and/or Ryukyu Islands, 2 = South China Sea, 3 = Philippine region, 4 = Celebes Sea and/or Makassar Strait, 5 = Molucca, Halmahera, and/or Ceram Seas, 6 = Banda Sea (including Teluk Bone), 7 = Arafura, Timor, and/or Savu Seas, 8 = Flores and/or Bali Seas, 9 = Java Sea, 10 = Indian Ocean, 11 = western and central Pacific islands (including Hawaiian Islands), 12 = Australia and/or New Zealand, 13 = eastern Pacific, 14 = Atlantic Ocean. Bathymetric ranges (given in meters) only for records from Philippine-Indonesian region.

Symbols: * no new records of these species and not included in text; ** no new records of these species but included in text; # distribution unknown; + fossil occurrence only.

			Philippine-Indonesian Region												Depth (m)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
POCILLOPORIDAE															
Madracis asanoi Yabe & Sugiyama, 1936	x		x								x				146-161
M. sp. cf. *M. pharensis pharensis* (Heller, 1868)			x			x									85-421
M. sp. A			x	x		x				x			x		124-208
FUNGIACYATHIDAE															
Fungiacyathus (F.) stephanus (Alcock, 1893)	x		x	x	x	x	x	x		x		x			245-1977
F. (F.) paliferus (Alcock, 1902)	x		x	x	x	x		x		x		x			69-530
F. (B.) sibogae (Alcock, 1902)					x	x				x					200-1914
F. (B.) granulosus Cairns, 1989	x		x	x		x	x								287-640
F. (B.) variegatus Cairns, 1989	x	x	x			x	x	x			+				84-440
F. (B.) turbinolioides Cairns, 1989		x	x	x											514-635
F. (B.) fissidiscus sp. nov.						x									282-287
MICRABACIIDAE															
Leptopenus sp. A sensu Cairns, 1989				x		x									287-871
**L. solidus* Keller, 1977	x				x										2000
Letepsammia formosissima (Moseley, 1876)	x	x	x			x	x	x		x	x				115-390
L. superstes (Ortmann, 1888)	x	x	x			x	x					x			185-282
Rhombopsammia niphada Owens, 1986	x		x			x	x								405-804
R. squiresi Owens, 1986			x	x			x								675-1401
Stephanophyllia fungulus Alcock, 1902	x	x	x	x		x	x			x					210-635
S. neglecta Boschma, 1923			x			x		x							49-555
S. complicata Moseley, 1876						x				x		x			210-397
RHIZANGIIDAE															
**Oulangia stokesiana* ME & H, 1848	x	x	x												shallow
Culicia stellata Dana, 1846	x	x	x												14-20
OCULINIDAE															
Madrepora oculata Linnaeus, 1758	x	x	x	x	x	x	x		x	x	x	x	x	x	112-2021
M. arbuscula (Moseley, 1881)			x	x		x		x							212-658
M. minutiseptum sp. nov.	x	x		x	x	x		x							150-200
Cyathelia axillaris (Ellis & Solander, 1786)	x		x	x	x	x		x	x						13-329
Neohelia sp. cf. *N. porcellana* Moseley, 1881				x		x	x	x							55-170
ANTHEMIPHYLLIIDAE															
Anthemiphyllia dentata (Alcock, 1902)	x	x	x	x		x				x		x			122-534
A. frustum Cairns, 1994	x	x				x									209-340

			Philippine-Indonesian Region												Depth (m)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
CARYOPHYLLIIDAE															
Caryophyllia (C.) diomedeae Marenzeller, 1904			x		x	x	x				x	x	x		300-885
C. (C.) crosnieri nom. nov.			x			x				x		x			206-330
C. (C.) secta sp. nov.			x			x	x								220-366
**C. (C.) panda* Alcock, 1902					x										1633
C. (C.) lamellifera Moseley, 1881			x			x						x			95-212
C. (C.) transversalis Moseley, 1881						x	x	x							210-397
C. (C.) rugosa Moseley, 1881	x		x			x				x	x	x			137-581
C. (C.) octonaria sp. nov.			x												186-194
C. (C.) hawaiiensis Vaughan, 1907		x	x	x		x					x	x			85-170
C. (C.) quadragenaria Alcock, 1902	x	x		x		x	x					x			112-385
C. (C.) scobinosa Alcock, 1902	?		x	x		x	x			x	x	x			353-1270
C. (C.) cornulum sp. nov.	x			x	x										1525-2350
C. (C.) ambrosia ambrosia Alcock, 1898	x		x	x			x			x	x	x		x	468-1048
C. (C.) grandis Gardiner & Waugh, 1938				x			x			x					251-567
C. (A.) grayi (ME & H, 1848)	x	x	x	x	x	x	x	x		x					54-268
C. (A.) dentata (Moseley, 1881)						x	x				x				90-263
C. (A.) spinigera (Saville Kent, 1871)	x		x			x	x	x							127-347
C. (A.) spinicarens (Moseley, 1881)		x	x		x	x	x								70-750
C. (A.) karubarica sp. nov.						x	x								389-477
C. (A.) unicristata sp. nov.							x								251-477
Premocyathus dentiformis (Alcock, 1902)	x	+	x			x	x		x			x			22-545
Crispatotrochus rubescens (Moseley, 1881)	x	x	x			x	x				x				226-522
C. rugosus Cairns, 1995			?	x								x			220-616
Labyrinthocyathus sp. A						x									210-268
Trochocyathus (T.) caryophylloides Alcock, 1902	x		x			x	x								185-304
T. (T.) rhombocolumna Alcock, 1902			x			x	x			x	x	x			209-522
T. (T.) maculatus Cairns, 1995			x									x			92-95
*#*T. (T.) cavatus* Alcock, 1902															unknown
T. (T.) philippinensis Semper, 1872	x	x	x	x		x									54-268
T. (T.) semperi sp. nov.			x	x		x									38-245
T. (T.) apertus sp. nov.			x			x		x							33-70
T. (T.) burchae (Cairns, 1984)			x			x		x	x		x				35-70
T. (T.) cooperi (Gardiner, 1905)	x		x			x	x	x	x	x	x				25-100
T. (T.) gardineri (Vaughan, 1907)			x									x			490
T. (T.) discus sp. nov.						x									240-278
T. (Aplocyathus) brevispina sp. nov.						x									240-282
T. (A.) longispina sp. nov.			x	x											326-558
Tethocyathus virgatus (Alcock, 1902)			x			x	x	x				x			137-315
Bourneotrochus stellulatus (Cairns, 1984)						x					x	x			263-340
Paracyathus rotundatus Semper, 1872		x	x						x		x				18-66
Paracyathus sp.						x	x								90-397
**P. pruinosus* Alcock, 1902	x		x							x					?15
**Polycyathus hodgsoni* Verheij & Best, 1987			x							x					35
**P. marigondoni* Verheij & Best, 1987			x												35
**P. furanaensis* Verheij & Best, 1987				x						x					6-52
Stephanocyathus (S.) regius sp. nov.		x	x	x			x					x			563-2160
S. (A.) spiniger (Marenzeller, 1888)	x	x	x			x	x			x	x	x			52-401

			Philippine-Indonesian Region													Depth (m)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
S. (A.) explanans (Marenzeller, 1904)				x		x	x			x					405-1016
S. (O.) weberianus (Alcock, 1902)	x	x	x	x	x	x	x					x			563-1756
Ericiocyathus echinatus gen. nov., sp. nov.			x												814-1401
Deltocyathus vaughani Yabe & Eguchi, 1932	x		x			x	x								247-807
D. philippinensis sp. nov.		x	x												402-522
D. stella sp. nov.			x			x	x								130-280
D. andamanicus Alcock, 1898			x			x	x			x	x				187-385
D. suluensis Alcock, 1902			x			x	x	x				x			204-540
D. rotulus (Alcock, 1898)	x		x	x	x	x	x	x		x					210-1719
D. magnificus Moseley, 1881	x	x	x	x	x	x	x					x			118-717
Conotrochus funicolumna (Alcock, 1902)	x	x	x	x		x	x				x	x			268-616
C. brunneus (Moseley, 1881)		x	x		x	x	x	x		x		x			97-477
Lochmaeotrochus oculeus Alcock, 1902		x		x	x	x		x							240-616
Aulocyathus recidivus (Dennant, 1906)	x			x						x		x			616-871
Paracontrochus zeidleri Cairns & Parker, 1992				x		x	x				x	x			351-558
Desmophyllum dianthus ME & H, 1848	x	x		x		x				x	x	x	x	x	487-522
Dactylotrochus cervicornis (Moseley, 1881)		x	x			x					x				84-205
Asterosmilia marchadi (Chevalier, 1966)		x	x	x		x		x		x				x	32-210
Thalamophyllia tenuescens (Gardiner, 1899)			x	x		x		x			x	x			22-288
Rhizosmilia robusta Cairns, 1993			x							x					194-202
R. sagamiensis (Eguchi, 1968)	x		x	x											97-183
R. elata sp. nov.	?		x												70-313
Phyllangia papuensis Studer, 1878			x			x				x	x				81-183
Sympodangia albatrossi gen. nov., sp. nov.			x	x		x									208-616
***Colangia moseleyi* (Faustino, 1927)			x												18-54
Coenosmilia arbuscula Pourtalès, 1874	x		x											x	296
Goniocorella dumosa (Alcock, 1902)	x	x		x	x	x				x		x			469-616
Confluphyllia juncta gen. nov., sp. nov.			x			x									266-385
TURBINOLIIDAE															
Conocyathus zelandiae Duncan, 1876							x			x		x			125
Endocyathopora laticostata Cairns, 1989			x			x	+	x							46-100
Alatotrochus rubescens (Moseley, 1876)	x		x			x						x			136-460
**Sphenotrochus hancocki* Durham & Barnard, 1952		x	x										x		42-274
"Cryptotrochus" venustus (Alcock, 1902)						x						x			200-397
**C. javanus* Cairns, 1988									x						585
Notocyathus venustus (Alcock, 1902)	x	x	x	x		x	x		x						70-555
N. conicus (Alcock, 1902)	x		x	x		x						x			34-923
Deltocyathoides orientalis (Duncan, 1876)	x	x	x	x		x	x			x	x	x		x	44-635
P. minimus (Yabe & Eguchi, 1937)	x	x	x	x		x		x							161-903
Peponocyathus folliculus (Pourtalès, 1868)	x		x	x		x	x							x	50-534
Tropidocyathus lessonii (Michelin, 1842)	x	x	x			x	x	x		x					50-421
"T." pileus (Alcock, 1902)	x	x	x			x	x			x		x			143-522
"T." labidus sp. nov.	x					x	x								206-390
Idiotrochus kikutii (Yabe & Eguchi, 1941)	x	x	x			x									97-645
Thrypticotrochus multilobatus Cairns, 1989		x	x			x				x		x			192-535

			Philippine-Indonesian Region												Depth (m)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
GUYNIIDAE															
Guynia annulata Duncan, 1872	x		x		x	x				x	x	x		x	97-194
FLABELLIDAE															
Flabellum (F.) pavoninum Lesson, 1831	x	x	x	x		x				x	x				96-156
F. (F.) magnificum Marenzeller, 1904	x		x	x		x	x			x					225-567
F. (F.) patens Moseley, 1881	x	x	x			x	x								204-439
F. (F.) lamellulosum Alcock, 1902		x	x			x	x		x						187-486
F. (F.) politum Cairns, 1989	x	x	x			x	x								40-288
F. (U.) deludens Marenzeller, 1904	x	x	x			x	x			x					176-480
F. (U.) marenzelleri Cairns, 1989			x			x	x	x							240-390
F. (U.) japonicum Moseley, 1881	x		x					x							425-1060
F. (U.) hoffmeisteri Cairns & Parker, 1992						x	x	x				x			345-477
F. (U.) messum Alcock, 1902			x	x			x		x	x		x			368-949
F. (U.) sp.			x									x			441-550
F. (U.) sexcostatum Cairns, 1989			x												685-772
F. (U.) conuis Moseley, 1881	x		x					x			x				1160-2570
Polymyces wellsi Cairns, 1991			x			x						x	x		385-842
Rhizotrochus typus ME & H, 1848	x	x	x	x		x		x		x					70-296
"R." flabelliformis Cairns, 1989			x			x	x					x			263-390
Gardineria philippinensis Cairns, 1989			x				x								192-494
**G. hawaiiensis* Vaughan, 1907			x								x	x			192-220
G. paradoxa (Pourtalès, 1868)						x								x	285-323
Javania insignis Duncan, 1876	x		x	x		x		x		x	x				73-296
J. lamprotichum (Moseley, 1880)			x								x	x			191-842
J. pachytheca Cairns, 1995				x	x							x			534-601
J. sp.							x								209-291
Truncatoflabellum spheniscus (Dana, 1846)	x	x					x		x			x			30-174
T. aculeatum (ME & H, 1848)		x	x	x	+	x	x	x	x						11-81
**T. crassum* (ME & H, 1848)			x												unknown
**T. stokesi* (ME & H, 1848)		x	x				x		+	x					256
**T. cumingi* (ME & H, 1848)			x		x										46-55
T. candeanum (ME & H, 1848)	x	x	x	x		x									70-290
T. incrustatum Cairns, 1989		x	x				x	x							30-415
T. irregulare (Semper, 1872)			x				x								18-42
T. paripavoninum (Alcock, 1894)			x	x		x	x	x		x		x			411-1022
T. formosum Cairns, 1989	x		x	x		x				?					42-933
T. pusillum Cairns, 1989			x	x		x				x					85-300
T. dens (Alcock, 1902)			x			x					x	x			300-522
T. phoenix Cairns, 1995	x		x			x	x					x			18-421
T. mortenseni sp. nov.			x			x		x							50-156
T. angustum sp. nov.			x			x						x			195-490
Blastotrochus nutrix ME & H, 1848			x	x		x	x	x	x						11-62
Placotrochides scaphula Alcock, 1902	x	+	x	x			x	x		x		x			462-1628
Placotrochus leavis ME & H, 1848		x	x	x	x	x	x	x	x	x		x			12-289
DENDROPHYLLIIDAE															
Balanophyllia carinata (Semper, 1872)			x	x	+	x		x	x	x	x				33-100

			Philippine-Indonesian Region												Depth (m)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
B. stimpsonii (Verrill, 1865)			x		x	x		x		x	x				18-75
**B. parallela* (Semper, 1872)			x				x			?					18-55
B. desmophyllioides Vaughan, 1907			x	x		x	x	x			x				95-393
B. cornu Moseley, 1881	x	x	x			x	x	x							185-520
B. gemma (Moseley, 1881)			x			x	x			?					137-522
**B. ovalis* (Semper, 1872)			x												11-18
*#*B. corniculans* (Alcock, 1902)															unknown
**B. dubia* (Semper, 1872)			x												55
**B. cumingi* ME & H, 1848	x		x							?					unknown
B. parvula Moseley, 1881		x	x			x	x								192-300
B. crassiseptum sp. nov.			x			x	x								183-250
**B. tenuis* van der Horst, 1922			x												unknown
B. rediviva Moseley, 1881			x	x	+	x									90-235
B. gigas Moseley, 1881	x		x			x					x	x			90-393
B. serrata sp. nov.			x												190-194
B. generatrix sp. nov.			x			x	x	x							96-535
B. imperialis Saville Kent, 1871		x	x	x	x					x					27-170
Endopachys grayi ME & H, 1848	x	x	x	x	x	x		x		x	x	x	x		50-245
E. bulbosa sp. nov.							x								233-251
Leptopsammia stokesiana ME & H, 1848			x					x		x					46-69
L. crassa van der Horst, 1922			x			x									22-187
**L. poculum* (Alcock, 1902)						x									90
Endopsammia philippensis ME & H, 1848			x			x		x	x	x	x	x			2-10
**Rhizopsammia minuta* van der Horst, 1922						x									36
R. verrilli van der Horst, 1922			x			x				x			x		6-278
R. nuda van der Horst, 1926		x	x					x	x	?					25-105
Eguchipsammia gaditana (Duncan, 1873)	x		x			x		x	x	x	x	x		x	30-212
E. wellsi (Eguchi, 1968)	x		x												32-124
**E. fistula* (Alcock, 1902)			x			x				x		x			90-275
**E. japonica* Rehberg, 1892	x					x						x			245
Cladopsammia echinata Cairns, 1984							x				x				222-226
**C. gracilis* ME & H, 1848	x					x				x	x		x		27-54
Dendrophyllia sp. cf. *D. ijimai*			x			x		x				x			69-130
D. arbuscula van der Horst, 1922	x		x			x	x			x		x			45-353
**D. sphaerica* Nemenzo, 1960			x												unknown
D. alcocki (Wells, 1954)		x		x		x				x	x	x			205-616
**D. florulenta* Alcock, 1902	x							x			?				91-113
**D. cribrosa* ME & H, 1851		x													unknown
Enallopsammia pusilla (Alcock, 1902)		x	x			x		x		x		x			325-730
E. rostrata (Pourtalès, 1878)	x		x		x	x				x	x	x		x	417-2021
Tubastraea micranthus (Ehrenberg, 1834)			x		x	x				x	x				0-60
T. diaphana (Dana, 1846)			x			x	x			x	x				1-54
T. coccinea Lesson, 1829	x		x			x				x	x		x	x	3-40
**T. faulkneri* Wells, 1982			x			x					x		x		3-8

TOTALS: Area 1: 77. — Area 2: 60. — Area 3: 157. — Area 4: 66. — Area 5: 30. — Area 6: 138. — Area 7: 83. — Area 8: 51. — Area 9: 20. — Area 10: 64. — Area 11: 47. — Area 12: 67. — Area 13: 11. — Area 14: 11.

Currently, 157 species of azooxanthellate Scleractinia are known from the Philippine Islands (Table 1), which, when combined with the 410 species of zooxanthellate species known from this country (VERON & HODGSON, 1989), results in 567 species of Scleractinia from this archipelago. 69 of the 157 azooxanthellate species (44%) are known from a small region north and northeast of Lubang Island, Verde Island Passage, which was intensively sampled by MUSORSTOM 1, 2 and 3. 66 azooxanthellate species (42%) of the Philippine fauna are recorded from the Sulu Archipelago, mainly as a result of the *"Siboga"* and *"Albatross"* expeditions early in the century. CAIRNS (1989a) reported no azooxanthellate species from the eastern coasts of the Philippines (*i.e.*, Pujada Bay, Mindanao to the Batan Islands); however, the present study indicates 10 such species, primarily found in Leyete and Lagonoy Gulfs: *Fungiacyathus stephanus, Caryophyllia scobinosa, Stephanocyathus regius, S. weberianus, Deltocyathus magnificus, Rhizosmilia elongata, Peponocyathus minimus, Flabellum deludens, Truncatoflabellum incrustatum*, and *T. formosum*.

A total of 174 azooxanthellate species are known from the Indonesian region (Table 1), the most species-rich subregion being the Banda Sea (138 species) and the most species-rich archipelago the Kai Islands, from which 125 species are known. As can be seen from Table 1, 66 species are known from the Celebes Sea (Sabah) and Makassar Strait; only 30 from the combined region of the Molucca, Halmahera, and Ceram Seas; 83 from the Arafura, Timor, and Savu Seas; 51 from the Flores and Bali Seas; and 20 from the Java Sea. It is highly probable that the wide variation in numbers of species for various seas reflects the unequal collecting effort. For example, the impressive total from the Kai Islands reflects collections made by the *"Challenger"*, *"Siboga"*, Danish Expedition to the Kei Islands, and the KARUBAR expeditions, making it one of the most intensively sampled upper slope areas in the world. Conversely, little collecting has been done in the Java Sea and even less off the southern coast of Java, which results in low numbers for these regions.

Regional Affinities. — The Philippine-Indonesian region lies at the heart of the largest and most diverse tropical marine province — the Indo-Polynesian — extending from the Persian Gulf to the Tuamotu Archipelago (BRIGGS, 1974). 65 of the 206 species known from this region (31.5%) are also known from the tropical regions of the Indian Ocean. ALCOCK (1902c) was surprised to discover that only 10% of his Indonesian *"Siboga"* species also occurred in the Indian Ocean; later, CAIRNS (1989a) was able to report an overlap of 25%, and the current ratio of 31.5% will probably continue to increase as Indian Ocean corals become better known. An even higher number of Philippine-Indonesian species are found to the north in the warm temperate region of southern Japan (77/206, or 37%). This may be due to the better-known nature of the Japanese fauna (CAIRNS, 1994) and/or suggests that the boundaries that distinguish shallow-water tropical and temperate regions do not coincide with boundaries of deep-water organisms. The number of shared species with southern tropical regions (*i.e.*, Australia and ridges/islands north of New Zealand) is similar to that shared with the Indian Ocean (*i.e.*, 67/206, or 32.5%). Only 47 (or 23%) of the Philippine-Indonesian species are known from other western and central Pacific islands (*e.g.*, Pelau, New Guinea, Fiji, Hawaiian Islands), which, except for the Hawaiian Islands (VAUGHAN, 1907; CAIRNS, 1984), have been poorly sampled. Only 11 Philippine-Indonesian species occur as far east as the west coast of the Americas (Table 1): of these, 4 are restricted to the Pacific Ocean, 4 have an Indo-Pacific distribution, and 3 are cosmopolitan in distribution. Of the 11 species that also occur in the Atlantic, most (9) are cosmopolitan species, 1 occurs in the eastern Atlantic and Pacific (*i.e.*, *Asterosmilia marchadi*), and 1 (*i.e.*, *Gardineria paradoxa*) is known only from the western Atlantic and western Pacific. The disjunct nature of the last 2 categories may be the result of inadequate collection.

Depth Distribution. — 198 azooxanthellate species were scored for their occurrence in 8 bathymetric zones. The remaining 8 of the 206 species known from this region are not considered because their depth distribution is unknown or uncertain (Table 1). The results were: 0-100 m (82 species), 100-200 m (89 species), 200-400 m (123 species), 400-600 m (79 species), 600-800 m (40 species), 800-1000 m (25 species), 1000-2000 m (19 species), and over 2000 m (4 species). When these data are graphed (depth range on the x-axis, number of species on the y-axis), a bell-shaped curve results, in this case peaking at the 200-400 m category (62%) and gradually attenuating with greater depth to only 2.5% at over 2000 m. This is consistent with a peak diversity of 53% at 200-300 fathoms (= 366-549 m) for Philippine azooxanthellates given by VAUGHAN & WELLS (1943, table 2), although their data were limited to only 51 species. A similar unpublished analysis of the southwest

Indian Ocean (CAIRNS & KELLER, 1993) and New Zealand (CAIRNS, 1995) azooxanthellates results in similar bell-shaped curves, but in the case of the southwest Indian Ocean (N = 97), peaking at a shallower depth of 100-200 m (55%), and for the New Zealand fauna (N=104) at a greater depth of 400-600 m (54%). The bell-shaped maximum at various depths in different parts of the world is probably correlated with regional water characteristics, especially temperature.

Although the depth record for a scleractinian coral is 6328 m (KELLER, 1976), only 4 species are known from the Philippine-Indonesian region at depths slightly in excess of 2000 m: *Flabellum conuis* (1160-2570 m), *Caryophyllia cornulum* (1525-2350 m), *Stephanocyathus regius* (563-2160 m), and *Enallopsammia rostrata* (417-2021 m).

SYSTEMATIC ACCOUNT

Order SCLERACTINIA

Suborder ASTROCOENIINA

Family POCILLOPORIDAE Gray, 1842

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

Madracis asanoi Yabe & Sugiyama, 1936

Figs 1 a-d

Madrasis (sic) *asanoi* Yabe & Sugiyama, 1936: 349, figs 4-4a.
Madracis palaoensis Yabe & Sugiyama, 1936: 349, figs 5-5a; 1941: 71, pl. 62, figs 1-1a (**new synonym**).
Madracis asanoi - YABE & SUGIYAMA, 1941: 71, pl. 61, fig. 4, pl. 62, fig. 2. — ? EGUCHI, 1968: C11.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5277, 1 branch (USNM 96671). — Stn 5381, 1 branch (USNM 96672).

TYPE LOCALITY. — West channel of Pelau barrier reef, Pelau, 160 m.

DESCRIPTION. — Corallum ramose, sparsely branched in 3 dimensions; distal branches blunt, 3.5-4.0 mm in diameter. Calices circular to slightly elliptical; GCD from 1.07-*1.62*-2.04, with large calices directly adjacent to some of the smallest. Calices at branch tips relatively close to one another (*e.g.*, 0.3 mm apart), this intercalicular distance increasing to 1.0-1.5 mm on large-diameter branches. Coenosteum covered with short (0.15-0.17 mm in height) spines arranged in rows, 1 row occurring between closely packed distal calices and 3 or 4 rows between spaced out calices on larger-diameter branches.

Ten primary septa 0.20-0.25 mm exsert and 0.25-0.30 mm in width, their inner edges fused to the massive columella. In some larger calices traces of secondary septa occur in some interseptal chambers formed by the primary septa, these secondaries irregular in development, quite small, and having dentate inner edges. Columella a large dome-shaped structure occupying most of calice and rising slightly above coenosteal level. In centre of dome is a wedge-shaped columellar lamella that rises as high as primary septa.

REMARKS. — *Madracis asanoi* is similar to *M. interjecta* Marenzeller, 1907, which is known only from the Red Sea, but differs in having calices of very unequal size — the calices of *M. interjecta* being of a uniform size. *M. asanoi* is distinguished from *M. kauaiensis* Vaughan, 1907 (Hawaiian Islands) by having thicker and blunt terminal branches; a shallower fossa; and nonuniform calicular sizes. The record of *M. asanoi* from Japan (EGUCHI, 1968) is queried because of its delicate, attenuate branching; deep calicular fossa; and large calices (up to 3 mm).

Madracis palaoensis is considered to be synonymous with *M. asanoi* given the similarity evident in their respective illustrations; the differences cited by YABE & SUGIYAMA (1936) are considered as intraspecific variation.

DISTRIBUTION. — *Philippines*: Lubang Island; Ragay Gulf, Luzon; 146-161 m. *Elsewhere*: Palau; ? Sagami Bay, Honshu; 110-183 m.

Madracis sp. cf. *M. pharensis* (Heller, 1868)

Figs 1 g-h

Madracis sp. - WELLS, 1954: 414, pl. 99, fig. 5.
Madracis pharensis - WELLS, 1983: 224, pl. 16, figs 1, 5-6.
Madracis sp. cf. *M. pharensis* - CAIRNS, 1991: 6, pl. 1, figs b-e, pl. 11, fig. g (synonymy). — GARDINER & WAUGH, 1939 : 229.
Madracis sp. A - CAIRNS, 1994: 36-37 (in part: USNM 88378, not pl. 13, figs c-f).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5162, 1 (USNM 96674). — Stn 5268, 1 (USNM 96675). MUSORSTOM 3: stn 117, 1 (USNM 96676). — Stn 131, 1 (MNHN). — Stn 134, 5 (MNHN).
Indonesia. DEKI: stn 24, 1 (ZMUC).
Fiji. Korolevu, 27 m, 10 colonies (USNM 96673).
Gulf of California. Las Animas, La Paz, Gulf of California, 12 m, 1 colony (USNM 93920).

TYPE LOCALITY. — Hvarski Kanal, Adriatic Sea, 36 m.

DIAGNOSIS. — Coralla exclusively encrusting, forming relatively small colonies (usually less than 20 corallites) shaped as: thin, irregular masses; stoloniferous ribbons; or small nodules. Perimeter of colonies usually enclosed by a smooth, low epithecal lip. Corallites polygonal in shape and 1.5-2.5 mm in diameter, each calice sharing a thin (0.07-0.09 mm) common wall with its adjacent calices. Intercalicular walls bear tall (up to 0.2 mm) triangular spines, one corresponding to each of the 20 septa in corallite.

Septa decamerally arranged in 2 cycles (20 septa), the 10 primary septa rising as high as the costal spines, but their outer edges separated from the costal spines by a deep notch. Inner edges of primary septa smooth and vertical, each primary bearing a discrete paliform lobe; however, paliform lobes of 5 primary septa are wider and taller than the lobes of the other 5 alternate primaries, the larger lobes being 0.12-0.15 mm in width, the smaller, 0.06-0.07 mm (Fig. 1h). Septal faces covered with tall (40-50 µm), blunt spines. Secondary septa 1/2 to 2/3 width of primaries and much less thick, having dentate to laciniate inner edges. Columella a massive pointed style rising well above paliform lobes as high as the exsert septa. Columellar style varies from cylindrical to slightly elliptical or flattened in cross section and is surrounded by a crown of 10 P_1.

REMARKS. — Three species of *Madracis* are characterised as having exclusively encrusting coralla: *M. decactis* (Lyman, 1859); *M. kirbyi* Veron & Pichon, 1976; and *M. pharensis*. *M. pharensis* is distinguished from the other two by having well-developed secondary septa and a distinct ring of P_1. *M. kirbyi* is also reported from the Philippines (VERON & HODGSON, 1989), but is not discussed herein because it is considered to be a zooxanthellate.

Although no skeletal differences could be found between Atlantic and Pacific populations of *Madracis* reported herein, the second author believes that characteristics of the soft parts of these populations may ultimately place the Atlantic and Indo-Pacific populations in different species or subspecies.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Mindoro Strait; Sibuyan Sea; Sulu Sea (west of Panay and Sulu Archipelago); 95-421 m. *Indonesia*: Banda Sea (Kai Islands); 85-124 m. *Elsewhere*: Marshall Islands; Galápagos; Fiji; Gulf of California; 5-343 m.

Madracis sp. A

Figs 1 e-f

Madracis asperula ? - GARDINER & WAUGH, 1939: 229. — DURHAM & BARNARD, 1952: 14-15, pl. 1, figs 2 a-b. — WELLS, 1983: 224. [Not *Madracis asperula* H. Milne Edwards & Haime, 1849].
Madracis sp. cf. *M. asperula* - CAIRNS, 1991: 5-6, pl. 1, fig. a.

Madracis sp. A - CAIRNS & KELLER, 1993: 228-229, pl. 3, figs A-B (in part: not USNM 91499). — CAIRNS, 1994: 36-37, pl. 13, figs c-f (in part: not USNM 88378).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5217, 3 branches (USNM 96679). — Stn 5311, 1 branch (USNM 96680). — Stn 5398, 2 branches (USNM 96681).
Indonesia. CORINDON 2: stn 248, 1 branch (USNM 96684).
KARUBAR: stn 22, 1 fragment (POLIPI). — Stn 29, 1 fragment (MNHN).

DIAGNOSIS. — Corallum ramose, sparsely branched in all directions; distal branches slender and attenuate, about diameter of a calice. Calices circular to slightly elliptical, 1.75-2.5 mm in GCD, and usually separated by 0.4-0.5 mm of coenosteum, although calices more crowded near branch tips. Coenosteum spinose. Septa decamerally arranged in 2 cycles (20 septa). The 10 primary septa are exsert, having spinose faces, each bearing a small axial paliform lobe. The 10 secondary septa are rudimentary, each expressed as a row of small spines. Fossa shallow. Columella consists of a central, circular platform from which a pointed, laterally compressed style projects. 10 P_1 encircle the columellar style at the edge of the circular platform.

REMARKS. — *Madracis* sp. A was compared to *M. asperula* H. Milne Edwards & Haime, 1849 (type locality: Madeira), primarily because both species have slender branches and decameral symmetry; however, *Madracis* sp. A consistently differs in having rudimentary secondary septa and a ring of small P_1. *Madracis* sp. A is more similar to *M. profunda* Zibrowius, 1980 (northeastern Atlantic, 112-327 m), both species having slender branches, 10 primary and 10 small secondary septa. *M.* sp. A appears to differ in having a distinct crown of P_1. In calicular features, *Madracis* sp. A is similar to *M. pharensis*, but differs significantly in having a ramose corallum.

DISTRIBUTION OF SIMILAR FORMS. — *Philippines*: Ragay Gulf, Luzon; Samar Sea; 161-208 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 124-181 m. *Elsewhere*: southwestern Indian Ocean; Arabian Sea; Galápagos; 46-274 m.

Suborder FUNGIINA

Superfamily FUNGIOIDEA Dana, 1846

Family FUNGIACYATHIDAE Chevalier, 1987

Genus ***FUNGIACYATHUS*** Sars, 1872

Subgenus ***FUNGIACYATHUS (FUNGIACYATHUS)*** Sars, 1872

DISCUSSION. — The nominate subgenus has recently been defined (CAIRNS, 1989a) as including those species that have 5 cycles of septa (96 septa), the subgenus *Bathyactis* reserved for those species having 4 cycles of septa (48). However, the second author suggests that a more meaningful division of the genus would be based on the characteristic of their septal edges, the nominate subgenus, defined by type species *F. fragilis,* having corrugated septa with sinuous edges, and the subgenus *Bathyactis*, defined by the type species *F. symmetricus*, having planar septa with straight edges. Under this suggestion, 3 Recent species would be placed in the nominate subgenus: *F. fragilis, F. stephanus*, and *F. pliciseptus* Keller, 1981, only the last having 4 cycles of septa. The 15 remaining Recent species would be placed in the subgenus *Bathyactis*, all but 3 having 4 cycles of septa.

Fungiacyathus (F.) stephanus (Alcock, 1893)

Bathyactis symmetrica - MOSELEY, 1881: 189 (in part: *"Challenger"* stn 194). — ALCOCK, 1902c: 37 (in part: *"Siboga"* stn 12 and 18). [Not *Fungia symmetrica* Pourtalès, 1871].
Bathyactis stephanus Alcock, 1893: 149, pl. 5, figs 12, 12a; 1902c: 38.

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

Fungiacyathus (F.) stephanus - Zou *et al.*, 1988: 195. — 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. — Cairns & Keller, 1993: 230.

Material examined. — **Philippines**. *"Siboga"*: stn 95, 1 with flat base (ZMA).
Musorstom 1: stn 49, 1 with flat base (MNHN). — Stn 54, 1 with flat base (USNM 96694).
Musorstom 2: stn 24, 17 with concave bases (MNHN). — Stn 25, 26 with concave bases (MNHN).
Musorstom 3: stn 116, 20 with concave bases: 5 (MNHN), 15 (USNM 96696).
Indonesia. *"Hakuho Maru"*: stn KH72-1-26, 4 with flat bases (USNM 96698).
Deki: stn 49, 1 (NNM 22472).
Corindon 2: stn 286, 1 with flat base (MNHN).
Karubar: stn 12, 2 with flat bases (USNM 96686). — Stn 20, 3 with concave bases (POLIPI). — Stn 21, 4 with flat bases: 3 (MNHN), 1 (POLIPI). — Stn 35, 1 with flat base (USNM 96687). — Stn 36, 2 with flat bases (MNHN). — Stn 39, 2 with concave bases (MNHN). — Stn 56, 1 with concave base (USNM 96693). — Stn 59, 9 with flat bases (MNHN). — Stn 62, 2 with flat bases (USNM 96691).

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

Diagnosis. — Two forms of the species occur, one having a flat base and another with a highly concave base. Corallum large and fragile, the flat-based form up to 62 mm in diameter (Karubar stn 36); concave-based coralla usually smaller and may have a marginal shelf. Costae consist of thin, finely serrate ridges. Septa hexamerally arranged in 5 full cycles, the inner septal edges highly sinuous. Each S_1 bears 20-23 trabecular ridges on each face and is linked to adjacent septa by 12-15 T-shaped synapticulae. Septal canopies porous and rudimentary. Small P_2 usually present adjacent to columella. Columella crispate and flat.

Remarks. — *Fungiacyathus stephanus* is distinguished from *F. paliferus* (Alcock, 1902), the only other Indonesian species having 5 cycles of septa, by having a larger, more fragile corallum; sinuous septa; and smaller P_2. It is more fully described and illustrated by Cairns (1989a, 1994).

Distribution. — *Philippines*: Lubang Island; Verde Island Passage; Bohol Sea; Sulu Sea (Palawan and Sulu Archipelago); South China Sea (Palawan); 245-1335 m. *Indonesia*: Makassar Strait; Halmahera Sea; Banda Sea (Kai Islands, Banda Islands, and Tukangbesi Islands); Arafura Sea (southeast of Tanimbar Islands); Timor Sea (south of Leti Islands); Bali Sea; 245-1977 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); southwestern Indian Ocean; Bay of Bengal; Lord Howe Rise; Norfolk and Kermadec Ridges; Japan (Honshu, Kyushu, and Ryukyu Islands); 446-2000 m.

Fungiacyathus (F.) paliferus (Alcock, 1902)

Bathyactis palifera Alcock, 1902a: 108; 1902c: 38, pl. 5, figs 34, 34a. — Van der Horst, 1921: 38. — Faustino, 1927: 214, pl. 71, figs 1-2.

Bathyactis symmetrica - Alcock, 1902c: 37 (in part: *"Siboga"* stn 95). — Faustino, 1927: 213 (in part: *"Siboga"* stn 95). [Not *Fungia symmetrica* Pourtalès, 1871].

Bathyactis kikaiensis Yabe & Eguchi, 1942b: 138, 155-156, pl. 12, figs 6-7.

Fungiacyathus (F.) paliferus - Cairns, 1989a: 9-10, pl. 2, figs c-i, pl. 3, figs a-c (synonymy); 1994: 37-38, pl. 14, figs a-e. — Cairns & Parker, 1992: 6-7, pl. 1, figs a-b. — Cairns & Keller, 1993: 230.

Not *Bathyactis palifera* - Latypov, 1986: 266, 268 [probably a juvenile fungiid].

Not *Fungiacyathus palifera* - Keller, 1976: 33-34, pl. 1, figs 1-2 [= *Fungiacyathus* sp., see Cairns, 1994].

Material examined. — **Philippines**. Musorstom 3: stn 102, 2 (USNM 96700). — Stn 130, 2 (MNHN). — Stn 131, 2 (MNHN).
Indonesia. *"Siboga"*: stn 49a, 1 (ZMA Coel. 706).
Deki: stn 2, 1 (NNM 22475). — Stn 3, 2 (NNM 22476). — Stn 5, 1 (NNM 22477). — Stn 6, 1 (NNM 22478). — Stn 24, 1 (NNM 22479). — Stn 42, 1 (NNM 22482). — Stn 49, 4 (NNM 22481). — Stn 58, 1 (NNM 22483). — Stn 63, 1 (NNM 22482).

CORINDON 2: stn 210, 1 (MNHN). — Stn 275, 1 irregular fragment (MNHN).
SNELLIUS 2: stn 4.019, 2 (NNM 22529). — Stn 4.033, 3 (NNM 22528). — Stn 4.034, 2 (NNM 22484).
KARUBAR: stn 2, 1 (MNHN). — Stn 3, 10 irregular fragments (MNHN). — Stn 7, 15 irregular fragments (MNHN). — Stn 15, 6 irregular fragments (MNHN). — Stn 18, 1 (USNM 96699). — Stn 28, 2 irregular fragments (MNHN). — Stn 49, 2 irregular fragments (MNHN).

TYPE LOCALITY. — Sulu Sea and Moluccas, 141-350 m.

DIAGNOSIS. — Corallum robust, up to 21 mm in calicular diameter, having a slight to only slightly concave base covered with rounded, granular costae. 5 cycles of hexamerally arranged, straight, planar septa. Each S_1 bears 15-20 trabecular ridges on each face and is linked to its 2 adjacent septa by 9-14 solid synapticulae. Septal canopies porous and rudimentary. Well-developed P_2 and sometimes even P_3 present. Columella crispate and rudimentary.

REMARKS. — Comparisons to the other species in this subgenus known from the Indonesian region, *F. stephanus* (Alcock, 1893), are made in that account and by CAIRNS (1989a, table 1). *F. paliferus* is more fully described and illustrated by CAIRNS (1989a, 1994) and CAIRNS & PARKER (1992).

Small (up to 5 mm CD) irregularly regenerated specimens thought to be *F. paliferus* were obtained from KARUBAR stations 3, 7, 15, 28, and 49.

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (west of Panay and Sulu Archipelago); 90-522 m. *Indonesia*: Makassar Strait; Halmahera Sea; Banda Sea (Kai and Tukangbesi Islands; Teluk Bone, Sulawesi); Flores Sea (Sumbawa); 69-530 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); southwestern Indian Ocean; Great Australian Bight; Japan (Honshu, Korea Strait, and Ryukyu Islands); 70-823 m.

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

Fungiacyathus (B.) sibogae (Alcock, 1902)

Bathyactis sibogae Alcock, 1902a: 108; 1902c: 38 (in part: *"Siboga"* stn 175). — FAUSTINO, 1927: 214 (in part: *"Siboga"* stn 175). — VAN SOEST, 1979: 109 (in part: *"Siboga"* stn 175), pl. 2, figs 1-2.
Bathyactis symmetrica - ALCOCK, 1902c: 37 (in part: *"Siboga"* stn 208). [Not *Fungia symmetrica* Pourtalès, 1871].
Bathyactis stabilis Gardiner & Waugh, 1939: 231-232, text-figs 1-2.
Fungiacyathus sibogae - WELLS, 1977: 7. — CAIRNS, 1989a: 10-11, pl. 3, figs d-k, pl. 4, figs a-c. — CAIRNS & KELLER, 1993: 229-230 (synonymy).

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 50, 1 (NNM 22474). — Stn 57, 5 (NNM 22473).

TYPE LOCALITY. — *"Siboga"* stn 175: 2°37.7'S, 130°33.4'E (Ceram Sea), 1914 m.

DIAGNOSIS. — Corallum fragile, up to 14.5 mm in GCD; base flat, covered with narrow ridged, serrate costae. Septa hexamerally arranged in 4 cycles of planar septa, each S_1 composed of 14-19 trabeculae, the innermost 5 or 6 forming tall exsert spines. Synapticular plates T-shaped, approximately 6 per S_1. Columella papillose and rounded.

REMARKS. — It was previously thought that 2 of the paralectotypes of *Bathyactis sibogae*, those from *"Siboga"* stn 95 and 159, were missing (CAIRNS, 1989a: 11); however, in 1994 the specimen from *"Siboga"* stn 95 was found in the collections of the ZMA (Coel. 5098). It was mounted on a board along with a specimen of *Flabellum japonicum* in a bottle of preservative, filed under the name of the latter species. It is the flat-based form of *Fungiacyathus stephanus* and measures about 48 mm in diameter. *F. sibogae* is more fully described and illustrated by CAIRNS (1989a), which also includes a key to the species from this region.

DISTRIBUTION. — *Indonesia*: Molucca Sea; Ceram Sea; Banda Sea (Kai Islands and southeast of Sulawesi); 200-1914 m. *Elsewhere*: southwest Indian Ocean; 463-1948 m (CAIRNS & KELLER, 1993).

Fungiacyathus (B.) granulosus Cairns, 1989

Bathyactis symmetrica - ALCOCK, 1902c: 37 (in part: *"Siboga"* stn 59). [Not *Fungia symmetrica* Pourtalès, 1871].
Fungiacyathus (B.) granulosus Cairns, 1989a: 11, pl. 4, figs d-i; 1994: 39, pl. 15, figs d-e.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 43, 5 (USNM 96705). — Stn 44, 13 (MNHN). — Stn 50, 1 (MNHN).
MUSORSTOM 2: stn 25, 20 (USNM 96707). — Stn 82, 14 (MNHN).
MUSORSTOM 3: stn 106, 6 (MNHN).
Indonesia. KARUBAR: stn 3, 1 (USNM 96708). — Stn 7, 7 + 8 juveniles (USNM 96702). — Stn 40, 3 (USNM 96704). — Stn 56, 1 (POLIPI). — Stn 58, 1 (MNHN). — Stn 59, 2 (MNHN).

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

DIAGNOSIS. — Corallum robust, up to 24.5 mm in calicular diameter (KARUBAR stn 40), with a flat to slightly concave base covered with rounded, granular costae. Septa hexamerally arranged in 4 cycles, each S_1 having 21-24 coarsely dentate trabecular ridges on each face and linked to its adjacent septa by 6-9 Y-shaped synapticulae. Septa planar. Septal canopies porous, but well developed. Paliform lobes absent, but well-developed trabecular spines present on all septa. Columella large and tuberculate.

REMARKS. — As noted by CAIRNS (1989a), *F. granulosus* differs from *F. sibogae* in having a granular base and beaded costae that are rounded to triangular in cross section, not covered with thin, serrate ridges as in *F. sibogae*. Also, *F. granulosus* attains a larger diameter (24 mm vs 15 mm) and has more robust inner trabecular spines, especially those of the S_2. *F. granulosus* is more fully described and figured by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Tablas Strait, Mindoro; 428-640 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Savu Sea (Timor); 287-567 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); northern Ryukyu Islands; 402-410 m.

Fungiacyathus (B.) variegatus Cairns, 1989

Fungiacyathus fragilis - WELLS, 1984: 205-206 (in part: USGS 24918, pl. 1, figs 1-2). [Not *Fungiacyathus fragilis* G.O. Sars, 1872].
Fungiacyathus (B.) variegatus Cairns, 1989a: 11-12, pl. 5, figs a-h; 1994: 38-39, pl. 15, figs a-b.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 13, 2 (MNHN). — Stn 14, 3 (MNHN). — Stn 15, 4 (MNHN). — Stn 25, 1 (MNHN).
MUSORSTOM 2: stn 4, 1 (USNM 96710). — Stn 12, 1 ((USNM 96711). — Stn 64, 2 (MNHN). — Stn 66, 1 (MNHN).
MUSORSTOM 3: stn 87, 3 (MNHN). — Stn 88, 1 (USNM 96713). — Stn 95, 1 (USNM 96714). — Stn 96, 1 (USNM 96715). — Stn 97, 2 (MNHN). — Stn 99, 7 (MNHN). — Stn 100, 7 (USNM 96718). — Stn 101, 21: 5 (MNHN), 16 (USNM). — Stn 108, 1 (USNM 96720). — Stn 111, 3: 2 (MNHN), 1 (USNM 96721). — Stn 112, 2 (MNHN). — Stn 121, 1 (MNHN). — Stn 140, 3 (USNM 96722).
Indonesia. DEKI: stn 24, 1 (NNM 22485). — Stn 48, 1 (NNM 22486). — Stn 50, 1 (ZMUC), 6 (NNM 22487). — Stn 63, 8 (NNM 22488).
"Galathea": stn 480, 9 (ZMUC).
SNELLIUS 2: stn 4.174, 1 (NNM 22490).
KARUBAR: stn 31, 1 (POLIPI). — Stn 76, 1 (MNHN).

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

DIAGNOSIS. — Corallum delicate, up to 10.3 mm in calicular diameter (KARUBAR stn 76), with a flat to slightly concave base. Centre of base granular, but edge of base covered with thin, serrate costal ridges. Septa hexamerally arranged in 4 cycles, each S_1 bearing 15-17 low dentate trabecular ridges per face and linked to their

adjacent septa by 3 or 4 solid synapticulae. Septa planar. Septal canopies well developed, solid, and inclined. Paliform lobes absent, but S_2 trabecular spines well developed. Columella rudimentary.

REMARKS. — *Fungiacyathus variegatus* is distinguished by its relatively small size and its broad, solid canopies that unite the inner edges of the S_3 to their common S_2, and the S_4 to their common S_3. In well-preserved coralla S_{1-2} are pigmented a dark brown, but this pigmentation was present on only about 1/3 of the specimens listed above, the colour apparently fading after the death of the coral. Small coralla (< 4 mm GCD) are stellate in shape, their S_{1-2} projecting beyond the otherwise circular calicular perimeter. This species is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan Sea; Visayan Sea; Sulu Sea (Semirara Islands); 84-333 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Flores Sea (Selayar Island, Sulawesi); Bali Strait; 100-440 m. *Elsewhere*: South China Sea (Hong Kong); Japan (Kyushu and Ryukyu Islands); 422-715 m. Pleistocene of Vanuatu (WELLS, 1984).

Fungiacyathus (B.) turbinolioides Cairns, 1989

Fungiacyathus (B.) turbinolioides Cairns, 1989a: 12-13, pl. 6, figs a-g.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5424, 1 (USNM 96724).
"Galathea": stn 490, 1 (ZMUC).
"Hakuho Maru": stn KH72-1-20, 1 (USNM 96723).

TYPE LOCALITY. — *"Albatross"* stn 5586: 4°06'50"N, 118°47'20"E (off Sabah, Celebes Sea), 635 m.

DIAGNOSIS. — Corallum robust, relatively small (up to 10.3 mm calicular diameter), with a flat to slightly concave base covered with rounded granular costae. Costae separated by deep intercostal furrows. Septa hexamerally arranged in 4 cycles, each S_1 bearing 20-25 low, serrate trabecular ridges and joined to adjacent septa by 3 or 4 T-shaped synapticulae. Septal edges straight. Septal canopies absent. No paliform lobes, but trabecular spines robust. Columella well developed, tuberculate.

REMARKS. — *Fungiacyathus turbinolioides* is distinguished from all other species in the genus by having deep intercostal furrows, which suggests a resemblance to a turbinoliid. It is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Sulu Sea (Cagayan Islands and Sulu Archipelago); 514-622 m. *Indonesia*: Java Sea; 570-635 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea (northeast of Pratas Island); 622 m.

Fungiacyathus (B.) fissidiscus sp. nov.

Figs 2 a-d

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 3, 8 paratypes (MNHN). — Stn 7, holotype and 140 paratypes (MNHN); 31 paratypes (POLIPI); 99 paratypes (USNM 96725).

TYPE LOCALITY. — KARUBAR stn 7: 5°47'35"S, 132°20'39"E (Kai Islands, Banda Sea), 282-287 m.

ETYMOLOGY. — The species name *fissidiscus* (Latin *findere*, to split + *discus*, a circular plate) refers to the tendency of this species to reproduce by fragmentation. The name is considered as a noun in apposition.

DESCRIPTION. — Corallum reproduces primarily by fragmentation (see Remarks), resulting in wedge-shaped pieces of 6-12 septa that ultimately regenerate into a roughly circular corallum containing 48 septa. Largest completely regenerated specimen (holotype) 4.9 mm in diameter and 1.7 mm in height. Base flat, often featureless at centre, but toward peripheral edge formed into well-defined, rounded, granular costae. Costae up to 0.27 mm wide, separated by deep intercostal furrows about 0.05 mm wide.

Septa hexamerally arranged in 4 cycles. S_1 extend to centre of fossa, each septum bearing 8-10 trabecular spines, the innermost spines short, flattened, and curved inward toward fossa; the outer spines are much more robust and cylindrical in cross section (0.20 mm in diameter). S_2 similar to S_1 in shape, but smaller, extending only 3/4 distance to centre of fossa, bearing only 7-9 trabecular spines that are less robust than those on the S_1. S_3 smallest septa, extending only 1/5 distance to centre of fossa and quite low, bearing only 2 or 3 small trabecular spines. S_4 dimorphic in size, those adjacent to S_1 being almost as large as S_1, bearing 7-9 trabecular spines, the inner edges of each pair within a system fusing near centre of fossa. S_4 adjacent to S_2 much smaller than those adjacent to S_1 and only marginally larger than the S_3, *i.e.*, extending 1/4 distance to centre of fossa, bearing 4 or 5 trabecular spines. All septa have straight upper edges and highly granular faces. Face granules up to 80µm in height and occasionally bifid, the granules aligned in low ridges only at upper septal edges along trabecular spines. Approximately 5 solid synapticular plates connect each S_1 to its adjacent S_4, the 4th plate from corallum centre being the tallest, rising almost to the upper edge of S_4. Only 2 synapticular plates connect S_2 to their adjacent S_4, and no synapticulae were noted on the S_3. Fossa shallow; no columella.

REMARKS. — The lack of synapticulae between S_3 and their adjacent S_4 creates radial lines of weakness throughout a corallum that are presumed to facilitate the fragmentation process.

Three other species of *Fungiacyathus* are characterised by having highly regenerative coralla: *F. crispus* (Pourtalès, 1871): Atlantic, 183-1010 m; *F. fissilis* Cairns, 1984: Hawaiian Islands, 212-503 m; and *F. dennanti* Cairns & Parker, 1992: South Australia, 190-770 m. *F. fissidiscus* is distinguished from all 3 in having intercostal furrows, granular costae, and dimorphic S_4. *F. fissidiscus* is perhaps more similar to *F. turbinolioides* Cairns, 1989 (see above), both species having a similar costal structure and septal ornamentation; however, it differs in having dimorphic S_4, a smaller corallum, a regenerative corallum, and in lacking a columella.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 282-287 m.

Family MICRABACIIDAE Vaughan, 1905

Genus ***LEPTOPENUS*** Moseley, 1881

Leptopenus sp. A

Figs 2 e-f

Leptopenus sp. A - CAIRNS, 1989a: 14-15, pl. 7a-f.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 7, 1 fragment (MNHN).

REMARKS. — One small specimen, a wedge-shaped fragment measuring 3.3 mm in calicular radius, is reported herein. It appears to be the same species described by CAIRNS (1989a) from the Celebes Sea. Based on this small fragment, nothing can be added to the previous description. Four other fragments, too small to identify, are also reported from KARUBAR stations 3 (USNM 96728) and 15 (USNM 96729). It is noteworthy that these specimens represent the shallowest record for *Leptopenus* (*i.e.*, 214-300 m), a genus customarily found at depths in excess of 2000 m.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands). Malaysia: Celebes Sea (off Sabah); 287-871 m.

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

Letepsammia formosissima (Moseley, 1876)

Stephanophyllia formosissima Moseley, 1876: 561-562; 1881: 201-204, pl. 4, fig. 11, pl. 13, figs 6-7, pl. 16, figs 8-9. — ALCOCK, 1902c: 39 (in part: *"Siboga"* stn 95). — BOSCHMA, 1923: 144-145, pl. 10, fig. 31. — FAUSTINO, 1927: 244-245, pl. 77, figs 7-8.

Letepsammia formosissima - OWENS, 1986b: 486-487. — CAIRNS, 1989a: 15-18, pl. 6, fig. j, pl. 7, figs g-i, pl. 8, figs a-d (synonymy); 1995: 36-37, pl. 3, figs f-g. — CAIRNS & PARKER, 1992: 8-9, pl. 1, figs f, h.
Not *Stephanophyllia formosissima* var. - ALCOCK, 1902c: 39-40 [= *Rhombopsammia squiresi* Owens, 1986].
Not *Letepsammia formosissima* - CAIRNS & KELLER, 1993: 230-231, pl. 3, fig. D [= *L. franki* Owens, 1994]. — CAIRNS, 1994: 40-41, pl. 15, figs c, f [= *L. superstes* (Ortmann, 1888)].

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 2, 1 (USNM 96568). — Stn 3, 1 (USNM 96579). — Stn 4, 1 (USNM 96557). — Stn 9, 6 (MNHN). — Stn 10, 9 (MNHN). — Stn 12, 9 (MNHN). — Stn 14, 1 (USNM 96555). — Stn 20, 3 (USNM 96567). — Stn 24, 18 (MNHN). — Stn 25, 17 (MNHN). — Stn 35, 2 (MNHN). — Stn 61, 57: 1 (MNHN), 56 (USNM 96556). — Stn 62, 8 (USNM 96562). — Stn 64, 1 (MNHN).

MUSORSTOM 2: stn 1, 16 (MNHN). — Stn 2, 27 (MNHN). — Stn 4, 3 (USNM 96551). — Stn 6, 1 (USNM 96566). — Stn 10, 40: 29 (MNHN), 11 (USNM 96575). — Stn 11, 6 (USNM 96553). — Stn 12, 9 (MNHN). — Stn 13, 4 (USNM 96552). — Stn 15, 1 (MNHN). — Stn 18, 11: 6 (USNM 96576), 5 (BMNH 1992.8.11.12). — Stn 33, 6 (MNHN). — Stn 62, 4 (?). — Stn 63, 3: 1 (MNHN), 2 (USNM 96550). — Stn 64, 22 (USNM 96559). — Stn 66, 7 (USNM 96573). — Stn 68, 14 (MNHN).

MUSORSTOM 3: stn 86, 13 (MNHN). — Stn 87, 15 (USNM 96570). — Stn 88, 42 (MNHN). — Stn 90, 8 (MNHN). — Stn 91, 31 (MNHN). — Stn 92, 5 (MNHN). — Stn 96, 116: 63 (MNHN), 46 (USNM 81879), 7 (BMNH 1992.8.11.11). — Stn 97, 39: 23 (MNHN), 16 (USNM 96565). — Stn 98, 36: 6 (MNHN), 30 (USNM 96563). — Stn 99, 28: 17 (MNHN), 11 (USNM 96549). — Stn 100, 34: 19 (MNHN), 15 (USNM 96548). — Stn 101, 25 (MNHN). — Stn 102, 27 (MNHN). — Stn 103, 15: 8 (MNHN), 7 (USNM 96571). — Stn 107, 1 (MNHN). — Stn 108, 62: 17 (MNHN), 45 (USNM 81877). — Stn 109, 78: 54 (MNHN), 17 (USNM 81878), 7 (BMNH 1992.8.11.13). — Stn 110, 2 (MNHN). — Stn 111, 17 (MNHN). — Stn 112, 20 (USNM 96561). — Stn 124, 1 (MNHN). — Stn 126, 3 (MNHN). — Stn 131, 5 (MNHN). — Stn 139, 1 (MNHN). — Stn 143, 81 (USNM 81878).

Indonesia. DEKI: stn 2, 1 (NNM 22502). — Stn 3, 7 (NNM 22501). — Stn 4, 1 (NNM 22503). — Stn 41, 25 (NNM 22504). — Stn 42, 1 (NNM 22505). — Stn 44, 1 (NNM 22506). — Stn 46, 2 (NNM 22507). — Stn 49, 2 (NNM 22509). — Stn 58, 2 (NNM 22511). — Stn 63, 4 (NNM 22512).

"Hakuho Maru": stn KH72-1-28, 1 (USNM 96580).

SNELLIUS 2: stn 4.057, 1 (NNM 22513).

KARUBAR: stn 2, 9 (MNHN). — Stn 3, 8 (USNM 96577). — Stn 7, 5: 1 (MNHN), 4 (USNM 96578). — Stn 35, 1 (MNHN). — Stn 36, 11 (MNHN). — Stn 67, 2 (POLIPI). — Stn 85, 2 (POLIPI). — Stn 86, 8: 2 (MNHN), 6 (USNM 96569).

South China Sea. *"Hakuho Maru"*: stn KH72-1-50, 2: 1 (USNM 96581), 1 (ORI).

TYPE LOCALITY. — Philippines and Indonesia, 174-236 m.

DIAGNOSIS. — Discoidal corallum up to 50.8 mm in GCD (KARUBAR stn 35); base flat to slightly convex; D:H up to 4.9 in large specimens. Thin (0.06-0.07 mm), ridged costae bear very small teeth or short spines, producing a finely serrate edge; intercostal region quite wide (3-6 times costal width) and porous, the synapticular bars connecting each costa to its 2 alternating, adjacent septa clearly visible in basal view through intercostal region. A low, marginal shelf, up to 4 mm wide, present on large, well-preserved specimens. Septa arranged in typical micrabaciid fashion (CAIRNS, 1989a, text-fig. 2), attaining the 120-septa stage at a GCD of 17-20 mm and often maintaining this number; however, a large syntype of GCD 38 mm has 144 septa, and the largest known specimen of GCD 51 mm has 228 septa. S_1 independent and unbranched, having a smooth upper, inner edge, but a spinose peripheral edge. S_1 of small specimens highly porous, but as corallum increases in size they develop a more solid, lamellar upper, inner edge — retaining their porosity only on their lower half near the base. S_2 also unbranched but not independent, a pair of S_3 fusing to each S_2 near the columella. Each S_3 bifurcates repeatedly, producing the majority of the septa. Columella elongate, spongy, and often densely fused.

REMARKS. — *Letepsammia formosissima* was the coral most commonly collected on the MUSORSTOM cruises, taken at 55 stations ranging from 115-390 m. A more complete description and illustrations of this species are given by CAIRNS (1989a) and CAIRNS & PARKER (1992), and a comparison to *Rhombopsammia niphada* is given in the account of that species.

Another species, *L. franki* Owens, 1994, occurs in the southwestern Indian Ocean where it had occasionally been ascribed to *L. formosissima* (see CAIRNS, 1989a; CAIRNS & KELLER, 1993; OWENS, 1994). *L. franki* differs from the latter by its papillose columella and coarse septal dentation that give the corallum a distinctly beaded appearance.

DISTRIBUTION. — *Philippines:* common from Lubang Island to the Bohol Sea; 115-390 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Timor Sea (south of Leti Islands); Savu Sea (west of Timor); 154-390 m. *Elsewhere*: western Pacific to Hawaiian Islands, including South China Sea (Charlotte Bank); 97-457 m.

Letepsammia superstes (Ortmann, 1888)

Stephanophyllia superstes Ortmann, 1888: 160-161, pl. 6, fig. 5. — OWENS, 1986a: 487.
Stephanophyllia (Letepsammia) japonica Yabe & Eguchi, 1934a: 281, figs 1-3; 1942b: 156-157, pl. 12, figs 8a-c.
Letepsammia formosissima forma *superstes* - CAIRNS, 1994: 40, pl. 15, figs c, f.
Letepsammia superstes - CAIRNS, 1995: 34-35, pl. 2, figs f-i (synonymy).
Not *Stephanophyllia (Letepsammia) japonica* - ZOU, 1988: 75, pl. 5, fig. 7 [= *Stephanophyllia neglecta* Boschma, 1923].

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 32, 3 (USNM 96733).
Indonesia. KARUBAR: stn 1, 12 (MNHN). — Stn 7, 1 (USNM 96730). — Stn 18, 1 (USNM 96731). — Stn 50, 1 (USNM 96732).

TYPE LOCALITY. — Sagami Bay, Japan, 183-366 m.

REMARKS. — Although collected on the same type of bottom and often together mixed with the more common *L. formosissima*, *L. superstes* differs in having a smaller corallum with fewer septa. The largest known specimen (MUSORSTOM 2 stn 32) is only 22 mm in calicular diameter and has 96 septa, a size at which *L. formosissima* would have 120 septa. Although similar to *L. formosissima*, *L. superstes* differs in having a papillose columella, more robust trabecular spines, and a tendency to have a patellate (vs a flat based) corallum. The species is more fully described by CAIRNS (1994) as *L. formosissima* forma *superstes* and by CAIRNS (1995).

DISTRIBUTION. — *Philippines*: Verde Island Passage; 192-220 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (east of Tanimbar Islands); 185-282 m. *Elsewhere*: Japan (Honshu and northern Ryukyu Islands); Korea Strait; South China Sea (Hong Kong); Kermadec Ridge; 77-710 m. Pleistocene of Ryukyu Islands.

Genus ***RHOMBOPSAMMIA*** Owens, 1986

Rhombopsammia niphada Owens, 1986

Rhombopsammia niphada Owens, 1986a: 252-255, figs 2b, 3a-d. — CAIRNS 1989a: 19-20, pl. 9, figs d-i, pl. 10, figs a-b, text-fig. 2 (synonymy); 1994: 41, pl. 15, figs i-k, pl. 16, fig. e.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 47, 1 (USNM 96738).
MUSORSTOM 2: stn 25, 1 (MNHN).
MUSORSTOM 3: stn 116, 1 (MNHN).
Indonesia. DEKI: stn 3, 1 (NNM 22493).
KARUBAR: stn 20, 3 (POLIPI). — Stn 21, 15 (MNHN). — Stn 39, 14 (MNHN). — Stn 40, 15 (USNM 96735). — Stn 59, 17 (MNHN). — Stn 70, 7: 6 (MNHN), 1 (USNM 96737). — Stn 71, 3 (MNHN). — Stn 75, 4 (MNHN).

TYPE LOCALITY. — *"Albatross"* stn 4911: 31°38'30"N, 129°19'E (East China Sea, off Kyushu), 715 m.

DIAGNOSIS. — Discoidal corallum up to 46 mm in diameter (KARUBAR stn 59); base usually flat. Costae thin (0.06-0.07 mm) ridges. Intercostal regions much wider (about 0.45 mm) than costae, traversed by thin synapticulae, which produce a series of pores in each elongate space. Marginal shelf present but not wide and often damaged. Septa arranged in typical micrabaciid fashion (CAIRNS, 1989a, text-fig. 2), both septa and costae up to 144 in number, which alternate in position. Columella elongate and spongy.

REMARKS. — The similarities between *R. niphada* and *Letepsammia formosissima* have been noted previously (OWENS, 1986a; CAIRNS, 1989a). *R. niphada* differs in having solid S_1 that bear faint vertical ridges (vepreculae) on their faces, whereas the S1 of *L. formosissima* are highly porous at a small calicular diameter and become more solid with age, but do not bear vepreculae, and always maintain some porosity adjacent to the base. *R. niphada* usually has 144 septa, whereas *L. formosissima* usually has 120 septa, but as many as 228. *R. niphada* has well-developed septal canopies and reduced trabecular spines, whereas *L. formosissima* has well-developed septal spines on the S_3 and $S_{3'}$ and no canopies. Finally, *R. niphada* is characteristic of deeper water than *L. formosissima*, all records of the former between 405 and 804 m, of the latter species, 97-457 m. A more detailed description and illustrations of this species are found in OWENS (1986a) and CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Mindoro Strait; Palawan Passage; 512-804 m. *Indonesia* : Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 405-768 m. *Elsewhere*: Japan (Honshu, Kyushu, and Ryukyu Islands); 660-783 m.

Rhombopsammia squiresi Owens, 1986

Stephanophyllia formosissima var. - ALCOCK, 1902c: 39-40. [See CAIRNS, 1989a].
Rhombopsammia squiresi Owens, 1986a: 250-252, figs 1a-d, 2a. — CAIRNS, 1989a: 18-19, pl. 8, figs e-j, pl. 9, figs a-c (synonymy).

MATERIAL EXAMINED. — **Indonesia**. CORINDON 2: stn 240, 3 (MNHN).
KARUBAR: stn 87, 1 (MNHN), 1 (POLIPI). — Stn 89, 2 (USNM 96741).

TYPE LOCALITY. — *"Albatross"* stn 5423: 9°38'30"N, 121°11'E (Cagayan Island, Philippines), 929 m.

REMARKS. — Previously known from only 5 specimens from 5 stations, 7 additional specimens of this rarely collected species are reported herein from the Indonesian region, the largest (KARUBAR stn 89) 41.2 mm in calicular diameter. *R. squiresi* is distinguished from *R. niphada* by its distinctive marginal shelf, wherein each septum projects as a broad, flat, spongy mass; and by having only 96 septa.

DISTRIBUTION. — *Philippines*: Sulu Sea (Cagayan Islands and Palawan); Iligan Bay, Bohol Sea. The Philippine depth range is 905-1401 m, not 622-1401 as previously reported (CAIRNS, 1989a). Also, the paratype mentioned by CAIRNS (1989a) from *"Albatross"* stn 5424, should read *"Albatross"* stn 5429. *Indonesia*: Makassar Strait; Timor Sea (southwest of Tanimbar Islands and southeast of Timor); 675-1048 m.

Genus ***STEPHANOPHYLLIA*** Michelin, 1841

Stephanophyllia fungulus Alcock, 1902

Stephanophyllia fungulus Alcock, 1902b: 122; 1902c: 40, pl. 5, figs 35a-b. — FAUSTINO, 1927: 245-246, pl. 77, figs 9-11. — ZOU *et al.*, 1988: 195. — CAIRNS, 1989a: 21-23, pl. 10, figs c-k, pl. 11, figs a-b, text-fig. 3 (synonymy). — CAIRNS & KELLER, 1993: 231. — CAIRNS, 1994: 41-42, pl. 16, figs a-d, f-g (synonymy).
Stephanophyllia complicata - ALCOCK, 1902c: 40 (in part: 1 of 3 specimens from *"Siboga"* stn 59). [Not *Stephanophyllia complicata* Moseley, 1876].

MATERIAL EXAMINED. — **Philippines**. *"Hakuho Maru"*: stn KH72-1-20, 7 (USNM 96743).
Indonesia. DEKI: stn 6, 66, (NNM 22545). — Stn 49, 115 (NNM 22547). — Stn 52, 1 (NNM 22548).
SNELLIUS 2: stn 4019, 5 (NNM 22550).

TYPE LOCALITY. — *"Siboga"* stn 100: 6°11'N, 120°37.5'E (Sulu Archipelago), 450 m.

DIAGNOSIS. — Corallum discoidal, with a thick, flat base and slightly upturned edges; D:H = 1.9-2.6. Largest known specimen (*"Albatross"* stn 5586, Celebes Sea) 15.6 mm in diameter. Costae flat, ornamented with a medial row of coarse granules close to epicentre, but outward from basal centre each costa bears 2 rows of smaller granules, one row on each edge of the costa. No marginal shelf. Adjacent septal faces fused together by massive, elongate mural synapticulae (fulturae *sensu* GILL, 1979), producing a sturdy, robust corallum. 96 septa arranged in typical micrabaciid fashion (CAIRNS, 1989a, text-fig. 3). Septal edges straight; septal face granules wide-based, equilateral triangular-shaped spines. Columella massive, lenticular to rectangular in cross section, often surrounded by additional papillae.

REMARKS. — *Stephanophyllia fungulus* is distinguished from the other 2 Recent species in the genus by its massive columella and its thick, upturned base. A more complete description and comparisons to the other Recent species can be found in CAIRNS (1989a, table 2; 1994).

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 450-514 m. *Indonesia*: Banda Sea (Kai and Tukangbesi Islands); Savu Sea (Timor); 210-635 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); widespread from southwestern Indian Ocean to Japan, including South China Sea (north of Pratas Island); 73-256 m.

Stephanophyllia neglecta Boschma, 1923

Fungia patella - VAN DER HORST, 1921: 57 (in part: *"Siboga"* stn 260). [Not *Madrepora patella* Ellis & Solander, 1786].
Stephanophyllia neglecta Boschma, 1923: 144-145, pl. 10, figs 28-30. — CAIRNS, 1989a: 23-24, pl. 11, figs c-j (synonymy).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 1 (USNM 81866).
MUSORSTOM 3: stn 91, 1 (USNM 81865). — Stn 102, 46 (USNM 81859). — Stn 131, 1 (USNM 81864).
Indonesia. DEKI: stn 50, 1 (NNM).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 54: 48 (ZMUC), 6 (USNM 96746). — Stn 6, 1 (ZMUC). — Stn 8, 2 (ZMUC).
SNELLIUS 2: stn 4.039, 2 (NNM 22758).
KARUBAR: stn 1, 1 (MNHN).

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

DIAGNOSIS. — Corallum discoidal, with a thin, flat to highly convex base; D:H = 2.8-3.2. Largest known specimen (MORTENSEN'S JAVA EXP. stn 5) 12.2 mm in calicular diameter and 5.1 mm in height. Costal ornamentation as in *S. fungulus*. No marginal shelf. Synapticulae variable in shape: circular, elliptical, or quite elongate. 96 septa arranged in typical micrabaciid fashion. Septal edges straight; septal face granules blunt to clavate cylindrical spines. Columella variable, usually papillose but in some coralla lamellar.

REMARKS. — *Stephanophyllia neglecta* is more fully described and illustrated by CAIRNS (1989a), who also compared it to the other Recent species.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan Sea; Samar Sea; Tablas Strait; Sulu Sea (Sulu Archipelago and Palawan); 49-555 m. *Indonesia*: Banda Sea (Kai and Tukangbesi Islands); Bali Strait; 50-525 m.

Stephanophyllia complicata Moseley, 1876

Stephanophyllia complicata Moseley, 1876: 558-561, text-fig.; 1881: 198-201, pl. 4, fig. 12, pl. 13, figs 3-5. — ALCOCK, 1902c: 40 (in part: *"Siboga"* stn 256). — CAIRNS, 1989a: 21, pl. 12, figs a-b; 1995: 37-38, pl. 3, fig. h, pl. 4, figs a-e (synonymy). — CAIRNS & KELLER, 1993: 231-232.
Stephanophyllia japonica - WELLS, 1984: 207, pl. 1, figs 5-6. Not *Stephanophyllia japonica* Yabe & Eguchi, 1934.

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 6, 1 (NNM 22542). — Stn 50, 7 (NNM). — Stn 52, 4 (NNM 22543).
KARUBAR: stn 2, 51 (MNHN). — Stn 3, 46 (POLIPI). — Stn 5, 1 (USNM 96748). — Stn 7, 66 (USNM 96749). — Stn 15, 1 (MNHN).

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

DIAGNOSIS. — Corallum discoidal, with a thin, flat base; D:H = 2.5-2.7. Corallum up to 18 mm in calicular diameter. Costal ornamentation as in *S. fungulus* Alcock, At calicular edge of well-preserved specimens, costae are slightly upturned, and bifid, extending about 0.5 mm beyond calicular perimeter and producing a small marginal shelf. Synapticulae circular to elliptical in cross section. 96 septa arranged in typical micrabaciid fashion, the S_{1-2} having straight edges, but the S_3 meandering toward the calicular edge. Septal faces covered with narrow-based isosceles triangular-shaped granules. Columella a prominent, but thin lamella, sometimes divided into papillae or sub-lamellar elements at its summit.

REMARKS. — All specimens reported above are essentially topotypic, being collected very close to the type locality in the Kai Islands. *S. complicata* is distinguished from the other species in the genus (see CAIRNS, 1989a, table 2) by having a thin, lamellar columella, and a narrow marginal shelf. It is described in greater detail by CAIRNS (1995) based on specimens from the New Zealand region.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 210-397 m. *Elsewhere*: western Indian Ocean; Norfolk and Three Kings Ridges; 229-1137 m.

Suborder FAVIINA

Superfamily FAVIOIDEA Gregory, 1900

Family RHIZANGIIDAE d'Orbigny, 1851

Genus ***CULICIA*** Dana, 1846

Culicia stellata Dana, 1846

Figs 3 a-b

Culicia stellata Dana, 1846: 377, pl. 28, figs 5a-d. — NEMENZO, 1976: 252, pl. 9, figs 2-3.
Culicia truncata Dana, 1846: 378, pl. 28, figs 7, 7a (**new synonym**).
Culicia japonica Yabe & Eguchi, 1936: 167-168, figs 1-3 (**new synonym**). — CAIRNS, 1994: 42, pl. 17, figs a-e (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Alpha Helix"*: stn 79-M140, 1 large colony (USNM 80029).
Malaysia. Kota Kinabalu, Sabah, depth unknown, 2 colonies (USNM 78565).

TYPE LOCALITY. — Singapore, South China Sea (depth not given).

DESCRIPTION. — Philippine corallum consists of 50-60 corallites produced by extratentacular, reptoid budding. Stolons linking corallites thin and flat, 1.5-2.0 mm wide; corallites spaced 1-5 mm apart. Stolons often covered by encrusting epifauna. Corallites circular to slightly elliptical in cross section, up to 3.8 mm in GCD, and 4.3 mm in height. Corallites epithecate when well-preserved, with a very thin (50 µm), almost translucent, smooth upper rim that rises above upper outer septal edges (fig. 3b).

Septa hexamerally arranged in 4 cycles, the last cycle never complete, 34-42 being the most common septal complement. S_1 independent, each composed of a tall but narrow upper lobe, a vertical inner edge, and 1 or 2 laciniate teeth on its lower, inner margin. S_{2-3} equal in size and shape, the inner edges of the 2 S_3 and 1 S_2 in

each system fusing near the columella. S_{2-3} not lobate as the S_1, but bearing 3 or 4 laciniate teeth that grade into the columellar elements. S_4 rudimentary, consisting of a discontinuous row of spines, each spine 1/3 to 1/4 height of the adjacent lower cycle septum. Fossa of moderate depth. Columella papillose, consisting of 5-9 elements similar in size and shape to innermost septal teeth.

REMARKS. — DANA (1846: 377) described *C. stellata* as having corallites "3 lines high, and 1.5 broad" and 24 septa per corallite. Since a "line" is 1/12 inch (2.12 mm), the corallites are inferred to be about 6.4 mm in height and 3.2 mm in GCD. Examination of DANA's holotype (USNM 185) shows it to have shorter (4.3 mm max.) and broader (to 3.8 mm) corallites, most of which have septa of the 4th cycle, up to 42 septa/corallite. Likewise, his description of *C. truncata* implies corallites of 2.6 mm in height and GCD, and 24 septa; whereas the type (USNM 183) has corallites up to 3.5 mm in GCD and none over 2 mm in height, and most having some pairs of S_4. *C. truncata* would appear to be a specimen of *C. stellata* in which the corallites remained slightly lower than normal, possibly for an environmental reason. The description and figures of *C. japonica*, as well as the Japanese specimens reported by CAIRNS (1994), are also consistent with *C. stellata.*

DISTRIBUTION. — *Philippines*: Cebu and Bohol; 14-20 m. *Elsewhere*: South China Sea (Singapore; Kota Kinabalu, Sabah); Japan (Honshu, Kyushu, Ryukyu Islands, and Korea Strait); Fiji; 5-100 m.

Family OCULINIDAE Gray, 1847

Genus ***MADREPORA*** Linnaeus, 1758

Madrepora oculata Linnaeus, 1758

Madrepora oculata Linnaeus, 1758: 798. — ZIBROWIUS, 1974b: 762-766, pl. 2, figs 3-5 (synonymy). — CAIRNS, 1982: 15, pl. 3, figs 4-6 (synonymy); 1991: 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. — CAIRNS & KELLER, 1993: 233.
Lophohelia tenuis Moseley, 1881: 180-181, pl. 8, figs 11-14.
Amphihelia oculata - ALCOCK, 1902c: 35. — MARENZELLER, 1904a: 308-310, pl. 14, fig. 1.
Amphihelia ramea - ALCOCK, 1902c: 35. [See ZIBROWIUS, 1980: 39 for a discussion of *Madrepora ramea*].
Amphihelia arbuscula - ALCOCK, 1902c: 35 (in part: *"Siboga"* 95, 156). [Not *Lophohelia arbuscula* Moseley, 1881].
Amphihelia tenuis - ALCOCK, 1902c: 36.
Sclerohelia formosa - ALCOCK, 1902c: 36. [See ZIBROWIUS, 1974a: 570 for a discussion of *Madrepora formosa*].
Desmophyllum sp. - ALCOCK, 1902c: 28.
Madrepora alcocki Faustino, 1927: 106 (*nom. nov.* for *M. ramea* Duncan, 1873; see ZIBROWIUS, 1980: 39).
Madrepora tenuis - FAUSTINO, 1927: 107-108, pl. 14, figs 2, 5. — ZIBROWIUS, 1974b: 765 (discussion).
Lophelia tenui (sic) - HU, 1987: 40-41, pl. 2, figs 8-10, 12.

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 95 (ZMA Coel. 6455).
"Albatross": stn 5123, 50 branches (USNM M235386). — Stn 5124, 2 branches (USNM 96608). — Stn 5201, 3 branches (USNM 96602). — Stn 5202, 1 (USNM 96612). — Stn 5327, 7 branches (USNM 96631). — Stn 5348, 1 (USNM 96625). — Stn 5349, 1 (USNM 96627). — Stn 5373, 5 branches (USNM 96607). — Stn 5378, 5 branches (USNM 96606). — Stn 5381, 6 branches (USNM 96630). — Stn 5403, 1 (USNM 96621). — Stn 5405, 10 fragments (USNM 96618). — Stn 5406, 4 branches (USNM 96609). — Stn 5407, 13 branches (USNM 96622). — Stn 5408, 2 branches (USNM 96616). — Stn 5411, 1 (USNM 96626). — Stn 5417, 1 (USNM 96619). — Stn 5418, 2 branches (USNM 96617). — Stn 5423, 2 (USNM 96620). — Stn 5424, 2 branches (USNM 96613). — Stn 5425, 1 branch (USNM 96602). — Stn 5428, 1 branch (USNM 96598). — Stn 5513, 5 branches (USNM 96604). — Stn 5516, 1 (USNM 96615). — Stn 5527, 4 branches (USNM 96594). — Stn 5529, 7 branches (USNM 96593). — Stn 5541, 2 branches (USNM 96614). — Stn 5543, 5 branches (USNM 96632). — Stn 5574, 3 branches (USNM 96633).
"Galathea": stn 436 (ZMUC). — Stn 443 (ZMUC).
"Hakuho Maru": stn KH72-1-20, 20 branches: 10 (ORI), 1 (USNM 96628).
MUSORSTOM 1: stn 49, 1 branch (USNM 96601).
MUSORSTOM 2: stn 36 (MNHN). — Stn 39 (MNHN). — Stn 49 (MNHN).

MUSORSTOM 3: stn 89 (MNHN). — Stn 105, 2 branches (USNM 96597). — Stn 106 (MNHN). — Stn 122, 3 branches (USNM 96599). — Stn 123 (MNHN). — Stn 128, 10 branches (USNM 96596). — Stn 139, 1 branch (USNM 96600).

Indonesia. *"Siboga"*: stn 156 (ZMA). — Stn 259 (ZMA Coel. 5523).

"Albatross": stn 5586, 1 (USNM 96629). — Stn 5625, 8 branches (USNM 96623). — Stn 5645, 3 colonies (USNM 96592).

DEKI: stn 22, 2 branches (NNM 22723). — Stn 33 (NNM 22724). — Stn 45 (NNM 22726). — Stn 50 (NNM 22728). — Stn 52 (NNM 22729). — Stn 58 (NNM 22730 and ZMUC). — Stn 59 (NNM 22731).

"Galathea": stn 490 (ZMUC).

"Hakuho Maru": stn KH72-1-28, 10 branches (USNM 96603).

SNELLIUS 2: stn 4.144, 1 colony (NNM).

KARUBAR: stn 7, 2 (MNHN). — Stn 9, many branches (USNM 96582, 96635). — Stn 13, many branches (MNHN). — Stn 16, 3 branches: 2 (MNHN), 1 (POLIPI). — Stn 19, 7 branches (USNM 96584). — Stn 35, 3 branches (POLIPI). — Stn 39, 1 (USNM 96585). — Stn 42, 8 branches (POLIPI). — Stn 56, 3 branches (POLIPI). — Stn 59, many branches (POLIPI). — Stn 69, many branches (MNHN and USNM 96582). — Stn 77, 3 branches (MNHN and USNM 96634).

South China Sea. *"Albatross"*: stn 5314, 2 branches (USNM 96610). — Stn 5317, 4 branches (USNM 96605).

"Hakuho Maru": stn KH72-1-52, 6 branches (USNM 96628). — Stn KH73-2-44-2, 20 branches (USNM 96586, 96587).

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

DIAGNOSIS AND REMARKS. — *Madrepora oculata* is a widespread, variable species. Many names have been used for it (ZIBROWIUS, 1974b) and more recently various forms have also been distinguished (CAIRNS, 1991). The most commonly collected form occurring in the Philippine/Indonesian region is characterized by having delicate uniplanar colonies formed of regular, nonanastomosing, sympodially budded corallites (*M. tenuis* of MOSELEY 1881 and form *beta* of CAIRNS, 1991). Its coenosteum is often light beige, finely granular, and longitudinally striate. It is often attached to long hexactinellid spicules. Corallites 2.3-3.0 mm in diameter, containing 3 full cycles of hexamerally arranged, narrow septa ($S_1>S_2>S_3$), the CS_{1-2} usually slightly exsert but extending only about 1 mm down from calice as thin, ridged costae. Inner edges of septa finely dentate to highly laciniate. Septal faces may also bear tall, slender spines. Fossa of distal corallites usually deep, containing a papillose columella.

Specimens from two lots (KARUBAR stn 56 and *"Albatross"* stn 5645) differ from the form described above in that they live in association with a symbiotic eunicid polychaete, which causes the coral to form a bushy corallum of highly anastomotic branches.

Specimens from seven lots (KARUBAR stns 9, 13, 19, 77; *"Albatross"* stn 5529; *"Hakuho Maru"* stn 73-2-44-2; and DEKI stn 50) bear some bell-shaped, hypertrophied corallites, as much as 23 mm in GCD and having up to 82 porous septa. Once reported as the first neoplasms in Scleractinia (SQUIRES, 1965), these abnormally large corallites are now known to be the manifestation of a parasitic petrarcid ascothoracidan crustacean (GRYGIER & CAIRNS, 1996).

A more complete description and illustrations of this species are found in ZIBROWIUS (1974b) and CAIRNS (1982, 1991).

DISTRIBUTION. — *Philippines*: common throughout Philippines from Lubang Island to Bohol Sea; Sulu Archipelago; 161-2021 m. *Indonesia*: Molucca Sea; Halmahera Sea; Banda Sea (Kai Islands and Sulawesi); Arafura Sea (southeast of Tanimbar Islands); Timor Sea (south of Leti and Timor Islands); Savu Sea; Flores Sea (Selayar Island, Sulawesi); Java Sea; 112-984 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); cosmopolitan, except for continental Antarctica; 15-1500 m.

Madrepora arbuscula (Moseley, 1881)

Figs 3 c-g

Not *Madrepora arbuscula* Dana, 1846: 474 [= *Acropora* sp.].
Lophohelia arbuscula Moseley, 1881: 180, pl. 8, figs 9-10.
Amphihelia arbuscula - ALCOCK, 1902c: 35 (in part: *"Siboga"* stn 12).
Madrepora arbuscula - FAUSTINO, 1927: 107 (in part). — ZIBROWIUS, 1974b: 765.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 126, 2 large colonies (USNM 96750) and 13 branch fragments (MNHN).

Indonesia. *"Challenger"*: stn 194, holotype (BMNH 1880.11.25.96).

"Siboga": stn 12, 2 branches (ZMA).

"Albatross": stn 5584, 1 branch (USNM 96757).

KARUBAR: stn 18, 17 branch fragments (USNM 96752). — Stn 32, 4 branches: 1 (POLIPI), 3 (MNHN).

TYPE LOCALITY. — *"Challenger"* stn 194: 4°31'S, 129°57'E (Banda Island, Banda Sea), 366 or 658 m.

DESCRIPTION. — Corallum massive, the largest colony (MUSORSTOM 3 stn 126) 26 cm in height, having a stout, dense basal stem 5.0 cm in diameter. Lower 1/3 to 1/2 of colony consists only of basal stem and individual corallites that bud directly from the coenosteum, but upper corallum ramifies into anastomosing branches, each of which contains a central tubular cavity about 5 x 7 mm in diameter that is presumed to be inhabited by a eunicid polychaete. Calices 2.5-3.1 mm in diameter, circular to slightly elliptical, tending to concentrate on one face of the corallum (here defined as anterior). Whereas corallites do occur on the posterior face, they are fewer in number, often nonfunctional, filled in with stereome, and usually completely absent from the lower 10 cm of basal stem due to incorporation within basal coenosteal layering. Coenosteum on distal branches remarkably smooth and porcellaneous (not granular) even at a magnification of x 2500; however, larger-diameter branches and worn coenosteum sometimes reveal very shallow longitudinal striae that delimit perfectly flat costae. Septocostal ridges absent from calicular edges. Corallum white; however, coenosteum immediately adjacent to calice a dark brown.

Septa hexamerally arranged in 3 complete cycles: $S_1 > S_{2-3}$. S_1 only about 0.4 mm exsert, extremely narrow (0.10-0.15 mm), having entire (nondentate) inner edges and irregularly granular septal faces. S_{2-3} nonexsert, only about 0.06 mm (60 µm) in width, and otherwise similar to the S_1. Deep in fossa the lower, inner edges of the 6 S_1 and sometimes some of the S_2 widen and join one another in centre of fossa, forming a short styliform columella (Fig. 3f). Deep in fossa S_3 are very narrow, each pair within a system bending toward and fusing to its common S_2. Fossa deep and spacious, due to the very narrow septa.

Each polyp possesses 1 long sweeper tentacle, up to 11 mm long in the preserved state, the other more typical tentacles being only 1-2 mm in length. This is the first case of sweeper tentacles being observed in a deep-water coral.

REMARKS. — *Madrepora arbuscula* differs from other species of *Madrepora* in several significant characters. It has: 1) a very massive basal stem, 2) no coenosteal granules, which produces a porcellaneous texture, 3) white coenosteum but brown-edged calices, 4) extremely narrow septa with no inner edge dentition, 5) a rudimentary styliform columella (that of *M. oculata* is papillose), and 6) sweeper tentacles. Although tentacle length of *Madrepora* generally had no special attention, the second author has occasionally observed that live *M. oculata* had short, uniform-length tentacles. It was therefore surprising to see that *M. arbuscula* from MUSORSTOM 3 stn 126 had one long sweeper tentacle per polyp in addition to normal-sized, shorter tentacles. This was seen on the freshly dredged live colonies kept in seawater, and can still be seen after preservation in formalin.

In addition to the ubiquitous spirocysts, both the normal and sweeper tentacles of *M. arbuscula* (MUSORSTOM stn 3-126) contain b-rhabdoids (type 1), p-rhabdoids D (type 1), and holotrichs (type I). According to DEN HARTOG (1977), the cnidae of sweeper tentacles are always different from that of normal tentacles, so *M. arbuscula* may present a unique condition among the approximately 14 scleractinian species now known to have sweeper tentacles (WILLIAMS, 1991). Nematocyst identifications and terminology follows the review by PIREZ and PITOMBO (1992) and is considered only preliminary — the quantification of sizes remains to be tabulated.

Madrepora arbuscula (Moseley, 1881) is a junior secondary homonym of *M. arbuscula* Dana, 1846, but because DANA's species is now considered to be in the genus *Acropora*, according to the ICZN (article 59c) MOSELEY's name does not have to be replaced.

DISTRIBUTION. — *Philippines*: Sulu Sea (Semirara Islands); 266 m. *Indonesia*: Banda Sea (Kai Islands and Banda Islands); Bali Sea; 212-658 m; Malaysia (Celebes Sea off Sabah).

Madrepora minutiseptum sp. nov.

Figs 4 a-d, 5 a-b

Amphihelia infundibulifera - SAVILLE KENT, 1871: 276-277, pl. 24, figs 4, 4a, 4b. — QUELCH, 1886: 26, 53. [Not *Oculina infundibulifera* Lamarck, 1816: 286; 1836: 457 (= stylasterid), see Remarks].

MATERIAL EXAMINED/TYPES. — **Indonesia**. Ternate, from local governor S.C.J. MUSSCHENBROEK to *"Challenger"* naturalists, October 1874, 1 paratype colony (BMNH 1886.12.9.57).

CORINDON 2: stn 235 (confused station data!), 1 branch fragment with 6 calices, paratype (USNM 96756). — Stn 248, 1 small branch with ca. 20 calices, paratype (POLIPI) and 1 small colony with remarkably different calices, but possibly the same species, see description (MNHN).

SNELLIUS 2: stn 4.196, 1 colony (holotype) (NNM 22734).

KARUBAR: stn 18, 3 tiny fragments altogether 4 calices (USNM 96755).

Taiwan (= Formosa). From R. SWINHOE, 3 paratype colonies (BMNH 1865.12.15.1), 6 paratype colonies (BMNH 1870.5.9.21-22-24-25-26-27). — 1 colony (AMS G 7014; probably transfer from BMNH). — coll. FRIES, 1 paratype colony (NMW 8227; old number 3180, registered in 1884).

Japan. From F. VAN HEUKELOM, 1 colony (ZMA Coel. 7400). — No details, 2 colonies (ZMA Coel. 138, 139). — No details, 1 colony (USNM 96754, ex ZMA Coel. 137, transfer Sept. 1994).

No origin indicated. Formerly GERRESHEIM collection, seen by EHRENBERG, 1 colony (ZMB 582).

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

ETYMOLOGY. — The species name *minutiseptum* (Latin *minutus*, small + *septum*, a fence, bar), alludes to the very small septa of this species. The name is treated as a noun in apposition.

DESCRIPTION. — Corallum arborescent, irregularly branching, often tending to form subflabellate colonies. Larger colonies (holotype; Ternate specimen) 20-25 cm in height. A strongly developed trunk and main branches are hollow, containing a central canal with lateral openings (by analogy with *Madrepora oculata* interpreted as tubular growth induced by an eunicid polychaete). Inner diameter of these tubes generally ca 3.5 mm. Anastomoses of branches frequent. Thin distal or peripheral branches distinctly zigzag-shaped, with corallites sympodially budded (1 or 2 on the parent corallite), on trunk and main branches corallites immersed into sclerenchyme. Corallum solid with smooth surface; no costae. White, except for pigmented calicular edge or upper 1/2 of sympodial corallites. Pigmentation reddish brown to dark brown, extending throughout the skeleton thickness at the pigmented level, not only superficial; also extending inside calice on septa. Pigmentation of septa decreasing in depth of calice. Corallites on thin branches about equal in height and width, 1.5-2.5 mm in calicular diameter, with a narrow base, and up to 2.5 mm in height. Corallites distinctly infundibuliform, with wide "empty" fossa because of the low septa. Septa are essentially reduced to a row of flattened septal edge teeth coalescent laterally with granules of the reduced septal faces. Septa hexamerally arranged in 3 complete cycles, as ridges of low papillae rather than distinct lamellae. S_1 to S_3 slightly decreasing in width, with a correspondingly slight decrease in exsertness above the calicular edge. No columella, bottom of fossa covered by small papillae similar to those of the higher and more peripheral parts of the septa.

CORINDON 2 stn 248 provided 1 small branch (21 mm in length) with the eunicid-induced deformation and comprising ca. 20 calices, of the typical aspect. But from the same station there is another small colony about 15 mm in height with the same type of deformation, the calices of which are exceptionally small (1 mm or less in diameter), with only 12 septa. These septa are similar to those in typical *M. minutiseptum* with 24 septa (*i.e.*, as in the branch from CORINDON 2 stn 248) by being very low and denticulate. This unique specimen may be an initial colony of the same species, dwarfed for some reason. For this reason it is not given paratype status.

REMARKS. — Although differing considerably from the type of the genus, *Madrepora oculata*, the species in question is attributed herein, provisionally, to the genus *Madrepora* on the basis of a series of characters: the small sized corallites arranged in sympodial branches, septa in 3 cycles, the general shape of colonies, and the regular presence of a not yet observed symbiont which causes the tubular growth deformation and which is presumed to be an eunicid polychaete. *M. minutiseptum* differs from all congeners by its very low septa which are hardly more than a denticulate ridge. Like *M. arbuscula*, it is partly pigmented (near the calicular edge).

The species described here under *Madrepora minutiseptum* had recognizably been characterized and illustrated by SAVILLE KENT (1871) as a scleractinian under the name *Amphihelia infundibulifera*, on the basis of "specimens in the British Museum, collected at Formosa by Consul Swinhoe" (material which we have seen). SAVILLE KENT was mistaken in being convinced that his material was "evidently identical with the species described .. by Lamarck", *i.e.*, *Oculina infundibulifera* Lamarck, 1816, presumed to come from the Indian Ocean. LAMARCK's (1816: 286) text in Latin and French (the same in the 2nd edition, 1836: 457, without additions) is brief and imprecise, as usual for most coral descriptions in the early 19th century. A critical analysis of this text strongly suggests that LAMARCK's *O. infundibulifera* is not a scleractinian but a stylasterid coral (at that time stylasterids were not yet recognized as a distinct group). *O. infundibulifera* was said to be close to the "following" species, *O. flabelliformis* Lamarck, 1816 (now *Stylaster flabelliformis*; for a detailed description, including of LAMARCK's type, see BOSCHMA, 1957b); to be almost flabellate; and to have very small zigzag-shaped branches aside the thicker main ones, both of which are coalescent. All this characterizes a stylasterid rather than a scleractinian.

LAMARCK's *O. infundibulifera* was mentioned by H. MILNE EDWARDS & HAIME (1857: 131) as a problematical stylasterid under the combination *Allopora (Stylaster) infundibulifera*. Having not seen LAMARCK's type, they referred to DANA (1848) for this interpretation. LAMARCK's type of *O. infundibulifera* appears lost. It is not with the LAMARCK collection at the Muséum national d'Histoire naturelle, Paris. It probably has never been there since LAMARCK's text does not indicate "Mus. no.", his usual way of referring to specimens present in the MNHN collection.

Many (not all) secondary quotations of LAMARCK's species are listed by BOSCHMA (1957a: 62-63, under *Amphelia infundibulifera*) who, following SAVILLE KENT (1871), considered it as a scleractinian. But, given the strong arguments for LAMARCK's *O. infundibulifera* being a stylasterid, this name cannot be used for SAVILLE KENT's species which is a *Madrepora (= Amphihelia)*.

Should there be another old name available for SAVILLE KENT's scleractinian? EHRENBERG (1834: 302-303) distinguished 4 new varieties of *Oculina virginea* (this name dates back to *Madrepora virginea* Linnaeus, 1758, an unidentifiable taxon): *pachyclados, leptoclados, tubulifera, immersa*. As typical for EHRENBERG's taxa, the characterization of these 4 varieties is too brief to allow adequate identification based on his text alone, *O. virginea* being itself a confused taxon since the beginning.

The Berlin Museum possesses 5 colonies referable to 2 species of *Madrepora (= Amphihelia)* and considered as being part of the museum's initial collection studied by EHRENBERG (1834). All are without indication of origin, as common at that time of "natural history cabinets", and 4 of them are ascribed to GERRESHEIM, an early 19th century collector. The 2 species in question are: *Madrepora oculata* Linnaeus, 1758 (see CAIRNS, 1979; ZIBROWIUS, 1980) represented by 4 colonies, and *M. "infundibulifera"* sensu SAVILLE KENT, 1871, represented by one colony. Only one colony (of *M. oculata*) is accompanied by a label in EHRENBERG's handwriting, reading *Oculina virginea* Lam. (but no variety is indicated). The 4 other colonies (3 *M. oculata*; 1 *M. "infundibulifera"* sensu SAVILLE KENT) all have later 19th century, not original, labels reading *Oculina virginea* var. *leptoclados*. It cannot be elucidated whether the identification of colonies of 2 distinct species to var. *leptoclados* was by EHRENBERG himself or was due to some later confusion. EHRENBERG's characterization (*ramis tenuioribus*; Latin: with thinner branches) of var. *leptoclados* (Greek: thin branch), opposed to the characterization (*ramis crassioribus*; Latin: with thicker branches) of var. *pachyclados* (Greek: thick branch) is of no help, especially since no authentically labeled sample of var. *pachyclados* is present that could be the reference. Accordingly the only colony (ZMB 582, GERRESHEIM) of *M. "infundibulifera"* sensu SAVILLE KENT in the old Berlin collection should not be considered as the type of EHRENBERG's var. *leptoclados* and this name is rejected as unavailable for SAVILLE KENT's species. The latter is here named *Madrepora minutiseptum* because of its very reduced low septa.

DISTRIBUTION. — Remarkably, this species is represented by quite a number of colonies in several old museum collections (Berlin, Amsterdam, London, Sydney, Wien), received in the 19th century. A few more specimens were collected in the 1980's. Although there is no modern record from the area, Taiwan (= Formosa) as the origin of a series of colonies at the BMNH received from "consul Swinhoe" is surely correct since Robert SWINHOE (1836-1877) had indeed been on duty in China for many years, including in Taiwan (in 1858, 1861 and 1864-1866, especially at Tansui, in the north of the island; see MEARNS & MEARNS, 1988).

In Indonesia the species has been recorded from 4 distinct areas: from Salayer, type locality (SNELLIUS 2: 150-200 m); from Ternate (*"Challenger"* expedition: undetailed); from Makassar Strait (CORINDON 2 stn 235, although the depth of 1110 m is certainly confused); and from the Kai Islands (KARUBAR stn 18: 205-212 m).

Confirmed distribution. — Taiwan, Japan and Indonesia; 150-212 m.

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

Cyathelia axillaris (Ellis & Solander, 1786)

Madrepora axillaris Ellis & Solander, 1786: 153, pl. 13, fig. 5.
Cyathohelia axillaris - MOSELEY, 1876: 547; 1881: 175-176. — BASSETT-SMITH, 1890: 367. — BEDOT, 1907: 145 pl. 15, figs 1-3.
Cyathelia axillaris - NEMENZO, 1979: 11-12, pl. 3, fig. 3. — CAIRNS, 1994: 43-44, pl. 18, figs a-c (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5134, 1 (USNM 96758). — Stn 5255, 1 (USNM 96759). — Stn 5268, 1 (USNM 96760). — Stn 5367, 5 (USNM 96761).
MUSORSTOM 3: stn 131, 2 (USNM 96763).
Indonesia. *"Siboga"*: stn 260, 1 (ZMA Coel. 6438). — Stn 310, 1 colony (ZMA Coel. 6619); unknown station 1 colony (ZMA Coel. 6439).
DEKI: stn 24, 2, (NNM 22449). — Stn 104, 1 (NNM 22448). — Stn 105, 1 (NNM 22443). — Unnumbered station Ambon, 25-130 m, 1 (NNM 22445-47).
CORINDON 2: stn 248, 2 (MNHN).
SNELLIUS 2: stn 4.106, 1 (NNM 22444).
KARUBAR: stn 22, 1 (USNM 96762). — Stn 30, 1 (USNM 96763).

TYPE LOCALITY. — Eastern Indian Ocean (depth not given).

DIAGNOSIS. — Corallum sparsely branched, resulting in small, robust, bushy colonies, the largest known 7.5 cm in height, consisting of about 100 corallites (EGUCHI, 1968). Extratentacular branching essentially sympodial, 2 buds usually originating on opposite sides of a terminal corallite, the parent corallite eventually becoming immersed in thick coenosteum in resultant branch axil. Corallites relatively large, up to 11 mm GCD. Corallum light brown, the corallites usually a darker shade. Septa hexamerally arranged in 4 cycles: $S_{1-2}>S_3>S_4$. A crown of 12 thick pali (P_{1-2}) encircle the columella and a second, slightly more recessed crown of 12 P_3 stand higher in the fossa, resembling the calice of a *Trochocyathus*. Columella papillose.

REMARKS. — Among the colonial azooxanthellate corals known from this region, *Cyathelia* is distinguished by its distinctive branching: two large corallites budding from opposite sides of a parent corallite, the parent corallite often becoming constricted. Also distinctive, the coenosteum of this species is white to beige, whereas the calice and near-calice coenosteum are a darker brown. A complete description is given by NEMENZO (1979) and CAIRNS (1994).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Bohol Sea (Negros); Davao Gulf; Sulu Sea (Zamboanga Peninsula); 46-329 m. *Indonesia*: Makassar Strait; Molucca Sea; Ceram Sea (south of Obi Islands); Banda Sea (Kai and Ambon Islands); Flores Sea (Sumbawa); Java Sea (Sunda Strait); 13-170 m. *Elsewhere*: South China Sea (Tizard Bank); northern Indian Ocean; Japan (Honshu and northern Ryukyu Islands); Korea Strait; 15-366 m.

Genus *NEOHELIA* Moseley, 1881

Neohelia sp. cf. *N. porcellana* Moseley, 1881

Figs 5 c-e, g-h

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 289, 1 colony (USNM 96766). — Stn 305, 1 colony (ZMA).

DEKI: unnumbered station in Bay of Ambon, 91 m, 1 broken colony (ZMUC). — Unnumbered station in Bay of Ambon, 46-55 m, 1 colony (NNM 22680).

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

SNELLIUS 2: stn 4.104, several colonies (NNM 22681), 1 colony (USNM 96765). — Stn 4.105, 2 colonies (NNM 22733).

DESCRIPTION. — Corallum up to 5 cm in height, forming a very thin, easily fractured encrustation around the parchment-like tube of a eunicid polychaete or gorgonian axis. Only very short, slender branches consisting of 3-5 corallites project from the basal encrustation. If encrusting a polychaete tube, the terminal aperture created by the polychaete is approximately 2.8 mm in diameter; however, additional circular to elliptical pores of variable diameter (0.4-1.6 mm) penetrate the coenosteum providing feeding apertures for the worm. Calices circular but variable in diameter, ranging from 0.70-1.50 mm. Theca white, with very faint, longitudinal costal striations. Coenosteum of some coralla also densely covered with small, blunt papillae up to 70 µm in diameter and 80 µm in height, similar to the "granular echinulations" illustrated by PRATT (1900: pl. 62, fig. 2).

Septa hexamerally arranged in 3 generally full cycles: $S_1>S_2>S_3$; in some corallites from Ambon (ZMUC), 1 or 2 pairs of S_3 are sometimes missing, resulting in 20-22 septa. S_1 highly exsert (up to 0.25 mm) and quite narrow (about 0.11 mm). Vertical inner edges of S_1 slightly thickened and sinuous deep in fossa, where they extend to the centre of fossa. S_2 less exsert and narrower (about 0.6 mm) than the S_1, not extending quite as far toward centre of fossa. S_3 least exsert and least wide (about 0.4 mm) septa, attenuating before they reach base of fossa. Fossa relatively shallow and quite wide, resulting from the small size of the septa; fossa with a horizontal floor. Columella rudimentary, consisting of several irregularly shaped papillae, the papillae often an extension of the inner S_1 septal edges.

REMARKS. — Both MOSELEY (1881) and PRATT (1900) reported their Vanuatu specimens of *N. porcellana* to have exclusively pentameral symmetry in 3 cycles (5:5:10), resulting in 20 septa, although PRATT (1900: 592) acknowledged that "there is a tendency for them to lose their symmetry of arrangement". Likewise, most of WELLS' (1984) Pleistocene Vanuatu specimens (USNM) have 20 septa, but several corallites were found to have 24 septa arranged in three cycles. Whereas most of the Ambon corallites have hexameral symmetry in 3 cycles (24 septa), the 3rd cycle is occasionally incomplete, resulting in 20, 22, or 24 septa. Because of the difference in septal symmetry (pentameral resulting in 20 septa for previously reported *Neohelia* vs. hexameral resulting in 24 septa) the Indonesian specimens are not definitively identified as *N. porcellana*.

Some early authors (PRATT, 1900; HICKSON, 1903) believed that *N. porcellana* was able to produce a horny membrane underlying its calcareous coenosteum. In fact, similar to *Madrepora*, *Neohelia* may overgrow the productions of other organisms and especially the membrane-like tubes of symbiotic eunicid polychaetes. However, more recently, polychaetes have been found within *Madrepora* axes (CAIRNS, 1991, 1995) and, indeed, a dried eunicid was found in the tube of the *Neohelia* from Ambon, suggesting that the polychaete, not the coral, secretes the horny membrane.

WELLS (1984) synonymised *Neohelia* with *Madrepora* without explanation. The rudimentary columella in *Neohelia* and its distinctive coenosteal papillae would seem to justify the retention of this genus. *Neohelia porcellana* is described in great detail by PRATT (1900), including characteristics of the soft parts.

DISTRIBUTION. — *Indonesia*: Makassar Strait; Banda Sea (Bay of Ambon: Solar Strait); Timor Sea (southeast of Timor); Lintah Strait, west of Flores; 55-170 m.

Typical pentameral *Neohelia porcellana* is known from Vanuatu (Api Island, type locality) (Fig. 5f) and Pleistocene of Kere and Navaka River (WELLS, 1984); Loyalty Islands (PRATT, 1900; HICKSON, 1903); and New Caledonia. WELLS (1984) listed *N. porcellana* from northwestern Australia (140-141 m), but we can find no documentation of this record. According to MOSELEY (1881) the types were collected at *"Challenger"* stn 177 at 63 fathoms (=115 m), but according to TIZZARD *et al.* (1885, cruise narrative) it is 130 fathoms (= 238 m). VAUGHAN & WELLS (1943) indicate a range of 91-115 m for the species, but again without documentation. The only reliable depth range for the species is that of the types: 115-238 m.

Family ANTHEMIPHYLLIIDAE Vaughan, 1907

Genus *ANTHEMIPHYLLIA* Pourtalès, 1878

Anthemiphyllia dentata (Alcock, 1902)

Discotrochus dentatus Alcock, 1902a: 104; 1902c: 27, pl. 4, figs 26, 26a. — FAUSTINO, 1927: 63, pl. 7, figs 1-2.
Anthemiphyllia dentata - BEST & HOEKSEMA, 1987: 398-399, figs 9a-c. — ZOU *et al.*, 1988: 195. — CAIRNS & PARKER 1992: 16-17, pl. 4, figs e-f (synonymy). — CAIRNS & KELLER, 1993: 233, pl. 3, fig. E. — CAIRNS, 1994: 44, pl. 18 figs d-f (synonymy); 1995: 41-42, pl. 6, figs c-g (synonymy).
Anthemiphyllia dentatus - YABE & EGUCHI, 1941b: 213, figs 1a-b.
Deltocyathus andamanicus - KELLER, 1982: 52 (in part: pl. 1 [= 4], figs 3-4, *"Dimitri Mendeleev"* stn 1411). [No *Deltocyathus andamanicus* Alcock, 1898].
Not *Discotrochus* sp. - ALCOCK, 1902c: 27-28 [= undescribed *Anthemiphyllia* having costal spines].
Not *Anthemiphyllia dentata* - CAIRNS, 1984: 11, pl. 1, figs F-G [= undescribed *Anthemiphyllia*, see CAIRNS, 1994].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5162, 2 (USNM 96767). — Stn 5178, 1 (USNM 96768). *"Hakuho Maru"*: stn KH72-1-20, 1 (USNM 96774).
MUSORSTOM 2: stn 33, 7 (MNHN).
MUSORSTOM 3: stn 108, 1 (USNM 96771). — Stn 126, 2 (USNM 96772). — Stn 130, 1 (MNHN). — Stn 131 11 (MNHN).
Indonesia. *"Albatross"*: stn 5584, 1 (USNM 96770).
SNELLIUS 2: stn 4.033, 1 (NNM 22494). — Stn 4.034, 3 (NNM 18013, mentioned by BEST & HOEKSEMA, 1987).
KARUBAR: stn 1, 10 (MNHN).

TYPE LOCALITY. — Sulu Sea, 350-522 m.

DIAGNOSIS. — Corallum discoidal, with a flat to slightly bowl-shaped base; largest Philippine specimen (MUSORSTOM 3 stn 126) 21.3 mm in calicular diameter. Corallum usually free, but with a circular scar or irregularity 2-6 mm in diameter at centre of base. Costae rounded and granular, separated by shallow intercostal furrows, that, in large coralla, are bisected by very thin ridges. Septa hexamerally arranged in 5 cycles, the 5th cycle complete only in large specimens. Septal formula: $S_{1-2}>S_3>S_4>S_5$. S_{1-2} quite thick, highly exsert, bearing 7-11 coarse septal lobes. Like the S_{1-2}, the S_3 also reach the columella but are less thick, having more numerous, finer teeth. S_4 much smaller than S_3, having laciniate inner edges. S_5 rudimentary and highly laciniate. Fossa shallow; columella papillose.

REMARKS. — *Anthemiphyllia dentata* is distinguished from other solitary, discoidal, azooxanthellate species from this region by having very thick S_{1-2} with coarse septal dentition.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan Sea; Sulu Sea (Semirara Islands, Sulu Archipelago); 122-522 m. *Indonesia*: Banda Sea (Kai and Tukangbesi Islands); 280-534 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea (west of Palawan; north of Pratas Islands); widespread from southwestern Indian Ocean to southern Japan, the Kermadecs, and Tasmania; 50-570 m.

Anthemiphyllia frustum Cairns, 1994

Figs 6 a-b

Anthemiphyllia frustum Cairns, 1994: 44-45, pl. 18, figs g-i, pl. 19, figs a-b.

MATERIAL EXAMINED. — **Indonesia**. SNELLIUS 2: stn 81.2, 3 (NNM 23073).
KARUBAR: stn 2, 1 (MNHN). — Stn 15, 24: 6 (MNHN), 18 (USNM 96776).
South China Sea. *"Albatross"*: stn 5313, 1 (USNM 96769).

TYPE LOCALITY. — 30°59'N, 130°32'E (Osumi Strait, southern Kyushu, Japan), 237-241 m.

DIAGNOSIS. — Anthocyathus: base flat, its calicular diameter being less than its basal diameter. Largest known specimen (SNELLIUS 2 stn 81.2) 10.2 mm in calicular diameter and 7.4 mm in height, consisting of 2 anthocyathi that have not completely separated (Fig. 6a). A faint, circular detachment scar 5-6 mm in diameter present in centre of base. Septa hexamerally arranged in 4 cycles ($S_1>S_2>S_3>S_4$), being thick and closely spaced. Adjacent septa strongly fused by 3 or 4 vertical synapticular plates, similar to those illustrated for *Fungiacyathus turbinolioides* (CAIRNS, 1989a, pl. 6, fig. f), but only visible in a longitudinal fracture of a damaged corallum. All septa bear massive triangular teeth for their entire length. Columella papillose, composed of 10-15 massive, granular papillae. Anthocaulus unknown.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai and Tanimbar Islands); 209-340 m. *Elsewhere*: South China Sea (Pratas Islands); Osumi Strait (south of Kyushu, Japan); 237-274 m.

Suborder CARYOPHYLLIINA

Superfamily CARYOPHYLLIOIDEA Dana, 1846

Family CARYOPHYLLIIDAE Dana, 1846

Genus ***CARYOPHYLLIA*** Lamarck, 1816

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

Key to the 13 species of *Caryophyllia (Caryophyllia)* known from the Philippine/Indonesian region

Note: Additional undescribed and/or unreported species of *Caryophyllia* probably also occur in this region. Thus this key should be considered as only a guide to the more common species included in this review.

1. Corallum attached (ceratoid, trochoid, or subcylindrical) **2**
— Corallum free (unattached), usually ceratoid **12**

2. Septa arranged hexamerally (6 or 12 primary septa) **3**
— Septa arranged pentamerally, septamerally, octamerally, decamerally, or tetradecamerally (5, 7, 8, 10, or 14 primary septa) **7**

3. Penultimate cycle of septa (S_3) equal to or wider than last cycle ($S_3 \geq S_4$) **4**
— Penultimate cycle of septa (S_3) less wide than last (S_4) cycle ($S_3 < S_4$) **6**

4. Corallum firmly attached to substratum **5**
— Corallum rises from a slender pedicel that bears a small detachment scar ..... ***C. secta***

5. Theca transversely ridged; septa often brown ..... ***C. lamellifera***
— Theca longitudinally costate; corallum white ..... ***C. diomedeae***

6. Fossa quite deep; columella rudimentary ..... ***C. crosnieri***
— Fossa not deep; columella well developed ..... ***C. panda***

7. Septa arranged octomerally **8**
— Septa arranged pentamerally, decamerally, or tetradecamerally **9**

8. Theca transversely ridged; $S_1>S_2>S_3$; S_{1-2} and pali quite sinuous ..... ***C. rugosa***
— Theca costate or porcellaneous; $S_1>S_3>S_2$; septa and pali only moderately sinuous ..... ***C. octonaria***

9. Corallum with 5 large primaries (pentameral symmetry); theca and septa usually bear a mottled pigmentation ..... ***C. hawaiiensis***
— Corallum with 10-14 large primary septa **10**

10. Corallum with 10 primary septa (decameral symmetry) ..... ***C. quadragenaria***
— Corallum with 14 (rarely 16) primary septa **11**

11. Theca transversely ridged; septa usually darkly pigmented ..... ***C. lamellifera***
— Theca longitudinally costate; septa not pigmented ..... ***C. transversalis***

12. Corallum with 96 or more septa **13**
— Corallum with less than 96 septa (usually 48-72) **14**

13. S_4 wider than S_5; pedicel may be present; known depth range 251-567 m ... ***C. grandis***
— S_5 equal to or wider than S_4; pedicel absent; known depth range deeper, 468-1048 m ..... ***C. ambrosia***

14. Calicular margin lanceted; 48 septa usually present; depth range 353-1276 m ..... ***C. scobinosa***
— Calicular margin serrate; usually 48-72 septa; known depth range deeper, 1525-2623 m ... ***C. cornulum***

Caryophyllia (C.) diomedeae Marenzeller, 1904

Caryophyllia ephyala - ALCOCK, 1902c: 9. [= ? *C. ephyala* Alcock in Wood-Mason & Alcock, 1891].
Caryophyllia diomedeae Marenzeller, 1904b: 79-80, pl. 1, fig. 2. — CAIRNS, 1991: 11-12, pl. 4, figs c-e (synonymy); 1995: 49-50, pl. 9, figs a-d (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 95, 1 (ZMA).
"Albatross": stn 5317, 2 (USNM 96778).
MUSORSTOM 1: stn 49, 2 (USNM 96781).
MUSORSTOM 2: stn 15, 1 (MNHN).
MUSORSTOM 3: stn 95, 2 (MNHN).
Indonesia. *"Siboga"*: stn 59, 1 (ZMA).
"Albatross": stn 5634, 1 (USNM 96789). — Stn 5656, 3 (USNM 96780).
KARUBAR: stn 3, 1 (MNHN).

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

DIAGNOSIS. — Corallum conical, distally flared; largest known corallum 29.9 mm in GCD (CAIRNS, 1995), but largest from Indonesian region only 12 mm in GCD and 21 mm in height. PD:GCD = 0.26-0.40. Costae flat and poorly distinguished, covered with inconspicuous granules, sometimes porcellaneous. Septa hexamerally arranged in 4 full cycles: $S_{1-2}>S_3>S_4$. S_3 have highly sinuous inner edges, those of $S_{1-2,4}$ less sinuous. Septa only moderately exsert. A tight crown of 12 P_3 encircle a fascicular columella of 3-12 slender lamellae. Fossa shallow.

REMARKS. — Among the 56 Recent species of *Caryophyllia* listed by CAIRNS (1991), the largest subset (19 species) are those species having attached coralla and hexamerally arranged septa in 4 cycles. *C. diomedeae* belongs to this morphological subset, as do the first 3 species in the account of this genus, the 4th (*C. lamellifera*) having both hexameral and heptameral symmetry. *C. diomedeae* can be distinguished from other species in this region using the key.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (Sulu Archipelago); 330-865 m. *Indonesia*: Ceram Sea (south of Obi Islands); Banda Sea (Kai Islands); Teluk Bone (Sulawesi); Savu Sea (Timor); 300-885 m. *Elsewhere*: widespread, including throughout Pacific from Panama to Tasmania; 225-2200 m.

Caryophyllia (C.) crosnieri nom. nov.

Caryophyllia elongata Cairns in CAIRNS & KELLER, 1993: 236-237, pl. 4, figs A-B. — CAIRNS, 1995: 52, pl. 10, figs d-f. [Not *Caryophyllia clavus* var. *elongata* Duncan, 1873].

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 15, 1 (MNHN).
Indonesia. DEKI: stn 3, 2 (NNM 22885). — Stn 12, 3 (NNM 22884).
KARUBAR: stn 5, 1 (MNHN). — Stn 31, 7 (USNM 96785). — Stn 32, 1 (POLIPI).

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

DIAGNOSIS. — Corallum ceratoid to subcylindrical; largest known specimen (KARUBAR stn 31) 8.8 x 10.8 mm in calicular diameter and 14.1 mm in height. PD:GCD = 0.50-0.81. Theca porcellaneous, covered with low, rounded granules. Corallum white, but often having a light brown calicular edge. Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_4\geq S_3$. S_1 highly exsert, forming triangular calicular lancets. Inner septal edges only slightly sinuous. A tight crown of 12 slender P_3 encircle a fascicular columella composed of 3-9 very slender twisted lamellae. P_3 appear to be paired within each system. Fossa extremely deep and narrow.

REMARKS. — *Caryophyllia crosnieri* is more fully described and illustrated by CAIRNS & KELLER (1993) and CAIRNS (1995) as *C. elongata*. The name *elongata* Cairns *in* CAIRNS & KELLER (1993) is a junior primary homonym of *Caryophyllia clavus* var. *elongata* Duncan, 1873, and thus is replaced herein. This species is renamed for Alain CROSNIER (MNHN), one of the driving forces behind the MUSORSTOM expeditions and the resultant publications. The species also occurs in Madagascar, Indonesia, Philippines, and New Caledonia, areas where he contributed to the collection of deep-water benthos.

Caryophyllia crosnieri is distinguished from its congeners by having an extremely deep fossa and small "paired" pali (see key).

DISTRIBUTION. — *Philippines*: Mindoro Strait; 326-330 m. *Indonesia*: Banda Sea (Kai Islands); 206-296 m. *Elsewhere*: Madagascar Plateau; Kermadec and Three Kings Ridges; New Caledonia region; 165-680 m.

Caryophyllia (C.) secta sp. nov.

Figs 6 c-e

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5116, 1 paratype (USNM 96786). — Stn 5265, holotype (USNM 96787) and 1 paratype (USNM 96788). — Stn 5567, 1 paratype (USNM 96789).
MORTENSEN'S PACIFIC EXPEDITION: Zamboanga Peninsula, 160-200 fv (= 301-373 m), 14 March 1914, 2 paratypes (NNM 22771).
MUSORSTOM 2: stn 32, 8 paratypes (MNHN).
MUSORSTOM 3: stn 126, 2 paratypes (USNM 96790).
Indonesia. MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 1 paratype (ZMUC).
KARUBAR: stn 3, 1 paratype (MNHN).

TYPE LOCALITY. — *"Albatross"* stn 5265: 13°41'N, 120°00'E (Lubang Island, Philippines), 247 m.

ETYMOLOGY. — The species name *secta* (Latin *sectus*, cut) refers to the base of the anthocyathus stage, which appears to be cut from the anthocaulus.

DESCRIPTION. — Anthocaulus stage unknown, probably not collected because of its small size. Corallum (anthocyathus) elongate-conical (edge angle 24°-36°), straight, and always unattached, the pedicel narrowing to a small circular to elliptical detachment scar 2.0-2.5 x 2.2-3.4 mm in diameter. Holotype 15.7 x 12.9 mm in calicular diameter and 21 mm in height; largest calice (KARUBAR stn 3) 17.6 mm in GCD, and largest corallum (MUSORSTOM 3 stn 126) 30.0 mm in height. Calice elliptical: GCD:LCD = 1.19-*1.24*-1.39 (N=6). Costae flat to only slightly convex, each about 0.85 mm wide near calice and separated by very thin, shallow striae. Costae

covered with low, rounded granules — 4 or 5 occurring across width of a costa near calice. Thin porcellaneou epithecal bands present on well-preserved coralla. Corallum white to light reddish-brown.

Septa usually hexamerally arranged in 4 complete cycles of 48 septa according to formula: $S_{1-2}>S_3>S_4$; onl one corallum (KARUBAR stn 3) having 14 sectors, or 56 septa and 14 pali. Septa evenly and widely spaced 0.6-0.7 mm from one another. S_{1-2} only slightly exsert (1.1-1.2 mm), extending about 3/4 distance to columella having moderately sinuous inner edges. S_3 and S_4 equally exsert (about 0.8 mm), the S_3 about 3/4 width of S_{1-2} having very sinuous inner edges. S_4 3/4 to 4/5 width of an S_3, inner edges moderately sinuous. Septal face covered with small, pointed granules arranged in closely-spaced, parallel rows in a fan system radiating from th thecal wall. An elliptical crown on 12 lamellar P_3 encircle the elongate columella, each palus having a slightl sinuous inner and outer edge and measuring 1.0-1.3 mm in width. Fossa shallow to moderate in depth. Columell consists of 4-9 slender, twisted lamellae.

REMARKS. — The nature of the base of *C. secta* is unique within *Caryophyllia*. If only one specimen wer found to be truncate, with a small, basal scar, it might be interpreted as an accidental fracture from the substratum but its presence in all specimens reported above suggests that it is a normal feature of the species. Basal scars ar assumed to have resulted from transverse division from a small, attached anthocaulus stage; however, no such stag has yet been identified for this species.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (Semirara Islands an Zamboanga Peninsula); 220-366 m. *Indonesia*: Banda Sea (Kai Islands); Bali Sea; 240-278 m.

Caryophyllia (C.) lamellifera Moseley, 1881

Caryophyllia lamellifera Moseley, 1881: 140-141, pl. 1, figs 7a-b. — CAIRNS, 1995: 51-52 , pl. 9, fig. i, pl. 1(figs a-c (synonymy).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 131, 2 (USNM 96791). — Stn 134, 5 (MNHN).
Indonesia. DEKI: stn 24, 1 (NNM 22747).
KARUBAR: stn 18, 2 (MNHN). — Stn 30, 1 (MNHN).

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

DIAGNOSIS. — Corallum elongate-conical to trochoid; largest known specimen 15.5 mm in GCD (CAIRNS, 1995); largest reported herein (MUSORSTOM 3 stn 134) 11.5 mm in GCD and 17.2 mm in height. PD:GCD = 0.38-0.53. Theca glisteny, covered with closely spaced, transverse ridges. Most coralla have brown thecal striping and brown S_{1-2}. Septal symmetry variable, most specimens reported above having 4 cycles of heptamerally arranged septa (56 septa, 14 pali), but one small specimen (KARUBAR stn 18) having hexamerally arranged septa (48 septa, 12 pali). Septal formula: $S_1>S_2>S_3>S_4$, the S_{1-2} highly exsert, forming triangular calicular lancets with their flanking S_4. Inner edges of all septa slightly sinuous. 12 to 14 robust P_3 encircle a fascicular columella composed of 1-19 very slender twisted lamellae. Fossa of moderate depth.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1995). It is distinguished by its relatively large, pigmented corallum and its transverse thecal ridging (see key).

DISTRIBUTION. — *Philippines*: northwestern Panay (Sulu Sea and Tablas Strait); 95-120 m. *Indonesia*: Banda Sea (Kai Islands); 100-212 m. *Elsewhere*: Kermadec Ridge; southern Norfolk Ridge; Lord Howe Island; Taupo Tablemount, Tasman Sea; 89-1152 m.

Caryophyllia (C.) transversalis Moseley, 1881

Figs 6 f-h

Caryophyllia clavus var. *transversalis* Moseley, 1881: 134-135, pl. 1, figs 2, 2a. — ALCOCK, 1902c: 9-10.

MATERIAL EXAMINED. — **Indonesia**. *"Challenger"*: stn 192, syntype of *C. clavus transversalis* (BMNH 1880.11.25.23).

"Siboga": stn 12, 1 (ZMA). — Stn 256, 1 (ZMA).

DEKI: stn 3, 24 (NNM 22704). — Stn 6, 2 (NNM 22703). — Stn 32, 1 (NNM 22705). — Stn 41, 1 (NNM 22706). — Stn 42, 7 (NNM 22707). — Stn 44, 12 (NNM 22708). — Stn 46, 2 (NNM 22709). — Stn 48, 2 (NNM 22710). — Stn 50, 18 (NNM 22712). — Stn 62 , 1 (NNM). — Stn 63, 1 (NNM 22713).

KARUBAR: stn 2, 8 (USNM 96793). — Stn 7, 6 (POLIPI). — Stn 67, 2 (MNHN). — Stn 68, 4: 2 (MNHN), 2 (USNM 96794). — Stn 79, 4 (POLIPI). — Stn 84, 4: 3 (MNHN), 1 (USNM 96796).

TYPE LOCALITY. — *"Challenger"* stn 192: 5°42'S, 132°25'E (Kai Islands, Banda Sea), 235 m.

DESCRIPTION. — Corallum trochoid (edge angle 53°-65°), straight, and always attached through a narrow pedicel 1.6-2.9 mm in diameter (PD:GCD = 0.11-0.19). Substratum often a small scaphopod, gastropod, or bivalve shell. Calice elliptical: GCD:LCD = 1.21-*1.27*-1.36 (N=6). Largest known specimen (KARUBAR stn 79) 21.6 x 15.9 mm in calicular diameter and 23.8 mm in height, with a pedicel diameter of 2.7 mm. Costae flat to slightly convex, each about 1.0 mm wide near the calice of a large specimen, and separated by thin, shallow striae. Costae covered with low, rounded, glisteny granules — 4 or 5 occurring across a costa. Corallum near calice of large specimens beige, becoming white or discoloured 4-5 mm below calicular edge.

Septa, even of coralla as small as 8.8 mm GCD, arranged accordingly: 14:14:28 (56 septa and 14 pali); however, 1 large corallum from KARUBAR stn 67 has 16 primary septa and 16 pali, and altogether in 60 septa. Primary septa highly exsert (up to 3.5 mm), with straight, vertical inner edges that attain the columella low in fossa. Secondary septa least exsert (about 1.3 mm), about 3/4 width of a primary, with highly sinuous inner edges. Tertiary septa about 2 mm exsert, each pair adjacent to a primary fusing to that primary in a low, triangular calicular lancet, producing a serrate calicular margin. Tertiary septa about 4/5 width of a secondary, with straight inner edges. An elliptical crown of 14-16 P_3 encircles an elongate columella, each palus about 1.7 mm wide, having highly sinuous edges. Fossa of moderate depth, containing a columella of 9-15 slender, closely-spaced twisted lamellae.

REMARKS. — *Caryophyllia transversalis* is similar to *C. secta* sp. nov., but can be distinguished by its attached, trochoid (vs unattached, ceratoid) corallum; lanceted calicular edge; and tendency to have 14 (vs 12) primary septa. Among the Recent *Caryophyllia*, attached species having decatetrameral symmetry (x 14) are not common, only three being listed by CAIRNS (1991, table 3), all of those species having a range of septal symmetry that includes decatetrameral.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Bali Sea; 210-397 m.

Caryophyllia (C.) rugosa Moseley, 1881

Caryophyllia rugosa Moseley, 1881: 141-143, pl. 1, figs 8a-b. — FAUSTINO, 1927: 70-71, pl. 8, figs 12-14. — CAIRNS & KELLER, 1993: 236, pl. 3, fig. I. — CAIRNS, 1994: 47, pl. 20, fig. i, pl. 21, fig. a (synonymy); 1995: 43-44, pl. 6, fig. h, pl. 7, figs a-c.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5172, 1 (USNM 96797). — Stn 5217, 1 (USNM 96798).
MUSORSTOM 2: stn 33, 1 (MNHN).
Indonesia. DEKI: stn 3, 1 (NNM 22746).
KARUBAR: stn 18, 9: 5 (MNHN), 4 (USNM 96799).

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

DIAGNOSIS. — Corallum elongate-conical to cylindrical, firmly attached through a thick pedicel (PD:GCD = 0.3-0.6); largest known corallum only 8.5 mm in GCD (CAIRNS, 1994). Theca covered with fine transverse ridges. Septa octamerally arranged in 3 cycles (S_1>S_2>S_3), resulting in 32 septa. Inner edges of S_1 and S_2 extremely sinuous. Septal faces bear blunt granules, some fused into short carinae. A crown on 8 very sinuous pali occurs

before the secondary septa, encircling a fascicular columella composed of 1-*4*-15 slender, twisted lamellae. Fossa shallow.

REMARKS. — *Caryophyllia rugosa* is a very common azooxanthellate coral found throughout the Indo-West Pacific, characterised by having a relatively small corallum, 3 cycles of very sinuous, octamerally arranged septa, and a transversely ridged theca. The 5 species of attached *Caryophyllia* having octamerally symmetrical septa are discussed in the following species account.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Ragay Gulf; Sulu Sea (Sulu Archipelago); 137-581 m. *Indonesia*: Banda Sea (Kai Islands); 205-256 m. *Elsewhere*: widespread in Indo-West Pacific from South Africa to the Hawaiian Islands, including Japan and the Kermadec Islands; 71-508 m.

Caryophyllia (C.) octonaria sp. nov.

Figs 7 a-b

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5527, 1 paratype (USNM 97060).
MUSORSTOM 1: stn 64, holotype (MNHN).
MUSORSTOM 2: stn 2, 2 paratypes (MNHN).
MUSORSTOM 3: stn 88, 3 paratypes (USNM 96802). — Stn 90, 1 paratype (USNM 96803). — Stn 100, 3 paratypes (MNHN). — Stn 101, 1 paratype (MNHN). — Stn 102, 8 paratypes (USNM 96804).

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

ETYMOLOGY. — The species name *octonaria* (Latin *octonarius*, consisting of 8 units) refers to the octameral symmetry of this species.

DESCRIPTION. — Corallum conical, straight to slightly bent, and always attached by a slender pedicel (PD:GCD = 0.26-*0.31*-0.40). Coralla always attached to gastropod or bivalve shells; one dead corallum (MUSORSTOM 2 stn 2) secondarily incorporated into a *Xenophora* shell. Calice slightly elliptical: GCD:LCD = 1.06-*1.08*-1.13. Largest known specimen (the holotype) 7.8 x 8.4 mm in calicular diameter, 13.9 mm in height, and 2.2 mm in pedicel diameter. Costae not well defined, the theca often smooth and porcellaneous near calice. Costae on lower corallum equal in width (0.5-0.6 mm) and flat, separated by very shallow, narrow intercostal striae and covered with low, rounded granules. Theca light grey-brown or reddish-brown; septa, pali, and columella usually white.

Septa octamerally arranged in 3 complete cycles (32 septa) in all specimens examined. Eight primary septa relatively highly exsert (1.7-2.2 mm), extend about 3/4 distance to columella, having moderately sinuous inner edges. Remaining septa equally exsert (1.0-1.2 mm), the 8 secondaries being about 5/6 width of a primary, also having moderately sinuous inner edges. Tertiary septa of small coralla equal to or slightly less wide than secondaries, but at a later stage its tertiaries become slightly wider than its secondaries ($S_1 > S_3 > S_2$). Inner edges of tertiaries only slightly sinuous. Septal faces covered with prominent, pointed granules. Fossa quite shallow, containing an elliptical crown of 8 sinuous pali before the secondaries, each palus 1.0-1.1 mm wide. The fascicular columella consists of a field of 6-9 twisted elements strongly fused together basally.

REMARKS. — There are 4 previously described octamerally symmetrical, attached *Caryophyllia: C. rugosa* Moseley, 1881; *C. barbadensis* Cairns, 1979; *C. octopali* Vaughan, 1907; and *C. marmorea* Cairns, 1984, all of which are characterised by having their tertiaries equal to or wider than their secondaries. *C. octonaria* is similar to *C. octopali*, but differs in having a narrower pedicel (PD:GCD = 0.26-0.40 vs >0.5 for *C. octopali*), a more flared corallum (that of *C. octopali* is elongate and subcylindrical), and in having relatively exsert septa. In the last character *C. octonaria* resembles *C. octopali* var. *incerta* Vaughan, 1907, but that form differs in having hexameral or heptameral symmetry, a very reduced columella, and a quasicolonial habit.

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol Sea; 186-194 m.

Caryophyllia (C.) hawaiiensis Vaughan, 1907

Caryophyllia hawaiiensis Vaughan, 1907: 76, pl. 5, figs 4a-b. — Cairns, 1984: 11; 1995: 44-45 , pl. 7, figs d-f.

Material examined. — **Philippines**. *"Albatross"*: stn 5310, 1 (USNM 96805).
Musorstom 2: stn 33, 3 (MNHN).
Musorstom 3: stn 117, 1 (MNHN).
Indonesia. Deki: stn 25, 1 (NNM 22744). — Stn 53, 1 (NNM 22745).
Corindon 2: stn 248, 2 (MNHN).
Karubar: stn 1, 1 (POLIPI). — Stn 22, 1 (USNM 96807).

Type Locality. — *"Albatross"* stn 3838: 21°04'05"N, 157°10'35"W (off Molokai, Hawaiian Islands), 168-388 m.

Diagnosis. — Corallum elongate-conical and attached; largest known specimen 11.6 mm in GCD (Cairns, 1995); largest specimen reported herein (*"Albatross"* stn 5310) 8.4 mm in GCD. PD:GCD = 0.34-0.49. Costae absent or poorly defined, the theca porcellaneous and covered with low, rounded granules. Theca and most septa speckled with dark brown pigmentation. Septa pentamerally arranged in 4 cycles (5:5:10:20, $S_1>S_2>S_4>S_3$) resulting in 40 septa and 10 pali. The asymmetrical arrangement of the 5 S_1 results in a pentagonal disposition of major septa, with only one of the S_1 being aligned with the greater calicular axis. S_1 highly exsert, forming tall calicular lancets. A crown of 10 P3 encircles a fascicular columella consisting of 6-18 slender, twisted lamellae.

Remarks. — *Caryophyllia hawaiiensis* is unique among the *Caryophyllia* in having pentamerally arranged septa. It is more fully described and illustrated by Cairns (1995).

Distribution. — *Philippines*: Verde Island Passage; Midoro Strait; 97-130 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 85-170 m. *Elsewhere*: South China Sea (Vereker Banks near Pratas Island); Hawaiian Islands; Kermadec Ridge; 126-279 m.

Caryophyllia (C.) quadragenaria Alcock, 1902

Caryophyllia quadragenaria Alcock, 1902a: 91-92; 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 (synonymy).

Material examined. — **Indonesia**. Deki: stn 46, 2 (NNM 22741). — Stn 59, 1 (NNM 23080).
Snellius 2: stn 81.2, 1 (NNM 23079).
Karubar: stn 2, 16 (MNHN). — Stn 3, 5 (USNM 96811).
South China Sea. *"Albatross"*: stn 5313, 2 (USNM 96809). — Stn 5317, 6 (USNM 96810).

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

Diagnosis. — Corallum elongate-conical and attached, straight, and relatively small; largest Indonesian specimen (Karubar stn 3) 8.9 x 12.0 mm in calicular diameter and 15.4 mm in height. PD:GCD = 0.11-0.39. Costae well defined only near calice. Septa decamerally arranged in 3 cycles (10:10:20, 40 septa; $S_1>S_3>S_2$). Ten broad, highly sinuous P_2 encircle a fascicular columella of 3-11 twisted lamellae.

Remarks. — Comparisons of *C. quadragenaria* to the other 6 species of *Caryophyllia* that have decameral symmetry are made by Cairns (1995), and the species is more fully described and illustrated by Cairns (1994, 1995).

Distribution. — *Indonesia*: Makassar Strait; Banda Sea (Kai and Tanimbar Islands); Timor Sea (Timor); 112-385 m. *Elsewhere*: South China Sea (north of Pratas Island); Japan (Honshu, Shikoku, and northern Ryukyu Islands); New Zealand; 54-296 m.

Caryophyllia (C.) scobinosa Alcock, 1902

Caryophyllia cultrifera Alcock, 1902a: 89-90; 1902c: 7-8, pl. 1, figs 1, 1a. — Faustino, 1927: 67-68, pl. 8, figs 8-9.
Caryophyllia scobinosa Alcock, 1902a: 90; 1902c: 8, pl. 1, figs 2, 2a. — Faustino, 1927: 68-69, pl. 8, figs 10-11. — Cairns, 1994: 45-46 (in part: pl. 20, figs a-b); 1995: 52-53, pl. 10, figs g-i, pl. 11, figs a-c (synonymy).

Material examined. — **Philippines**. *"Albatross"*: stn 5348, 1 (USNM 96812). — Stn 5444, 1 (USNM 96813). — Stn 5445, 12 (USNM 96814). — Stn 5447, 14 (USNM 96815). — Stn 5551, 4 (USNM 96816). — Stn 5564, 1 (USNM 96817). — Stn 5565, 2 (USNM 96818).
Musorstom 1: stn 44, 1 (MNHN). — Stn 47, 10 (MNHN).
Musorstom 2: stn 25, 1 (USNM 96821).
Indonesia. *"Albatross"*: stn 5650, 2 (USNM).
Corindon 2: stn 240, 1 (USNM 96822).
Karubar: stn 91, 2 (POLIPI).

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

Diagnosis. — Corallum ceratoid (usually curved between 45°-90°) and free; rarely more than 20 mm in GCD. C_{1-2} ridged, C_{3-4} flat and granular. Septa hexamerally arranged in 4 complete cycles: $S_{1-2}>S_4\geq S_3$. S_{1-2} highly exsert, forming calicular lancets with adjacent pairs of S_4. A crown of wide, lamellar P_3 encircles a fascicular columella of 4-14 relatively broad, twisted elements.

Remarks. — *Caryophyllia scobinosa* is more fully described, illustrated, and discussed by Cairns (1994, 1995), and compared to *Caryophyllia cornulum* sp. nov. in the following account.
The second author believes that this taxon is a species complex, composed of several morphologically distinct species that are also bathymetrically distinct.

Distribution. — *Philippines*: Lubang Island; South China Sea (Palawan); Lagonoy Gulf; Sulu Sea (Sulu Archipelago); 353-1270 m. *Indonesia*: Makassar Strait; Banda Sea (Gulf of Bone, Sulawesi); Timor Sea (south of Babar Islands); 675-988 m. *Elsewhere*: southwestern Indian Ocean; Queensland; Lord Howe Rise; Tonga and Samoa; 535-1276 m.

Caryophyllia (C.) cornulum sp. nov.

Figs 7 d-e

Material examined/Types. — **Indonesia**. *"Albatross"*: stn 5606, 2 paratypes (USNM 96823). — Stn 5670, 16 paratypes (USNM 96824).
Corindon 2: stn 220, holotype (MNHN), 12 paratypes (POLIPI). — Stn 241, 1 paratype (USNM 96826). — Stn 286, 1 paratype (MNHN).
Japan. *"Tansei-Maru"*: stn KT86-16-F, 2 paratypes (USNM 96827). — Stn KT90-13-T6, 6 paratypes (USNM 96828).

Type Locality. — Corindon 2 stn 220: 0°13.8'S, 118°12.7'E (Makassar Strait), 2350 m.

Etymology. — The species name (Latin *cornulum*, small horn) refers to the shape of the corallum. The name is treated as a noun in apposition.

Description. — Corallum ceratoid, unattached, and rarely curved more than 45°, the base of all but 1 specimens being strongly eroded; the base of one specimen (Corindon 2 stn 220) is 1.5 mm in diameter and shows 6 protosepta in the basal disc. Corallum of most specimens medium to small in size, the holotype only 15.3 x 17.9 mm in calicular diameter and 16.5 mm in height; however, the 8 Japanese specimens are larger, one up to 27 mm in GCD. Calice slightly elliptical: GCD:LCD = 1.06-1.18. Costae well preserved only near calice, where they are about 0.6 mm wide, separated by thin, shallow striae and covered with small granules. Below 2 mm

from the calicular edge the corallum is usually eroded, becoming grayish in color. Primary costae sometimes slightly ridged.

Septal arrangement variable, the most common complement being: 14:14:28, and 14 pali, shared by 11 of the 30 specimens analyzed. Nine specimens have 16 primary septa (up to 64 septa); the 8 Japanese specimens have only 12 primary septa (48 septa); 1 has 13 primary septa (52 septa); and 1 has 18 primary septa (72 septa). It is common, however, for 1 or more sectors to lack its tertiary pair of septa and corresponding palus, resulting in septal and palar complements that fall short of the expected for that number of primary septa (*e.g.*, a corallum having 16 primary and 16 secondary septa, may have only 28 or 30 (instead of 32) tertiary septa and only 14 pali). Primary septa little exsert (1.0-1.1 mm), extending only about 1/2 distance to columella, having straight to slightly sinuous inner edges. Secondary and tertiary septa equally exsert (0.7-0.8 mm), producing a low, serrate calicular margin. Secondaries about 1/2 width of a primary septum, having slightly sinuous inner edges; tertiaries equal to or slightly wider than a secondary, having slightly sinuous inner edges. A crown of 12-18 (usually 14-16) wide pali occurs before the secondary septa, the pali usually wider (2.2-2.8 mm) than septa they border. Palar edges slightly sinuous, their faces bearing a granulation coarser than that of septa. Columella fascicular, composed of 1-7 (usually 2 or 3) broad, twisted elements, often arranged in a line.

REMARKS. — *Caryophyllia cornulum* is similar to *C. scobinosa* but differs in having: much less exsert septa that do not form calicular lancets; a tendency to have 14-16 primary septa (vs 12 for the typical form); a less curved corallum with a strongly eroded base; and a deeper bathymetric range (1525-2576 m vs 353-1276 m for *C. scobinosa*). Although some large specimens of *C. scobinosa* occasionally have 14 or 16 primary septa (CAIRNS, 1995), even small specimens of *C. cornulum* have 14-16 primary septa, only the Japanese specimens having 12 primary septa.

DISTRIBUTION. — *Indonesia*: Makassar Strait; Gulf of Tomini, Sulawesi; 1525-2350 m. *Elsewhere*: Shikoku, Japan; 2576-2603 m.

Caryophyllia (C.) ambrosia Alcock, 1898

Caryophyllia ambrosia Alcock, 1898: 12, pl. 1, figs 1, 1a. — ZIBROWIUS, 1980: 63-65, pl. 25, figs A-K (synonymy). — CAIRNS & KELLER, 1993: 234, pl. 3, fig. 14 (synonymy). — CAIRNS, 1994: 48, pl. 21, figs d-h; 1995: 53-54, pl. 11, figs d-e.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 49, 4 (MNHN). — Stn 54, 1 (MNHN).
MUSORSTOM 3: stn 94, 1 (MNHN).
Indonesia. *"Hakuho Maru"*: stn KH72-1-26, 3: 1 (USNM 96835), 2 (ORI).
CORINDON 2: stn 240, 4 (USNM 96834).
KARUBAR: stn 40, 1 (USNM 96829). — Stn 56, 3 (MNHN). — Stn 57, 1 (POLIPI). — Stn 72, 1 (POLIPI). — Stn 87, 10 (USNM 96832). — Stn 89, 3 (MNHN). — Stn 91, 2 (MNHN).

TYPE LOCALITY. — Laccadive Sea, Arabian Sea, 1829-1957 m.

DIAGNOSIS. — Corallum massive (GCD up to 60 mm) and curved, having a pointed and/or eroded base. C_{1-3} usually slightly ridged. Coralla contain 18-30 (but usually 24) primary septa, an equal number of secondaries, and twice that number of tertiaries, resulting in calices with 72-120 (but usually 96) septa. Tertiary septa equal to or wider than secondaries, but always more exsert than secondaries, fusing with their flanking primary septum to form highly exsert lancets. A broad palus occurs before each secondary septum, each of the 18-*24*-30 pali usually wider than the septa they border. Fascicular columella composed of numerous, broad, twisted elements.

REMARKS. — CAIRNS (1994, 1995) redescribed what he believed to be the nominate subspecies of *C. ambrosia*. It appears to be a widespread Pacific and Atlantic species with regional variation regarding corallum size and number of septa (CAIRNS, 1995). The Philippine/Indonesian specimens are the largest thus far recorded, up to 60 mm in GCD and containing 130 septa, which makes them most similar to those reported from New Zealand

(CAIRNS, 1995). However, the second author believes that *"C. ambrosia"* may represent a species complex, the coralla of which are similar to virtually indistinguishable, and the species of this complex having more restricted geographic and bathymetric ranges. Characteristics of the soft parts or molecules may be necessary to resolve this taxonomic issue.

C. ambrosia is compared to *C. grandis* in the account of the latter species.

DISTRIBUTION. — *Philippines:* Lubang Island; 842-975 m. *Indonesia*: Makassar Strait; Arafura Sea (south of Tanimbar Islands); Timor Sea (south of Leti Islands); 468-1048 m. *Elsewhere*: amphi-Atlantic; Indo-West Pacific, including Japan and New Zealand; 311-2670 m.

Caryophyllia (C.) grandis Gardiner & Waugh, 1938

Figs 7 g-h

Caryophyllia grandis Gardiner & Waugh, 1938: 177, pl. 1, fig. 2. — CAIRNS & KELLER, 1993: 234 (synonymy).

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5589, 3 (USNM 96837). — Stn 5590, 15 (USNM 96836). — Stn 5592, 1 (USNM 86838).

KARUBAR: stn 39, 2 (USNM 96839). — Stn 40, 4 (POLIPI). — Stn 59, 8 (MNHN). — Stn 62, 1 (MNHN). — Stn 70, 3 (MNHN). — Stn 71, 4 (MNHN). — Stn 75, 2 (MNHN).

TYPE LOCALITY. — John Murray Expedition stn 145: 4°58'42"S, 73°16'24"E (Fadiffolu Atoll), 494 m.

DIAGNOSIS. — Corallum large (GCD up to 50 mm), sometimes free and curved, but more often straight to slightly bent, and attached by a narrow pedicel 1.8-6.5 mm in diameter. C_{1-3} usually slightly ridged. Upper theca and septal faces light beige; lower theca white or discoloured. Septa usually hexamerally arranged in 5 cycles ($S_{1-3}>S_4>S_5$), but some large coralla have up to 28 primary septa and a total of 112 septa. S_5 narrower than S_4, but more exsert, fusing with their adjacent S_{1-3} to form highly exsert lancets. 24 P_3, which are usually narrower than the S_3 they border, form a crown encircling a fascicular columella composed of broad, twisted lamellae.

REMARKS. — *Caryophyllia grandis* is distinguished from *C. ambrosia* by its: attached, reinforced pedicel; highest cycle septa (*i.e.*, S_5) that are narrower than their S_4; narrower pali; brownish theca; and usually straighter, less curved, corallum. In the Indonesian region *C. grandis* is also found at shallower depths than *C. ambrosia*: 251-567 m vs 468-1048 m, respectively.

DISTRIBUTION. — *Indonesia*: Arafura Sea (southeast of Tanimbar Islands); 251-567 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); Indian Ocean from South Africa to western Sumatra; 183-595 m.

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

Key to the six species of *Caryophyllia (Acanthocyathus)* known from the Philippine/Indonesian region

1. Corallum bears thecal edge spines **2**
— Corallum bears 1 or 2 thecal edge crests (but no spines) **4**

2. Spines occur on both thecal edges, and sometimes even on thecal faces **3**
— Spines occur only on convex thecal edge ..... ***C. (A.) dentata***

3. Corallum with 14 primary septa (≥56 septa) and 14 pali; C_{1-2} rounded; 3 size classes of septa (14:14:28); thecal spines circular to elliptical in cross section ..... ***C. (A.) grayi***

— Corallum with 12 primary septa (48 septa) and 12 pali; C_{1-2} ridged; 4 size classes of septa (6:6:12:24); thecal edge spines flattened in cross section ..... ***C. (A.) spinigera***

4. C_{1-2} ridged; $S_4 \geq S_3$ in width ..... ***C. (A.) spinicarens***
— C_{1-2} rounded; $S_4 \leq S_3$ in width **5**

5. Corallum with 14 primary septa (56 septa) and 14 pali; both thecal edges crested; up to 25 mm in GCD .... ***C. (A.) karubarica***
— Corallum with 12 primary septa (48 septa) and 12 pali; only convex thecal edge crested; smaller, only up to 16 mm GCD ..... ***C. (A.) unicristata***

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

Figs 7 c, f, i

Acanthocyathus grayi H. Milne Edwards & Haime, 1848a: 293, pl. 9, figs 2, 2a. — Alcock, 1898: 15. — van der Horst, 1931: 6. — Umbgrove, 1938: 264-265; 1950: 641-642, pl. 81, figs 27-32 (synonymy). — Wells, 1984: 209, pl. 2, figs 5-9. — Zou, 1988: 76, figs 8-9.
Caryophyllia (A.) grayi - Cairns, 1994: 49, pl. 21, figs i-k (synonymy).

Material examined. — **Philippines**. *"Albatross"*: stn 5381, 1 (USNM 96843). — Stn 5593, 1 (USNM 96844). *"Hakuho Maru"*: stn KH72-1-50, 1 (USNM 96855).
Musorstom 1: stn 45, 2 (USNM 96851). — Stn 56, 10 (MNHN). — Stn 72, 5 (USNM 96847).
Musorstom 2: stn 29, 1 (MNHN). — Stn 47, 4 (USNM 96848).
Musorstom 3: stn 99, 1 (MNHN). — Stn 107, 1 (USNM 96850). — Stn 108, 1 (MNHN). — Stn 124, 3 (MNHN). — Stn 131, 22: 11 (MNHN), 11 (USNM 96846). — Stn 140, 8 (MNHN).
Indonesia. *"Siboga"*: stn 204, 14 (ZMA Coel. 1159). — Stn 289, 6 (ZMA Coel. 1168).
Deki: stn 4, 2 (NNM 22695). — Stn 6, 2 (NNM 22696). — Stn 25, 2 (NNM 22697). — Stn 44, 2 (NNM 22698). — Stn 49, 2 (NNM 22699). — Stn 53, 7 (NNM 22700).
Mortensen's Java-S.A. Expedition: stn 1, 1 (ZMUC). — Stn 5, 21 (ZMUC). — Stn 6, 11 (ZMUC). — Stn 8, 37 (ZMUC). — Stn 9, 18 (ZMUC).
Corindon 2: stn 208, 2 (USNM 96852). — Stn 216, 4 (POLIPI). — Stn 251, 5 (MNHN). — Stn 261, 1 (MNHN).
Snellius 1: unnumbered station, 8.04.1929, 7°33'S, 114°36'E, 200 m, 2 (NNM 22701).
Japan. Syntype (BMNH 1840.9.29.42).

Type Locality. — Unknown.

Diagnosis. — Corallum ceratoid, compressed (GCD:LCD = 1.3-1.5), and usually curved in plane of GCD. Largest Philippine specimen (Musorstom 1 stn 56) 16.7 x 21.4 mm in calicular diameter and 24.9 mm in height. Corallum either attached to a small object through a slender pedicel 1.5-1.8 mm in diameter or secondarily unattached. Thecal edges rounded, the concave edge with 2 or 3 elongate spines, the convex edge bearing 3-5 elongate spines. Edge spines circular to elliptical in cross section. Costae rounded, not ridged. Septa usually arranged in 14 sectors: 14:14:28 (56 septa), with 14 pali; however, a large specimen from Japan (BMNH 1840.9.29.42) with a GCD of 22.3 mm has 16 pali and a septal complement of 64. Primary septa highly exsert, forming small (up to 3 mm) calicular lancets. Pairs of quaternary septa sometimes present in end half-systems. A distinct crown of 14 pali occurs before secondary septa, encircling an elongate fascicular columella composed of 7-10 highly fused (basally), twisted elements.

Remarks. — *Caryophyllia (A.) grayi* is distinguished from *C. (A.) spinigera* by having: more septa and pali (usually 56 septa and 14 pali vs 48 septa and 12 pali for *C. spinigera*); low, rounded C_{1-2} (not ridged as in *C. spinigera*); a gently curved corallum in the plane of the GCD and thus an asymmetrical arrangement of thecal edge spines; cylindrical, not spatulate, thecal edge spines; the absence of lateral face thecal spines; a brownish corallum (corallum of *C. spinigera* is more gray); and equally developed primary septa (the 6 S_1 of *C. spinigera* are much more exsert than their 6 S_2). *C. (A.) grayi* is more fully described and illustrated by Cairns (1994).
Caryophyllia (A.) guangdongensis Zou, 1984, known only from the northern South China Sea (167-179 m), is intermediate between *C. spinigera* and *C. grayi* . It resembles *C. spinigera* in having spatulate edge spines and only

48 septa with 12 pali, but differs from *C. spinigera* (and is thus similar to *C. grayi*) in having: convex, rounded C_{1-2}, equal-sized S_1 and S_2, less exsert S_{1-2}, and no thecal face spines.

Five more species are recognised in this subgenus: 4 having edge crests, not spines: *C. (A.) spinicarens* (Moseley, 1881), *C. (A.) zanzibarensis* Zou, 1984, *C. (A.) karubarica* sp. nov. and *C. (A.) unicristata* sp. nov., and one having spines on only one thecal edge: *C. (A.) dentata* (Moseley, 1881). A 9th possible species, reported as *Caryophyllia laoagana* Smith, 1913, from the Pleistocene of the Philippines, may also belong to this subgenus, but the single type specimen is very poorly preserved. The second author suggests that only the 5 species having edge spines should be placed in the subgenus *Acanthocyathus*, the 4 species listed that have edge crests belonging more properly to the nominate subgenus.

DISTRIBUTION. — *Philippines:* Lubang Island; Verde Island Passage; Sibuyan Sea; Sulu Sea (Semirara Islands and west of Panay); 50-268 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands and southeastern Sulawesi); Timor Sea (south of Timor); Bali Sea and Bali Strait; 50-150 m. Pleistocene of Talaud, Timor, and Vanuatu (UMBGROVE, 1938, 1950). *Elsewhere*: South Africa; Bay of Bengal; Andaman Islands; South China Sea (Charlotte Bank); Japan (Honshu and northern Ryukyu Islands); 37-490 m.

Caryophyllia (A.) dentata (Moseley, 1881)

Figs 8 a-d

Acanthocyathus sp. - MOSELEY, 1876: 550.
Acanthocyathus dentatus Moseley, 1881: 143, pl. 2, figs 7a-c.

MATERIAL EXAMINED. — **Indonesia**. *"Challenger"*: stn 174, holotype (BMNH 1880.11.25.42).
DEKI: stn 2, 1 (NNM 23077). — Stn 3, 5 (USNM 96858). — Stn 6, 4 (NNM 22752). — Stn 48, 2 (NNM 22753). — Stn 63, 2 (NNM 22754). — Unnumbered station between Neira and Lontor, Banda Islands, 70-90 m, 1 (NNM 23076).
KARUBAR: stn 49, 1 (USNM 96856). — Stn 65, 5: 2 (MNHN), 3 (USNM 96857).

TYPE LOCALITY. — *"Challenger"* stn 174D: 19°05'50"S, 178°16'20"E (Fiji), 210 m.

DESCRIPTION. — Corallum compressed (GCD:LCD = 1.3-1.5) and usually slightly curved in plane of GCD, but rarely more than 90°. Holotype (BMNH 1880.11.25.42) 11 mm in GCD; largest known specimen (DEKI stn 3) 9.4 x 12.3 mm in calicular diameter. Pedicel quite small (1.2-1.5 mm in diameter) and circular in cross section. C_{1-2} of holotype highly ridged, but on all other specimens examined costae are low and rounded, covered with small granules. C_1 on convex thecal edge of holotype, as well as other specimens reported, ridged, bearing 4 or 5 prominent spines. Corallum white.

Septa of holotype and one specimen from the DEKI (between Neira and Lontor) hexamerally arranged in 4 cycles ($S_1>S_2>S_3>S_4$, 48 septa); however, in remaining 10 specimens reported herein the symmetry is decameral: 10:10:20, 40 septa. S_{1-2} (or 10 primary septa) highly exsert as much as 2.8 mm, forming rectangular lancets with their adjacent S_4 (or tertiaries). Inner edges of S_{1-2} moderately sinuous. S_3 (or secondaries) about 1/2 width of S_{1-2}, having very sinuous inner edges. S_4 (or tertiaries) 1/3 to 1/2 width of the S_3, having moderately sinuous inner edges. 12 (10 in the case of the decameral specimens) lamellar, highly sinuous pali occur in a crown before the S_3 (or secondaries). Fossa of moderate depth containing a fascicular columella composed of 3-7 twisted elements.

REMARKS. — As noted in the description, the holotype differs from all other specimens herein reported by having distinctly ridged C_{1-2}, but this is considered to be a variable character and thus within the range of variation for the species. More disconcerting is the difference between the hexameral symmetry of the holotype and the decameral symmetry of most of the other specimens reported. The decamerally symmetrical specimens may represent a different species, but more specimens of both forms (especially the hexameral form) will have to be studied to resolve this problem.

Caryophyllia (A.) dentata is similar to *C. (A.) grayi*, but distinguished by having spines on only one thecal edge, having a smaller corallum, and having fewer septa (40-48 vs 56).

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai and Banda Islands); Arafura Sea (southeast of Tanimbar Islands); 90-263 m. *Elsewhere*: Kandavu Island, Fiji; 384 m.

Caryophyllia (A.) spinigera (Saville Kent, 1871)

Figs 7 e-f

Acanthocyathus spiniger Saville Kent, 1871: 275-276, pl. 23, figs 1 a-c.
Caryophyllia (A.) spiniger - CAIRNS, 1994: 49-50, pl. 21, fig. l, pl. 22, figs a-d (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5117, 1 (USNM 96859). — Stn 5273, 3 (USNM 96860). — Stn 5278, 1 (USNM 96861). — Stn 5353, 1 (USNM 96862). — Stn 5369, 29 (USNM 92689). — Stn 5371, 66 (USNM 92690). — Stn 5372, 1 (USNM 96863). — Stn 5374, 3 (USNM 96864). — Stn 5376, 15 (USNM 96865). — Stn 5418, 1 (USNM 96866).

MUSORSTOM 1: stn 5, 1 (USNM 96869). — Stn 10, 1 (MNHN). — Stn 11, 1 (MNHN). — Stn 20, 3 (MNHN). — Stn 24, 5 (MNHN). — Stn 25, 9: 6 (MNHN), 3 (BMNH 1992.8.11.2). — Stn 40, 1 (USNM 96874). — Stn 61, 2 (MNHN). — Stn 71, 5 (MNHN). — Stn 72, 1 (MNHN).

MUSORSTOM 2: stn 1, 3 (MNHN). — Stn 4, 1 (USNM 96878). — Stn 10, 4 (MNHN). — Stn 11, 4 (MNHN). — Stn 12, 17 (MNHN). — Stn 13, 9 (USNM 96887). — Stn 18, 1 (MNHN). — Stn 20, 2 (USNM 96881). — Stn 21, 1 (USNM 96882). — Stn 62, 1 (?). — Stn 63, 26 (USNM 96883). — Stn 64, 9 (USNM 96884). — Stn 66, 95: 91 (USNM 96885), 4 (BMNH 1992.8.11.3). — Stn 68, 4 (MNHN).

MUSORSTOM 3: stn 86, 1 (MNHN). — Stn 87, 9 (MNHN). — Stn 88, 1 (MNHN). — Stn 90, 2: 1 (MNHN), 1 (USNM 96890). — Stn 91, 5 (MNHN). — Stn 92, 3 (MNHN). — Stn 96, 2 (MNHN). — Stn 97, 27 (USNM 96892). — Stn 98, 27 (USNM 96893). — Stn 99, 27: 17 (MNHN), 10 (USNM 96894). — Stn 100, 8: 6 (MNHN), 2 (USNM 96895). — Stn 101, 13 (USNM 96896). — Stn 102, 5 (MNHN). — Stn 103, 3 (USNM 96897). — Stn 108, 8 (USNM 96898). — Stn 109, 6 (MNHN). — Stn 111, 23 (MNHN). — Stn 112, 14: 3 (MNHN), 11 (USNM 96899). — Stn 120, 6 (USNM 96900). — Stn 139, 4 (MNHN).

Indonesia. DEKI: stn 42, 1 (NNM 22743).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 2, 4 (ZMUC).

KARUBAR: stn 62, 1 (USNM 96867). — Stn 79, 2 (POLIPI).

TYPE LOCALITY. — Japan, depth not given.

DIAGNOSIS/REMARKS. — This species was recently described and figured (CAIRNS, 1994) based on Philippine specimens; however, the following observations can be added. The largest known specimen (MUSORSTOM 1 stn 61) is 16.7 x 20.9 mm in calicular diameter, 24.6 mm in height, containing 50 septa; a slightly smaller specimen (MUSORSTOM 2 stn 1) of GCD 20.4 mm has 52 septa and 14 pali. All other specimens examined have 48 septa and 12 pali. Many specimens originally attached to a small, conically-shaped bryozoan colony. The corallum is straight, compressed (GCD:LCD = 1.3-1.4), and has ridged C_{1-2}. 2 to 4 pairs of elongate, spatulate thecal edge spines occur on each corallum, the 4th pair present only on the largest coralla. In 15-20% of the coralla examined, additional spines are also present on the lateral faces of the corallum, corresponding to each of the 4 lateral C_1. When present, the lateral thecal spines originate at a height intermediate between the 2nd and 3rd edge spines. In rare cases, a 2nd set of lateral thecal spines may occur above the 1st. Lateral thecal spines very irregular in development: sometimes present on one face and not the other; sometimes present on 1 lateral C_1 and not the other on the same face; and sometimes 2 occurring on one lateral C_1 and only one on the other C_1 on the same face. Presence of lateral thecal spines is not necessarily related to corallum size, since many of the largest coralla have none. Septal formula: $S_1>S_2>S_3>S_4$, the S_1 being highly exsert (up to 4.5 mm) and forming tall calicular lancets. A crown of 12 planar P_3 encircle a linear-fascicular columella composed of 3-12 broad, twisted elements.

Caryophyllia (A.) spinigera is easily distinguished from its congeners by its elongate, spatulate edge spines; it is compared to *C. grayi* in the account of that species.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan Sea; Bohol; Sulu Sea (Semirara Islands); South China Sea (Balabac Island); 127-347 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Bali Sea; 200-245 m. *Elsewhere*: Japan (locality and depth unknown).

Caryophyllia (A.) spinicarens (Moseley, 1881)

Figs 8 g-i

Acanthocyathus spinicarens Moseley, 1881: 143-144, pl. 2, figs 6a-c.
Caryophyllia (Premocyathus) spinacarens (sic) - Cairns & Keller, 1993: 237 (listed only).

Material examined. — **Philippines**. *"Challenger":* stn 210, holotype (BMNH 1880.11.25.43).
"Albatross": stn 5118, 1 (USNM 96901). — Stn 5198, 1 (USNM 96902). — Stn 5256, 8 (USNM 96903). — Stn 5260, 1 (USNM 36477). — Stn 5374, 11 (USNM 96908). — Stn 5403, 1 (USNM 96909). — Stn 5408, 1 (USNM 96910). — Stn 5411, 2 (USNM 96911). — Stn 5412, 1 (USNM 96912). — Stn 5417, 1 (USNM 96913). — Stn 5418, 2 (USNM 96914). — Stn 5505, 2 (USNM 96915). — Stn 5508, 3 (USNM 96916). — Stn 5527, 1 (USNM 96917). — Stn 5535, 1 (USNM 96918). — Stn 5536, 1 (USNM 96919). — Stn 5537, 1 (USNM 96920). — Stn 5538, 3 (USNM 97021). — Stn 5541, 1 (USNM 96922). — Stn 5565, 2 (USNM 96923).
"Galathea": stn 423, 5 (ZMUC). — Stn 436, 2 (ZMUC).
Musorstom 1: stn 20, 2 (USNM 97024).
Musorstom 2: stn 45, 2 (MNHN). — Stn 46, 16: 15 (MNHN), 1 (BMNH 1992.8.11.1). — Stn 63, 6 (USNM 97027). — Stn 83, 2 (USNM 97028).
Musorstom 3: stn 92, 1 (MNHN). — Stn 119, 1 (MNHN). — Stn 125, 1 (MNHN). — Stn 138, 1 (USNM 97029). — Stn 139, 3 (USNM 97030). — Stn 145, 1 (MNHN).
Indonesia. *"Albatross"*: stn 5622, 4 (USNM 97034). — Stn 5625, 2 (USNM 97032). — Stn 5626, 3 (USNM 97033).
Deki: stn 62, 1 (NNM 22748).
South China Sea. *"Albatross"*: stn 5301, 6 (USNM 96905). — Stn 5314, 1 (USNM 96907).
"Hakuho Maru": stn KH72-1-52, 2: 1 (ORI), 1 (USNM 97031).

Type Locality. — *"Challenger"* stn 210: 9°26'N, 123°34'E (off Negros, Philippines), 686 m.

Description. — Corallum compressed (GCD:LCD = 1.28-1.67) and often slightly curved up to 45° in plane of LCD. Angle of lateral edges 45°-76°; angle of thecal faces 22°-50°. Largest known specimen (*"Albatross"* stn 5256) 14.1 x 19.6 mm in calicular diameter and 25.5 mm in height. Pedicel small (1.8-2.5 mm in diameter), unattached as an adult, and circular to elongate in cross section. Convex thecal faces meet in sharp thecal edges, which are carinate from about 4 mm above base to calicular edge. Delicate edge crests, best preserved in small coralla, up to 1.9 mm in height, sometimes convoluted and frilled, and occasionally notched with thin discontinuities. This delicate structure usually reduced to a low, continuous ridge in larger coralla. Remaining C_{1-2} on lateral faces highly ridged, up to 0.8 mm in height. Higher cycle costae (C_{3-4}) low and convex, covered with small, rounded granules. Corallum reddish-brown, the colour usually well preserved only near calice or on small specimens, the theca of larger coralla often discoloured or partly black.

Septa usually hexamerally arranged in 4 complete cycles ($S_{1-2}>S_4\geq S_3$), with 12 pali, but large coralla may have 14 primary septa and 14 pali (56 septa), and coralla were also noted with 11 and 13 primary septa (44 and 52 septa, respectively). S_{1-2} highly exsert, having straight to slightly sinuous inner edges that extend 4/5 distance to columella. S_3 least exsert (1.1-1.3 mm) and least wide septa (about 2/3 width of an S_{1-2}), with sinuous inner edges, each bordered by a slightly sinuous, lamellar P_3 1.5-1.7 mm in width. S_4 about 2.2 mm exsert, fusing to their adjacent S_1 or S_2 in rectangular lancets. S_4 equal to or slightly wider than S_3, having slightly sinuous inner edges. S_4, especially of small coralla, spaced slightly closer to their adjacent S_1 or S_2 than to their adjacent S_3, appearing to be angled inward toward their adjacent S_3. Fossa relatively shallow, containing the palar crown (12 P_3) and a linear-fascicular columella composed of 7-20 closely-spaced twisted elements arranged in 1 or 2 rows.

Remarks. — As Moseley (1881) suggested and as followed herein, even though *A. spinicarens* bears thecal edge crests instead of spines, it is similar to *Caryophyllia (A.) grayi* and was therefore placed in the same subgenus (but see alternate opinion in discussion of *C. (A.) grayi*). *C. (A.) spinicarens* also differs from *C. grayi* in having: $S_4\geq S_3$; highly exsert calicular lancets; and ridged C_{1-2}. It is more similar to *C. zanzibarensis* Zou, 1984, known only from Tanzania at 238-302 m (Cairns & Keller, 1993), differing only in having a less compressed corallum (GCD:LCD of *C. spinicarens*, 1.28-1.67; *C. zanzibarensis*, 1.77-2.10).

DISTRIBUTION. — *Philippines*: from Lubang Island to Sulu Archipelago; 222-717 m. *Indonesia*: Molucca Sea (Kayoa Island); Banda Sea (Kai Islands); Timor Sea (Timor); 290-750 m. *Elsewhere*: South China Sea (Pratas Island, Hong Kong, and Vanguard Bank); 223-380 m.

Caryophyllia (A.) karubarica sp. nov.

Figs 9 a-c

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 10, 2 paratypes (MNHN). — Stn 12, 2 paratypes (POLIPI). — Stn 13, 1 paratype (MNHN). — Stn 39, 12 paratypes (USNM 97036). — Stn 58, holotype (MNHN). — Stn 71, 1 paratype (POLIPI).

TYPE LOCALITY. — KARUBAR stn 58: 8°22'S, 132°01'E (southeast of Tanimbar Islands), 457-461 m.

ETYMOLOGY. — This species is named for the KARUBAR expedition.

DESCRIPTION. — Corallum compressed (GCD:LCD = 1.26-*1.36*-1.50) and usually slightly curved in plane of LCD, but rarely more than 45°. Angle of lateral thecal edges 50°-61°; angle of thecal faces 38°-41°. One of the larger specimens (the holotype) is 18.8 x 25.3 mm in calicular diameter and 24.5 mm in height. Pedicel small (1.1-1.6 mm in diameter), circular, and always unattached as an adult; 6 protosepta usually can be seen on the basal disc. Thecal faces meet in sharply defined, carinate edges, but edge crests only 1.0-1.7 mm in height, usually discontinuous, and less developed on one side. Costae 0.8-1.0 mm wide, slightly convex in shape, and separated by narrow, shallow striae; every costa covered with low, rounded granules — 3 or 4 across the width of a costa. Primary costae slightly more prominent than others, but no costae are ridged. Theca of proximal 4/5 of corallum worn and white in colour, whereas uppermost theca adjacent to calice usually light reddish brown.

Septa of most specimens (GCD = 12-25 mm) 56 in number, arranged in 3 size classes and 14 sectors: *i.e.*, 14:14:28, and 24 pali; but, several of the larger specimens have 1 or 2 extra pairs of tertiary septa, resulting in 58 or 60 septa and 15 or 16 pali. Primary septa highly exsert (up to 5 mm), having sinuous inner edges that extend to the columella. Secondary septa only 2.1-2.2 mm exsert, 2/3 width of a primary, also having sinuous inner edges. Tertiary septa highly exsert (3.5-3.9 mm), each pair fused to its adjacent primary septum in a prominent calicular lancet that produce a highly serrate margin. Tertiary septa about 4/5 width of a secondary, having straight to only slightly sinuous inner edges. A ring of broad (up to 2.6 mm), sinuous pali occurs before the secondary septa. Fossa shallow, containing a fascicular columella consisting of 1 or 2 parallel rows of large, twisted elements.

REMARKS. — *Caryophyllia karubarica* is most similar to *C. spinicarens*, but differs in having: convex (rounded, not ridged) primary costae; less prominent edge crests; 14 primary septa, instead of a tendency toward 12 as in *C. spinicarens*; a "fuller" corallum (*i.e.*, a lower GCD:LCD), especially in lower half of corallum; and S_4 that are less wide than the S_3. *Caryophyllia karubarica* differs from *C. unicristata* sp. nov. in having a larger, less curved corallum; 14 primary septa, instead of exclusively 12; two carinate thecal edges, instead of a ridge only on the convex thecal edge; and more pronounced calicular lancets. These 2 species co-occur at 3 KARUBAR stations.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 389-477 m.

Caryophyllia (A.) unicristata sp. nov.

Figs 9 d-e

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 39, 5 paratypes (POLIPI). — Stn 40, 1 paratype (USNM 97038). — Stn 58, 2 paratypes (POLIPI). — Stn 59, 81: 6 (MNHN), 75 paratypes (USNM 97040). — Stn 62, 17 paratypes (MNHN). — Stn 69, 1 paratype (POLIPI). — Stn 70, 1 paratype (MNHN). — Stn 71, 3 paratypes (USNM 97041). — Stn 76, holotype (MNHN) and 4 paratypes (MNHN).

TYPE LOCALITY. — KARUBAR stn 76: 8°49'S, 131°36'E (south of Tanimbar Islands), 400 m.

ETYMOLOGY. — The species name *unicristata* (Latin *unus*, one + *crista*, crest) refers to the single edge crest of this species.

DESCRIPTION. — Corallum relatively small, the largest specimen (KARUBAR stn 39) only 15.5 mm in GCD; the holotype is 10.9 x 13.4 mm in calicular diameter and 16.0 mm in height. Corallum ceratoid, regularly curved 45°-90° usually in plane of GCD. Pedicel small (0.8-0.9 mm in diameter), unattached, and not reinforced. Calice elliptical: GCD:LCD = 1.21-1.32. Base of pedicel often free, detached from substratum, its flat lower side revealing the 6 protosepta; sometimes worn to a rounded tip; or occasionally overgrown by a bryozoan colony. A low (0.9-1.1 mm), sinuous crest occurs on convex edge of each corallum, the concave edge being evenly rounded. Convex edge crest best developed in small coralla, often worn or lost in larger coralla. The other 11 C_{1-2} are raised and slightly rounded (not ridged); C_{3-4} flat. All costae covered with low, rounded granules, 3 or 4 across width of a costa. Upper 1-2 mm of theca and adjacent septa reddish-brown; remainder of corallum white.

Septa hexamerally arranged in 4 complete cycles: $S_{1-2} > S_3 \geq S_4$, and 12 pali. S1-2 about 1.5 mm exsert, having vertical, slightly sinuous inner edges that almost attain the columella. S_3 about 0.4 mm exsert and 2/3 width of the S_{1-2}, having highly sinuous inner edges. S_4 intermediate in exsertness, each pair of S_4 fusing to its common S_1 or S_2 to form a low calicular lancet. S_4 equal to or slightly less wide than S_3, the widest S_4 occurring in coralla of greatest size. Inner edges of S_4 slightly sinuous. 12 prominent P_3 1.2-1.4 mm wide, with sinuous edges. Columella consists of 4-12 well-formed, twisted elements, 4-6 arranged in a line or a larger number in 2 parallel rows.

REMARKS. — Within the subgenus *Acanthocyathus*, *A. unicristata* needs to be compared only to the 3 species that have ridged (nonspinose) thecal edges: *C. spinicarens*, *C. zanzibarensis*, and *C. karubarica*, from which it differs in having: only one carinate thecal edge (on its convex side); a more circular calice (a relatively low GCD:LCD of 1.21-1.32); a smaller pedicel diameter; consistently hexameral symmetry; and low calicular lancets.

DISTRIBUTION. — *Indonesia*: Arafura Sea (southeast of Tanimbar Islands); 251-477 m.

Genus ***PREMOCYATHUS*** Yabe & Eguchi, 1942

Premocyathus dentiformis (Alcock, 1902) comb. nov.

Figs 9 f-j

Placotrochides dentiformis Alcock, 1902b: 121; 1902c: 33-34, pl. 4, figs 31, 31a.
Caryophyllia compressa Yabe & Eguchi, 1932a: 443 (*nom. nud.*).
Premocyathus compressus Yabe & Eguchi, 1942b: 121, 151-152, pl. 10, figs 13-14 (junior homonym).
Caryophyllia (P.) compressa - MORI, 1987: 21-30, 9 figs. — CAIRNS, 1994: 50-51, pl. 22, figs e-f (synonymy); 1995: 54-55, pl. 11, figs f-i.
? Caryophyllia (P.) ceratoconus Hu, 1987: 38-39, pl. 1, figs 16, 20.
Not *Caryophyllia compressa* Gardiner & Waugh, 1938: 180 [junior synonym = *Caryophyllia (A.) zanzibarensis* Zou, 1984, nom. nov.].
Not *Caryophyllia (P.) compressa* - WELLS, 1956: F422, fig. 323, 3 [= *Trochocyathus (T.) apertus* sp. nov. herein].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5155, 1 (USNM 97042). — Stn 5217, 28 (USNM 62708).
Indonesia. *"Siboga"*: stn 59, holotype (ZMA Coel. 1093).
"Galathea": stn 490, 4 (ZMUC).
KARUBAR: stn 15, 1 (MNHN). — Stn 18, 1 (USNM 97044).

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

DIAGNOSIS. — Corallum compressed (GCD:LCD = 1.2-1.4) and curved 30°-45° in plane of GCD, the concave thecal edge rounded, the convex thecal edge usually crested or even keeled. Base of corallum typically an open,

irregular scar 1.0-1.5 mm in diameter. Only one specimen (KARUBAR stn 15) was found bearing an opposite bud at this level, instead of having an open base. In fact, the usually open base is probably the result of breaking apart of parent or opposite bud. Septal symmetry quite variable. Of the 57 septal/palar permutations inferred by MORI (1987), the 4 well-preserved Philippine specimens displayed the following symmetries: 8/8/16, 8 (1 specimen), 10/10/20, 10 (1 specimen), and 10/10/18, 9 (2 specimens), which were the 13th, 4th, and 5th most common arrangements, respectively, among specimens MORI examined from the type locality. Primary and secondary septa and all pali have sinuous inner edges. Pali occur before secondary septa. Fascicular columella composed of 1-4 twisted elements.

REMARKS. — The holotype of *Placotrochides dentiformis* (ZMA Coel. 1093) is a poorly preserved specimen 4.2 x 6.9 mm in calicular diameter and 7.4 mm in height, having a septal complement of 8:8:10 (26 septa). This septal arrangement is shared with only 7 of the 1090 specimens analyzed by MORI (1987). Due to poor preservation, no pali are present, but a fascicular columella composed of twisted elements is recognizable. Although a poor specimen, there is little doubt that it is conspecific with the species later reported as *Premocyathus compressus*. Coralla of *Trochocyathus apertus* sp. nov. are similar in shape and size to *P. dentiformis* but differ in having a papillose columella, P_{1-3} (not just P_3), and in having a less compressed corallum.

CAIRNS & KELLER (1993) and CAIRNS (1995) previously considered there to be 5 species in the subgenus *Caryophyllia (Premocyathus)*, but we now place 2 of them, *Acanthocyathus spinicarens* (Moseley, 1881) and *C. zanzibarensis* Zou, 1984, in the subgenus *Caryophyllia (Acanthocyathus)*; and the other 2, *C. (Premocyathus) burchae* Cairns, 1984, and *C. (P.) compressa* sensu Wells (1956) (= *Trochocyathus apertus* sp. nov.) are herein transferred to *Trochocyathus*. Only 1 species remains in *Premocyathus*, *P. dentiformis*. The genus *Premocyathus* is thus defined as having: a curved, laterally compressed corallum with a carinate convex edge and an open base that most likely is the result of separation from an opposite budded specimen; a variable septal symmetry; pali before the penultimate septal cycle; and a fascicular columella.

DISTRIBUTION. — *Philippines*: Ragay Gulf; Sulu Sea (Sulu Archipelago); 22-192 m. *Indonesia*: Banda Sea (Kai Islands); Savu Sea (Timor); Java Sea; 221-545 m. *Elsewhere*: Japan (from Honshu to northern Ryukyu Islands); Kermadec Islands; 115-757 m. Pleistocene of Japan. ? Plio-Pleistocene of Taiwan (as *C. (P.) ceratoconus* Hu, 1987).

Genus ***CRISPATOTROCHUS*** Tenison Woods, 1878

Crispatotrochus rubescens (Moseley, 1881)

Figs 10 a-c

Cyathoceras rubescens Moseley, 1881: 157, pl. 2, figs 8a-c. — CAIRNS, 1984: 15.
Cyathoceras tydemani Alcock, 1902a: 93-94; 1902c: 14, pl. 1, figs 7, 7a (**new synonym**). — FAUSTINO, 1927: 65, pl. 9, figs 5-6.
Cyathoceras diomedeae Vaughan, 1907: 77-78, pl. 7, figs 1-2.
Crispatotrochus rubescens - CAIRNS, 1991: 15; 1994: 51, pl. 22, figs g-h (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5519, 1 (USNM 60586).
MUSORSTOM 2: stn 15, 4: 2 (MNHN), 2 (USNM 97049).
Indonesia. *"Siboga"*: stn 105, syntype of *C. tydemani* (ZMA Coel. 579, Fig. 10c).
DEKI: stn 3, 1 (NNM 22418). — Stn 48, 1 (NNM 22415). — Stn 59, 4 (NNM 22416).
SNELLIUS 2: stn 4.066, 2 (NNM 22417).
KARUBAR: stn 16, 1 (USNM 97046). — Stn 67, 1 (USNM 97047). — Stn 86, 1 (MNHN).
South China Sea. *"Hakuho Maru"*: stn KH73-2-44-2, 4: 2 (USNM 97050), 2 (ORI).

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

DIAGNOSIS. — Corallum elongate-conical to trochoid, with a straight, flared calice and a robust pedicel about 25% diameter of GCD. Largest known specimen (*"Albatross"* stn 5519) 34 x 28 mm in calicular diameter, 39 mm

in height, and 9.3 mm in pedicel diameter. Costae ridged near calice, but otherwise flat and granular. Septa hexamerally arranged in 5 cycles ($S_{1-2}>S_3>S_4>S_5$), the 4th cycle (48 septa stage) attained at a GCD of 7-9 mm. Inner edges of S_{1-2} moderately sinuous. Fossa deep; pali absent; fascicular columella composed of numerous (15-20), slender, twisted elements.

REMARKS. — *Crispatotrochus rubescens* is more fully described and illustrated by CAIRNS (1994). *Cyathoceras tydemani* is a juvenile specimen of *C. rubescens*, collected at a stage transitional between the 4th and 5th septal cycles, *i.e.*, 60 septa at a GCD of 8 mm.

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol Sea (south of Negros); Sulu Sea (Sulu Archipelago); 275-522 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Savu Sea (Sumba); 226-315 m. *Elsewhere*: South China Sea (southern Formosa Strait); Japan (Honshu, Shikoku, and Kyushu); Hawaiian and Christmas Islands; 110-634 m.

Crispatotrochus rugosus Cairns, 1995

Crispatotrochus rugosus Cairns, 1995: 57, pl. 13, figs a-b.

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5586, 1 (USNM 97052).

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

REMARKS. — *Crispatotrochus rugosus* was recently described based on specimens from the New Zealand region; only a single, worn specimen of 8.7 mm GCD is reported herein. It is distinguished from *C. rubescens* by having fine, transverse thecal ridges, and S_1 that are wider than S_2. Fragments of a much larger specimen (MUSORSTOM 2 stn 32, MNHN) — having an estimated GCD of 32 mm, 5 cycles of septa, and transverse thecal costal ridges — may represent a large specimen of this species. Unfortunately, that specimen is missing its pedicel and columellar region.

DISTRIBUTION. — ? *Philippines*: Verde Island Passage; 192-220 m. *Malaysia*: Celebes Sea (Sabah); 616 m. *Elsewhere:* Kermadec Islands; Lord Howe Seamount Chain; 142-508 m.

Genus ***LABYRINTHOCYATHUS*** Cairns, 1979

Labyrinthocyathus sp. A

Figs 10 f, i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 36, 1 (MNHN).

DESCRIPTION. — Unique specimen 8.0 mm in calicular diameter, 15.5 mm in height, and 1.65 mm in pedicel diameter. Theca thick (about 0.9 mm) and heavily encrusted with serpulid tubes, otherwise C_{1-2} slightly ridged. Corallum white. Septa hexamerally arranged in 4 cycles: $S_1>S_2>S_3>>S_4$. S_1 1.7 mm exsert, having moderately sinuous inner edges. S_2 only slightly narrower than S_1; S_3 about 1/2 width of S_2. S_4 rudimentary: expressed only as a short costoseptal ridge at calicular margin, absent from upper fossa, and present in lower fossa only as a narrow lamella. Fossa of moderate depth; columella labyrinthiform.

REMARKS. — This specimen differs from the four Recent species of *Labyrinthocyathus* that have 4 cycles of septa [*L. delicatus* (Marenzeller, 1904); *L. limatulus* (Squires, 1964); *L. langae* Cairns, 1979; and *L. facetus* Cairns, 1979] by having rudimentary S_4. It may represent an undescribed species.

DISTRIBUTION. — *Indonesia:* Banda Sea (between Tanimbar and Aru Islands); 210-268 m.

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

Key to the 12 species of *Trochocyathus* known from the Philippine/Indonesian region

1. Corallum with 6 basal spines (C_1), 1 corresponding to each C_1 ..... **2**
— Corallum nonspinose, or, if spinose, the spines are limited to edge spines corresponding to only 2 C_1 ..... **3**

2. Basal spines short (less than 5 mm); some S_5 usually present ..... ***T. (A.) brevispina***
— Basal spines longer (up to 10 mm); only 48 septa ..... ***T. (A.) longispina***

3. Corallum reproduces predominantly by transverse division, resulting in a characteristic basal scar on anthocyathus **4**
— Corallum does not reproduce by transverse division, the base either being firmly attached or having an open (broken) base **6**

4. Corallum discoidal or bowl-shaped; thecal spines not present **5**
— Corallum elongate-conical; flattened edge spines present ..... ***T. (T.) cooperi***

5. Corallum discoidal: H:D about 0.5 ..... ***T. (T.) discus***
— Corallum bowl-shaped: H:D 0.7-0.8 ..... ***T. (T.) gardineri***

6. Base of corallum attached to a substratum; corallum straight **7**
— Base of corallum open, as though broken; corallum curved **12**

7. Corallum nonspinose **8**
— Corallum bears 1 or more pairs of thecal edge spines **11**

8. Theca transversely ridged ..... ***T. (T.) rhombocolumna***
— Theca longitudinally costate **9**

9. Corallum (theca and septa) speckled with black pigment; pedicel robust (PD:GCD = 0.60-0.80), composed of chambered concentric rings ..... ***T. (T.) maculatus***
— Corallum not speckled; pedicel small to medium-sized (PD:GCD = 0.10-0.45), not chambered **10**

10. P_{1-2} much smaller than P_3; corallum usually contains 48 septa; columella a field of 6-20 medium-sized elements ..... ***T. (T.) philippinensis*** (nonspinose form)
— P_{1-3} equal in width; corallum usually contains more than 48 septa; columella a field of up to 40 slender elements ..... ***T. (T.) caryophylloides***

11. Septa decamerally arranged in 3 size classes (40 septa); pedicel small (1.7-1.9 mm diameter); ≥2 pairs of delicate thecal edge spines usually present ..... ***T. (T.) semperi***
— Septa hexamerally arranged ($S_{1-2}>S_3>S_4$, 48 septa); pedicel larger (2.9-6.7 mm diameter); usually only 1 pair of robust edge spines present ..... ***T. (T.) philippinensis*** (spinose form)

12. Crest on convex thecal edge continuous from base to calice; calice often brown-black near calice ..... ***T. (T.) burchae***
— Crest on convex thecal edge restricted to lower corallum; corallum white ..... ***T. (T.) apertus***

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

Trochocyathus (T.) caryophylloides Alcock, 1902

Trochocyathus caryophylloides Alcock, 1902a: 94; 1902c: 14-15, pl. 2, figs 10, 10a. — Faustino, 1927: 80, pl. 7, figs 5-6. — Yabe & Eguchi, 1942b: 123-124, pl. 10, fig. 21. — ? Zou *et al.*, 1988: 195. — Cairns, 1994: 52-53, pl. 23, figs a-c, h.

Not *Trochocyathus caryophylloides* Zou, 1988: 76, pl. 5, fig. 5, 5a [= *Trophocyathus (T.) ?philippinensis* sp. nov. herein].

Material examined. — **Philippines**. Musorstom 1: stn 63, 1 (USNM 97057).
Musorstom 2: stn 2, 1 (MNHN). — Stn 32, 1 (MNHN).
Musorstom 3: stn 88, 1 (MNHN).
Indonesia. Deki: stn 7, 2 (NNM 22763).
Karubar: stn 32, 1 (MNHN). — Stn 49, 1 (MNHN). — Stn 50, 2 (MNHN). — Stn 61, 1 (MNHN). — Stn 86, 2 (USNM 97056).

Type Locality. — *"Siboga"* stns 96, 251, and 253: Celebes and Banda Seas, Indonesia, 115-304 m.

Diagnosis. — Corallum trochoid, firmly attached through a robust pedicel (PD:GCD = 0.11-0.41), up to 21 mm in GCD. Costae broad, flat to slightly convex, and covered with low, rounded granules. Corallum white to light brown. Septal symmetry appears to change with size. Coralla 8-12 mm in GCD have 4 cycles of 48 hexamerally arranged septa ($S_{1-2}>S_3>S_4$). Larger coralla over 16 mm GCD often have 16 primary septa and 3 size classes of septa, resulting in 64 septa, or hexameral symmetry but with an incomplete 4th cycle, also resulting in 64 septa (Musorstom 1 stn 63). Discrete pali arranged in 2 or 3 crowns before all but last cycle of septa. Columella composed of an elliptical field on numerous (up to 45), slender rod-shaped papillae.

Remarks. — One aberrant specimen (Musorstom 2 stn 32) has undergone intratentacular budding, resulting in a small colony of 3 massive corallites, each the result of equal, intratentacular division. *T. caryophylloides* is more fully described and figured by Cairns (1994).

In our opinion, the species name was originally incorrectly formed, being derived from the root *Caryophyllia*, and thus should be *caryophyllioides*. However, according to the ICZN (Article 32dii) the original spelling cannot be changed.

Distribution. — *Philippines*: Lubang Island; Verde Island Passage; 186-192 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 185-304 m. *Elsewhere*: Japan (Honshu and Fukue Jima); 115-344 m.

Trochocyathus (T.) rhombocolumna Alcock, 1902

Trochocyathus rhombocolumna Alcock, 1902a: 98; 1902c: 16, pl. 2, fig. 12. — Cairns, 1995: 60-61, pl. 13, fig. i, pl. 14, figs a-b (synonymy).

Material examined. — **Indonesia**. Deki: stn 8, 1 (NNM 22755). — Stn 59, 1 (NNM 22756).
Karubar: stn 27, 1 (USNM 97061). — Stn 49, 2 (POLIPI). — Stn 86, 1 (MNHN).

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

Diagnosis. — Corallum elongate-conical to trochoid, straight, firmly attached through a robust pedicel (PD:GCD = 0.34-0.56), and up to 14 mm in GCD (Cairns, 1995). Theca covered with thin transverse ridges. Corallum white. Septa hexamerally arranged in 4 full cycles: $S_1>S_2>S_4>S_3$, the S_1 being highly exsert. Pali arranged in 3 crowns before all but last septal cycle, each P_2 and pair of P_3 within a system forming a distinctive

triangular pattern. Columellar elements few in number and irregular in shape, sometimes rhomboidal in cross section.

REMARKS. — *Trochocyathus rhombocolumna* is more fully described and illustrated by CAIRNS (1995) based on New Zealand specimens. One specimen from KARUBAR stn 27 has a characteristic lenticular-shaped aperture of an acrothoracican cirripede in the side of its corallum, but the symbiont no longer present.

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 522 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south and east of Tanimbar Islands); 209-385 m. *Elsewhere*: widespread in Indo-West Pacific from southwestern Indian Ocean to Hawaiian Islands, including ridges north of New Zealand; 110-530 m.

Trochocyathus (T.) maculatus Cairns, 1995

Trochocyathus (T.) maculatus Cairns, 1995: 61, pl. 14, figs c-d.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 134, 2 (MNHN).

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

DIAGNOSIS. — Corallum elongate-conical, straight, flared distally, and attached by a broad pedicel 0.60-0.80 GCD. Pedicel increases in diameter by formation of thin exothecal dissepiments over raised basal costae, similar to the process in *Rhizosmilia*. Largest Philippine specimen 8.6 x 10.3 mm in calicular diameter and 9.7 mm in height; largest known specimen (CAIRNS, 1995) 13.8 mm in GCD. Costae granular, well-defined only in upper part of corallum. Corallum white, but theca and all septa (not pali) speckled with dark brown-black pigmentation. Septa hexamerally arranged in 5 cycles, the 5th never complete. The large Philippine specimen has only 1 pair of S_5 (50 septa) and a New Zealand specimen has as many as 64 septa. S_1 highly exsert, forming calicular lancets. S_2 smaller than S_1 but larger than S_3. S_4 variable in width, those adjacent to S_1 often wider than the S_3, those adjacent to S_2 usually less wide than S_3. Two crowns of pali present: 12 small P_{1-2} occurring low in the fossa, and 12 larger P_3 rising much higher in fossa. P_4 present on septa flanked by a pair of S_5. Papillose columella a field of 20-30 fine pillars.

REMARKS. — *Trochocyathus maculatus* is more fully described and illustrated in the original account. It is distinguished from its congeners by its distinctively speckled corallum and exothecal dissepiments.

DISTRIBUTION. — *Philippines*: Sibuyan Sea (northeastern tip of Panay); 92-95 m. *Elsewhere*: Kermadec and Lord Howe Islands; Taupo Seamount and Dampier Ridge, southeastern Australia; 100-183 m.

Trochocyathus (T.) philippinensis Semper, 1872

Figs 10 d-e

Trochocyathus philippinensis Semper, 1872: 253, pl. 20, fig. 16. — FAUSTINO, 1927: 79-80, pl. 7, figs 3-4.
? *Trochocyathus caryophylloides* - ZOU, 1988: 76, pl. 5, figs 5, 5a. [Not *T. caryophylloides* Alcock, 1902a].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5178, 8 (USNM 97065). — Stn 5213, 2 (USNM 97066). — Stn 5217, 1 (USNM 97067). — Stn 5381, 3 (USNM 97070).

MUSORSTOM 1: stn 13, 1 (USNM 97075). — Stn 14, 1 (MNHN). — Stn 35, 1 (USNM 97076). — Stn 64, 1 (MNHN). — Stn 72, 1 (MNHN).

MUSORSTOM 2: stn 6, 1 (MNHN). — Stn 10, 1 (USNM 97079). — Stn 17, 1 (MNHN). — Stn 33, 32 (USNM 97080).

MUSORSTOM 3: stn 88, 2 (USNM 97081). — Stn 96, 6 (USNM 97083). — Stn 98, 1 (USNM 97083). — Stn 102, 3 (MNHN). — Stn 108, 1 (MNHN). — Stn 124, 3. — Stn 131, 1 (USNM 97084).

Indonesia. DEKI: stn 6, 2 (NNM 22772). — Stn 24, 2 (NNM). — Stn 44, 8 (NNM 22773). — Stn 49, 7 (NNM 22774).

CORINDON 2: stn 248, 2 (MNHN).

KARUBAR: stn 2, 24 (POLIPI). — Stn 3, 8: 1 (MNHN), 7 (USNM 97071). — Stn 15, 1 (USNM 97072). — Stn 18, 1 (USNM 97073). — Stn 32, 1 (POLIPI).

South China Sea. *"Albatross"*: stn 5311, 2 (USNM 97068). — Stn 5314, 1 (USNM 97069).

Ryukyu Islands. *"Tansei Maru"*: stn KT93-09-AM6, 1 (USNM 93163). — Stn KT93-09-AM7, 1 (USNM 93160).

TYPE LOCALITY. — Pandanon, west coast of Bohol, Philippines, 27-54 m.

DESCRIPTION. — Corallum ceratoid to trochoid and relatively small, the largest corallum (MUSORSTOM 3 stn 88) 12.3 x 17.6 mm in calicular diameter and 26.4 mm in height, but most specimens less than half this size; one syntype measures 9.5 x 11.0 mm in calicular diameter and 19 mm in height (*fide* SEMPER, 1872). Calice elliptical : GCD:LCD = 1.15-1.64. Coralla often maintain their attachment to substratum through a robust pedicel 2.9-6.7 mm in diameter (PD:GCD = 0.20-0.44), the substratum often consisting of a small gastropod shell, an echinoid spine, a pebble, or a corallum of a dead Scleractinia such as *Flabellum* or *Balanophyllia*. Corallum usually straight, occasionally bent near base. About 1/3 of specimens examined bear slender thecal edge spines, the remaining coralla having evenly rounded thecal edges. Of those having edge spines, size and symmetry are quite variable. Some specimens have a pair of spines, but coralla bearing a single spine or just a nub or low crest on one thecal edge are not uncommon. Only one specimen (MUSORSTOM 3 stn 96) has 3 spines: 2 on one edge and 1 on the other. Lower 1/3 to 1/2 of theca white and porcellaneous; however, upper 1/2 to 2/3 dark brown, bearing well-formed, convex costae separated by deep intercostal furrows. Costae in upper corallum with minute granules.

Septa hexamerally arranged in 4 full cycles: $S_{1-2}>S_3\geq S_4$; however, some large specimens have 1 or 2 pairs of S_5 resulting in 50-52 septa, and small coralla less than 9 mm GCD often lack several pairs of S_4. S_{1-2} about 1.7 mm exsert, having vertical, slightly sinuous inner edges, each bordered by a small (0.3-0.5 mm) papillose to lamellar palus. S_3 about 1.3 mm exsert, with slightly more sinuous inner edges, and bordered by lamellar P_3. P_3 each about 1.0 mm wide and forming a crown that rises higher in the fossa than the crown of P_{1-2}. S_4 equally exsert as S_3; in small to medium-sized coralla S_4 slightly less wide than the S_3, but S_4 become proportionately wider with growth of the corallum, until they sometimes slightly exceed the S_3 in width. Fossa of moderate depth, containing a papillose columella consisting of 6-20 interconnected papillae.

REMARKS. — Among the 23 Recent species in the nominate subgenus of *Trochocyathus*, only 2 other have thecal edge spines: *T. semperi* sp. nov. and *T. cooperi* (Gardiner, 1905). *T. philippinensis* is distinguished from *T. semperi* by having: a larger corallum with a more robust pedicel (2.9-6.7 mm in diameter vs 1.7-1.9 mm for *T. semperi*); hexameral septal symmetry resulting in 48 septa (not 40 septa); asymmetrical and erratic development of thecal edge spines (vs usually two pairs for *T. semperi*); and highest cycle septa (S_4) that are sometimes as large as the penultimate cycle (S_3), whereas the tertiary septa of *T. semperi* are 1/2 the width of their secondaries. Furthermore, *T. philippinensis* is more common in deeper water than *T. semperi*, *i.e.*, 100-268 m whereas most records of *T. semperi* are from less than 100 m.

Although similar in calicular features, *T. cooperi* differs from *T. philippinensis* by dividing transversely (basal scar), and in having plate-like, lamellar thecal edge spines.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan and Samar Seas; Burias Pass; Pandanon; Sulu Sea (Semirara Islands and west of Panay); 54-194 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 100-268 m. *Elsewhere*: South China Sea (north of Pratas Island); Japan (northern Ryukyu Islands); 108-223 m.

Trochocyathus (T.) semperi sp. nov.

Figs 10 g-h, 11 f

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5133, 1 paratype (USNM 97085). — Stn 5142, 5 paratypes (USNM).

MUSORSTOM 3: stn 140, 9 paratypes (MNHN).

Indonesia. DEKI: stn 6, 3 paratypes (NNM 22784). — Stn 53, 2 paratypes (ZMUC), 2 paratypes (NNM 22785).

CORINDON 2: stn 251, 59: holotype (MNHN), 10 paratypes (POLIPI), 48 paratypes (USNM 97086).

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

ETYMOLOGY. — This species named for Carl Gottfried SEMPER, in recognition of his work on shallow water azooxanthellate corals of the Philippine region (see SEMPER, 1872).

DESCRIPTION. — Corallum ceratoid and relatively small, most specimens examined only 5-7 mm in GCD and equally tall, the largest (*"Albatross"* stn 5142) being 7.7 x 9.7 mm in calicular diameter and 15 mm in height. Holotype 4.9 x 6.6 mm in calicular diameter and 8.4 mm in height. Calice elliptical: GCD:LCD = 1.25-1.37. Coralla often maintain their attachment to substratum through a robust pedicel 1.7-1.9 mm in diameter (PD:GCD = 0.18-0.30), the substratum often being a bivalve shell, large foraminiferan, or other corals, such as *Heteropsammia*. Pedicel next to basal disc often bent 30°-45°. Occasionally corallum detached from the substratum, revealing the basal disc and original 6-12 protosepta. Most coralla bear at least 2 pairs of delicate thecal edge spines, the 1st pair beginning its development almost immediately above the basal disc as an extension of the 2 principal CS_1; in 2 cases the lowermost spines were fused to the substratum. Edge spines spatulate proximally, cylindrical distally, and up to 3.6 mm in length, but, because of their delicate nature, only small coralla bear intact, elongate spines. All costae equally convex and granular. Upper 1/2 of theca blackish-brown; lower 1/2 of theca and calicular elements white.

In early development, septa are hexamerally arranged in 3 cycles, but by a GCD of about 4 mm a decameral symmetry is adopted, adult coralla usually having 3 size classes of decamerally arranged septa (40 septa). Primary septa 0.8-1.0 mm exsert, having vertical, slightly sinuous inner edges, each bordered by a small, poorly-formed palus. Secondary septa 0.6 mm exsert and about 2/3 width of a primary, having sinuous inner edges, each bordered by a narrow (about 0.5 mm), lamellar palus. Tertiary septa equally exsert, but only 1/2 width of a secondary. Fossa of moderate depth, containing a papillose columella composed of 5-9 slender elements, sometimes indistinguishable in size and shape from the P_1.

REMARKS. — Only 3 of the approximately 23 Recent species of *Trochocyathus (Trochocyathus)* have thecal edge spines: *T. cooperi* (Gardiner, 1905); *T. semperi*; and *T. philippinensis*, the last 2 species being compared in the previous account. Within the Scleractinia, edge spines are often associated with coralla of species that transversely divide as a method of asexual propagation (*e.g.*, *Trochocyathus cooperi*, most species of *Truncatoflabellum*); however, in both *T. philippinensis* and *T. semperi*, no specimens show evidence of transverse division, many displaying their original basal disc.

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Sulu Sea (Zamboanga Peninsula and Sulu Archipelago); 38-93 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 65-245 m.

Trochocyathus (T.) apertus sp. nov.

Figs 11 a-d

Caryophyllia (Premocyathus) compressa - WELLS, 1956: F422, fig. 323,3. [Not *Premocyathus compressus* Yabe & Eguchi, 1942].

Premocyathus compressus - CAIRNS, 1984: 14 (in part: *"Albatross"* specimens). [Not *Premocyathus compressus* Yabe & Eguchi, 1942].

Not *Caryophyllia (Premocyathus) compressa* - CAIRNS, 1995: 54-55. [See discussion of *Premocyathus dentiformis*].

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5156, 19 paratypes (USNM 62709). — Stn 5164, 526+: holotype (USNM 97087), 500+ paratypes (USNM 62710), 26 (MNHN).

Indonesia. DEKI: stn 10, 2 paratypes (NNM 22498).

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

TYPE LOCALITY. — *"Albatross"* stn 5156: 5°01'40"N, 119°52'20"E (Sulu Archipelago), 33 m.

ETYMOLOGY. — The species name (Latin *apertus*, open) alludes to the open base of all specimens.

DESCRIPTION. — Corallum relatively small, usually curved about 90° in plane of GCD, and somewhat compressed (GCD:LCD = 1.19-1.37). Largest known specimen (ZMUC) 7.2 x 9.9 mm in calicular diameter and

14.3 mm in height; holotype 7.9 x 6.3 mm in calicular diameter and 11.8 mm in height. All coralla examined unattached (free), with an open base 1.2-1.8 mm in diameter that reveals the 12 septa: 6 thick and 6 thin. Each corallum bears a short thecal edge crest on its lower convex edge, up to 5 mm long, up to 3 mm in height, and about 0.5 mm thick. Crests best developed on small coralla, becoming worn or broken with age, not extending to calicular edge. Crests absent from concave thecal edge, but occasionally the principal C_1 of the concave edge is slightly prominent or thickened. Costae low, convex, granular ridges separated by broad, shallow intercostal furrows. Corallum white.

Septa hexamerally arranged in 4 cycles, but 4th cycle never complete. The most common septal complement is 40, arranged: 12:12:16, with 4 half-systems lacking pairs of S_4 (*e.g.*, the holotype). If the 12 half-systems are numbered in a clockwise direction, starting with the half-system to the right of the principal septum aligned with the convex edge, the 4 half-systems that lack S_4 pairs are usually the 3rd, 5th, 8th, and 10th. Coralla having 44 septa, the largest number of septa observed, usually lack S_4 pairs in the 5th and 8th half-systems. S_{1-2} up to 1.3 mm exsert, having vertical, slightly sinuous inner edges. S_3 about 1.0 mm exsert, with slightly sinuous inner edges, about 3/4 the width of an S_2. S_4 slightly less exsert and 3/4 width of an S_3. Most, but not all, S_{1-2} bear a small (0.3-0.5 mm wide) papillose to lamellar palus, the papillae being indistinguishable from columellar elements, except that they rise higher in the fossa. P_3 always lamellar, about 1 mm wide, with straight edges, and rising even higher in the fossa. The fossa contains a papillose columella consisting of 7-10 interconnected pillars, each about 0.3 mm in diameter.

REMARKS. — CAIRNS (1984) previously considered this species to be *Premocyathus compressus* (= *Premocyathus dentiformis* herein) because of their similarity in corallum size and shape; because both species have open bases; and because many specimens of *T. apertus* lacked P_{1-2} and thus resembled a *Caryophyllia* ground plan. In spite of these convergent characters, *T. apertus* differs significantly in having a papillose columella composed of slender rods (not a fascicular composed of twisted lamellae), and in having often distinct P_{1-2}. Furthermore, whereas the septal symmetry of *P. dentiformis* [= *C. (P.) compressa* sensu MORI, 1987] is quite variable, the hexameral pattern that is most common in *T. apertus* (12:12:16) is quite rare (0.3%) in *P. dentiformis*. Overall hexameral symmetry is the rule in *T. apertus*, but rare (only 3%) in *P. dentiformis*.

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 33 m. *Indonesia*: Banda Sea (Kai Islands); Bali Strait; 50-70 m.

Trochocyathus (T.) burchae (Cairns, 1984) comb. nov.

Premocyathus burchae Cairns, 1984: 14, pl. 2, figs G-H.
Caryophyllia (P.) burchae - CAIRNS, 1995: 54 (listed).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5133, 6 (USNM 97064).
Indonesia. DEKI: stn 10, 18 (NNM 22764). — Stn 82, 1 (NNM 23202).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 1 (ZMUC). — Stn 9, 4: 3 (ZMUC), 1 (USNM 97089).

TYPE LOCALITY. — 20°43.7'N, 156°54.6'W (Lanai, Hawaiian Islands), 64 m.

DIAGNOSIS/REMARKS. — Little can be added to the original description based on Hawaiian specimens. Although quite similar, *T. burchae* differs from *T. apertus* in having a smaller corallum with a smaller open base; a brown-black pigmented upper theca; and a more distinctly developed thecal edge crest. The crest of the convex side of *T. burchae* is up to 4.8 mm in height and usually continuous from base to calice, occasionally bilobate. Furthermore, some coralla have a low crest on the lower concave thecal edge. The largest known specimen (MORTENSEN stn 9) is 6.4 x 10.0 mm in calicular diameter.

Trochocyathus burchae is placed in this genus for the same reasons cited for *T. apertus*: its papillose columella and the occasional presence of P_{1-2} as well as P_3.

DISTRIBUTION. — *Philippines*: Sulu Sea (Zamboanga Peninsula); 70 m. *Indonesia*: Banda Sea (Kai Islands); Bali Strait; Sunda Strait (Java Sea); 35-70 m. *Elsewhere*: Lanai, Hawaiian Islands; 64 m.

Trochocyathus (T.) cooperi (Gardiner, 1905)

Fig. 11 e

? *Trochocyathus weberi* Alcock, 1902a: 95-96.
Tropidocyathus cooperi Gardiner, 1905: 955, pl. 93, fig. 30.
Trochocyathus sp. - Vaughan & Wells, 1943: 47, fig. 20b (inverted view of specimen from *"Albatross"* stn 5142).
Trochocyathus cooperi - Cairns, 1994: 54, pl. 23, figs f-g.

Material examined. — **Philippines**. *"Albatross"*: stn 5133, 1 (USNM 97090). — Stn 5136, 5 (USNM 97091). — Stn 5137, 2 (USNM 97092). — Stn 5142, 9 (USNM 97093). — Stn 5143, 3 (USNM 97094). — Stn 5144, 1 (USNM 97095). — Stn 5146, 5 (USNM 97096). — Stn 5147, 3 (USNM 97097). — Stn 5151, 9 (USNM 97098). — Stn 5202, 1 (USNM 97099). — Stn 5355, 1 (USNM 97100).
Musorstom 1: stn 57, 1 (MNHN).
Musorstom 2: stn 47, 1 (MNHN).
Musorstom 3: stn 137, 2 (USNM 97102).
Indonesia. Deki: stn 15, 1 (NNM). — Stn 17, 1 (NNM 22564). — Stn 24, 4 (NNM 22565). — Stn 53, 4 (NNM 22566). — Stn 90, 1 (NNM 22569). — Stn 95, 1 (NNM). — Stn 103, 72 (NNM 22570).
Snellius 2: stn 4.234, 1 (NNM 22571).
South Pacific. *"Pele"*: stn TH1, 16 (USNM 73764).

Type Locality. — Kolumadulu and Suvadiva, Maldive Islands, 64-70 m.

Diagnosis. — Corallum (anthocyathus) compressed (GCD:LCD = 1.4-2.3). Angle of thecal edges, not including crests, 19°-30°; angle of thecal faces, 20°-25°. One of the largest known specimens (*"Albatross"* stn 5202) 12.1 x 17.3 mm in calicular diameter and 17.7 mm in height, whereas another, rejuvenescent corallum (Musorstom 1 stn 57) is 15.9 x 17.6 mm in calicular diameter and 26.9 mm in height. Basal scar elliptical, up to 4.0 mm in greater diameter. Base of each thecal edge bears a large (up to 4.5 mm), downward-projecting crest, sometimes recurved toward the basal scar. Corallum reddish-brown, often with a more intense costal striping and/or costal speckling near the calice. Septa hexamerally arranged in 4 full cycles ($S_{1-2}>S_3>S_4$). Large coralla may have some additional pairs of S_5 up to a total of 56-62 septa. Two crowns of pali occur, 12 small P_{1-2} and 12 larger P_3. Papillose columella composed of 10-30 slender, cylindrical elements.

Anthocaulus stage rarely collected, attaining up to 6 mm in height, 7.7 mm in GCD, and having a robust pedicel diameter of 3.4 mm. It may have 4 complete cycles of septa ($S_{1-2}>S_3>S_4$) and prominent edge crests.

Remarks. — *Trochocyathus cooperi* is one of 4 species in the subgenus that divides transversely. The other 3 species [*T. gardineri* (Vaughan, 1907); *T. cepulla* Cairns, 1995; and *T. discus* sp. nov.] are discoidal (bowl-shaped), nonspinose, and noncrested. *T. cooperi* is more fully described and illustrated by Cairns (1994).

The description of *Trochocyathus weberi* Alcock, 1902a fits that of *T. cooperi*, except for the colour of its corallum, which was stated to be "snow white". *T. weberi* was one of 8 species described by Alcock (1902a) in his preliminary *"Siboga"* report but not included in his final report (Alcock, 1902c). It was never illustrated, a station number was never cited, and it could not be found in the collections of the ZMA in 1994. Therefore, its equivalence with *T. cooperi* remains questioned.

Distribution. — *Philippines*: Lubang Island; Sibuyan Sea; Sogod Bay, Leyte; Sulu Sea (Zamboanga Peninsula, Sulu Archipelago, and Balabac Island); 34-96 m, with one assumed incorrect record at 918 m (*"Albatross"* stn 5202). *Indonesia*: Banda Sea (Kai Islands); Flores Sea (Selayar Island, Sulawesi; Lintah Strait); Sunda Strait, Java Sea; 25-100 m. *Elsewhere*: Maldive Islands; northern Ryukyu Islands; Tahuata, Marquesas Islands (reported herein); 70-80 m.

Trochocyathus (T.) gardineri (Vaughan, 1907)

Paracyathus gardineri Vaughan, 1907: 68-69, pl. 4, fig. 4.
Trochocyathus gardineri - Cairns, 1984: 16.

Not *Paracyathus gardineri* - GARDINER & WAUGH, 1938: 183-184, pl. 3, fig. 5 [= *Trochocyathus (T.)* sp.].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5567, 1 worn anthocyathus (USNM 97103).

TYPE LOCALITY. — *"Albatross"* stn unknown: Hawaiian Islands (exact locality and depth unknown).

DIAGNOSIS/REMARKS. — Based on the single poorly-preserved specimen reported above, nothing can be added to the original description of VAUGHAN, except for the range extension. *T. gardineri* reproduces by transverse division, the anthocyathus having a flat base with a central circular detachment scar about 5 mm in diameter. At a calicular diameter of 10-12 mm, the thecal walls abruptly turn upward, forming a cylindrical corallum. Septa hexamerally arranged in 4 complete cycles: $S_{1-2}>S_4\geq S_3$. Three crowns of well-formed pali are present: P_1, P_2, and P_3. Columella papillose.

DISTRIBUTION. — Philippines: Sulu Sea (Sulu Archipelago); 490 m. *Elsewhere*: Hawaiian Islands; 274-470 m.

Trochocyathus (T.) discus sp. nov.

Figs 11 g-h, 12 a-c

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 2, 1 dead corallum, paratype (USNM 97104). — Stn 3, 20: holotype and 6 paratypes (MNHN), 3 paratypes (POLIPI), and 11 paratypes (USNM 97105).

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

ETYMOLOGY. — The species name (Latin *discus*, circular plate) refers to the shape of the anthocyathus.

DESCRIPTION. — Corallum (anthocyathus) discoidal and free, with a flat to slightly convex base. Central region of base a circular detachment scar, measuring 3.6-4.1 mm in diameter, with traces of 24 septa but no costae. Instead, small (about 40 µm in width), pointed granules cover the scar region and surrounding base, 4 or 5 occurring across the width of a costa. Holotype 9.2 x 9.7 mm in diameter and 5.2 mm in height: largest known specimen (KARUBAR stn 2) 12.2 mm in diameter. Toward calicular edge the costae are better defined by thin (70-90 µm wide), deep intercostal furrows that become progressively wider toward the periphery. Costae convex and about 0.4 mm wide, bearing a coarser granulation than the base, only 3 or 4 blunt granules occurring across the width of a costa (Fig. 12 a-b). Thecal edges and upper, outer regions of septa reddish-brown in well-preserved coralla, but base of colony and remaining septa, pali, and columella white. Anthocaulus unknown.

Septa hexamerally arranged in 4 cycles, a complete 4th cycle achieved at a GCD of about 8 mm. Specimens smaller than this always lack several pairs of S_4 (*e.g.*, having 40-46 septa). S_1 highly exsert (about 1.8 mm), having vertical, slightly sinuous inner edges that extend 2/3 distance to columella. S_2 less exsert and about 2/3 width of an S_1, also with slightly sinuous inner edges. S_3 less exsert than S_2 and about 2/3 width of an S_2, having moderately sinuous inner edges. S_4 dimorphic in width and exsertness: those adjacent to S_1 being slightly more exsert and wider than an S_3; those adjacent to S_2 being slightly less exsert and less wide than an S_3. Septal faces covered with tall (0.11 mm height), pointed granules. P_1 lamellar, but only 0.3-0.5 mm in width; P_2 0.5-0.6 mm wide, rising slightly higher in fossa; P_3 same size as P_2 but recessed from the columella, each pair within a system loosely fused to its common P_2 in a chevron pattern. Pali with granulation coarser than that of septa, also bearing short, oblique carinae. Fossa shallow, containing a columella of 10-15 irregularly-shaped (fig. 11g-h) papillae that are fused among themselves and to inner edges of P_{1-2}.

REMARKS. — Among the 4 species of *Trochocyathus (Trochocyathus)* that undergo transverse division, this species resembles *T. cepulla* Cairns, 1995, but is distinguished by its smaller, bowl-shaped corallum, which attains a full 4th cycle at a smaller size; its more regular septal arrangement; and its dimorphic S_4, those of *T. cepulla* being uniformly less wide than their S_3. It differs from *T. gardineri* in having a discoidal (vs bowl-shaped) corallum with lower H:D ratio (see key).

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 240-278 m.

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

Trochocyathus (A.) brevispina sp. nov.

Figs 12 d-f

Odontocyathus ? sp. Alcock, 1902c: 24.

MATERIAL EXAMINED/TYPES. — **Indonesia**. *"Siboga"*: stn 262, 1 paratype (ZMA Coel. 890).
DEKI: stn 12, 1 paratype (NNM 22499). — Stn 13, 1 paratype (NNM 22430). — Stn 41, 1 paratype (NNM 22500).
KARUBAR: stn 2, 1 paratype (POLIPI). — Stn 3, holotype (MNHN) and 8 paratypes (MNHN). — Stn 7, 19 paratypes (USNM 97106).

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

ETYMOLOGY. — The species name *brevispina* (Latin *brevis*, short + *spina*, spine) refers to the 6 short C_1 spines.

DESCRIPTION. — Corallum bowl-shaped and free, the base flat to evenly rounded, often with a imprint of original substratum attachment or even an incorporated fragment of substratum at centre of base. Holotype 20.3 x 22.1 mm in calicular diameter and 9.3 mm in height, containing 66 septa; largest specimen (KARUBAR stn 3) 22.3 x 26.1 mm in calicular diameter and 12.8 mm in height, containing 72 septa. Calice elliptical: GCD:LCD = 1.07-1.17. Costae well defined only near calice, where they are slightly convex and granular; remainder of base usually worn and/or smooth, often with a hexagonal region of epitheca bounded by the 6 costal spines. All specimens examined bear 6 short (not more than 5 mm in length) costal spines associated with the C_1, the spines of some coralla being strongly compressed and ridged basally, these ridges extending to the centre of the base. Well-preserved coralla black-brown in colour.

Septa hexamerally arranged in 5 cycles, several pairs of S_5 present already in small coralla of 12 mm GCD, but even in large specimens 5th cycle never complete, the largest corallum having only 12 pairs of S_5, or a total of 72 septa. Septal formula: $S_{1-2}>S_4 \geq S_3>S_5$. S_{1-2} are 3.5-4.0 mm exsert, robust, having thick, straight inner edges bordered by a well-defined palus. S_3 slightly less exsert (2.5 mm) and about 3/4 width of an S_{1-2}, each S_3 also bordered by a palus of equivalent size to a P_{1-2} but recessed slightly from the columella. S_4 of equal exsertness to S_3, but slightly wider than S_3, unless flanked by a pair of S_5, in which case the S_4 are narrower than an S_3. S_4 flanked by S_5 bear a palus of similar size to the others, but recessed even more from the columella than the P_3. When present, S_5 are least exsert and least wide class of septa. All pali (P_{1-4}) thick, about 1.5 mm wide, having straight, vertical inner edges; pali separated from their bordering septa by narrow (about 0.8 mm), deep notches. Fossa shallow, containing a papillose columella composed of 9-20 small, irregularly-shaped pillars.

REMARKS. — Three Recent species are now attributed to the subgenus *Aplocyathus*. *Trochocyathus brevispina* differs from *T. hastatus* Bourne, 1903 (Figs 13 a-c), in always having 6 short costal spines, not 5 elongate ones. It also differs in: having a larger corallum with more septa, the maximum known size of *T. hastatus* is 18 mm GCD with 48 septa; having $S_1=S_2$, *T. hastatus* having $S_1>S_2$; and having equal-sized P_{1-4}, those of *T. hastatus* being unequal in size. *T. brevispina* is compared to *T. longispina* in the account of that species (see below).

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 240-282 m (a dead corallum from 560 m).

Trochocyathus (A.) longispina sp. nov.

Figs 12 g-i

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5331, 1 paratype (USNM 97108). — Stn 5506, 1 paratype (USNM 97109). — Stn 5537, 1 paratype (USNM 97667).
MUSORSTOM 1: stn 50, holotype (MNHN).
MUSORSTOM 2: stn 44, 1 paratype (USNM 97111).
Indonesia. *"Albatross"*: stn 5592, 1 paratype (USNM 97110).

TYPE LOCALITY. — MUSORSTOM 1 stn 50: 13°49'N, 120°01'E (Lubang Island, Luzon), 415-510 m.

ETYMOLOGY. — The species name *longispina* (Latin *longus*, long + *spina*, spine) refers to the 6 elongate C_1 spines.

DESCRIPTION. — Corallum bowl-shaped and free, the base flat to slightly convex, often maintaining the scar of original attachment. At a diameter of 9-11 mm the horizontal base is sharply inflected upward at 65-70°. Largest specimen (holotype) 17.0 mm in calicular diameter and 12.7 mm in height. Calice circular. Costae well defined only near calicular edge, otherwise lower theca and base uniformly granular. Six slender, elongate (up to 10 mm) costal spines (C_1) project horizontally from the outer edge of base; spines circular in cross section. Corallum white.

Septa hexamerally arranged in 4 complete cycles in all specimens reported ($S_{1-2}>S_3>S_4$). Each S_{1-2} up to 3.0 mm exsert, with a slightly sinuous inner edge, bearing a small palus 0.5-1.0 mm in width that contributes to a crown of 12 P_{1-2} located close to the columella. S_3 less exsert (about 1.7 mm) and about 2/3 width of S_{1-2}, having moderately sinuous inner edges. Each S_3 bordered by a large, lamellar P_3 about 2.0 mm wide, the 12 P_3 forming a crown that rises higher in the fossa and is slightly more recessed than the P_{1-2} crown. S_4 about 0.8 mm exsert, 1/2 the width of S_3, without lobes. Fossa shallow, containing a prominent columella consisting of irregularly-shaped papillae.

REMARKS. — *Trochocyathus longispina* differs from *T. brevispina* sp. nov. in having a smaller corallum, less septa, a circular (not elliptical) calice, a white (not black-brown) corallum, and longer costal spines that are circular (not flattened) in cross section. *T. hastatus* Bourne, 1903 (Figs 13 a-c), the other Recent species in the subgenus, differs from *T. longispina* in having $S_1>S_2$, a porcellaneous base, a brown-black corallum, and only 5 costal spines. *T. longispina* also resembles *Stephanocyathus (Acinocyathus) explanans* (Marenzeller, 1904), both species having 6 long costal spines, a white corallum, and a similar palar arrangement, but differs in having a smaller corallum and correspondingly less septa and pali (48 vs 72 septa), and sinuous inner septal edges, especially of the S_3. The inner septal edges of *S. explanans* are straight, which is one of the few characters that differentiate the subgenera *Stephanocyathus (Acinocyathus)* and *Trochocyathus (Aplocyathus)*.

DISTRIBUTION. — *Philippines*: Zambalas, Luzon; Lubang Island; Sibuyan and Bohol Seas; 326-760 m. *Malaysia*: Celebes Sea (Sabah); 558 m.

Genus ***TETHOCYATHUS*** Kühn, 1933

Tethocyathus virgatus (Alcock, 1902)

Trochocyathus (Tethocyathus) virgatus Alcock, 1902a: 98-99; 1902c: 16-17, pl. 2, fig. 13. — FAUSTINO, 1927: 82-83, pl. 7, fig. 10.
Tethocyathus virgatus - CAIRNS, 1995: 65-66, pl. 16, figs c-f (synonymy).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 32, 2 (MNHN). — Stn 63, 2 (MNHN).
MUSORSTOM 2: stn 2, 1 (USNM 97113). — Stn 33, 2 (MNHN).
MUSORSTOM 3: stn 108, 4 (USNM 97114).
Indonesia. MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 4: 1 (NNM 23201), 3 (ZMUC).
KARUBAR: stn 16, 1 (USNM 97115). — Stn 27, 1 (POLIPI). — Stn 44, 2 (MNHN).

TYPE LOCALITY. — *"Siboga"* stns 96 and 105: Sulu Archipelago, 275 m.

DIAGNOSIS. — Corallum elongate-conical to subcylindrical, firmly attached through a robust pedicel (PD:GCD = 0.54-0.84). Largest Philippine specimen (MUSORSTOM 1 stn 63) 13.8 mm in GCD and 14.9 mm in height, elsewhere coralla reported up to 16.3 mm in GCD (CAIRNS, 1995). Epitheca usually present, but variable in development. CS_1 darkly pigmented, highlighting hexameral symmetry of corallum; however, in some specimens CS_2 are also pigmented, and in a few coralla upper edges of all septa are dark blackish-brown. Septa

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

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

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

Genus ***BOURNEOTROCHUS*** Wells, 1984

Bourneotrochus stellulatus (Cairns, 1984)

Deltocyathus stellulatus Cairns, 1984: 15-16, pl. 3, figs C-D.
Bourneotrochus veroni Wells, 1984: 213-214, pl. 3, figs 7-18.
Bourneotrochus stellulatus - CAIRNS, 1995: 71-72, pl. 18, figs f, i, pl. 19, figs a-c (synonymy).

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 48, 3 (NNM 22760).
SNELLIUS 2: stn 81.2, 2 (NNM 23075).
KARUBAR: stn 3, 2 (USNM 97118). — Stn 7, 2 (POLIPI). — Stn 18, 6 (MNHN).

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

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

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

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

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

Paracyathus rotundatus Semper, 1872

Figs 13 d-e

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

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5164, 5 (USNM 97120). Holotype (NMW 8177).
MUSORSTOM 2: stn 9, 3 (MNHN).

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

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

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

Septa hexamerally arranged in 5 cycles, the last cycle never complete. Largest specimen with 84 septa (5th cycle lacking 6 pairs of septa); a specimen 7.5 mm GCD with 66 septa. S_{1-2} about 1 mm exsert, having vertical, straight inner edges that bear 1-3 paliform lobes, the uppermost lobe occurring about 1/2 distance to columella. S_3 only slightly less exsert than S_{1-2}, each bearing 3-5 narrow paliform lobes, the uppermost lobe reaching slightly higher than the P_{1-2}. S_4 less exsert and less wide than S_3, their narrow paliform lobes mingling with those of S_3 low in fossa. S_5 smallest septa, their paliform lobes fusing with those of S_4 in a complex tuberculate region. Fossa relatively deep. Columella trabecular to papillose, concave, and indistinguishable from lowermost paliform lobes of all septa (nondiscrete).

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

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

Paracyathus sp.

Figs 13 g-i

Paracyathus defilippi - MOSELEY, 1881: 144 (in part: *"Challenger"* stn 190). [Not *Paracyathus defilippi* Duchassaing & Michelotti, 1860].
Paracyathus agassizi - ALCOCK, 1902c: 18. [Not *Paracyathus agassizi* Duncan, 1873].

MATERIAL EXAMINED. — **Indonesia**. *"Challenger"*: stn 190, 1 (BMNH).
"Siboga": stn 256, 1 (ZMA Coel. 1306).
DEKI: unnumbered station, Ambon, unknown depth, 2 (NNM).

DIAGNOSIS. — Only 4 specimens of this species are known, the largest (*"Siboga"* stn 256) 8.8 x 9.3 in calicular diameter and 9.4 mm in height, and the *"Challenger"* specimen 3.9 x 4.5 mm in calicular diameter and 5.6 mm in height. Corallum elongate-conical and solidly attached through a broad, polycyclic pedicel and base. Costae poorly developed, covered with low, rounded granules. Theca, septa, and pali all mottled with a brown pigmentation, the columella being uniformly brown. Septa hexamerally arranged in 4 complete cycles according to formula: $S_{1-2}>S_4>S_3$. S_{1-2} highly exsert (up to 2.5 mm) and, along with their adjacent pairs of S_4, form 12 rectangular lancets. Inner edges of S_{1-2} bear 1 or 2 narrow paliform lobes. S_3 about 3/4 width of S_{1-2}, each bearing 1-3 slender paliform lobes. S_4 usually slightly wider than S_3, also bearing paliform lobes. Septal faces bear prominent granules and all paliform lobes are highly sinuous and carinate. Columella papillose, consisting of a field of numerous irregularly-shaped rods.

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

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

Genus *STEPHANOCYATHUS* Seguenza, 1864

Subgenus *STEPHANOCYATHUS (STEPHANOCYATHUS)* Seguenza, 1864

Stephanocyathus (S.) regius sp. nov.

Figs 14 a-c

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

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5444, 2 paratypes (USNM 97123). — Stn 5445, 16 paratypes (USNM 97124). — Stn 5447, 2 paratypes (USNM 97125).
MUSORSTOM 1: stn 49, 7 paratypes (USNM 97129). — Stn 54, 2 paratypes (MNHN).
Indonesia. *"Albatross"*: stn 5585, 1 paratype (USNM 97126). — Stn 5650, 3 paratypes (USNM 97127). — Stn 5670, 1 paratype (USNM 97128).
"Hakuho Maru": stn KH72-1-26, holotype (USNM 97122) and 1 paratype (USNM 97130).
CORINDON 2: stn 241, 2 paratypes (MNHN).
New Zealand Region. *"Tangaroa"*: stn T243, 1 paratype (USNM 94362).

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

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

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

Septa hexamerally arranged in 5 full cycles ($S_1 \geq S_2 > S_3 > S_4 > S_5$), some specimens as small as 18 mm GCD having a full 5th cycle, whereas other larger specimens (*e.g.*, 25-32 mm GCD) may lack several pairs of S_5, resulting in 86-94 septa. S_1 highly exsert (3.9-4.2 mm), having straight inner edges, each S_1 internally bordered by a broad (up to 2.2 mm) notch and 2 or 3 paliform lobes, each lobe decreasing in size toward columella. S_2 virtually the same as S_1, but sometimes slightly less exsert. S_3 less exsert (about 3.3 mm), only about 4/5 width of an S_1 or S_2, each S_3 bordered by a narrow notch and 1-4 paliform lobes, the outermost lobe sometimes quite wide (2.0 mm). Outermost lobes of P_3 crown always stand higher in fossa than those of P_{1-2} and are more recessed from the columella. S_4 less exsert (about 2.5 mm), about 4/5 width of an S3, with slightly sinuous edges, and bordered by 3 or 4 paliform lobes, the outermost lobe being the largest and occurring higher in the fossa and farther from the columella than P_3. Innermost P_4 often fuse with their common P_3 near columella. S_5 least exsert septa (about 1.5 mm), with slightly sinuous inner edges, becoming rudimentary lower in fossa, bearing no paliform lobes. Thus, only the S_1 and S_5 are independent septa, the inner edges of the P_1 reaching the columella and those of the S_5 diminishing in size, whereas the inner P_3 merge with their common P_2 and the inner P_4 with their common P_3. Fossa shallow, containing an elliptical field of 20-30 small densely fused papillae, the innermost P_{1-4} being indistinguishable in size and shape from the columellar elements.

REMARKS. — Among the 7 species in the nominate subgenus, *S. regius* most closely resembles *S. paliferus* Cairns, 1977 (known only from the western Atlantic at 229-715 m), both species having a similarly-shaped corallum and well-developed paliform lobes. *S. regius* differs in having multiple paliform lobes and in lacking small costal spines on the C_{1-2}. *S. regius* also resembles *Vaughanella multipalifera* Cairns, 1995 in most characters but differs in having an unattached corallum.

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

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

Subgenus *STEPHANOCYATHUS (ACINOCYATHUS)* Wells, 1984

Stephanocyathus (A.) spiniger (Marenzeller, 1888)

Figs 13 f, 14 d

Stephanotrochus spiniger Marenzeller, 1888: 20-21.
Odontocyathus sexradiis Alcock, 1902a: 100-101.
Odontocyathus stella Alcock, 1902b: 119-120.
?*Odontocyathus coloradus* Smith, 1913: 288, pl. 18, fig. 8.
Stephanocyathus (A.) spiniger - WELLS, 1984: 209, pl. 2, figs 10-13. — CAIRNS & PARKER, 1992: 26-27, pl. 7, figs g-i (synonymy). — CAIRNS, 1994: 57, pl. 25, figs a-c (synonymy); 1995: 67-68, pl. 17, figs d-f, pl. 18, fig. c.

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

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

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

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

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

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

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

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

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

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

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

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

Stephanocyathus (A.) explanans (Marenzeller, 1904)

Fig. 14 e

Stephanotrochus explanans Marenzeller, 1904a: 304-307, pl. 18, figs 19a-b.
Stephanocyathus nobilis - BOSHOFF, 1981: 39. [Not *Ceratotrochus nobilis* Moseley, 1873].
Stephanocyathus (A.) explanans - CAIRNS & KELLER, 1993: 243-244.

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5589, 4 (USNM 97151).
KARUBAR: stn 35, 1 (USNM 97152). — Stn 39, 10 (MNHN). — Stn 40, 9 (POLIPI). — Stn 58, 5 (USNM 97154). — Stn 59, 14 (MNHN). — Stn 70, 2 (MNHN). — Stn 71, 11 (POLIPI). — Stn 75, 7 (POLIPI). — Stn 87, 1 (USNM 97156).

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

DESCRIPTION. — Corallum bowl-shaped, with a slightly rounded base, the thecal edges diverging at a 40°-45° angle. Most coralla 21-27 mm in calicular diameter, the largest known corallum (KARUBAR stn 35) 27 mm in calicular diameter and 20.1 mm in height. All specimens bear 6 relatively short, slender, tapered, straight costal spines (basal diameter 1.5-1.7 mm) that project horizontally from the C_1 at point of upward thecal inflection. Spines best known from juveniles, where they are up to 9 mm long; in larger (older) coralla, C_1 spines are either broken or reduced to small nubs. In about 1/4 of specimens examined, 1-5 additional costal spines present on C_2. All costal spines circular in cross section. Lower corallum, to a level just above costal spines, usually eroded, as though submerged in a soft substratum. Theca above this region costate, the costae slightly convex and granular. Corallum white.

Septa hexamerally arranged in 5 cycles, the 5th cycle never complete: the most common septal complement is 72, achieved by having a pair of S_5 in each of the 12 quarter systems adjacent to the 6 S_1. S_{1-2} about 3.3 mm exsert, having straight, vertical inner edges, each bordered internally by a deep, broad (up to 1.6 mm) notch and a rather narrow, lamellar paliform lobe only about 1 mm wide, which is often merged into the columella. S_3 about 2 mm exsert, 3/4 width of an S_{1-2}, and bordered by a narrow (about 0.5 mm) notch and a prominent, broad (2.0-3.5 mm) paliform lobe. S_4 that are flanked by S_5 almost as wide and exsert as an S_3, but bear a narrow paliform lobe (about 0.9 mm), which is often fused into or subsumed by the P_3. Unflanked S_4 only 1.5 mm exsert, about half width of an S_3, becoming rudimentary lower in fossa. Because P_{1-2} are directly adjacent to the columella, and P_4 are often fused into the P_3 or poorly developed, many coralla appear to have only 1 crown of 12 massive P_3. S_5 resemble unflanked S_4. Inner edges of all septa and paliform lobes straight. Calicular margin serrate, but not produced into lancets. Fossa relatively shallow. Columella composed of 8-10 granular papillae that are circular in cross section, which distinguish them from the closely adjacent lamellar P_{1-2}.

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

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

Subgenus *STEPHANOCYATHUS (ODONTOCYATHUS)* Moseley, 1881

Stephanocyathus (O.) weberianus (Alcock, 1902)

Figs 14 g-h

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

Stephanotrochus sibogae Alcock, 1902a: 102-103; 1902c: 25-26, pl. 3, figs 23, 23a.
Stephanotrochus sp. - ALCOCK, 1902c: 26.
Stephanocyathus (O.) ixine Squires, 1958: 54 (in part: *"Albatross"* stn 5545, pl. 8, figs 3-4).
Stephanocyathus nobilis - ZOU, 1988: 74-75 (in part: pl. 1, figs 1-3). [Not *Ceratotrochus nobilis* Moseley, 1873].
Stephanocyathus (O.) weberianus - CAIRNS, 1994: 57-58, pl. 25, figs d-f (synonymy); 1995: 68-69, pl. 17, figs g-i (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5348, 1 (USNM 97157). — Stn 5349, 1 (USNM 97158). — Stn 5444, 2 (USNM 97159). — Stn 5445, 54 (USNM 46819).
MUSORSTOM 1: stn 49, 4 (MNHN). — Stn 54, 1 (USNM 97166).
Indonesia. *"Albatross"*: stn 5586, 4 (USNM 97160). — Stn 5587, 1 (USNM 97161). — Stn 5601, 1 (USNM 97162). — Stn 5648, 1 (USNM 97163). — Stn 5650, 1 (USNM 97164). — Stn 5671, 1 (USNM 97165).
"Hakuho Maru": stn KH72-1-26, 6: 4 (USNM 97168), 2 (ORI).
KARUBAR: stn 20, 2 (POLIPI). — Stn 89, 1 (MNHN). — Stn 91, 33: 26 (USNM 97167), 7 (MNHN).

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

DIAGNOSIS. — Corallum bowl-shaped, often with an eroded lower surface. Largest known specimen (KARUBAR stn 91) 54 mm in calicular diameter and 30 mm in height. 12 to 18 costal tubercles correspond to the 12 C_{1-2} and the C_3 of those half systems that possess 4 C_5. In some specimens, tubercles are replaced by a thickened rim that encircles the base of the corallum. Corallum white. Septa hexamerally arranged in 5 cycles ($S_{1-2}>S_3>S_4>>S_5$) — the 5th cycle never complete, 72 being a common number of septa. Paliform lobes present before all but last cycle of septa. Columella papillose to lamellar (Fig. 14h), the latter aspect a result of the intermingling of lamellar P_{1-2}.

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

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

Genus ***ERICIOCYATHUS*** nov.

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

DIAGNOSIS. — Corallum solitary, bowl-shaped, and free. Septotheca costate, each C_{1-2} bearing a series of elongate spines. Pali in a crown before penultimate septal cycle (P_3). Columella papillose.

REMARKS. — Among the caryophylliid genera, *Ericiocyathus* is most similar to *Stephanocyathus (Odontocyathus)*, both taxa having similarly shaped coralla of approximately the same size, and costal tubercles or spines on their C_{1-2}. *Ericiocyathus* differs in having pali associated only with the S_3, whereas *S. (Odontocyathus)* has 3 (or 4) cycles of paliform lobes. Also, *S. (Odontocyathus)* has only 12-18 costal tubercles ($C_{1-2, 3}$) relegated to the lower, outer edges of the corallum, whereas *Ericiocyathus* has a series of elongate spines along each C_{1-2}. *Stephanocyathus (Acinocyathus)* and *Trochocyathus (Aplocyathus)* are also similar to *Ericiocyathus* in having elongate costal spines, but differ in having a total of only 5 or 6 spines (one per C_1), and in having P_{1-2} in addition to P_3.

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

Ericiocyathus echinatus sp. nov.

Figs 15 a-b

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

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

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

DESCRIPTION. — Corallum bowl-shaped and unattached, the base being evenly rounded and the thecal edge angle 43°-53°. Small coralla bowl-shaped, but older coralla have high thecal edges, the largest specimen (the holotype) 18.6 mm in calicular diameter and 16.8 mm in height. Each C_{1-2} bears a row of long, tapered costal spines that project perpendicularly to the theca. These spines are short (eroded) near the base, but on the sides of the corallum costal spines up to 6.0 mm long with a basal diameter of 1.2 mm. Spines occur approximately every 2 mm, up to 6 aligned on each C_{1-2}; the holotype has at least 60 spines, whereas smaller specimens have fewer. Costae developed as low, convex, granulated ridges only near calicular edge. Corallum white.

Septa hexamerally arranged in 4 complete cycles ($S_{1-2}>S_3>S_4$), septa of the 4th cycle beginning to be present at a GCD of 5 mm. S_{1-2} about 3 mm exsert, having straight, vertical inner edges that extend about 2/3 distance to columella. S_{1-2} do not have paliform lobes or pali. S_3 about half as exsert as and 3/4 width of S_{1-2}, with straight to only slightly sinuous inner edges. S_4 lowest septa, 2/3 width of an S_3, having straight inner edges, becoming rudimentary lower in fossa. A crown of 12 thin, lamellar, planar P_3, each 1.5-2.5 mm wide, encircles a columella composed of 3-6 papillae or short lamellae. Fossa relatively shallow, the pali rising high in the fossa contrasting with the columella, which is deeply seated.

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

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

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

1. Adult corallum with 5 full cycles of septa (96) **2**
— Adult corallum with 4 cycles of septa or an incomplete 5th cycle (48-80 septa) **4**

2. P4 much larger than all other pali ..... ***D. rotulus***
— P4 of similar size to other pali **3**

3. Base flat, no scar; all septa project an equal distance beyond calicular margin; S_5 well developed ..... ***D. magnificus***
— Base convex (bowl-shaped), usually with a central scar or eroded region; S_5 project much less than S_{1-4} beyond calicular margin; S_5 rudimentary, often absent near calicular edge ... . ***D. suluensis***

4. All septa project beyond calicular edge an equal distance; costae coarsely dentate .... ***D. vaughani***
— Septa of higher cycle less prominent than others; costae finely dentate or granular **5**

5. CS_3 thick, projecting beyond calicular margin as 12 triangular lancet ..... ***D. stella***
— CS_3 of normal thickness, although they may project as lancets **6**

6. Corallum often having several pairs of S_5 (up to 80 septa); S_4 fuse to P_3 relatively high in fossa; CS_3 often hyperextended in a lobate structure ..... ***D. andamanicus***
— Corallum always having only 4 cycles of septa (48 septa); S_4 much smaller, fusing to S_3 very low in fossa near columella; CS_3 never hyperextended ..... ***D. philippinensis***

Deltocyathus vaughani Yabe & Eguchi, 1932

Levipalifer orientalis Vaughan, 1900: 201-202, pl. 16, figs 3-7 (junior secondary homonym of *Deltocyathus orientalis* Duncan, 1876).
Deltocyathus vaughani Yabe & Eguchi, 1932b: 388-389. — Zibrowius & Grygier, 1985: 121, fig. 12. — Cairns, 1994 : 54-55, pl. 23, figs i-j, pl. 24, figs a-c, f (synonymy).

Material examined. — **Philippines**. *"Albatross"*: stn 5110, 10 (USNM 40051). — Stn 5198, 8 (USNM 97173). — Stn 5529, 1 (USNM 97174). — Stn 5536, 2 (USNM 97175).
Indonesia. Deki: stn 62, 1 (NNM 22458).
Karubar: stn 28, 5 (MNHN). — Stn 39, 13 (USNM 97176). — Stn 40, 4 (POLIPI). — Stn 56, 1 (POLIPI). — Stn 59, 1 (MNHN). — Stn 71, 6 (MNHN). — Stn 76, 1 (MNHN).

Type Locality. — Bosyu (= Awa), Japan (depth not given).

Diagnosis. — Corallum discoidal, having a convex base with a basal angle of 130°-170°. Largest known specimen (Karubar stn 40) 26.8 mm in calicular diameter and 9.4 mm in height. Costae prominently ridged and coarsely dentate. Corallum white. Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_4>S_3$. One palus or paliform lobe occurs on each septum (P_{1-4}). Fossa shallow; columella papillose.

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

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

Deltocyathus philippinensis sp. nov.

Figs 15 d-e

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

Material examined/Types. — **Philippines**. *"Siboga"*: stn 95, 1 paratype (ZMA Coel. 5441). — Stn 100, 2 paratypes (ZMA Coel. 5443).
"Albatross": stn 5505, 4 paratypes (USNM 97179). — Stn 5506, holotype (USNM 97178). — Stn 5538, 1 paratype (USNM 97180).
South China Sea. *"Penguin"*: stn 32, Macclesfield Bank (ca. 16°N, 114°E), 342 m, 1 (BMNH 1892.10.17.123).

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

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

Description. — Corallum bowl-shaped, the largest specimen (holotype) 15.0 mm in calicular diameter and 6.0 mm in height. Centre of base (up to 5-7 mm) usually eroded and discoloured to a chalky white. Beyond central worn region radiate 24 ridged costae (C_{1-3}), which become prominent near calicular edge. C_{1-3} covered with very

fine spines, both laterally and apically. C_4 ridges present only near calicular edge, also bearing fine, elongate spines. Intercostal spaces broad and smooth. Calicular margin adjacent to every CS_{1-3} produced into a short, triangular apex, resulting in a moderately serrate calicular margin. Upper, outer edges of all septa light brown.

Septa hexamerally arranged in 4 complete cycles. S_1 extend up to 1.6 mm beyond calicular edge and reach 1/2 distance to columella, where each is bordered by a lamellar paliform lobe about 1.5 mm wide. S_1 are the only independent septa. S_2 as exsert as S_1, about 4/5 width of an S1, bearing a palus of equal size, the P_2 rising slightly higher in the fossa and recessed slightly more from the columella than P_1. S_3 as exsert as S_{1-2} but only about 2/3 width of an S2. Each S_3 bears a highly spinose palus (P_3) 1.5-1.7 mm in width, each pair of S_3 within a system fusing to its common P_2 through several robust processes, the uppermost process at the level of S_2-P_2 notch. P_3 rise higher in fossa and are more recessed from the columella than are P_2. S_4 extend about 1.1 mm beyond calicular edge and are about 2/3 width of an S_3 in upper fossa. Deeper in the fossa, far below S_3-P_3 notch and near columella, S_4 are rudimentary, each pair of S_4 joining its common S_3 through 1-3 slender processes. S_4 do not bear paliform lobes. Fossa shallow to moderate in depth. Columella papillose, consisting of 15-20 fused granular elements, each about 0.25 mm in diameter.

REMARKS. — The rudimentary nature of the S_4 and the tenuous connection to their adjacent S_3 distinguish this species from other western Pacific *Deltocyathus*. *D. philippinensis* resembles *D. eccentricus* Cairns, 1979 (amphi-Atlantic, 183-1000 m) in its S_4 morphology, but differs in having only 48 septa (*D. eccentricus* often has pairs of S_5), an eroded central basal region, and ridged costae.

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

Deltocyathus stella sp. nov.

Figs 15 f-h

MATERIAL EXAMINED/TYPES. — **Philippines**. MUSORSTOM 2: stn 33, 1 paratype (MNHN).
Indonesia. SNELLIUS 2: stn 4.034, 1 paratype (NNM 22777).
KARUBAR: stn 1, 35: holotype and 10 paratypes (MNHN), 10 paratypes (POLIPI), and 14 paratypes (USNM 97181). — Stn 2, 9 paratypes (USNM 97182). — Stn 18, 15 paratypes (MNHN). — Stn 32, 1 paratype (POLIPI).

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

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

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

Septa hexamerally arranged in 4 cycles, the 4th cycle complete at a GCD of about 6 mm; no specimens examined have more than 48 septa. S_1 independent, extending about 0.5 mm beyond calicular edge, and reaching about 1/2 distance to columella. Central most part of each S_1 bears a small P_1 about 0.8 mm wide. S_2 similar to S_1 but slightly narrower, having pali (P_2) that rise higher in the fossa and are more recessed from columella than P_1. S_3 highly exsert (1.5 mm beyond calicular edge) and quite thick (up to 0.45 mm), but only about 2/3 width of S_2. P_3 about 1.2 mm wide, bearing large, coarse granules up to 0.12 mm tall and fusing to their common P_2 near the columella. S_4 about 0.75 mm exsert, each pair fusing to its common S_3 in a short triangular lancet, producing a highly serrate calicular margin. Inner edges of S_4 fuse to adjacent P_3 through 2 or 3 narrow processes below S_3-P_3 notch. Inner edges of S_{1-3} slightly sinuous; edges of S_4 dentate to laciniate. Fossa shallow. Columella consists of 15-30 small (0.20 mm diameter) papillae, all fused at base level.

REMARKS. — *Deltocyathus stella* is distinctive in having quite exsert and thickened S_3. The 12 S_3 are not spinose as in *D. ornatus* Gardiner, 1899 or lobate as in *D. andamanicus*, but simply prominent and thickened. Another spinose *Deltocyathus*, *D. heteroclitus* Wells, 1984 (Pleistocene of Vanuatu), differs in having spinose (not thickened) CS_3, an irregular number of costal spines, and an incomplete 4th cycle.

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

Deltocyathus andamanicus Alcock, 1898

Fig. 15 c

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

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5273, 1 (USNM 97183). — Stn 5403, 11 (USNM 82156). — Stn 5412, 3 (USNM 97184). — Stn 5417, 6 (USNM 97185).
MUSORSTOM 2: stn 63, 17: 10 (MNHN), 7 (USNM 97187).
MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 92, 16 (USNM 97188). — Stn 126, 6 (MNHN). — Stn 130, 16 (USNM 97189). — Stn 138, 2 (MNHN). — Stn 139, 32 (MNHN).
Indonesia. DEKI: stn 59, 2 (NNM 22460).
SNELLIUS 2: stn 4.173, 2 (NNM 22461).

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

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

Septa hexamerally arranged in 5 cycles, but the last never complete, most coralla having 4-16 pairs of S_5, which results in a total of 56-80 septa. S_1 extend about 1.8 mm beyond calicular edge and have slightly sinuous inner edges, each S_1 internally bordered by a lamellar P_1 1.7-1.9 mm in width. S_1, not being joined to any other septa, are the only independent septa. S_2 similar to S_1 but less wide, their P_2 rising higher in the fossa and being more recessed from the columella than P_1. S_3 highly exsert, extending up to 3.8 mm beyond the calicular edge. In large, well-preserved coralla, the lower outer edge of the S_3 is hyperextended as a small (about 1 mm) lobe, this lobe being compressed in the septal plane. Each S_3 bordered by a large palus 1.5-2.4 mm wide that rises higher in the fossa and is more recessed from the columella than P_2. Inner edges of P_3 fused to their common P_2. S_4 small and low, extending only about 1.5 mm beyond calicular edge, each pair fused to their common S_3 to form rectangular lancets, resulting in a highly serrate calicular margin. Inner edges of S_4 fuse to their adjacent P_3 through a series of 3-5 slender processes. In half-systems having pairs of S_5, S_5 are equivalent to previously described S_4, and S_4 are same size as previously described S_3. Upper, outer edges of CS_{1-3} entire, whereas those of the S_{4-5} are laciniate. Fossa shallow; columella composed of 10-20 small (about 0.3 mm diameter) granular pillars that are fused basally.

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

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

Deltocyathus suluensis Alcock, 1902

Fig. 16 d

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

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 93, 11 (MNHN).
Indonesia. *"Siboga"*: stn 251, 1 (ZMA Coel. 1109).
DEKI: stn 44, 1 (NNM 22462). — Stn 51, 4 (NNM 22463). — Stn 52, 5 (NNM 22464). — Stn 57, 1 (NNM 22465). — Stn 58, 3 (NNM 22466). — Stn 62, 4 (NNM 22467).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 1 (ZMUC).
"Galathea": stn 500, 6 (ZMUC).
KARUBAR: stn 2, 80 (USNM 97191). — Stn 3, 3 (USNM 97192). — Stn 7, 3 (MNHN). — Stn 18, 2 (MNHN). — Stn 31, 5 (USNM 97193). — Stn 35, 4 (POLIPI). — Stn 36, 2 (POLIPI). — Stn 67, 4 (USNM 97196). — Stn 77, 1 (MNHN).

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

DIAGNOSIS. — Corallum with a flat to slightly convex base and a small central basal scar; peripherally the theca is thickened and abruptly upturned, resulting in a marked thecal edge. Largest known specimen (KARUBAR stn 77) 21.8 mm in diameter. Costae low, wide rounded ridges covered with granules. Well-preserved specimens show concentric bands of light brown pigmentation on the base and a light brown pigmentation on lower, outer septal edges. Septa hexamerally arranged in 5 cycles, the 5th cycle complete (a total of 96 septa) at a GCD of about 18 mm; however, pairs of S_5 begin to appear in coralla as small as 4 mm GCD. In fact, S_5 are usually more visible in small, flat-based coralla than in larger coralla where they are often rudimentary or even absent on the peripheral, upturned calicular edge, even though their corresponding C_5 are well developed. S_{1-4} extend equally beyond calicular edge (1.4-1.6 mm), the S_5 being only 1/2 as exsert. Calicular margin serrate but not lanceted. S_{1-4} and P_{1-4} arranged in typical deltocyathid fashion, but, as mentioned before, S_5 rudimentary to absent, especially near calicular edge of large coralla. S_5 join their adjacent S_4 very low in fossa near columella by a series of 2-5 thin processes. Columella papillose.

REMARKS. — *Deltocyathus suluensis* differs from *D. magnificus* Moseley, 1876, in having granular costae; a central basal scar or eroded region; less exsert and less developed S_5; and a smaller corallum. It differs from *D. rotulus* (Alcock, 1898), another species with 5 cycles of septa, in having granular, convex (not serrate ridged) costae; a serrate (not lanceted) calicular margin; smaller S_5; and a papillose columella; and is usually found in shallower water (142-565 m vs 210-1986 m for *D. rotulus*).

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

Deltocyathus rotulus (Alcock, 1898)

Figs 16 a-c

Trochocyathus rotulus Alcock, 1898: 16, pl. 2, figs 1, 1a.
Deltocyathus fragilis Alcock, 1902a: 99-100; 1902c: 21, pl. 2, figs 15, 15a.
Deltocyathus rotulus - CAIRNS & KELLER, 1992: 245, pl. 5, fig. I (synonymy). — CAIRNS, 1994: 55-56, pl. 24, figs j-k.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5423, 3 (USNM). — Stn 5425, 2 (USNM 97200). — Stn 5429, 2 (USNM 97201). — Stn 5438, 1 (USNM 97202). — Stn 5439, 1 (USNM 97203). — Stn 5445, 11 (USNM 97204). — Stn 5447, 1 (USNM 97205). — Stn 5527, 2 (USNM 97206).
MUSORSTOM 1: stn 54, 1 (MNHN).
MUSORSTOM 3: stn 94, 1 (MNHN).

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

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

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

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

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

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

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

DIAGNOSIS. — Corallum discoidal, with a flat to slightly bowl-shaped base. Largest known specimen (*"Albatross"* stn 5582) 36 mm in calicular diameter. Centre of base always eroded and without costae; otherwise C_{1-5} thin, finely serrate ridges. Septa hexamerally arranged in 5 cycles ($S_{1-2}>S_3>S_4>S_5$), the 5th cycle complete at a GCD of 30-32 mm. Each S_{1-2} and the adjacent pair S_5 project as short rectangular lancets, producing a highly serrate calicular margin. P_{1-3} small, sometimes even absent (Fig. 16 b); however, P_4 prominent (up to 4 mm wide), forming a distinctive crown of 24 lobes. S_5 rudimentary, each pair of S_5 fused to their common S_4 by 5-8 slender processes beginning near the S_4-P_4 notch and continuing to the columella. Fossa shallow, containing a columella in the shape of a circular, undercut platform that supports numerous irregularly-shaped papillae.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1994). It is one of the few species in the genus to attain 5 full cycles of septa and is unique in having such a well-developed P_4 crown.

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

Deltocyathus magnificus Moseley, 1876

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

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

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

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

MUSORSTOM 2: stn 83, 2 (MNHN).

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

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

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

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

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

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

DIAGNOSIS. — Corallum discoidal, with a flat to slightly concave base covered with straight, thin, finely dentate costae. Largest known specimen (KARUBAR stn 69) a damaged corallum 47 mm in calicular diameter and 9 mm in height. All costoseptae project an equal distance (about 1.5 mm) beyond calicular margin. Septa hexamerally arranged in 5 full cycles ($S_1>S_2>S_3>S_4>S_5$), the 5th cycle usually complete at a GCD of about

8 mm. Pairs of S_5 join their common S_4 by an elongate, porous lamella. All septa bear prominent pali or paliform lobes, even S_5 of larger coralla. Columella an elongate fusion of numerous papillae that rises as high as the septa and thus there is no fossa.

REMARKS. — *Deltocyathus magnificus*, the largest species in the genus, is easily distinguished from *D. rotulus* (Alcock, 1898) by its flat base, equally exsert septa, differently constructed columella, and smaller P_4.

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

Genus ***CONOTROCHUS*** Seguenza, 1864

Conotrochus funicolumna (Alcock, 1902)

Ceratotrochus (Conotrochus) funicolumna Alcock, 1902a: 93; 1902c: 11-12, pl. 1, figs 6, 6a. — FAUSTINO, 1927: 66, pl. 9, figs 7-8. — ZOU, 1988: 77, pl. 5, figs 1, 1a.
Conotrochus funicolumna - CAIRNS, 1984: 14, pl. 2, figs I-J; 1994: 58-59, pl. 24, fig. i, pl. 25, figs g-l (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5551, 1 (USNM 97238). — Stn 5567, 19 (USNM 97240).
"Hakuho Maru": stn KH72-1-20, 6 (USNM 97242).
Indonesia. *"Albatross"*: stn 5586, 19 (USNM 97241).
DEKI: stn 44, 1 (NNM 22551). — Stn 52, 4 (NNM 22552).
"Galathea": stn 500, 8 (ZMUC).
"Hakuho Maru": stn KH72-1-28, 2 (USNM 97243).
KARUBAR: stn 59, 1 (MNHN).
South China Sea. *"Albatross"*: stn 5312, 1 (USNM 97237). — Stn 5318, 1 (USNM 97238).

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

DIAGNOSIS. — Corallum elongate-conical to trochoid, and usually free (often having a small-diameter, blunt pedicel), but some coralla attached by a slender pedicel. Largest Indonesian specimen (KARUBAR stn 59) 14 mm in calicular diameter and 24.0 mm in height. Theca thick, covered with coarse granules and a thin epitheca, the theca projecting 0.5-0.7 mm above outer, upper septal edges as a continuous rim. Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_3>S_4$, the S_1 only slightly wider than S_2. Fossa shallow, containing a prominent columella composed of several short, twisted lamellae that are swirled in the typical clockwise direction.

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

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

Conotrochus brunneus (Moseley, 1881)

Fig. 16 e

Pleurocyathus brunneus Moseley, 1881: 159-160, pl. 2, figs 1a-c.
Phloeocyathus hospes Alcock, 1902b: 116-117.
Ceratotrochus (Phloeocyathus) hospes - ALCOCK, 1902c: 12, pl. 2, figs 8, 8a.

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

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5171, 1 (USNM M236517). — Stn 5217, 2 (USNM 97245). — Stn 5277, 1 (USNM 97246).
"Hakuho Maru": stn KH72-1-20, 1 (USNM 97260).
MUSORSTOM 2: stn 32, 1 (USNM 97248). — Stn 33, 69 (MNHN). — Stn 63, 5 (USNM 97250).
MUSORSTOM 3: stn 92, 22: 21 (USNM 97251), 1 (BMNH 1992.8.11.4). — Stn 102, 2 (MNHN). — Stn 109, 1 (USNM 97252). — Stn 117, 1 (MNHN). — Stn 126, 2 (MNHN). — Stn 139, 2 (MNHN).
Indonesia. DEKI: stn 3, 6 (NNM 22556). — Stn 4, 1 (ZMUC). — Stn 5, 1 (NNM). — Stn 6, 12 (NNM 22557). — Stn 42, 1 (NNM 22559). — Stn 46, 1 (NNM 22560). — Stn 48, 18 (NNM 22561). — Stn 58, 3 (NNM 22628). — Stn 63, 8 (NNM 22563).
"Hakuho Maru": stn KH85-1-A2, 1 (USNM 97247).
KARUBAR: stn 1, 1 (USNM 97253). — Stn 2, 31 (USNM 97254). — Stn 3, 7 (POLIPI). — Stn 7, 11 (MNHN). — Stn 15, 6 (MNHN). — Stn 18, 1 (MNHN). — Stn 31, 1 (POLIPI). — Stn 32, 1 (POLIPI). — Stn 36, 2 (POLIPI). — Stn 69, 1 (USNM 97257). — Stn 71, 1 (MNHN). — Stn 77, 5 (MNHN).
South China Sea. *"Albatross"*: stn 5301, 1 (USNM 97247).
"Hakuho Maru": stn KH72-1-52, 10: 7 (USNM 97161), 3 (ORI).

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

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

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

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

Genus ***LOCHMAEOTROCHUS*** Alcock, 1902

Lochmaeotrochus oculeus Alcock, 1902

Figs 16 f-i

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

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 159, 5 coralla (syntypes, ZMA Coel. 814). — Stn 259, 2 clusters and 18 individual coralla (syntypes, ZMA Coel. 700).
"Albatross": stn 5586, 1 cluster consisting of 3 coralla (USNM 97263). — Stn 5592, 2 clusters consisting of 6 coralla (USNM 97264).

DEKI: stn 52, 1 cluster (NNM 22554). — Stn 56, 2 clusters (NNM 22553).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 15, 3 clusters consisting of 22 coralla (ZMUC).
KARUBAR: stn 13, 15 clusters consisting of 89 coralla: 9 clusters (MNHN), 6 clusters (USNM 97265).
South China Sea. *"Hakuho Maru"*: stn KH73-2-44-2, 19 clusters and 12 coralla: 4 clusters (ORI), remainder (USNM 97266).

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

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

Septa hexamerally arranged in 4 cycles, most coralla from KARUBAR stn 13 having 48 septa, although 36 septa is also common in other specimens. S_1 1.0-1.2 mm exsert, having straight, vertical inner edges that border the columella. S_2 slightly less exsert and 3/4 to 4/5 width of an S_1 also having straight inner edges and occasionally bordered by a narrow, lamellar to papillose paliform lobe. These P_2 almost indistinguishable from columellar elements and not always present. S_3 slightly less exsert and 3/4 to 4/5 width of an S_2, having slightly sinuous inner edges, and sometimes bordered by a papillose or short lamellar paliform lobe, 2 of which sometimes unite within a system forming a V-shaped structure before their common S_2. In some coralla P_3 are absent, rudimentary, or irregular in development. S_4 about 1/2 width of an S_3 and have straight inner edges. Fossa of moderate depth, containing a columella of granular papillae or short lamellae, but never swirled as in *C. brunneus* or *C. funicolumna*.

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

ALCOCK (1902: 13) described *L. oculeus* as a colonial *Conotrochus*, very similar to *C. hospes* (= *C. brunneus*). Even though *L. oculeus* is now interpreted as a solitary coral, it can be distinguished from *C. brunneus* by having a tendency to form clusters or pseudocolonies, always having a white corallum, usually having 48 septa, having a papillose columella (rarely sublamellar and never swirled), and often having either P_2 and/or P_3. This is believed to be the first report of this species and genus subsequent to their original descriptions.

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

Genus *AULOCYATHUS* Marenzeller, 1904

Aulocyathus recidivus (Dennant, 1906)

Ceratotrochus recidivus Dennant, 1906: 159-160, pl. 6, figs 1-2.
Aulocyathus recidivus - CAIRNS, 1982: 25-26, pl. 7, figs 7-9, pl. 8, fig. 1 (synonymy); 1994: 59-60, pl. 26, figs a-b; 1995: 75, pl. 20, figs c-f. — CAIRNS & PARKER, 1992: 22-24, pl. 6, figs d-e, g-h (synonymy). — CAIRNS & KELLER, 1993: 247, pl. 5, fig. C.

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

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

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

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

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

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

Genus ***PARACONOTROCHUS*** Cairns & Parker, 1992

Paraconotrochus zeidleri Cairns & Parker, 1992

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

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5589, 2 (USNM 97270). — Stn 5590, 1 (USNM 97271). — Stn 5592, 1 (USNM 97272).
DEKI: stn 52, 8 (NNM 22751).
"Galathea": stn 500, 1 (ZMUC).
KARUBAR: stn 59, 1 (POLIPI). — Stn 69, 7: 6 (MNHN), 1 (USNM 97273). — Stn 77, 4: 3 (USNM 97274), 1 (MNHN).
Admiralty Islands. *"Challenger"*: stn 219, 1 (BMNH).

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

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

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

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

Genus *DESMOPHYLLUM* Ehrenberg, 1834

Desmophyllum dianthus (Esper, 1794)

Fig 17 g-h

Madrepora dianthus Esper, 1794: pl. 69, figs 1-3.
Desmophyllum dianthus - CAIRNS, 1994: 26-27, pl. 9, figs a-d (synonymy).
Desmophyllum cristagalli H. Milne Edwards & Haime, 1848a: 253. — ALCOCK, 1902c: 28. — ZIBROWIUS, 1980: 117-121, pl. 61, figs A-O, pl. 62, figs A-M (synonymy).
Not *Desmophyllum* sp. - ALCOCK, 1902c: 28 (= *Madrepora oculata* Linnaeus, 1758).

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 259, 2 (ZMA Coel. 1242, see ALCOCK, 1902c).
"Captain Christiansen": 1°31'N, 124°47'E, 457 m, 12 March 1913, 6 (NNM 22800).
South China Sea. *"Hakuho Maru"*: stn KH73-2-44-2, 9: 6 (USNM 97275), 3 (ORI).

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

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

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

Genus *DACTYLOTROCHUS* Wells, 1954

Dactylotrochus cervicornis (Moseley, 1881)

Tridacophyllia cervicornis Moseley, 1881: 183-184, pl. 10, figs 2a-2d, 3a. — BASSETT-SMITH, 1890: 368.
Tridacophyllia primordialis Gardiner, 1899: 168, pl. 19, figs 7a-e.
Dactylotrochus cervicornis - WELLS, 1954: 470-471, pl. 178, figs 1-3.

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

TYPE LOCALITY. — Unknown.

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

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

Genus *ASTEROSMILIA* Duncan, 1867

Asterosmilia marchadi (Chevalier, 1966)

Figs 17 a-b

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

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

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5133, 10 (USNM 97278). — Stn 5152, 2 (USNM 97279). — Stn 5156, 1 (USNM 97280). — Stn 5164, 55 (USNM 97282). — Stn 5178, 4 (USNM 97283). — Stn 5277, 1 (USNM 97284). — Stn 5357, 4 (USNM 97286).
MUSORSTOM 1: stn 32, 1 (USNM 97289). — Stn 57, 1 (USNM 97290). — Stn 73, 1 (USNM 97291).
SIPHILEXP: stn 78-T10, 1 (USNM 97287).
MUSORSTOM 2: stn 8, 1 (MNHN). — Stn 47, 1 (MNHN).
MUSORSTOM 3: stn 102, 2 (MNHN). — Stn 107, 3 (USNM 97293). — Stn 131, 7 (MNHN). — Stn 140, 10 (MNHN).
Indonesia. DEKI: stn 6, 1 (NNM 22537). — Stn 10, 2 (NNM 22538). — Stn 35, 2 (ZMUC), 3 (NNM 22539).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 42 (ZMUC). — Stn 6, 1 (ZMUC). — Stn 8, 6 (ZMUC). — Stn 9, 2 (ZMUC).
CORINDON 2: stn 216, 3 (MNHN). — Stn 251, 4 (MNHN). — Stn 261, 4 (MNHN). — Stn 263, 1 (MNHN). — Stn 266, 3 (USNM 97295).
SNELLIUS 2: stn 4.235, 9 (NNM 22536).
South China Sea. *"Albatross"*: stn 5311, 19 (USNM 97285).

TYPE LOCALITY. — Senegal, 97-85 m.

DESCRIPTION. — Corallum ceratoid, usually curved about 45°. Approximately half of the coralla examined originated by extratentacular budding from the edge zone of a parent corallum, their pedicels narrowing to a slender, open base only 0.6-0.7 mm in diameter. Other coralla firmly attached to a substratum through a robust pedicel up to 4.5 mm in diameter (PD:GCD = 0.18-0.30), these coralla assumed to have originated from planular settlement. Largest known specimen (MUSORSTOM 3 stn 140) 14.9 x 18.0 mm in calicular diameter, 15.8 mm in height, and 4.5 mm in pedicel diameter; however, most coralla are less than 13 mm in GCD. All costae (C_{1-4}) consist of low, rounded ridges, separated by equally wide, shallow furrows. Costae covered with tiny granules, 4 or 5 occurring across the width of a costa. Theca quite thin. Many coralla display small scars of bud detachment on their theca, some bearing as many as 25 shallow, circular (0.6-0.7 mm in diameter) concavities. Although some coralla are completely white, most coralla are reddish-brown, especially intense near calicular edge and fading to white at base.

Septa hexamerally arranged in 4 cycles, only larger coralla having pairs of S_5, up to 66 septa. S_1 highly exsert (about 2.9 mm), having straight, vertical inner edges that attain the columella. S_2 slightly less exsert (about 2.5 mm), about 4/5 width of an S_1. Both S_1 and S_2 occasionally bear an irregularly-shaped paliform lobe that mingles with the columella. S_3 about 1.2 mm exsert and only 1/2 width of an S_2. Each S_3 bears a lamellar paliform lobe about 1.2 mm wide, together forming a palar crown. S_4 as exsert as S_3 but only about 2/3 the width, with finely dentate inner edges, and attenuating in size low in fossa. If a pair of S_5 flanks an S4, that S_4 also bears a paliform lobe, the P_4 being larger than the P_3 and occurring higher in the fossa and more peripherally. Pairs of S_4 flanking S_1 and S_2 form low calicular lancets resulting in a serrate calicular margin. Fossa of moderate depth, containing a crispate, twisted columella. Endothecal dissepiments often present.

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

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

Genus *THALAMOPHYLLIA* Duchassaing, 1870

Thalamophyllia tenuescens (Gardiner, 1899)

Figs 17 d-e

Desmophyllum tenuescens Gardiner, 1899: 161-162, pl. 19, figs 1a-b.
Thalamophyllia tenuescens - CAIRNS, 1995: 78, pl. 21, figs g-i.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5255, 2 corallites (USNM 97296).
Marigondon cave entrance, Mactan Island, Cebu, 22 m, coll. H. SCHUHMACHER, 28 May 1981, 1 colony (USNM 94142).
MUSORSTOM 3: stn 131, 3 colonies (MNHN).
Indonesia. DEKI: stn 54, 1 (NNM).
CORINDON 2: stn 248, 1 colony (MNHN).
SNELLIUS 2: stn 4.226, 2 (NNM).
KARUBAR: stn 22, 1 colony (USNM 97298). — Stn 30, 1 (POLIPI).
Queensland. Steven's Reef, 12 m, 10 corallites (USNM 78584). — Reef D, Queensland, depth unknown, 3 corallites (USNM 78585).

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

DIAGNOSIS. — Corallum composed of a cluster of elongate-conical corallites, each originating from a common basal coenosteum or the lower pedicel of a larger corallite. Largest known corallite (CORINDON 2 stn 248) 14.9 mm in GCD and 28.7 mm in height, but calices of most other corallites examined less than 5 mm in diameter. C_1 and often C_2 highly ridged, producing a calice hexagonal in outline. Corallum white. Septa of most corallites hexamerally arranged in 3 cycles ($S_1>S_2>>S_3$), only the larger corallites having a 4th cycle (48 septa). Highest cycle septa (S_3 or S_4, depending on size) rudimentary, often absent from upper corallum. Fossa quite deep; no columella.

REMARKS. — Previously reported specimens of *T. tenuescens* were small (GCD < 4.5 mm) and thus had only 3 cycles of septa. A colony from CORINDON 2 stn 248, having a much larger calice (*i.e.*, 14.9 mm GCD) and 4 cycles of septa, is included without hesitation because from its base bud two smaller corallites (GCD = 4.1 and 4.9 mm), each having only 24 septa and being similar to previously known specimens.
The colony from KARUBAR stn 22 has the C_{1-2} on the lower pedicel prominently ridged and extending outward onto the common coenosteum. Exothecal dissepiments bridge adjacent C_{1-2}, forming chambers of tissue radiating outward from the base of each corallite, each a potential bud.
This species is more fully described and illustrated by CAIRNS (1995).

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

Genus *RHIZOSMILIA* Cairns, 1978

Rhizosmilia robusta Cairns, 1993

Rhizosmilia robusta Cairns in CAIRNS & KELLER, 1993: 250-253, pl. 6, figs F-I.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 65, 1 colony of 4 corallites (MNHN).

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

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

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

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

Rhizosmilia sagamiensis (Eguchi, 1968)

Coenocyathus sagamiensis Eguchi, 1968: C34, pl. C10, figs 6-7.
Rhizosmilia sagamiensis - CAIRNS, 1994: 62-63, pl. 27, figs c-e.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5255, 1 (USNM 97300).
MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 117, 4 (USNM 97301). — Stn 131, 3 (MNHN). — Stn 134, 1 (MNHN).
Indonesia. CORINDON 2: stn 248, 10 (MNHN).

TYPE LOCALITY. — Sagami Bay, 60-80 m.

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

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

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

Rhizosmilia elata sp. nov.

Figs 18 a-b

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

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5244, holotype (USNM 97304) and 15 paratype colonies (USNM 97305).
Indonesia. DEKI: stn 27, 3 corallites, paratypes (NNM 22497).
KARUBAR: stn 86, 1 paratype colony (MNHN).

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

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

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

7.6 mm in distal calicular diameter. Main corallite of holotype colony 8.3 cm long and 11.8 mm in calicular diameter, bearing 14 smaller corallites, most of which are assumed to be the result of independent settlement of planulae. Corallites budded from edge zone of parent corallite as well as from common basal coenosteum. On elongate corallites the edge zone covers only a small distal region of the corallum, whereas the remaining theca is often encrusted with epifauna (serpulids, bivalves, etc.), including juvenile corallites of *R. elata*. Thus, an elongate corallite may bear numerous, irregularly spaced smaller corallites, the secondary corallites resulting either from true budding or larval settlement. Well-preserved pedicels of this species indicate that the C_{1-2} form prominent ridges that radiate from the corallite base onto the adjacent coenosteum where exothecal dissepiments form over these raised costae, characteristic of the genus *Rhizosmilia*. In the more distal parts, costae (C_{1-4}) are broad and convex, covered with very fine granules, and separated from one another by narrow intercostal striae. C_{1-2} usually slightly more prominent than C_{3-4} and frequently pigmented a light reddish-brown, the remainder of the corallum being white.

Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_3>S_4$. S_1 highly exsert (up to 3.5 mm), having straight, vertical inner edges that reach the columella. S_2 slightly less exsert (up to 3.0 mm), about 2/3 width of an S_1. S_3 about 1/2 width of an S_2, and only about 2.3 mm exsert. Each S_3 bordered by a thin lamellar paliform lobe 1.3-1.5 mm in width, the 12 P_3 forming a distinct palar crown. S_4 only about 1.8 mm exsert, about 1/2 width of an S_3. Fossa of moderate depth, containing a crispate columella. Endothecal dissepiments common in elongate coralla, usually visible only in longitudinal section.

REMARKS. — Five other species are known in *Rhizosmilia*: *R. maculata* (Pourtalès, 1874); *R. gigas* (van der Horst, 1931); *R. sagamiensis* (Eguchi, 1968); *R. gerdae* Cairns, 1978; and *R. robusta* Cairns, 1993. *R. elata* is distinguished in having elongate, subcylindrical corallites and pigmented C_{1-2}.

Rhizosmilia elata is similar to *Anomocora* in having elongate coralla with endothecal dissepiments and irregular budding, but can be distinguished by its well-developed P_3, the fact that its buds do not detach, and by its characteristic basal structure of raised costae overlain with exothecal dissepiments.

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

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

Phyllangia papuensis Studer, 1878

Figs 17 c, f, i

Phyllangia papuensis Studer, 1878: 642-643. — RIDLEY, 1884: 396-397, pl. 16, figs 5-10.
Blastomussa lawtoni Nemenzo, 1988: 216, fig. 1 (**new synonym**).
Phyllangia sp. - KROPP & MANNING, 1995: 535, fig. 3 a-d.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 47, 9 colony fragments: 5 (MNHN), 4 (USNM 97307). Ambon, coll. H. O. FORBES, 10 colony fragments (BMNH 1884.2.16.9-18; Ridley's, 1884 specimens).
Indonesia. DEKI: stn 24, 1 colony (NNM 22496).
Solomon Islands. *"Gazelle"*: stn 37, 10 colonies (syntypes), (ZMB 1849).
Indian Ocean. Madagascar. NW coast Nosy Be: 13°23.5'S, 47°58.5'E , 100 m, coll. R. PLANTE, 29 October 1969, 1 large colony (MNHN).
Maldives Islands. Nilandu, 20 June 1900, depth unknown, 1 colony (NNM 22495).

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

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

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

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

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

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

Genus *SYMPODANGIA* nov.

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

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

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

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

Sympodangia albatrossi sp. nov.

Figs 18 c-g

MATERIAL EXAMINED. — Types: **Philippines**. *"Albatross"*: stn 5398, holotype (USNM 97308); 400+ small branch fragments, paratypes (USNM 97308), 28 branch fragments (MNHN).
Indonesia. *"Albatross"*: stn 5586, 2 branch fragments, paratypes (USNM 97310).
KARUBAR: stn 18, 24 branch fragments, paratypes (USNM 97311).

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

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

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

Septa hexamerally arranged in 4 cycles, the 4th never complete. A full 3rd cycle of septa (a total of 24 septa) present in calices of 2.4 mm GCD, and a maximum number of 36 septa (a pair of S_4 in each system) is achieved at GCD of about 3.4 mm. S_1 exsert (0.3-0.6 mm), having straight, vertical inner edges that bear 3-5 small (85-100 µm diameter), cylindrical papillae on their lowermost edges adjacent to the columella. Accelerated S_2 (those in systems having a pair of S_4) about 0.2 mm exsert and 3/4 width of an S_1; lower, inner edges of S_2 coarsely dentate, the teeth about 0.2 mm in width, beginning slightly higher in fossa than S_1 papillae. S_3 slightly less exsert than S_3 but about equal in width, their inner edges bearing even larger teeth (up to 0.3 mm width) that extend slightly higher in fossa than those of the S_2. S_4 less exsert and about 3/4 width of an S_3, their inner edges finely dentate for most of their length. Septal faces covered with tall (up to 90 µm), blunt granules. Fossa deep and narrow. Columella papillose, but quite small, composed of 1-4 papillae of equal size to those on the lower edges of the S_1.

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

Genus ***COLANGIA*** Pourtalès, 1871

Colangia moseleyi (Faustino, 1927) comb. nov.

Cladocora conferta Moseley, 1881: 185, pl. 10, fig. 5, 5a (junior secondary homonym of *Caryophyllia conferta* Dana, 1846: 380, pl. 27, fig. 6).
Cladocora moseleyi Faustino, 1927: 112-113, pl. 15, fig. 2-3 (*nom. nov.*).

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

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

DESCRIPTION. — Lectotype collected alive, a compact colony of ca. 27 clustered corallites of various sizes, some incomplete (damaged). Colony comprises some elongate parallel incomplete corallites, 10-20 mm high, lower end broken. Endotheca can be seen inside the fractured corallites (parasmiliid character). In upper part colony spreads laterally and short corallites overgrow the elongate ones, budding from a basal sheet as in *Phyllangia*. Larger corallites up to 5 x 6 mm in calicular diameter. Septa little exsert (S_1 most exsert of all). Outer surface quite smooth, locally with very attenuate costae covered by fine granules. Smaller calices with only 3 cycles of septa; larger calices with incomplete 4th cycle (for example 14 S_4). Septa decreasing in width from S_1 to S_4. Large S_1 with straight vertical axial edge. One distinct large paliform lobe, with vertical axial edge, separated by notch from corresponding septum, associated with S_2 in smaller calices, or with S_3 in larger calices (when S_4 present in same half system). Narrower septa of subsequent cycles with more sloping (less vertical) axial edge frequently bearing 2 or 3 narrow lobes, subhorizontally or obliquely upward directed. These narrow lobes very different from the main paliform lobes (but unlike septal dentation as in true *Astrangia*). Central area of fossa (up to ca. 1/3 calice diameter) occupied by columella composed of lobes similar to paliform lobes, but smaller.

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

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

Genus ***COENOSMILIA*** Pourtalès, 1874

Coenosmilia arbuscula Pourtalès, 1874

Figs 19 a-c

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

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

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

DESCRIPTION (Specimen from *"Albatross"* stn 5543). — Corallum a bushy, irregularly branched colony of about 30 corallites showing 5 generations of budding. Colony 9 cm in width, composed of elongate-conical corallites, the largest measuring 12.1 x 12.5 mm in calicular diameter and 37 mm in length. Each corallite bears up to 7 buds that originate from the edge zone just below calicular edge. C_{1-3} usually slightly ridged near calicular edge, flat and granular, like the C_4, on lower 2/3 of corallum. Corallum uniformly white.

Septa hexamerally arranged in 3 cycles ($S_1>S_2>S_3$), S_4 represented only as small exsert costosepta at calicular margin. S_1 about 1.8 mm exsert, quite narrow (only about 2/5 calicular radius in upper corallite), having straight, entire inner edges that thicken deep in fossa near columella. S_2 about 1.1 mm exsert, 2/3 width of an S_1, having coarsely dentate inner edges near columella. S_3 about 0.9 mm exsert, 2/3 width of an S_2, having highly laciniate inner edges. S_4 about 0.4 mm exsert, occurring only at calicular edge. Fossa very deep and wide. Columella variable, but most often composed of crispate lamellae that are attached to lower, inner edges of S_{1-2}. Endothecal dissepiments present.

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

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

Genus ***GONIOCORELLA*** Yabe & Eguchi, 1932

Goniocorella dumosa (Alcock, 1902)

Pourtalosmilia dumosa Alcock, 1902c: 36-37, pl. 5, fig. 33.
Goniocorella dumosa - CAIRNS, 1982: 31-34, pl. 9, figs 7-9, pl. 10, figs 1-2 (synonymy); 1994: 63-64, pl. 27, fig. j (synonymy); 1995: 80-81, pl. 22, figs e-h (synonymy).
Goniocorella glanulosa (sic) Hu, 1987: 41, pl. 3, figs 3, 13-15, 17-20 (**new synonym**).

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5586, 9 dead fragments (USNM 97313).
South China Sea. *"Hakuho Maru"*: stn KH73-2-44-2, 2 dead fragments (USNM 97314).

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

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

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

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

Genus ***CONFLUPHYLLIA*** nov.

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

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

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

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

Confluphyllia juncta sp. nov.

Figs 19 d-g

MATERIAL EXAMINED/TYPES. — **Philippines**. MUSORSTOM 3: stn 126, 2 dead colonies, paratypes (USNM 97315).
Indonesia. DEKI: stn 59, 5 paratype colonies (NNM 22442).
KARUBAR: stn 25, holotype (MNHN) and 1 paratype colony (USNM 97316).

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

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

DESCRIPTION. — Corallum bushy, produced by closely-spaced extratentacular budding from the edge zone of parent corallites, resulting in frequent branch anastomosis. Colonial structure reinforced by solid coenosteal bridges that link adjacent corallites, as in *Goniocorella*. Coenosteal bridges circular in cross section (about 1 mm in diameter), elliptical in cross section, or lamellar, the latter shape joining two adjacent corallites by a thin coenosteal sheet several mm long. Holotype colony 7 cm wide, consisting of about 85 corallites, one (perhaps the founder corallite) 6.5 cm in length. C_1 slightly ridged, especially near calice, and usually white. C_2 may also be ridged, but only near calice. Otherwise, theca covered with low, rounded (0.2 mm diameter) granules and light yellow-brown in colour. Edge zone on corallites extends about 7 mm from calice.

Septa hexamerally arranged in 4 cycles, the last cycle not complete. Corallites less than 4 mm in GCD have 24 or less septa, but larger corallites (up to 7.2 mm in GCD) have several pairs of S_4, the most common complements being 36 or 38 septa, although some corallites have as many as 42 septa. S_1 exsert (1.3-1.5 mm), having straight, vertical inner edges that extend to the columella. S_2 less exsert (about 0.8 mm) and only 0.8 width of an S_1, also having straight inner edges that fuse with the columella deep in fossa. S_3 about 3/4 exsertness and width of an S_3. S_4 2/3 width of an S_3. Fossa deep, containing a narrow fascicular columella consisting of 1-5 thick, granular elements.

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

Family TURBINOLIIDAE H. Milne Edwards & Haime, 1848

Genus *CONOCYATHUS* d'Orbigny, 1849

Conocyathus zelandiae Duncan, 1876

Conocyathus zelandiae Duncan, 1876: 431, pl. 38, figs 1-3. — WELLS, 1964: 113-114. — FILKORN, 1994: 16. — CAIRNS, 1995: 83-84, pl. 23, figs f-i (synonymy).
Conocyathus sulcatus - TENISON WOODS, 1878: 301-302. [Not *Conocyathus sulcatus* d'Orbigny in H. Milne Edwards & Haime, 1851].
Trematotrochus zelandiae - FOLKESON, 1919: 14.
Turbinolia australiensis Gardiner, 1939: 332-333, pl. 21, fig. 2.
Conocyathus - WELLS, 1967: 355.

MATERIAL EXAMINED. — **Indonesia**. SNELLIUS 2: stn 4.056, 11 (NNM 22637).
KARUBAR: stn 44, 4 (USNM 97320). — Stn 86, 1 (MNHN).

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

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

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

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

Genus ***ENDOCYATHOPORA*** Cairns, 1989

Endocyathopora laticostata Cairns, 1989

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

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

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

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

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

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

Genus ***ALATOTROCHUS*** Cairns, 1994

Alatotrochus rubescens (Moseley, 1876)

Fig. 18 h

Platytrochus rubescens Moseley, 1876: 553.
Sphenotrochus rubescens - MOSELEY, 1881: 157-159, pl. 6, figs 8, 8a.
Alatotrochus rubescens - CAIRNS, 1994: 68-69, pl. 29, figs g-l (synonymy); 1995: 84, pl. 24, figs a-b (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Hakuho Maru"*: stn KH72-1-20, 43 (USNM 97325), 10 (ORI).
MUSORSTOM 2: stn 2, 1 (MNHN).
MUSORSTOM 3: stn 86, 1 (MNHN). — Stn 88, 1 (MNHN). — Stn 91, 1 (MNHN). — Stn 96, 2 (MNHN). — Stn 102, 1 (MNHN).
Indonesia. DEKI: stn 44, 1 (NNM 22638). — Stn 49, 1 (NNM 22639).
KARUBAR: stn 2, 9 (USNM 97324). — Stn 3, 1 (POLIPI).

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

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

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

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

Genus ***CRYPTOTROCHUS*** Cairns, 1988

"Cryptotrochus" venustus (Alcock, 1902)

Ceratotrochus venustus Alcock, 1902a: 92; 1902c: 10, pl. 1, figs 5, 5a.
Not *Cryptotrochus venustus* - CAIRNS, 1995: 88-89, pl. 26, figs g-i, pl. 27, figs a-b (= gen. nov., sp. nov., CAIRNS, in press).

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

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

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

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

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

Genus *NOTOCYATHUS* Tenison Woods, 1880

Notocyathus venustus (Alcock, 1902)

Citharocyathus venustus Alcock, 1902b: 119; 1902c: 22, pl. 3, figs 19, 19a.
Notocyathus venustus - CAIRNS, 1989a: 27-28, pl. 12, figs c-h (synonymy); 1994: 64, pl. 27, figs k-l.

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 24, 10 (NNM 22682). — Stn 44, 1 (NNM 22683). — Stn 50, 17: 1 (USNM 97336), 16 (NNM 22685). — Stn 62, 1 (USNM 97338).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 18, 1 (USNM 97339).
SNELLIUS 2: stn D2, 1 (NNM 23090). — Stn 81.2, 6 (NNM 22690).
KARUBAR: stn 2, 157 (MNHN). — Stn 3, 200+ (USNM 97327). — Stn 7, 118 (MNHN). — Stn 15, 1 (MNHN). — Stn 22, 1 (USNM 97330). — Stn 31, 5 (POLIPI). — Stn 49, 3 (POLIPI). — Stn 50, 1 (USNM 97333).

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

DIAGNOSIS. — Corallum conical, the largest Indonesian specimen (a syntype) 6.5 x 6.7 mm in calicular diameter and 9.2 mm in height. Calice almost perfectly circular: GCD:LCD = 1.02-1.05. All costae bear a row of outward projecting granules, as well as 2 rows of laterally oriented granules that project across the deep intercostal furrow. Corallum white. Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_3>>S_4$. S_1 highly exsert, their upper edges being coarsely dentate and inclined inward toward fossa. S_4 considerably less exsert and less wide, but as thick as an S_3, their septal faces often lacking granules. Within each septal system a pair of lamellar P_3 fuse in V-shaped structures before their common P_2. Fossa shallow if any; columella papillose.

REMARKS. — As previously discussed (CAIRNS, 1989a, 1994), *Notocyathus venustus* is very similar to *N. conicus* (Alcock, 1902), the coralla of small specimens being difficult or impossible to distinguish. To reiterate, *N. venustus* differs in having a nearly circular calice and thus a lower GCD:LCD (1.02-1.05 vs 1.01-1.22 for *N. conicus*), and more exsert S_{1-2} and proportionally less exsert S_4. In large specimens of *N. venustus*, S3 become almost as wide and exsert as the S_2, but the S_4 remain quite small and thin. In large specimens of *N. conicus*, the S_4 are only slightly less exsert and less wide than the S_3. This species is more fully described and illustrated by CAIRNS (1989a, 1994).

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

Notocyathus conicus (Alcock, 1902)

Citharocyathus conicus Alcock, 1902b: 118-119; 1902c: 22, pl. 3, figs 18, 18a.
Notocyathus conicus - CAIRNS, 1989a: 28, pl. 13, figs a-i (not *"Albatross"* stn 5586, a worn unidentified specimen) (synonymy); 1994: 64-65, pl. 28, figs a-b; 1995: 91-92, pl. 27, figs c, g.

MATERIAL EXAMINED. — **Philippines**. *"Hakuho Maru "*: stn KH72-1-20, 1 (USNM 97343).
MUSORSTOM 2: stn 11, 1 (MNHN). — Stn 33, 10 (USNM 81801).
MUSORSTOM 3: stn 102, 6 (MNHN). — Stn 106, 1 (MNHN).
Indonesia. DEKI: stn 6, 20 (NNM 22761).
CORINDON 2: stn 235, 3 (MNHN).
KARUBAR: stn 2, 2 (USNM 97341). — Stn 15, 4 (POLIPI). — Stn 18, 18 (MNHN). — Stn 32, 1 (USNM 97342).

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

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

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

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

Genus ***DELTOCYATHOIDES*** Yabe & Eguchi, 1932

Deltocyathoides orientalis (Duncan, 1876) comb. nov.

Deltocyathus orientalis Duncan, 1876: 431, pl. 38, figs 4-7.
Peponocyathus australiensis - CAIRNS, 1989a: 29, 30-32, pl. 14, figs d-j, pl. 15, figs a-d (synonymy); 1994: 64-65, pl. 28, figs c-f, pl. 41, fig. i (synonymy). — CAIRNS & PARKER, 1992: 39-40, pl. 13, figs c-d.
Deltocyathus lens Alcock, 1902a: 99; 1902c: 19-20, pl. 2, figs 16, 16a. — ZOU, 1988: 77-78, pl. 5, figs 6, 6a.
Not *Peponocyathus orientalis* - YABE & EGUCHI, 1932a: 444-445 [= ? *P. folliculus* (Pourtalès, 1868)].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5137 (confused origin, probably 5135), 1 (USNM 97344).
"Hakuho Maru ": stn KH72-1-20, 1 (USNM 97353).
MUSORSTOM 2: stn 33, 142 (MNHN).
MUSORSTOM 3: stn 102, 1 (USNM 97345). — Stn 117, 1 (MNHN). — Stn 139, 1 (USNM 97346).
Indonesia. DEKI: stn 6, 11 (NNM 22640). — Stn 7, 8 (ZMUC). — Stn 24, 9 (NNM 22641). — Stn 26, 1 (ZMUC). — Stn 44, 1 (NNM 22642). — Stn 46, 2 (ZMUC). — Stn 49, 18 (NNM 22643). — Stn 53, 19 (ZMUC).
"Galathea": stn 500, 1 (ZMUC).
CORINDON 2: stn 248, 3 (MNHN).
SNELLIUS 2: stn D2, 6 (NNM 23093). — Stn 81.2, 14 (NNM 22094).
KARUBAR: stn 2, 49 (MNHN). — Stn 3, 26 (POLIPI). — Stn 7, 40 (USNM 97349). — Stn 13, 2 (MNHN). — Stn 15, 35 (POLIPI). — Stn 18, 19 (USNM 97350). — Stn 22, 9 (MNHN). — Stn 28, 4 (USNM 97351). — Stn 29, 1 (MNHN). — Stn 44, 22 (MNHN). — Stn 49, 18 (MNHN). — Stn 61, 35 (POLIPI).

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

DIAGNOSIS. — Corallum bowl-shaped, with a gently rounded base. Asexual reproduction through transverse division not observed in this species. Coralla usually less than 7.5 mm in calicular diameter. Costae equal in width, separated by deep intercostal furrows of about the same width. Each costa bears a row of outward-projecting, blunt spines as well as smaller spines that project into intercostal furrows. Corallum white. Septa hexamerally arranged in 4 complete cycles above a GCD of about 3.5 mm; 24 septa are present in smaller specimens, rarely with any intermediate number. Septal formula: $S_1>S_2>S_4>S_3$, all septa being equally exsert. S_1 independent; pairs of S_3 join S_2 and pairs of S_4 to S_3 within each septal system. P_{2-3}, and occasionally P_1, present. Columella papillose.

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

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

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

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

Genus ***PEPONOCYATHUS*** Gravier, 1915

Peponocyathus minimus (Yabe & Eguchi, 1937)

Fig. 18 i

Discotrochus (Cylindrophyllia) minimus Yabe & Eguchi, 1937: 146-147, pl. 20, figs 16-22; 1942b: 118.
Cylindrophyllia minimus - SQUIRES, 1958: 58. — EGUCHI, 1965: 289, 2 figs. — KIKUCHI, 1968: 8, figs 3a, b. — HU, 1988: 151, pl. 1, figs 9-12, 14-15.
Peponocyathus folliculus - CAIRNS, 1989a: 32-33 (in part: pl. 15, e-h, *"Albatross"*: stns 5172, 5217, 5311). [Not *Stephanophyllia folliculus* Pourtalès, 1868].
Cylindrophyllia orientalis - MORI & MINOURA, 1983: 185-191, figs 1-6. [Not *Peponocyathus orientalis* Yabe & Eguchi, 1932].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5172, 1 (USNM 81838). — Stn 5217, 1 (USNM 81839). — Stn 5236, 36 (USNM 97354). — Stn 5311, 6 (USNM 81841). — Stn 5312, 8 (USNM 97355). — Stn 5313, 13 (USNM 97356). — Stn 5315, 3 (USNM 97357). — Stn 5424, 1 (USNM 97358). — Stn 5579, 1 (USNM 97359). — Stn 5586, 8 (USNM 97360).
"Galathea": stn 477, 3 (ZMUC).
Indonesia. CORINDON 2: stn 210, 1 (MNHN). — Stn 235, 1 (MNHN).
SNELLIUS 2: stn 81.2, 4 (NNM 22762, 23099).
KARUBAR: stn 2, 4 (POLIPI). — Stn 3, 195 (POLIPI). — Stn 7, 500+ (USNM 97362). — Stn 15, 16 (MNHN). — Stn 18, 13 (MNHN). — Stn 22, 1 (MNHN). — Stn 44, 4 (MNHN). — Stn 49, 33 (MNHN). — Stn 61, 4 (MNHN).

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

DIAGNOSIS. — Anthocaulus not yet known for this species. Anthocyathus cylindrical (usually wider than high), often with a flat base, the result of asexual transverse division. Anthocyathi in process of division rare (but see Fig. 18i), the corallum base appearing "unfinished" or open (thickened closing deposit not yet developed), characteristic of a recent fission from a parent corallum. Corallum rarely over 4.0 mm in calicular diameter. Costae equal in width and covered with fine granules; costae separated by relatively wide intercostal furrows, often as wide as the costae. If C_4 are present, they originate on the horizontal flat base, not the vertical thecal walls. Corallum white. Septa hexamerally arranged in 3 to 4 cycles, the 4th cycle never complete, most coralla having 24 or 36 septa: $S_1 > S_{2-3}$. Small pali present before all but last septal cycle.

REMARKS. — *Peponocyathus minimus* is similar to *P. folliculus*, both species being known from the Philippine region. CAIRNS (1989a) mistakenly included 3 lots of *P. minimus* in a previous account of *P. folliculus* (see synonymy). *P. minimus* differs in having a short, squat corallum (that of *P. folliculus* is usually higher than wide); a flat base, not rounded; and intercostal furrows almost as wide as the costae (those of *P. folliculus* being very narrow and the costae quite wide). Furthermore, in *P. minimus* pairs of C_4 originate on the anthocyathus base, in *P. folliculus* on the thecal edges.

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

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

Peponocyathus folliculus (Pourtalès, 1868)

Stephanophyllia folliculus Pourtalès, 1868: 139.
Peponocyathus orientalis Yabe & Eguchi, 1932b: 444-445, unnumb. figs.
Peponocyathus folliculus - ZIBROWIUS, 1980: 113-115, pl. 58, figs A-L, pl. 59, figs A-K (synonymy). — CAIRNS, 1989a : 32-33 (in part: pl. 16, figs a-c, *"Albatross"* stns 5277, 5577, 5584); 1994: 66-67, pl. 28, figs g-k.

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

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

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

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

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

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

Tropidocyathus lessonii (Michelin, 1842)

Flabellum lessonii Michelin, 1842: 119.
Trochocyathus (Tropidocyathus) lessoni - ALCOCK, 1902c: 17, pl. 2, figs 14, 14a.
Tropidocyathus lessonii - ZOU *et al.*, 1988: 195.
Tropidocyathus lessoni - CAIRNS, 1989a: 33-34, pl. 16, figs d-l (synonymy); 1994: 67, pl. 29, figs a-b (synonymy). — CAIRNS & KELLER, 1993: 253, pl. 7, fig. C.

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

TYPE LOCALITY. — Unknown.

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

low, blunt granules, 3 or 4 occurring across the width of each C_{1-3}. Costae do not extend to thecal edge crests; however, crests are covered with low aligned granules and ridges. Theca pale orange; calicular elements white. Septa hexamerally arranged in 4 cycles: $S_1>S_2>S_3>S_4$. Lamellar pali present before S_{1-3}. Columella papillose.

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

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

"Tropidocyathus" pileus (Alcock, 1902)

Figs 19 h-i

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

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

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

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

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

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

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

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

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

DIAGNOSIS. — Corallum variable in shape: viewed from the side, most coralla are trapezoidal, the basal (shortest) edge often being straight or slightly curved. Other coralla triangular in profile or bowl-shaped. All coralla laterally compressed, resulting in an elliptical calice with a GCD:LCD = 1.50-1.65. Largest specimen (KARUBAR stn 2) 17.9 x 24.8 mm in calicular diameter and 20.8 mm in height. Thecal edges rounded and occasionally slightly protuberant near corallum base. Highly ridged, vertically oriented costae continuous from calice to base, extending onto edge protuberances. Costae bear 1 apical row of coarse teeth and smaller, laterally oriented granules. Intercostal furrows deep. Corallum white. Septa hexamerally arranged in 4 to 5 cycles (see Remarks): $S_1>S_2>S_4>S_3$ or $S_1>S_2>S_3>S_5>S_4$. Lamellar pali occur before all but last septal cycle (P_{1-3} or P_{1-4}), the P_2 and 2 P_3 within each system in a chevron-shaped arrangement. Columella linear-papillose.

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

All specimens obtained from the Indonesian region differ from typical *"T." pileus* in having more than 4 cycles of septa, often a full 5th cycle (96 septa) or pairs of S_5 in the 4 systems adjacent to the principal septa, resulting in 80 septa, some coralla even having a few pairs of S_6. This higher number of septa does not seem to be related to a larger corallum size, since specimens as small as 9.8 mm in GCD (*e.g.*, KARUBAR stns 3, 7) have a full 5th cycle. Coralla having 5 cycles of septa are often triangular (not trapezoidal) in profile and have finer (thinner) costae, their C_5 originating on the thecal faces 2-7 mm above the base.

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

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

"Tropidocyathus" labidus sp. nov.

Figs 20 a-g

MATERIAL EXAMINED/TYPES. — **Indonesia**. DEKI: stn 52, 1 paratype (NNM 22775).
"Galathea": stn 500, 1 (ZMUC).
KARUBAR: stn 2, holotype (MNHN) and 5 paratypes (MNHN). — Stn 3, 38 paratypes (MNHN). — Stn 7, 40 paratypes (USNM 97384). — Stn 15, 1 paratype (MNHN). — Stn 32, 1 paratype (POLIPI).
Japan. *"Tansei Maru"*: stn KT93-09-AM8, 3 paratypes (USNM 97385).

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

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

DESCRIPTION. — Corallum compressed-conical, resulting in a GCD:LCD of 1.06-1.23. Holotype 6.4 x 7.9 mm in calicular diameter and 10.5 mm in height; largest specimen (DEKI stn 52) 9.8 x 11.4 mm in calicular diameter and 13.2 mm in height. Tip of base pointed, covered by the slender lower distal edges of the 12 C_3; C_{1-2} originate about 0.5 mm above basal tip; C_4 originate 1.5-3.0 mm above tip. C_4 on centre of thecal faces originate highest on face, whereas C_4 near thecal edges originate lowest, such that the points of origin of the 6 pairs of C_4 on either thecal face form a crescent (Fig. 20d), the arc of which encircles the basal tip. Each costa bears a row of low, large (200-250 µm in diameter), smooth, rounded granules, producing a slippery texture. Intercostal furrows deep and narrow (50 µm). Corallum theca pale orange, as in *T. lessonii*, but basal tip and all calicular elements white. Dead specimens also uniformly white.

Septa hexamerally arranged in 4 complete cycles: $S_1>S_2>S_4>S_3$ (48 septa). S_1 highly exsert (up to 1.6 mm), having highly sinuous inner edges. S_2 slightly less exsert, about 4/5 width of an S_1, also having sinuous inner edges. S_3 much less exsert (about 0.8 mm), about 2/3 width of an S_2, having sinuous inner edges. S_4 as exsert as S_3, but wider than the S_3 (almost as wide as the S_2), having straight, thin inner edges. A crown of 12 sinuous-lamellar P_{1-2} encircles the columella, the P_1 about 0.5 mm in width, the P_2 about twice that width. A 2nd crown of 12 P_3, each P_3 about the same width of a P_2, stands higher in the fossa. Inner edges of P_3 slightly recessed from columella, each pair of P_3 within a system forming a chevron arrangement with its common P_2. All septa and pali bear tall (up to 0.11 mm), slender, pointed spines. Fossa shallow. Columella consists of a line of 3-6 robust papillae, fused at their bases to inner edges of P_{1-2}.

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

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

Genus *IDIOTROCHUS* Wells, 1935

Idiotrochus kikutii (Yabe & Eguchi, 1941)

Placotrochides kikutii Yabe & Eguchi, 1941a: 104; 1942b: 149, pl. 9, fig. 16a-c.
Idiotrochus kikutii - CAIRNS, 1989a: 36-37, pl. 18, figs a-b, d-h (synonymy); 1994: 69, pl. 30, figs a-d.

MATERIAL EXAMINED. — **Philippines:** MUSORSTOM 2: stn 32, 2 (MNHN). — Stn 33, 409: 33 (USNM 81911), 376 (MNHN).
MUSORSTOM 3: stn 102, 1 (MNHN). — Stn 117, 2 (MNHN).
Indonesia. DEKI: stn 46, 1 (ZMUC).
SNELLIUS 2: stn D2, 1 (NNM 23088).
KARUBAR: stn 2, 17 (MNHN). — Stn 3, 30 (MNHN). — Stn 7, 32 (USNM 97387). — Stn 15, 111 (USNM 97388). — Stn 18, 13 (MNHN). — Stn 22, 39 (POLIPI). — Stn 49, 23 (MNHN).

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

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

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

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

Genus ***THRYPTICOTROCHUS*** Cairns, 1989

Thrypticotrochus multilobatus Cairns, 1989

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

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 102, 2 (ZMA Coel. 710b).
MUSORSTOM 2: stn 33, 1 (MNHN).
MUSORSTOM 3: stn 100, 1 (MNHN).
Indonesia. DEKI: stn 46, 1 (ZMUC).
KARUBAR: stn 2, 1 (MNHN). — Stn 3, 10 (POLIPI). — Stn 7, 24 (USNM 97391). — Stn 18, 1 (MNHN).

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

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

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

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

Superfamily FLABELLOIDEA Bourne, 1905

Family GUYNIIDAE Hickson, 1910

Genus ***GUYNIA*** Duncan, 1872

Guynia annulata Duncan, 1872

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

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 10: 2 (MNHN), 8 (USNM 81892).
MUSORSTOM 3: stn 87, 1 (USNM 97382). — Stn 101, 1 (MNHN). — Stn 102, 7 (MNHN). — Stn 117, 1 (MNHN). — Stn 131, 1 (MNHN). — Stn 140, 1 (USNM 97394).
Indonesia. KARUBAR: stn 2, 4 (1 octameral, 1 nonameral, 2 decameral) (POLIPI). — Stn 3, 6 (3 octameral and 3 decameral) (MNHN). — Stn 7, 2 (1 octameral, 1 decameral) (MNHN). — Stn 15, 24 (16 octameral, 8 decameral) (USNM 97396). — Stn 22, 2 (hexameral)(MNHN). — Stn 28, 2 (decameral) (POLIPI). — Stn 29, 1 (decameral) (USNM 97398).
Japan. *"Tansei Maru"*: stn KT93-09-AM7, 3 (USNM 93159).

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

DIAGNOSIS. — Corallum cylindrical and quite small, rarely over 7 mm in length and 1.0-1.3 mm in diameter, straight to serpentine. Some coralla firmly attached along one side of the corallum, others attached at random points of their theca to sand grains, pebbles, or foraminifera. One specimen (MUSORSTOM 3 stn 140) was laterally attached to a dead specimen of *Heteropsammia*. Epitheca bears 2 sets of ridges: transverse, circumferential ridges, and 16, 18, or 20 longitudinal costal ridges, which form a grid-like pattern of rectangles. Within each rectangle is a chalky white thecal spot. Septa usually octamerally arranged in 2 cycles, the S_1 much thicker than the S_2; among the KARUBAR specimens there was an almost equal division between the typical octameral form (having 16 septa) and decameral specimens (having 20 septa), and one specimen having 18 septa. These septal symmetries are indicated in the Material Examined section. Furthermore, some small specimens have a hexameral symmetry. All septa have highly sinuous inner edges. Columella a single twisted or trefoil ribbon.

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

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

Family FLABELLIDAE Bourne, 1905

Genus ***FLABELLUM*** Lesson, 1831

Subgenus ***FLABELLUM (FLABELLUM)*** Lesson, 1831

Flabellum (F.) pavoninum Lesson, 1831

Fig. 20 h

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

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

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

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

DIAGNOSIS. — The specimens reported herein are all relatively small coralla of the *coalitum* form, the largest (CORINDON 2 stn 216) only 16.4 x 29.9 mm in calicular diameter and 29.2 mm in height. Angle of thecal edges ranges from 71°-113°; angle of thecal faces, 33°-43°. Thecal faces slightly convex and coarse in texture, meeting in acute thecal edges that often bear low, discontinuous crests. Calicular edge smooth. Theca of well-preserved specimens reddish-brown, often more intensely striped along the C_{1-3}, as in *F. politum* Cairns, 1989. Pedicel elongate and slender (1.1-1.5 mm in diameter), having 6 protosepta in the basal disc. Septa hexamerally arranged in 6 cycles: $S_{1-3}>S_4>S_5>S_6$. Lower, inner edges of S_{1-3} moderately sinuous, whereas their upper, outer margins (adjacent to theca) are notched, rising above calicular edge as exsert lobes. Columella rudimentary.

REMARKS. — Small specimens of *F. pavoninum* forma *coalitum* are similar to adult *F. politum* in many characters, but can be distinguished by having coarse, slightly convex thecal faces; less acute thecal edges; and less sinuous inner edges of the S_{1-3}. *F. pavoninum* is more fully described by CAIRNS (1989a, 1994).

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

Flabellum (F.) magnificum Marenzeller, 1904

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

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 15, 1 (USNM 97476). — Stn 75, 4 (MNHN). — Stn 78, 4 (MNHN).
MUSORSTOM 3: stn 135, 1 (USNM 97477).
Indonesia. DEKI: stn 3, 4 (NNM 22585). — Stn 12, 1 (NNM 22585). — Stn 41, 8 (NNM 22586). — Stn 42, 1 (NNM 22584).
KARUBAR: stn 12, 1 (MNHN). — Stn 36, 2 (MNHN). — Stn 59, 9 (MNHN). — Stn 67, 1 (USNM 97479). — Stn 69, 13 (USNM 97480). — Stn 70, 9: 7 (POLIPI), 2 (USNM 97481). — Stn 77, 11 (POLIPI). — Stn 85, 1 (POLIPI).

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

DIAGNOSIS. — Angle of thecal edges 140°-172°; angle of planar, slightly concave thecal faces, 44°-58°. GCD:H = 1.29-*1.48*-1.71, all coralla being significantly wider than tall and having long thecal edges. Largest specimen (KARUBAR stn 12) 57 x 90 mm in calicular diameter and 61 mm in height. Thecal faces meet in straight, acute edges but only rarely are edge crests present. Calicular edge smooth. Coralla homogeneously reddish-brown or white. Pedicel relatively short, 1.5-2.3 mm in diameter, containing 6 protosepta at the basal disc. Septa hexamerally arranged in 7 cycles: $S_{1-4}>S_5>S_6>S_7$, only the larger coralla having a complete 7th cycle of 384 septa, and one (the largest specimen examined) also having one pair of S8. S_{1-4} quite narrow near calicular edge but abruptly widening 10-12 mm lower in fossa, resulting in a very high septal concavity index. Lower, inner edges of S_{1-4} highly sinuous. Columella as in *F. lamellulosum*.

REMARKS. — *Flabellum magnificum* is one of the larger deep-water solitary scleractinians, second in size only to *F. impensum* Squires, 1962 and perhaps certain gigantic *Desmophyllum dianthus* (Esper, 1794) and *Rhizotrochus typus* H. Milne Edwards & Haime, 1848. It is easily confused with another large species, *F. lamellulosum* Alcock, 1902, but can be distinguished by: its broad corallum (GCD:H = 1.48 average vs 1.05 average for *F. lamellulosum*); its long, uncrested thecal edges (LEL:H = 0.70 average vs 0.48 average for *F. lamellulosum*); its sinuous S_{1-4} (SSI = 4.8 average vs 1.13 average for *F. lamellulosum*); and its wide S_{1-4} (SCI = 14.7 average vs 9.4 average for *F. lamellulosum*).

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

Flabellum (F.) patens Moseley, 1881

Fig. 20 i

Flabellum patens Moseley, 1881: 172 (in part: pl. 6, fig. 15). — CAIRNS, 1989a: 51-52, pl. 26, figs a-i (synonymy); 1989b: 67; 1994: 71-72, pl. 31, figs g-i.
Flabellum australe - ALCOCK, 1902c: 30-31. [Not *Flabellum australe* Moseley, 1881].

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 126, 1 (MNHN).
Indonesia: *"Siboga"*: stn 251, 1 (ZMA).
"Hakuho Maru": stn KH72-1-28, 2: 1 (USNM 97469), 1 (ORI).
KARUBAR: stn 5, 2 (MNHN). — Stn 31, 1 (MNHN).

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

DIAGNOSIS. — Corallum highly compressed, resulting in a very low angle of thecal faces (20°-24°), a very high GCD:LCD (2.0-2.5), and a very narrow fossa. Angle of thecal edges 76°-155°; GCD:H rather low (average = 1.04), indicating corallum to be approximately as tall as wide. Largest specimen known (*"Albatross"* stn 5313) 28.9 x 67.5 mm in calicular diameter and 54.7 in height, but most specimens examined less than 45 mm in GCD. Calicular edge smooth. Thecal edges prominently crested, usually as one continuous ridge, but occasionally forming spurs as in *F. lamellulosum*. Corallum white to grey, the theca near calicular edge usually discoloured and slightly corroded as a band 3-5 mm in width that parallels the calicular edge, an indication of an association with a commensal *Lumbrineris* polychaete (ZIBROWIUS, SOUTHWARD, & DAY, 1975). Pedicel elongate and slender (1.5-2.0 mm in diameter), containing 6 protosepta at the basal disc. Septa hexamerally arranged in 6 cycles: $S_{1-4}>S_5>S_6$, only the largest specimens (GCD > 40 mm) having some S_7. S_{1-4} relatively narrow, their inner edges almost in contact with those from opposite side across a narrow fossa; columella rudimentary.

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

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

Flabellum (F.) lamellulosum Alcock, 1902

Fig. 21 a

Flabellum lamellulosum Alcock, 1902a: 105-106; 1902c: 30, pl. 4, figs 28, 28a-b. — CAIRNS, 1989a: 52-53, pl. 27, figs a-l (synonymy); 1989b: 67.
Flabellum distinctum - ALCOCK, 1902c: 30 (in part: *"Siboga"* stn 12). [Not *Flabellum distinctum* H. Milne Edwards & Haime, 1848].
Flabellum pavoninum - FAUSTINO, 1927: 45-46 (in part). [Not *Flabellum pavoninum* Lesson, 1831].

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

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

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

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

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

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

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

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

DIAGNOSIS. — Angle of thecal edges 130°-240°; angle of planar thecal faces 32°-51°. GCD:H = 0.79-*1.05*-1.29, most coralla being higher than wide and having relatively short thecal edges. Largest specimen known (KARUBAR stn 70) 49 x 68 mm in calicular diameter and 67 mm in height. Calicular edges smooth. Thecal edges prominently crested, the crests beginning almost immediately adjacent to pedicel, formed by successive eversions (spurs) of the calice associated with the 2 principal septa and costae and subsequent retrenchment of the calice edge. Thecal edges of large specimens may bear 6 or 7 such spurs, some up to 8 mm in height. Well-preserved coralla homogeneously reddish-brown or white with reddish-brown stripes corresponding to C_{1-4}. Pedicel short and 1.5-2.1 mm in diameter, containing 6 protosepta in the basal disc. Septa hexamerally arranged in 7 cycles, the last cycle usually incomplete: $S_{1-4}>S_5>S_6>S_7$. Septa relatively narrow, having thickened, straight, lower inner edges. Columella a well-developed crescent of trabeculae 1.0-1.5 mm in width.

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

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

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

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

Flabellum (F.) politum Cairns, 1989

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

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

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

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

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

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

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

DIAGNOSIS. — Angle of thecal edges 90°-136°; angle of thecal faces 30°-45°. GCD:H = 0.98-1.30, indicating that most specimens are slightly wider than high. Largest known specimen (*"Albatross"* stn 5392) 22.0 x 36.1 mm in calicular diameter and 29.7 mm in height. Calicular edges smooth. Thecal faces planar, smooth, and porcellaneous, meeting in sharp, acute edges, which may bear a low thecal crest. Theca of well-preserved coralla reddish-brown, with stripes of more intense pigmentation associated with C_{1-3}. Pedicel elongate, 1.0-1.4 mm in cross section, and broken in all specimens examined, revealing the 6 protosepta. Septa hexamerally arranged in 6 complete cycles: $S_{1-3}>S_4>S_5>S_6$ (192 septa). Lower, inner edges of S_{1-3} highly sinuous. Columella rudimentary.

REMARKS. — *Flabellum politum* is distinguished from other West Pacific species of *Flabellum* by having a relatively small corallum; a smooth, lustrous theca; and S_{1-3} with highly sinuous inner edges. The species is more fully described by CAIRNS (1989a).

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

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

Flabellum (U.) deludens Marenzeller, 1904

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

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

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

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

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

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

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

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

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

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

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

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

	F. deludens	*F. marenzelleri*	*F. japonicum*	*F. hoffmeisteri*
Calicular Margin	Deeply lacerate rectangular lancets to 6 mm height	Lacerate rectangular lancets to 4 mm height	Serrate triangular apices (S1-2) to 3.5 mm height	Serrate triangular apices (primary septa) to 2.0 mm height
Septal Symmetry and Number	$S_{1-2}>S_3>S_4>>S_5$ or 16:16:32:32; 72 septa	16:16:32:0-32; 64-96 septa	$S_{1-2}>S_3>S_4>>S_5$; 96 septa	16:16:32:0-64; 64-128 septa
Thecal Face Concavity	Slightly convex	Little (almost planar)	Highly convex	Highly convex
Edge Crests	Pedicel to calice	Pedicel to calice	Pedicel to half way to calice	Rudimentary
Edge Angle	115°-150°	84°-112°	90°-108°	63°-112°
Face Angle	64°-80°	39°-52°	65°-88°	50°-67°
Robustness	Fragile	Robust	Fragile	Robust

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

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

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

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

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

Flabellum (U.) marenzelleri Cairns, 1989

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

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5523, 1 (USNM 97410).
MUSORSTOM 1: stn 40, 1 (MNHN).
Indonesia. DEKI: stn 52, 1 (NNM 22757).
"Hakuho Maru": stn KH72-1-28, 3 (USNM 97407). — Stn KH85-1-A1, 3: 1 (USNM 97409), 2 (ORI). — Stn KH85-1-A2, 1 (USNM 97408).
KARUBAR: stn 2, 4 (MNHN). — Stn 35, 2 (USNM 97406). — Stn 36, 2 (MNHN).

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

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

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

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

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

Flabellum (U.) japonicum Moseley, 1881

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

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 95, 1 (ZMA).
"Galathea": stn 436, 22 (ZMUC).
MUSORSTOM 2: stn 36, 2 (USNM 97402). — Stn 40, 1 (MNHN). — Stn 44, 2 (MNHN). — Stn 49, 10 (MNHN).
MUSORSTOM 3: stn 95, 1 (MNHN). — Stn 122, 15 (USNM 97403). — Stn 123, 10: 5 (MNHN), 5 (USNM 97404). — Stn 128, 2: 1 (MNHN), 1 (USNM 97405).

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

DIAGNOSIS. — Angle of thecal edges 90°-108°; angle of thecal faces 65°-88°. Largest known specimen (MUSORSTOM 3 stn 123) 47 x 62 mm in calicular diameter and 33 mm in height. Corallum very fragile, campanulate, and laterally compressed, having convex thecal faces that meet in sharp, crested thecal edges. Edge crests low, usually not extending to calice. Calicular edge serrate, a small (up to 3.5 mm) equilaterally triangular apex corresponding to each S_{1-2}. Upper part of corallum with reddish-brown stripes corresponding to C_{1-2}; lower part often discoloured (superficially eroded). Pedicel circular to slightly elliptical in cross section (occasionally elongate), 2.1-2.7 mm in greater diameter, short, containing 12 protosepta at the basal disc. Septa hexamerally arranged in 5 cycles: $S_{1-2}>S_3>S_4>>S_5$, a full 5th cycle present only in large coralla.

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

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

Flabellum (U.) hoffmeisteri Cairns & Parker, 1992

Flabellum japonicum - ALCOCK, 1902c: 32-33 (in part: *"Siboga"* stn 212). — HOFFMEISTER, 1933: 7, pl. 1, figs 1-2. [Not *Flabellum japonicum* Moseley, 1881].
Flabellum n. sp. - CAIRNS, 1989a: 57 (in part: pl. 29, figs j-k).
Flabellum (U.) hoffmeisteri Cairns & Parker, 1992: 47-48, pl. 16, figs d-f (synonymy). — CAIRNS, 1995: 103-104, pl. 33, figs g-h.

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 212, 1 (ZMA).
DEKI: stn 56, 3 (NNM 22541).
KARUBAR: stn 9, 1 (USNM 97411). — Stn 10, 13 (MNHN). — Stn 12, 83 (USNM 97412). — Stn 13, 1 (MNHN). — Stn 35, 1 (POLIPI). — Stn 39, 2 (USNM 97413). — Stn 40, 16 (MNHN). — Stn 59, 76 (MNHN). — Stn 69, 19 (MNHN). — Stn 70, 6 (MNHN). — Stn 71, 1 (USNM 97415). — Stn 75, 2 (POLIPI). — Stn 77, 23 (MNHN).

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

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

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

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

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

Flabellum (U.) messum Alcock, 1902

Flabellum laciniatum var. *messum* Alcock, 1902c: 31.
Flabellum (U.) messum - CAIRNS, 1989a: 58-59, pl. 30, figs f-i, k (synonymy); 1995: 101-102, pl. 33, figs a-c. — CAIRNS & KELLER, 1993: 263, pl. 10, figs G-H.

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

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

DIAGNOSIS. — Corallum highly compressed and constricted medially. Angle of straight, crested thecal edges 131°-210°; angle of concave thecal faces 36°-44°. Largest known specimen (KARUBAR stn 57) 31 x 56 mm in calicular diameter and 42 mm in height. Thecal edge crests extend from pedicel to calicular edge. Calicular edge highly lacerate, but rarely well preserved because of extreme fragility. Pedicel circular to slightly elliptical in cross section, up to 3.4 mm in greater diameter, short, and containing 12 protosepta at the basal disc. Thecal faces rough in texture. Corallum reddish-brown, except for pedicel and edge crests, which are white. Septa hexamerally arranged in 5 cycles: $S_{1-3}>S_4>S_5$ (96 septa). Fossa deep and narrow.

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

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

Flabellum (U.) sp.

Figs 21 d-f

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 78, 1 (MNHN).
New Zealand Region: *"Tangaroa"*: stn G3, 1 (USNM 94329). — Stn U582, 3 (USNM 94330).

DESCRIPTION. — The single Philippine specimen measures 24.9 x 32.0 mm in calicular diameter, 21.8 mm in height, and is curved 45° in plane of LCD. Its edge angle is 48° and its face angle is also approximately 48°, but the lower 6 mm of the corallum has a much higher edge angle and lower face angle than the upper part. Thecal faces convex, in lower half of corallum, meeting in an acute angle at thecal edges; in upper half thecal edges rounded. Calicular edge lacerate, each S_{1-2} and adjacent pair of S_4 forming a lancet about 3 mm in height. Pedicel circular, 1.6-1.7 mm in diameter, containing 6 protosepta at basal disc. Corallum white with very faint reddish-brown stripes associated with C_{1-2} and upper, outer edges of S_{1-2}.

Septa hexamerally arranged in 5 cycles, the 5th incomplete: $S_{1-2}>S_3>S_4>S_5$; pairs of S_5 occur only adjacent to S_3 (not S_{1-2}), resulting in 72 septa. Inner septal edges sinuous, the lower edges of S_{1-2} contributing to an elongate columella.

A well-preserved specimen from the New Zealand region (*"Tangaroa"* stn G3) is larger (29.8 x 33.6 mm in calicular diameter and 31.1 mm in height), curved 90°, and has more septa, *i.e.*, 90. It is otherwise similar to the Philippine specimen.

REMARKS. — The specimens reported above are similar to *F. moseleyi* Pourtalès, 1880, which is the only other species in the subgenus known to have a secondarily free, curved corallum. It differs in having fewer septa at a corresponding GCD (the 5th cycle of *F. moseleyi* is complete at a GCD of about 30 mm) and in its method of septal insertion, *i.e.*, S_4 pairs insert adjacent to S_3 before adjacent to S_{1-2}. *F. moseleyi* also has much more prominent (up to 6 mm) and more slender, triangular calicular lancets. *F. moseleyi* is known only from the Caribbean and eastern Gulf of Mexico, depth 216-1097 m (CAIRNS, 1979). Although the specimens reported above may represent an undescribed species, not enough specimens are available to properly describe it or definitively distinguish it from *F. moseleyi*.

DISTRIBUTION. — *Philippines:* Verde Island Passage; 441-550 m. *Elsewhere*: Norfolk Ridge between Norfolk Island and New Caledonia; Three Kings Ridge; 710-1058 m.

Flabellum (U.) sexcostatum Cairns, 1989

Flabellum (U.) sexcostatum Cairns, 1989a: 59, pl. 30, fig. j, pl. 31, figs a-b.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 47, 4: 2 (MNHN), 2 (USNM 97470).

TYPE LOCALITY. — *"Albatross"* stn 5284: 13°42'05"N, 120°30'45"E (Verde Island Passage, Philippines), 772 m.

DIAGNOSIS. — Corallum laterally compressed, the slightly convex thecal faces meeting at acute, carinate edges; edge crests small and present only on lower half of corallum. Angle of thecal edges changes from 90°-130° to 55°-75° 12-15 mm above the base; angle of thecal faces changes from 61°-73° to 29°-36°. Also at this height the 4 lateral C_1 are prominently ridged. Largest known specimen (MUSORSTOM 1 stn 47) 32.3 x 50.7 mm in calicular diameter and 42.2 mm in height. Calicular edges serrate, each S_{1-2} producing a tall (up to 4 mm) triangular lancet. Pedicel elliptical in cross section (2.0-2.1 mm in greater diameter), short, containing 12 protosepta at the basal disc. Septa hexamerally arranged in 5 cycles: $S_{1-2}>S_3>S_4>S_5$ (96 septa).

REMARKS. — This is the 2nd report of *F. sexcostatum*, the MUSORSTOM specimens being collected close to the type locality.

Flabellum sexcostatum was not placed by CAIRNS (1989a) in a species group within the subgenus *Flabellum (Ulocyathus)* because it is intermediate in shape between the laterally compressed and bowl-shaped groups. The species is more fully described and illustrated by Cairns (1989a).

DISTRIBUTION. — Philippines: known from only 12 specimens from the Verde Island Passage Luzon; 685-772 m.

Flabellum (U.) conuis Moseley, 1881

Figs 21 b-c

Flabellum conuis Moseley, 1881: 165-166, pl. 7, figs 6a-b.
Flabellum (U.) conuis - Cairns, 1989a: 59-60, pl. 31, figs c-g.

Material examined. — **Philippines**. *"Hakuho Maru":* stn KH72-1-8, 3 (USNM 97472).
Estase 2: stn 6, 1 (MNHN).
Indonesia. *"Galathea"*: stn 489, 2 (ZMUC).
Japan. *"Tansei Maru"*: stn KT86-16 F, 1 (USNM 97473).

Type Locality. — *"Challenger"* stn 218: 2°33'S, 144°04'E (Admiralty Islands), 1994 m.

Diagnosis. — Angle of thecal edges 45°-65°; angle of thecal faces 35°-50°. Corallum campanulate. Largest known specimen (*"Hakuho Maru"* stn KH72-1-8) 43.8 x 47.6 mm in calicular diameter and 37.3 mm in height. Calice slightly elliptical: GCD:LCD = 1.05-1.30. Thecal edges and faces convex. No edge crests, but the 6 C_1 are slightly ridged on lower half of corallum. Calicular edge serrate, a short (up to 3.5 mm) equilaterally triangular apex corresponding to each S_{1-2}, but generally damaged because of high fragility. Pedicel circular in cross section (2.1-2.3 mm in diameter), short, containing 12 protosepta at the basal disc. Theca smooth, light grey in colour. Septa hexamerally arranged in 5 cycles, the 5th cycle rudimentary and sometimes missing: $S_{1-2}>S_3>S_4>>S_5$. Fossa deep and narrow.

Remarks. — *Flabellum conuis* is unique in this region within the subgenus in having a bowl-shaped or campanulate corallum (Cairns, 1989a) and an almost circular corallum. Its deep range also distinguishes it from other *Flabellum* in the region. It is more fully described by Cairns (1989a).

Distribution. — *Philippines*: Sulu Sea (Palawan); Sulu Archipelago (Sibuto Passage); 2021-2570 m. *Indonesia*: Bali Sea; 1160 m. *Elsewhere*: Admiralty Islands; Bungo Strait, Japan; 1994-2603 m.

Genus ***POLYMYCES*** Cairns, 1979

Polymyces wellsi Cairns, 1991

Polymyces wellsi Cairns, 1991: 22, pl. 8, figs f, i, pl. 9, figs a-b; 1995: 108-109, pl. 35, figs d-f.

Material examined. — **Philippines**. Musorstom 3: stn 94, 1 (USNM 97484).
Indonesia. Deki: stn 59, 22 (NNM 22721).
Karubar: stn 13, 3 (MNHN).

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

Diagnosis. — Corallum elongate-conical, straight, with a slightly flared calice; corallum fragile. Philippine specimen 14 mm in GCD and 45 mm in height. Calicular edge jagged, a high (up to 5 mm) triangular lancet corresponding to each S_{1-2}. Pedicel thickened by asymmetrical development of 4 contiguous, hollow rootlets, 2 flanking each side of the 2 principal septa. These rootlets grow downward, completely encircle the base, and fuse, forming a V-shaped junction near the base of opposite thecal side. Theca smooth, streaked with reddish-brown pigment corresponding to the C_{1-2}, although rootlets and pedicel remain white. Septa hexamerally arranged in 5 complete cycles: $S_{1-2}>S_3>S_4>S_5$.

Remarks. — The distinctive asymmetrically placed rootlets distinguish *P. wellsi* from all other flabellids in the region. It is more fully described by Cairns (1991, 1995).

DISTRIBUTION. — *Philippines*: Lubang Island; 842 m. *Indonesia*: Banda Sea (Kai Islands); 385-417 m. *Elsewhere*: Galápagos; northeastern New Zealand; Kermadec Islands; 355-1165 m.

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

Rhizotrochus typus H. Milne Edwards & Haime, 1848

Figs 22 d-e

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).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn 131, 9: 5 (MNHN), 4 (USNM 97486).
Indonesia. *"Siboga"*: stn 260, 1 (ZMA).
DEKI: stn 5, 2 (NNM 22426). — Stn 24, 4 (NNM 22420, 22422). — Stn 25, 1 (NNM 22423, 23096). — Stn 26, 2 (NNM 22419). — Stn 27, 3 (NNM 22427). — Stn 53, 2 (NNM 22428). — Stn 54, 1 (NNM 22421).
SNELLIUS 2: stn 4.106, 1 (NNM 22424). — Stn 4.115, 2 (NNM 22425).
"Cable Ship Telegraaf": northern coast of Sumatra (Segli), 549 m, 1 (ZMA).
South China Sea. Macclesfield Bank (cf. BASSETT-SMITH, 1890), 73-92 m, "dredge 22", 1 (BMNH 1893.9.1.213).

TYPE LOCALITY. — Singapore, South China Sea (depth not given).

DIAGNOSIS. — Corallum conical (turbinate); calice elliptical (GCD:LCD = 1.20-1.45); calicular margin smooth. Largest Philippine specimen (*"Albatross"* stn 5357) 40.1 x 57.2 mm in calicular diameter and 38.3 mm in height. Pedicel narrow (1.0-1.5 mm in diameter) and not reinforced; however, several cycles of discrete, hollow rootlets (rootlet diameter 1.0-2.5 mm), extend from lower corallum to substrate, firmly anchoring the corallum. Corallum white. Septa hexamerally arranged in 6 cycles, the 6th complete only in large specimens: $S_{1-2}>S_3>S_4>S_5>S_6$. Upper, outer margin (near calice) of S_{1-3} quite narrow, but upper axial edge of same septa project as broad lamellae into fossa.

REMARKS. — *Rhizotrochus typus* is easily distinguished from all other flabellids in the Philippine/Indonesian region by having numerous, discrete (i.e., free standing, not contiguous with corallum) rootlets. One large specimen at the BMNH (1950.1.11.630) from Mauritius measures 108 mm in GCD. The species is more fully described and figured by CAIRNS (1989a).

One unusual specimen of *Rhizotrochus* from DEKI stn 25 (NNM 23096) deserves special note. It is 13.3 x 19.1 mm in calicular diameter, 11.5 mm in height, and has 96 septa. It differs from other *Rhizotrochus* in having a truncated base with a basal scar of 5.2 x 8.5 mm in diameter, which suggest that transverse division occurred. It also has a polygonal calicular cross section, each C_1 being slightly ridged, rootlets occurring only in series on the C_1. The presence of transverse division in *Rhizotrochus* is unexpected, since the upper part of the corallum is held stationary by numerous rootlets, which should not even allow division to occur. Nonetheless, one specimen is known with this character combination (Figs 22 d-e).

DISTRIBUTION. — *Philippines*: Mindoro Strait; Sulu Sea (Balabac); 120-124 m. *Indonesia*: Banda Sea (Kai Islands); Flores Sea (Lintah Strait); 70-296 m. *Elsewhere*: South China Sea (Macclesfield Bank); Malaysia (Darvel Bay, Celebes Sea); Red Sea; Persian Gulf; Bay of Bengal; Singapore; Pelau; Japan (Honshu and Kyushu); 20-1048 m.

"Rhizotrochus" flabelliformis Cairns, 1989

Flabellum latum - ALCOCK, 1902c: 31. [Not *Flabellum latum* Studer, 1878].
Rhizotrochus flabelliformis Cairns, 1989a: 81, pl. 41, figs k-l, pl. 42, figs b, d; 1995: 109-110, pl. 35, figs g-i, pl. 36, figs b, d.

MATERIAL EXAMINED. — **Indonesia**. DEKI: stn 48, 1 (NNM 22412). — Stn 56, 1 (NNM 22413). — Stn 59, 6 (NNM 22414).
"Galathea": stn 500, 1 (ZMUC).

TYPE LOCALITY. — *"Siboga"* stn 105: 6°08'N, 121°19'E (Sulu Archipelago, Philippines), 275 m.

DIAGNOSIS. — Corallum highly laterally compressed (GCD:LCD = 2.4-3.4); calicular edge smooth. Largest known specimen (DEKI stn 59) 25 x 73 mm in calicular diameter. Pedicel quite narrow (1.2-1.5 mm in diameter), but attachment reinforced by 2 compressed, massive (4-5 mm in diameter) rootlets, one originating from each calicular edge and firmly anchored to the substratum. Corallum light reddish-brown, young ones having a more intense C_{1-2} pigmentation. Septa hexamerally arranged in 6 to 7 cycles ($S_{1-4}>S_5>S_6>S_7$), but even largest specimens with incomplete 7th cycle. Fossa deep and narrow; columella rudimentary.

REMARKS. — The second author disagrees with the first in placing *"R." flabelliformis* in this genus. He considers that it is not a true *Rhizotrochus*, not being attached by circles of adventitious, cylindrical rootlets. The general morphology is closer to that of a species of *Flabellum (Flabellum)*, the anchoring pair of compressed opposite thecal edge eversions, by position and formation, being similar to irregular spurs on edge crests of *Flabellum (Flabellum)* and to spines on edge crests of *Truncatoflabellum*. The use of these eversions for attachment is a qualitative leap with respect to edge crest formation in those two other taxa.
This species is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Sulu Archipelago; 275 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (east of Tanimbar Islands); 263-390 m. *Elsewhere*: New Zealand region; 228-419 m.

Genus ***GARDINERIA*** Vaughan, 1907

Gardineria philippinensis Cairns, 1989

Gardineria philippinensis Cairns, 1989a: 82, pl. 42, fig. a.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 63, 1 (MNHN).
Indonesia. KARUBAR: stn 86, 1 (USNM 97488).

TYPE LOCALITY. — *"Albatross"* stn 5217: 13°20'N, 123°14'15"E (Sibuyan Sea, Philippines), 192 m.

DESCRIPTION. — Corallum conical (turbinate), with a basal angle of 38°-42° and a circular calice. Largest known specimen (MUSORSTOM 1 stn 63) 17.5 mm in calicular diameter and 19.6 mm in height, with a robust pedicel 7.1 mm in diameter (PD:GCD = 0.41). Corallum attached exclusively through the base of its pedicel. Theca usually heavily encrusted with bryozoans, foraminifera, serpulid tubes, and sponges. Unencrusted theca white, bearing fine horizontal epithecal striae. Calicular margin smooth, rising as a thin lip as much as 1.5 mm above upper, outer septal edges.
Septa hexamerally arranged in 4 complete cycles (48 septa): $S_1>S_2>S_3>S_4$. S_1 thick, their inner edges vertical and straight, extending to columella; their peripheral edges meet the theca below the calicular margin, their upper edges rise slightly above calicular edge. S_2 similar to S_1 in shape, but slightly less exsert and narrower, also attaining the columella. S_3 about 1/2 width of S_2, each bearing a small paliform lobe that merges with the columella. S_4 rudimentary. Fossa of moderate depth, containing a well-developed columella consisting of 12-17 papillose elements.

REMARKS. — The original description of *G. philippinensis* was based on a type series consisting of the dead, poorly-preserved holotype; a juvenile corallum; and a damaged pedicel of a 3rd specimen. The 2 specimens reported above are larger and better preserved, permitting the observation that the species attains 4 full cycles of septa and that it attaches exclusively through the base of its pedicel, not laterally.

Gardineria philippinensis is similar to *G. hawaiiensis* Vaughan, 1907, in shape and size but differs in attaining a full 4th cycle of septa and in having a robust columella. It differs from *Gardineria* sp. A (reported by CAIRNS, 1995 from the Chesterfield Islands, Lord Howe Seamount Chain, and Norfolk Ridge, depth 291-378 m) by its robust columella.

DISTRIBUTION. — *Philippines*: Lubang Island; Ragay Gulf, Luzon; Iligan Bay, Mindanao; 192-494 m. *Indonesia*: Arafura Sea (southeast of Tanimbar Islands); 222-226 m.

Gardineria paradoxa (Pourtalès, 1868)

Figs 21 g-h

Haplophyllia paradoxa Pourtalès, 1868: 140-141.
Duncania barbadensis Pourtalès, 1874: 45, pl. 9, figs 5-7.
Gardineria barbadensis - LEWIS, 1965: 1063.
Gardineria paradoxa - CAIRNS, 1979: 160-161, pl. 31, figs 4-6, 10 (synonymy).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 5, 2: 1 (MNHN), 1 (USNM 97489).

TYPE LOCALITY. — *"Bibb"* stn 22: 24°14'20"N, 80°59'40"W (Straits of Florida), 692 m.

DESCRIPTION (larger specimen). — Corallum elongate-conical: 20.2 mm in length and 11.2 mm in calicular diameter. Corallum attached to substratum by pedicel as well as theca on one side all along from pedicel to calice. Theca exteriorly eroded and encrusted with bryozoans. Although collected alive, specimen resembles a fossilized corallum. Theca dense, up to 1.5 mm thick, extending as a robust lip about 1.3 mm above upper, outer septal edges.

Septa decamerally arranged in 3 size classes: 10:10:20 (40 septa). Primary septa nonexsert, having straight, vertical inner edges that join the columella low in fossa. Secondary septa similar in shape, about 2/3 width of a primary, each secondary bearing a discrete paliform lobe about 0.8 mm in width. Tertiary septa narrow, about 1/2 width of a secondary, having finely dentate inner edges and extending only about 6 mm from calicular edge. Columella papillose, composed of 13 cylindrical (0.5 mm in diameter), granular elements.

The smaller of the 2 specimens is a juvenile only 5.1 mm in calicular diameter and contains only 30 septa.

REMARKS. — This is first report of *G. paradoxa* outside the western Atlantic, where it is known from the Greater and Lesser Antilles (CAIRNS, 1979). Comparison of the KARUBAR specimens to those from the Antilles shows no significant differences; a specimen from Barbados (Fig. 21 g) is particularly similar to the large KARUBAR specimen.

Gardineria paradoxa is distinguished from the other species in the genus by having decameral septal symmetry and a strong secondary lateral attachment.

DISTRIBUTION. — *Indonesia*: Banda Sea (Kai Islands); 285-323 m. *Elsewhere*: western Atlantic (Antilles); 91-700 m.

Genus ***JAVANIA*** Duncan, 1876

Javania insignis Duncan, 1876

Javania insignis Duncan, 1876: 435, pl. 39, figs 11-13. — ZIBROWIUS, 1974c: 8-9, pl. 1, figs 1-6. — CAIRNS, 1989a: 77-78, pl. 40, figs d-e, g-h, j-k (synonymy); 1994: 80, pl. 34, figs i-k. — CAIRNS & KELLER, 1993: 272.
Flabellum weberi Alcock, 1902a: 107.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 32, 1 (MNHN). — Stn 33, 19 (USNM 97490). MUSORSTOM 3: stn 131, 4 (USNM 97491).

Indonesia. DEKI: stn 24, 2 (NNM 22435).
CORINDON 2: stn 248, 2 (MNHN).
SNELLIUS 2: stn 4.100, 1 (NNM 22434).
KARUBAR: stn 22, 1 (MNHN). — Stn 32, 2 (POLIPI).

TYPE LOCALITY. — 34°13'N, 136°13'E (Honshu, Japan), 88 m.

DIAGNOSIS. — Corallum elongate-conical, straight, robust, and slightly flared distally; calice usually highly elliptical (GCD:LCD = 1.3-1.7). Pedicel thickened with concentric layers of dense stereome, its diameter up to 55% of GCD. Corallum rarely over 25 mm in GCD or 43 mm in height; white. Septa hexamerally arranged in 5 cycles according to formula: $S_{1-2}>S_3>>S_4>S_5$. S_5 begin to appear at a GCD of 9-10 mm and the cycle is usually complete at a GCD of 15-17 mm. S_{1-2} highly exsert, producing a lacerate calicular margin, but S_{4-5} nonexsert and much smaller than lower cycle septa.

REMARKS. — This species is more fully described and illustrated by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Sulu Sea (west of Panay and Balabac); Davao Gulf, Mindanao; 122-192 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Flores Sea (Sumbawa); 73-296 m. *Elsewhere*: widespread from southwest Indian Ocean to Hawaiian Islands, including Celebes Sea (Darvel Bay) and Japan; 46-825 m.

Javania lamprotichum (Moseley, 1880)

Desmophyllum lamprotichum Moseley, 1880: 41-42, figs 1-2.
? *Desmophyllum alabastrum* Alcock, 1902a: 105; 1902c: 28-29 (in part: *"Siboga"* stn 105, pl. 4, fig. 27, 27a). — FAUSTINO, 1927: 64, pl. 5, figs 11-12.
Javania lamprotichum - CAIRNS, 1984: 21, pl. 4, figs D-E; 1995: 112, pl. 37, figs b-c.

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 105, 1 (ZMA, see Remarks).
MUSORSTOM 1: stn 62, 1 (MNHN). — Stn 63, 1 (MNHN). — Stn 65, 1 (USNM 97492).
MUSORSTOM 2: stn 53, 1 (USNM 97493).
MUSORSTOM 3: stn 88, 1 (MNHN). — Stn 94, 1 (USNM 97494).

TYPE LOCALITY. — Unknown.

DIAGNOSIS. — Corallum elongate-conical and straight, having a pedicel thickened with layers of dense stereome up to a diameter of 10 mm; theca of upper part of corallum relatively thin and delicate. Largest known specimen (MUSORSTOM 1 stn 63) 29.5 x 44 mm in calicular diameter and 48 mm in height, with a pedicel diameter of 9.0 mm. Corallum flared distally, having an elliptical calice: GCD:LCD = 1.25-1.50. Upper corallum usually light reddish-brown, occasionally white; lower corallum usually white. Septa hexamerally arranged in 5 complete cycles: $S_{1-2}>S_3>S_4>S_5$. All septa exsert to some degree, producing a serrate calicular edge.

REMARKS. — The figured syntype of *Desmophyllum alabastrum* Alcock, 1902 (*"Siboga"* stn 105) is missing from the ZMA; however, ALCOCK's (1902c) illustration appears to show the lower half of a *Javania*. In 1994, a large, previously unidentified and well-preserved specimen of *J. lamprotichum* (35.8 x 27.6 mm in calicular diameter, 8.3 mm pedicel diameter), was found at the ZMA, also from *"Siboga"* stn 105. Although not the illustrated specimen and probably not even seen by ALCOCK, this is considered to be indirect evidence that ALCOCK's (1902c) figured specimen of *D. alabastrum* might have been *Javania lamprotichum*. The other syntype of *D. alabastrum,* from *"Siboga"* stn 95 (ZMA Coel. 1252), appears to be a *Thalamophyllia*.

Javania lamprotichum differs from *J. insignis* Duncan, 1876, in having a larger, more delicate, flared corallum; usually a pigmented, noncostate theca; and more prominent S4-5.

Coralla of 3 lots (MUSORSTOM 1 stns 63, 65, 2 stn 53) contain 1 or more borings of acrothoracican cirripedes.

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (Sulu Archipelago); 191-842 m. *Elsewhere*: Kermadec Ridge; Johnston Atoll; Hawaiian Islands; 244-710 m.

Javania pachytheca Cairns, 1995

Figs 21 i, 22 a

Javania pachytheca Cairns, 1995: 112-113, pl. 36, figs j-l, pl. 37, fig. a.

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5584, 1 (USNM 97495). — Stn 5634, 1 (USNM 97496). SNELLIUS 2: stn 81.2, 3 (NNM 23089).

TYPE LOCALITY. — *"Tangaroa"* stn K846: 30°13.1'S, 178°32.0'W (off Macauley Island, Kermadecs), 610 m.

DIAGNOSIS. — Corallum tall and slender, the specimen figured herein being 7.6 x 9.0 mm in calicular diameter, 20.2 mm in height, and 4.3 mm in pedicel diameter. Thecal wall quite thick (0.9-2.3 mm), covered with a fine granulation. Corallum white or light brown. Septa hexamerally arranged in 4 complete cycles: $S_{1-2}>S_3>>S_4$, the S_4 being nonexsert and quite slender. Inner edges of all septa moderately sinuous. Fossa deep and narrow.

DISTRIBUTION. — *Indonesia*: Ceram Sea (Obi Islands); 534-601 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); southwest Pacific from North Island, New Zealand to the Chesterfield Islands, including the Lord Howe Seamount Chain; 360-1045 m.

Javania sp.

Figs 22 b-c

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 44, 1 (MNHN). — Stn 49, 1 fragment (USNM 97498). — Stn 86, 1 (MNHN).

DIAGNOSIS (specimen from KARUBAR stn 44). — Corallum straight, slightly flared distally: 13.7 x 15.6 mm in calicular diameter and 33.8 mm in height, with a pedicel diameter of 7.2 mm. Upper part of corallum smooth and porcellaneous, a light purple-grey in colour; lower corallum superficially eroded, discoloured, and encrusted. Septa hexamerally arranged in 4 cycles: $S_1>>S_2>S_3>S_4$. S_1 extremely exsert (up to 6.5 mm), having vertical, straight inner edges. S_2 1/2 as exsert but almost as wide as S_1, having slightly sinuous inner edges. S_3 only 0.5-1.5 mm exsert, about 3/4 width of an S_2, also having slightly sinuous inner edges. S_4 not exsert (not even reaching the top of the calice), about 1/3 width of an S_3, having slightly sinuous inner edges. Fossa deep and narrow.

REMARKS. — The KARUBAR specimens reported above resemble the widespread species *J. cailleti* (Duchassaing & Michelotti, 1864), but differ in having more exsert S_1 (much more exsert than their S_2), and in having a purple-grey pigmentation. Whereas some specimens of *J. cailleti* have highly exsert septa (*e.g.*, holotype of *D. nobile* Verrill, 1885; USNM 82016 from Lydonia Canyon, NW Atlantic), the S_1 of most specimens rarely exceed 4 mm in exsertness, and in all cases S_2 equal in size to S1. Furthermore, the corallum of *J. cailleti* is always white, whereas the KARUBAR specimens are pigmented.

Descriptions and illustrations of *J. cailleti* are found in CAIRNS (1979, 1982, 1991) and ZIBROWIUS (1980). It is a widely distributed species known from the Atlantic, Pacific, and Indian Oceans at depths of 86-2165 m.

DISTRIBUTION. — Indonesia: Arafura Sea (south of Tanimbar Islands); 209-291 m.

Genus *TRUNCATOFLABELLUM* Cairns, 1989

Truncatoflabellum spheniscus (Dana, 1846)

Figs 23 a-b

Euphyllia spheniscus Dana, 1846: 160-161, pl. 6, figs 1a-e.
Truncatoflabellum spheniscus - CAIRNS, 1989a: 65-66, pl. 32, figs g-k (synonymy); 1994: 76, pl. 33, figs a-d (synonymy).

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 299, 1 (ZMA Coel. 1229).
DEKI: stn 67, 15 (NNM 22616). — stn 71, 3 (NNM 22617). — Stn 74, 3 (NNM 22618). — Stn 90, 3 (NNM 22619). — Stn 103, 100 (NNM 22620). — Stn 106, 13 (NNM 22621).
"Galathea": stn 501, 1 (ZMUC).
"Hakuho Maru": stn KH72-1-29, 4 (USNM 97500). — Stn KH72-1-30, 7 (USNM 97501).
KARUBAR: stn 65, 99: 40 (MNHN), 29 (POLIPI), 30 (USNM 97499).
South China Sea. *"Galathea"*: stn 330, 1 (ZMUC).
Singapore. 1, Phyletisches Museum, Jena, Germany (Coel. 922), coll. E. HAECKEL, October 1900.
Australia. *"Akademik Oparin"*: stn 18, 3 (USNM 93197).

TYPE LOCALITY. — Singapore, South China Sea, 3-6 m.

DESCRIPTION. — Anthocyathus highly compressed (GCD:LCD up to 3.65), the planar thecal faces meeting in rounded, but narrow, edges that bear 1 pair of edge spines about 4 mm above basal scar. Angle of thecal edges 57°-165°; angle of thecal faces quite low, 20°-31°. Largest known specimen (KARUBAR stn 65) 14.5 x 52.8 mm in calicular diameter. Basal scar of most Indonesian specimens reported herein small, only 3.2-5.0 mm in greater diameter. Calicular margin strongly arched, smooth. Corallum white but often encrusted with bryozoa, foraminifera, serpulids, and calcareous algae.

Large specimens (GCD > 45 mm) have septa hexamerally arranged in 6 cycles ($S_{1-4}>S_5>S_6$, 192 septa), often with additional pairs of S_7, but smaller specimens have only 40, 42, 44, or 46 primary septa, a corresponding number of secondaries, and twice that number of tertiary septa, resulting in coralla of 160, 168, 176, or 184 septa. S_{1-4} (primary septa) narrow, notched near the calicular margin, and slightly concave midway down fossa. Lower, inner edges of S_{1-4} quite thick and fused to columella. S_5 (secondary septa) about 3/4 width of S_{1-4}, not attaining the columella. S_6 (tertiary septa) about 1/2 width of S_5, extending only a short distance from calicular edge. When present, S_7 (quaternary septa) are paired but are quite narrow and short. Fossa deep and elongate, containing a well-developed columella about 1.4 mm in width.

REMARKS. — Specimens from *"Galathea"* stns 330 and 501, and HAECKEL's specimen are typical *T. spheniscus*, with the large basal scar as in the type series. The other specimens reported above differ in having a much smaller basal scar: 3.2-5.0 mm in greater diameter vs 10.0-11.2 mm for the syntypes. The specimens appear otherwise consistent in all characters, and thus scar diameter is considered by the first author to be variable in this species. The second author is highly skeptical about identifying these small-scar specimens as *T. spheniscus*. His general experience is that the size of the basal scar, reflecting the size at which transverse division occurred, is standard in species of *Truncatoflabellum* and other transversely dividing species. *T. spheniscus* is distinguished from most other species in the genus by its elongate, narrow calice and its distinctively shaped S_{1-4}.

DISTRIBUTION. — *Indonesia*: Arafura Sea (south of Tanimbar Islands); Timor Sea; Savu Sea; Sunda Strait, Java Sea; 30-174 m. *Elsewhere*: Japan (Shikoku; Korea Strait; Honshu; northern Ryukyu Islands); Formosa Strait; South China Sea (Singapore); Australia (Torres Strait, Gulf of Carpentaria, Western Australia); 2-106 m.

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

Flabellum aculeatum H. Milne Edwards & Haime, 1848a: 272, pl. 8, figs 3, 3a.
Truncatoflabellum aculeatum - CAIRNS, 1989a: 61, 64, pl. 31, figs h-l, pl. 32, figs a-c (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5141, 3 (USNM 97502). — Stn 5253, 1 (USNM 97503).
MUSORSTOM 3: stn 142, 3 (MNHN).
Indonesia. DEKI: stn 14, 1 (NNM 22651). — Stn 60, 8 (NNM 22653). — Stn 82, 220 (NNM 22669). — Stn 84, 2 (NNM 22655). — Stn 89, 1 (NNM 22656). — Stn 90, 1 (NNM 22657). — Stn 92, 2 (NNM 22658).
"Hakuho Maru": stn KH72-1-29, 4 (USNM 97506). — Stn KH72-1-30, 5 (USNM 97507).
CORINDON 2: stn 260, 1 (USNM 97505). — Stn 292, 1 (MNHN).
SNELLIUS 2: stn 4.099, 2 (NNM 22663). — Stn 4.134, 1 (NNM 22664). — Stn 4.228, 1 (NNM 22665). — Stn 4.232, 2 (NNM 22666). — Stn 4.234, 4 (NNM 22667).

TYPE LOCALITY. — Philippines (depth not given).

DIAGNOSIS. — Anthocyathus compressed (GCD:LCD = 1.8-2.6), the slightly convex thecal faces meeting in rounded edges that usually bear 1 pair of edge spines directly adjacent to basal scar. Angle of thecal edges 45°-53°; angle of thecal faces 28°-31°. Largest known specimen (KH72-1-29) 16.5 x 41.0 mm in calicular diameter and 25.5 mm in height, with a basal scar of 6.2 x 14.3 mm. Calicular margin of septal faces arched; corallum white. Septa of most specimens hexamerally arranged in 5 complete cycles: $S_{1-3}>S_4>S_5$ (96 septa); however, large specimens have additional primary septa equal to S_{1-3} in size. Shape of septa as described for *T. spheniscus*, but inner edges of S_{1-3} highly sinuous.

REMARKS. — Although not noted by CAIRNS (1989a), *T. aculeatum* is similar to *T. spheniscus* (Dana, 1846), especially in septal shape, and both species have been collected from the same stations. *T. aculeatum* is distinguished by having a lower edge angle and higher face angle and thus a smaller GCD:LCD; a smaller corallum; and less septa, most specimens having only 5 cycles (96 septa). The species is more fully described by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Visayan Sea; Bohol; Sulu Archipelago; 11-33 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Flores Sea (Lintah Strait and Selayar Island); Timor Sea; Sunda Strait, Java Sea; 18-81 m. Pleistocene of Talaud (UMBGROVE, 1938).

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

Flabellum candeanum H. Milne Edwards & Haime, 1848a: 278, pl. 8, fig. 13.
Flabellum elegans H. Milne Edwards & Haime, 1848a: 277.
Truncatoflabellum candeanum - CAIRNS, 1989a: 70-71, pl. 36, figs d-h (synonymy); 1994: 76-77, pl. 33, figs e-f.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 56, 8 (USNM 97508). — Stn 62, 1 (MNHN). — Stn 64, 1 (MNHN). — Stn 72, 11: 10 (MNHN), 1 (USNM 97509).
MUSORSTOM 2: stn 2, 1 (USNM 97510). — Stn 6, 5 (USNM 97511). — Stn 10, 2 (USNM 97512). — Stn 68, 1 (USNM 97513).
MUSORSTOM 3: stn 88, 4 (USNM 97514). — Stn 90, 1 (MNHN). — Stn 91, 1 (MNHN). — Stn 92, 1 (USNM 97515). — Stn 96, 3 (USNM 97516). — Stn 99, 1 (MNHN). — Stn 102, 25 (MNHN). — Stn 107, 2 (USNM 97517). — Stn 108, 5 (MNHN). — Stn 109, 1 (MNHN). — Stn 110, 1 (USNM 97518). — Stn 143, 20.
Indonesia. DEKI: stn 54, 16 (NNM 22593). — Stn 58, 1 (NNM 22594).

TYPE LOCALITY. — *"Albatross"* stn 5369: 13°48'N, 121°43'E (Luzon, Philippines), 194 m.

DIAGNOSIS. — Angle of acute thecal edges 40°-80°; angle of slightly convex thecal faces 30°-41°. GCD:LCD = 1.6-1.9. Largest known specimen (holotype of *F. elegans*) 16.5 x 32.3 mm in calicular diameter and 21.7 mm in height. Most coralla bear 3 pairs of thecal edge spines: the lowest pair directly adjacent to basal scar and curved downward; the middle pair directed horizontally; and the uppermost pair directed slightly upward. Spines often quite long (up to 10 mm) and strongly compressed, having wide triangular bases. Basal scar up to 6 mm in greater diameter. Calicular margin serrate, a small apex corresponding to each of the 20-24 primary septa. Upper, peripheral edges of primary septa and corresponding costae, reddish-brown. Septa arranged in 3 size classes: 20-24:20-24:40-48, resulting in 80-96 septa. Columella well developed.

REMARKS. — *Truncatoflabellum candeanum* is distinguished from other species by its multiple pairs of long, flattened edge spines; and its scalloped calicular margin. It is more fully described by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Lubang Island; Tayabas Bay; Samar Sea; Visayan Sea; 146-249 m. *Indonesia*: Banda Sea (Kai Islands); 70-290 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); South China Sea off Hong Kong; Japan (Korea Strait; Kyushu); 88-223 m.

Truncatoflabellum incrustatum Cairns, 1989

Truncatoflabellum incrustatum Cairns, 1989a: 68-69, pl. 35, figs d-e.
Truncatoflabellum formosum Cairns, 1989a: 69-70 (in part: *"Albatross"* stns 5137, 5484).

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 303, 1 (ZMA Coel. 1207).
Southwestern Sulawesi, 16.07.1985, 27-30 m, 1 (NNM 22595).
South China Sea. Macclesfield Bank, 64-82 m, 1 (BMNH).

TYPE LOCALITY. — *"Albatross"* stn 5251: 7°05'12"N, 125°39'35"E (Mindanao, Philippines), 37 m.

DIAGNOSIS. — Angle of rounded thecal edges 23°-32°; angle of thecal faces 15°-19°. GCD:LCD = 1.65-2.10. Largest known corallum (anthocyathus from *"Albatross"* stn 5253) 28 mm in GCD and 42 mm in height. One pair of downward-projecting edge spines present near basal scar. Basal scar up to 6.0 mm in greater diameter. Theca black-brown, but usually covered with a heavy encrustation of sessile organisms. Calicular edge smooth. Septa hexamerally arranged in 5 complete cycles ($S_{1-2}>S_3>S_4>S_5$). Fossa deep and elongate, containing a rudimentary trabecular columella.

Truncatoflabellum incrustatum is compared to *T. irregulare* (Semper, 1872) in the following account, and is described in greater detail by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Leyte Gulf; Davao Gulf; Sulu Sea (Sulu Archipelago); 37-415 m. *Indonesia*: Savu Sea; Flores Sea (southwestern Sulawesi); 30-36 m. *Elsewhere*: South China Sea (Macclesfield Bank); 64-82 m.

Truncatoflabellum irregulare (Semper, 1872)

Flabellum irregulare Semper, 1872: 242-245, figs 1-3, pl. 16, figs 7-17. — CAIRNS, 1989a: 67-68, pl. 34, figs i-k, pl. 35, figs a-c (synonymy).
Not *Flabellum irregulare* - ALCOCK, 1902c: 32 (= *Truncatoflabellum* sp.).

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 303, 3 (ZMA Coel. 1212).

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

DIAGNOSIS. — Angle of rounded thecal edges 36°-43°; angle of thecal faces 19°-21°. GCD:LCD = 1.6-2.0. Largest known specimen (anthocyathus from *"Albatross"* stn 5145) 27.5 mm in GCD and 42.8 mm in height. Usually one pair of downward-projecting thecal edge spines near basal scar. Basal scar usually 3 x 4 mm in diameter. Theca white and often encrusted with sessile organisms. Calicular edge smooth. Septa arranged in a variety of symmetries, 18:18:36 (72 septa) being the most common, but coralla with 16, 17, 19, and 12 primary septa are also known. Primary septa slightly exsert and notched near calicular edge. Fossa deep and elongate, containing a rudimentary trabecular columella.

REMARKS. — *Truncatoflabellum irregulare* is distinguished from *T. incrustatum* by having irregular septal symmetry and only 3 (not 4) size classes of septa. It also has a white (not dark) theca, a smaller basal scar, and a septal notch on each primary septum.

The specimens reported as *Flabellum irregulare* by ALCOCK (1902c) (*"Siboga"* stns 49a, 253) were re-examined and found to be juvenile specimens of an unknown species, not *T. irregulare*. *T. irregulare* is more fully described and illustrated by CAIRNS (1989a).

DISTRIBUTION. — *Philippines*: Bohol; Sulu Archipelago; 18-42 m. *Indonesia*: Savu Sea (Hainsisi, Samau Island); 36 m.

Truncatoflabellum paripavoninum (Alcock, 1894)

Fig. 22 f

Flabellum pari-pavoninum Alcock, 1894: 187; 1898: 21, pl. 2, figs 3a-b.
Truncatoflabellum paripavoninum - CAIRNS, 1989a: 72-73, pl. 37, figs j-l, pl. 38, fig. a (synonymy); 1995: 113-114, pl. 37, figs d-e.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 44, 1 (MNHN). — Stn 47, 2 (MNHN).
MUSORSTOM 2: stn 25, 3 (MNHN). — Stn 77, 1 (MNHN).
MUSORSTOM 3: stn 106, 2 (USNM 97548).
Indonesia. KARUBAR: stn 39, 1 (POLIPI). — Stn 56, 8 (USNM 97549). — Stn 57, 1 (MNHN). — Stn 70, 1 (USNM 97550). — Stn 71, 9: 3 (MNHN), 6 (USNM 97551). — Stn 87, 2 (MNHN). — Stn 91, 1 (POLIPI).

TYPE LOCALITY. — *"Investigator"* stn 177: 13°47'04"N, 73°07'E (Laccadive Sea), 1163 m.

DIAGNOSIS. — Angle of thecal edges 57°-138°; angle of thecal faces 31°-62°. Thecal faces virtually planar, meeting in straight, nonspinose, noncrested, acute thecal edges. Largest known specimen (KARUBAR stn 71) 34.4 x 61.7 mm in calicular diameter and 48.2 mm in height. Basal scar elliptical but variable in size, greater diameter 6.8 to 14.5 mm. Corallum white or uniformly reddish brown, the theca of most specimens being worn and discoloured. Septa hexamerally arranged in 6 cycles ($S_{1-3}>S_4>S_5>S_6$, 192 septa), the 6th cycle beginning to appear at a GCD of 26-30 mm. Columella well developed, consisting of a robust fusion of the lower, inner edges of S_{1-3}, and being about 2.1 mm in width.

REMARKS. — Among the western Pacific species, *T. paripavoninum* is distinguished by having a large corallum; nonspinose and noncrested thecal edges; and by occurring in relatively great depths. The diagnosis above is based on the anthocyathus stage, only one specimen (KARUBAR stn 56) being an anthocaulus. The species is more fully described and illustrated by CAIRNS (1989a, 1995).

Four specimens from KARUBAR stns 56 and 71 serve as the substratum for a stalked suberitid sponge (? *Rhizaxinella*, identified by K. RÜTZLER) (Fig. 22 f). The slender stalk (up to 60 mm long and 3 mm in diameter) supports a "head" about 20 x 10 mm in size. The stem of the sponge is attached to the theca of the living coral just below the calicular edge.

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol Strait; Sulu Archipelago; 512-772 m. *Indonesia*: Arafura Sea (southeast of Tanimbar Islands); Gulf of Bone, Sulawesi; Bali Sea; 411-1022 m. *Elsewhere*: Malaysia (Darvel Bay, Celebes Sea); Laccadive Sea; Kermadec Islands; 1035-1450 m.

Truncatoflabellum formosum Cairns, 1989

Truncatoflabellum formosum Cairns, 1989a: 69-70 (in part: not *"Albatross"* stns 5137, 5484, 5162, and 5483, the first 2 stations being *T. incrustatum*, the latter 2 unidentified species of this genus), pl. 35, figs j-k, pl. 36, figs a-b (synonymy); 1994: 77, pl. 33, figs g-h (synonymy).
Truncatoflabellum sp. nov. - CAIRNS, 1989a: 73, pl. 38, figs g-h.
? *Truncatoflabellum formosum* - CAIRNS & KELLER, 1993: 265, pl. 10, fig. I, pl. 11, fig. A.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 2, 1 (MNHN). — Stn 32, 1 (MNHN).
MUSORSTOM 3: stn 131, 5 (USNM 97540).
Indonesia. *"Siboga"*: stn 274, 1 (ZMA Coel. 1208).
CORINDON 2: stn 216, 6 (MNHN).
KARUBAR: stn 1, 4: 1 (POLIPI), 3 (USNM 97541). — Stn 3, 1 (POLIPI).

TYPE LOCALITY. — *"Albatross"* stn 5249: 7°06'06"N, 125°40'08"E (Mindanao, Philippines), 42 m.

DIAGNOSIS. — Angle of rounded thecal edges 37°-59°; angle of thecal faces 18°-34°. GCD:LCD = 1.4-1.8. Most anthocyathi have 2 pairs of thecal edge spines, the lowermost pair 3-4 mm above the basal scar and the upper pair usually quite short, each of these upper spines with a broad, flat, triangular base. Largest Philippine specimen (*"Albatross"* stn 5289) 13.4 x 23.0 mm in calicular diameter and 31.4 mm in height. Calicular margin arched and smooth. Basal scar relatively small, 4-5 mm in greater diameter. Well-preserved specimens have reddish-brown thecal stripes associated with the 20 primary septa. Septa arranged in 3 size classes (20:20:40 = 80 septa), some pairs of tertiaries occasionally missing. Primary septa gracefully arched near calicular edge, having sinuous inner edges. Tertiary septa rudimentary, much smaller than the secondaries. All septa widely spaced.

REMARKS. — This species is more fully described by CAIRNS (1989a, 1994).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (west of Panay and Sulu Archipelago); Leyte Gulf; Davao Gulf; 42-315 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Gulf of Bone, Sulawesi; 57-933 m. *Elsewhere*: Japan (Honshu, Shikoku, Kyushu); ?southwest Indian Ocean; 106-230 m.

Truncatoflabellum pusillum Cairns, 1989

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

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 10 (USNM 97532).
MUSORSTOM 3: stn 87, 1 (MNHN). — Stn 96, 1 (MNHN). — Stn 102, 4 (MNHN). — Stn 109, 1 (MNHN).
Indonesia. DEKI: stn 3, 2 (NNM 22588). — Stn 46, 4 (NNM 22589). — Stn 53, 1 (NNM 22590). — Stn 63, 4 (NNM 22591).
CORINDON 2: stn 248, 4 (USNM 97536).
KARUBAR: stn 15, 20 (MNHN). — Stn 18, 5 (MNHN). — Stn 44, 2 (POLIPI).

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

DIAGNOSIS. — Angle of thecal edges 14°-18°; angle of thecal faces 18°-20°. Thecal faces convex; thecal edges rounded, each edge bearing 2-4 slender spines. Corallum slender and high, the largest specimen (DEKI stn 3) 6.4 x 10.0 mm in calicular diameter, with a greater basal scar diameter of 2.7 mm. Theca smooth and porcellaneous, bearing fine transverse striae; theca streaked with reddish-brown stripes, one corresponding to every interseptal space adjacent to each S_{1-2}. Septa hexamerally arranged in 3 cycles and usually 4 pairs of S_4, 1 pair occurring in the half-systems adjacent to each principal septum, resulting in 32 septa: $S_{1-2}>S_3>S_4$. However, large specimens may contain a full 4th cycle of septa. Inner edges of S_{1-2} highly sinuous.

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

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sibuyan Sea; Sulu Sea (Sulu Archipelago); 137-205 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 85-300 m. *Elsewhere*: Mozambique; 110-132 m.

Truncatoflabellum dens (Alcock, 1902)

Flabellum dens Alcock, 1902a: 106-107; 1902c: 32, pl. 4, figs 30, 30a. — CAIRNS, 1989a: 54, pl. 28, figs g-k (synonymy).
Truncatoflabellum dens - CAIRNS, 1995: 114-115, pl. 37, figs f-h.

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 95, 9 syntypes: 8 (ZMA Coel. 1209, 1449), 1 (USNM 97538).
SNELLIUS 2: stn 4.032, 1 (NNM 22770).
KARUBAR: stn 2, 2 (MNHN).

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

DIAGNOSIS. — Angle of rounded thecal edges changes from 58°-80° at a height of about 6 mm to 21°-35°. Corallum highly compressed, angle of thecal faces 14°-18° and GCD:LCD = 1.7-2.3. Corallum small, up to 12.7 mm in GCD and about 15 mm in height, having a small basal scar about 2 x 3 mm. Thecal edges usually nonspinose. Theca bears reddish-brown stripes corresponding to each interseptal space. Calicular edge smooth. Septa hexamerally arranged in 4 cycles ($S_{1-2}>S_3>>S_4$), larger coralla with up to 4 pairs of S_5 (a total of 56 septa). S_{1-2} have extremely sinuous inner edges. Fossa deep and elongate, containing a rudimentary columella.

REMARKS. — *Truncatoflabellum dens* is characterized by having a relatively small corallum with a bimodal edge angle, no edge spines, and a very small basal scar diameter. It is more fully described and illustrated by CAIRNS (1989a, 1995).

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 522 m. *Indonesia*: Banda Sea (Tukangbesi and Kai Islands); 300-385 m. *Elsewhere*: Kermadec and Norfolk Ridges; New Caledonia; 320-555 m.

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.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5146, 27 (USNM 97542). — Stn 5147, 7 (USNM 97543). — Stn 5159, 21 (USNM 97544). — Stn 5162, 13 (USNM 97545). — Stn 5179, 21 (USNM 97546).
MUSORSTOM 3: stn 137, 21 (MNHN).
Indonesia. SNELLIUS 2: stn D2, 3 (NNM 23203).
KARUBAR: stn 7, 6 (MNHN). — Stn 22, 3 (MNHN). — Stn 44, 1 (POLIPI).

TYPE LOCALITY. — *"Tangaroa"* stn C531: 29°14'40"S, 178°02'W (Raoul Island, Kermadecs), 179 m.

DIAGNOSIS. — Corallum elongate and compressed (GCD:LCD = 1.3-2.3), having nearly parallel thecal edges and faces, which result in a basal scar of almost equal width to calice. Largest Philippine specimen (*"Albatross"* stn 5179) 2.9 x 3.9 mm in calicular diameter and 6.8 mm in height, with a greater scar diameter of 3.4 mm. In addition to transverse division, this species also undergoes rejuvenescence, resulting in elongate coralla of varying diameters. Thecal faces convex; thecal edges rounded, each edge bearing 1-6 strongly downcurved spines. Theca porcellanous, well-preserved specimens brown in colour, with more intense pigmentation in stripes adjacent to each C_{1-2}. Septa hexamerally arranged in 3 cycles ($S_{1-2}>>S_3$, 24 septa), only rarely having additional pairs of S_4 in end half-systems. Inner edges of S_{1-2} sinuous. Columella robust, about 0.4 mm wide.

REMARKS. — *Truncatoflabellum phoenix* is distinguished from *T. pusillum* Cairns, 1989, and *T. dens* (Alcock, 1902), species also having small coralla, by having: parallel thecal edges and faces that result in a basal scar almost as large as the calice; usually only 24 septa; a more robust columella; an elongate corallum characterized by multiple rejuvenescence events; and strongly downcurved thecal edge spines. The species is more fully described and illustrated by CAIRNS (1994, 1995).

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Sulu Sea (Sulu Archipelago); 18-421 m, but most specimens collected at 20-70 m. *Indonesia*: Banda Sea (Tanimbar Islands); Arafura Sea (southeast of Tanimbar Islands); 291-295 m. *Elsewhere*: Kermadec Islands; northern Ryukyu Islands; 80-179 m.

Truncatoflabellum mortenseni sp. nov.

Figs 22 g-h

MATERIAL EXAMINED/TYPES. — **Philippines**. MUSORSTOM 2: stn 33, 49 anthocauli and many juveniles (MNHN), paratypes.
MUSORSTOM 3: stn 124, 1 anthocaulus and 1 anthocyathus, paratypes (MNHN). — Stn 131, 93 anthocauli and 18 anthocyathi, paratypes (MNHN and USNM 97521).

Indonesia: MORTENSEN'S JAVA-S.A. EXPEDITION: Stn 5, 29 + 81: 20 anthocauli and 76 anthocyathi, paratypes (ZMUC), 1 anthocyathus, holotype (ZMUC), 9 anthocauli and 4 anthocyathi (USNM 97522). — Stn 6, 20 anthocauli and 73 anthocyathi, paratypes (ZMUC). — Stn 8, 7 anthocauli and 28 anthocyathi, paratypes (ZMUC). — Stn 9, 4 anthocyathi, paratypes (ZMUC). — Stn 18, 1 anthocaulus (ZMUC).

KARUBAR: stn 1, 4 anthocauli, paratypes (MNHN). — Stn 30, 2 anthocauli and 2 anthocyathi, paratypes (MNHN).

TYPE LOCALITY. — 11°36'N, 121°43'E (Sulu Sea west of Panay), 120-122 m.

ETYMOLOGY. — This species is named for Theodor MORTENSEN, who made many collections of Indo-West Pacific fauna, including this species from the Java Sea.

DESCRIPTION. — Anthocaulus: Angle of rounded thecal edges 49°-61°; angle of convex thecal faces 23°-31°. One pair of slender edge spines occurs 4-6 mm above the pedicel, these spines being elongate (up to 7.5 mm) only on small specimens; on larger specimens these delicate structures are always broken. Base of thecal spines broad and compressed. Pedicel circular and quite small (0.8-1.1 mm in diameter), sometimes revealing the 6 protosepta. Largest anthocaulus (MUSORSTOM 3 stn 131) 10.1 x 17.1 mm in calicular diameter and 19.5 mm in height. Calicular margin of thecal faces slightly arched and smooth; GCD:LCD = 1.65-1.85. A thin reddish-brown thecal stripe corresponds to each S_{1-3}, a thinner stripe to each S_{4-5}. Most anthocauli from MUSORSTOM 3 stn 131 tend not to divide transversely after the edge spines are formed, continue to grow up to 18 mm in height, and have 64 septa; however, anthocauli from all other stations rarely exceed 7 mm in height before transversely dividing or forming an incipient transverse fracture line.

Septa hexamerally arranged in 5 cycles ($S_{1-3}>S_4>S_5$), pairs of S_5 present only in large anthocauli (up to 64 septa). S_{1-3} nonexsert, attenuate, gracefully concave near calicular edge, having highly sinuous lower, inner edges. S_4 about 1/2 width of S_{1-3}, having straight inner edges. S_5 1/3 to 1/2 width of the S_4, having slightly dentate inner edges. S_5 originate in a progression from half-systems adjacent to the principal septa towards centre of thecal face. Fossa deep and elongate; columella rudimentary.

Anthocyathus: One of the largest anthocyathi (holotype) measures 12.3 x 22.5 mm in calicular diameter and 16.9 mm in height, with a basal scar of 3.5 x 7.1 mm. Angle of thecal edges and faces similar to that of anthocaulus. One, occasionally 2, pair(s) of edge spines, the lowermost pair occurring within 1 mm of basal scar. Basal scar elliptical, 6.3-7.3 mm in greater diameter. Theca pigmented as in anthocaulus.

Septa of anthocyathus hexamerally arranged in 5 cycles ($S_{1-3}>S_4>S_5$) as in anthocaulus, but in most anthocyathi the 5th cycle is complete (96 septa). S_{1-3} notched near theca, rising slightly above calicular margin toward centre of fossa. Inner septal edges highly sinuous. S_4 1/3 to 2/3 width of S_{1-3}, but having less sinuous inner edges. S_5 rudimentary. Columella well developed, about 1.3 mm in width.

REMARKS. — In many ways the anthocaulus of *T. mortenseni* is similar to that of *T. zuluense* Cairns, 1993, the corallum of both species often resisting transverse division after the basal pair of edge spines has formed. *T. mortenseni* differs from *T. zuluense* in having: a larger edge angle; a smaller diameter pedicel; S_{1-3} that are equal in size (versus $S_{1-2}>S_3$ in *T. zuluense*); and usually having more septa, *i.e.*, 56-80 vs 48-56 for *T. zuluense*. The anthocyathus of *T. mortenseni* is distinguished (CAIRNS, 1989a: table 6) by the combination of having a septal formula of $S_{1-3}>>S_4>S_5$ and having 1 or 2 pairs of thecal edge spines.

Many live specimens of *Truncatoflabellum mortenseni* from Bali Strait, 50-70 m (MORTENSEN's stn 5, 6, 8) were the substrate of the inarticulate disciniscid brachiopod *Discradisca stella* (Gould) (det. A. LOGAN, 1993) and the hipponicid prosobranch gastropod *Malluvium* sp. (det. A. WARÉN, 1993). Both epibionts were localized generally near the calicular edge of live corals, *Malluvium* sp. exceptionally also on a dead coral.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Tablas Strait; Sulu Sea west of Panay; 122-130 m. *Indonesia*: Banda Sea (Kai Islands); Bali Sea and Bali Strait; 50-156 m.

Truncatoflabellum angustum sp. nov.

Figs 23 c-f

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

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Albatross"*: stn 5567, 11 paratypes (USNM 97524).
MUSORSTOM 1: stn 64, 1 paratype (USNM 97525).
MUSORSTOM 2: stn 63, 1 paratype (MNHN).
MUSORSTOM 3: stn 92, 2 paratypes (USNM 97526). — Stn 126, 4 paratypes (USNM 97527). — Stn 130, 1 paratype (MNHN). — Stn 143, holotype and 12 paratypes (MNHN).
Indonesia. KARUBAR: stn 2, 19 paratypes (MNHN). — Stn 3, 2 paratypes (POLIPI) . — Stn 18, 2 paratypes (USNM 97530). — Stn 31, 1 paratype (MNHN). — Stn 44, 20 paratypes (USNM 97531).
NONTYPES: **Kermadecs**. *"Tangaroa"*: stn K858, 1 (ex USNM 94274, now USNM 97523).
"Acheron": stn BS441, 1 (USNM 94276).

TYPE LOCALITY. — MUSORSTOM 3 stn 143: 11°28.3'N, 124°11.6'E (Visayan Sea, Philippines), 205-214 m.

ETYMOLOGY. — The species name *angustum* (Latin *angustus*, slender, thin) alludes to the highly compressed (slender) calice of this species.

DESCRIPTION. — Anthocyathus: Thecal faces flat to slightly convex, meeting in sharp edges that bear 3 or 4 pairs of slender, delicate edge spines. Angle of thecal edges 28°-52°; angle of thecal faces 17°-22°. Basal scar relatively small: 1.8-2.5 x 2.7-3.3 mm. Largest specimen (holotype) 6.1 x 14.0 mm in calicular diameter and 10.8 mm in height, with a basal scar diameter of 2.1 x 3.1 mm. Calicular margin of septal faces slightly arched and smooth; GCD:LCD = 1.85-2.31. Theca white to slightly reddish-brown.

Septa hexamerally arranged in 5 cycles, the last cycle never complete: $S_{1-2}>S_3>>S_4>S_5$. Most specimens have only 4 pairs of S_5, 1 pair in each half-system adjacent to the 2 principal septa, resulting in a total of 56 septa. S_{1-2} nonexsert, attenuate, having very sinuous inner edges that fuse to the columella lower in fossa. S_3 7/10-9/10 width of S_{1-2} and usually less sinuous. S_4 1/4-1/3 width of the S_3; S_5 rudimentary, 1/2 width of S_4. Fossa deep and narrow, the columella being about 0.8 mm in width.

Anthocaulus: Only one unequivocal anthocaulus is known (MUSORSTOM 3 stn 130), the anthocyathus having become detached during this study. This anthocaulus is 1.3 mm in pedicel diameter, 2.7 mm in height, and has a GCD of 3.25 mm. It bears no thecal spines and has 24 septa arranged in 2 size classes: $S_{1-2}>S_3$.

REMARKS. — *Truncatoflabellum angustum* has a septal number and arrangement similar to *T. zuluense* Cairns, 1993, and *T. gardineri* Cairns, 1993, both from the southwest Indian Ocean. *T. angustum* differs from both in having a more elongate calice (higher GCD:LCD). It also differs from *T. gardineri* Cairns, 1993, in having a smaller basal scar, and having thecal edge spines, not crests. It differs from *T. zuluense* in consistently severing its anthocyathus from its anthocaulus.

Several specimens of *T. angustum* were reported and figured by CAIRNS (1995) as the anthocyathus stage of *T. dens*, both species having been found at the same station and being similar in size and colouration. *T. dens* (Alcock, 1902) is distinguished from *T. angustum* by having a bimodal edge angle and tending to have 32 septa vs 56 septa in *T. angustum*.

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (Semirara Islands, west of Panay, and Sulu Archipelago); Visayan Sea; 195-490 m. *Indonesia*: Banda Sea (Kai Islands); 212-288 m. *Elsewhere*: Kermadec Islands; 402-465 m.

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

Blastotrochus nutrix H. Milne Edwards & Haime, 1848

Blastotrochus nutrix H. Milne Edwards & Haime, 1848a: 284-285, pl. 8, fig. 14. — SEMPER, 1872: 238-241, pl. 16, figs 1-6. — CAIRNS, 1989a: 74-75, pl. 38, figs i-m, pl. 39, figs a-b (synonymy); 1989c: 643, figs a-b (upper).
Flabellum (Blastotrochus) nutrix - FAUSTINO, 1927: 59-60, pl. 5, figs 1-6.

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: Stn 240, 1 (ZMA Coel. 1177); stn 315, 1 (ZMA Coel. 1176). — Unnumbered station, Banda Sea, 1 (USNM 97553, ex. ZMA Coel. 1178). — Unnumbered station, Ambon, 1 (ZMA Coel. 1175).

"Galathea": Stn 485, 4 (ZMUC).

Koedingarrang Keke, southwestern Sulawesi, 30-32 m, 17.07.1985, 8 (NNM 22431, 22433); Samalona, southwestern Sulawesi, 23 m, 10.07.1985, 1 (NNM 22432).

TYPE LOCALITY. — Philippines (depth not given).

DIAGNOSIS. — Corallum elongate and compressed, having rounded thecal edges and 1 pair of downward projecting edge spines just above basal scar. Additional coralla (anthoblasts) bud from the thecal edges, up to 4 coralla occurring on each edge. Buds ultimately detach at a height of 4-5 mm. Largest Indonesian specimen (USNM 97553, ex ZMA Coel. 1178) 8.9 x 11.2 mm in calicular diameter and 27.8 mm in height. Angle of thecal edges 10°-16°; angle of thecal faces 10°-12°. Calice elliptical: GCD:LCD = 1.3-1.6. Basal scar 2.3-2.5 x 2.8-3.3 mm in diameter. Theca white and usually encrusted. Septa hexamerally arranged in 4 cycles ($S_{1-2}>S_3>S_4$), although 4th cycle sometimes incomplete. Columella rudimentary, consisting of a fusion of lower, inner edges of S_{1-2}.

REMARKS. — Although similar in shape to species of *Truncatoflabellum*, *Blastotrochus* differs in budding corallites from its thecal edges. *B. nutrix* is more fully described and illustrated by CAIRNS (1989a, c).

DISTRIBUTION. — *Philippines*: Lapinig Canal, north of Bohol; 11-18 m. *Indonesia*: Banda Sea (Ambon and Banda Islands); Flores Sea (southwestern Sulawesi); Bali Strait; eastern Java Sea; 23-62 m.

Genus ***PLACOTROCHIDES*** Alcock, 1902

Placotrochides scaphula Alcock, 1902

Placotrochides scaphula Alcock, 1902b: 121-122; 1902c: 34, pl. 4, figs 32, 32a. — CAIRNS, 1989a: 78-79, pl. 40, fig. 1, pl. 41, figs a-e (synonymy); 1994: 79-80, pl. 34, figs f-h; 1995: 116-117, pl. 38, fig. 38, pl. 39, fig. a. — CAIRNS & PARKER, 1992: 48-49, figs 15 h, i. — CAIRNS & KELLER, 1993: 272-273, pl. 12, figs D, G.

Flabellum elongatum Hu, 1987: 44, pl. 3, figs 4, 7-8 (**new synonymy**).

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: Stn 297, 1 (ZMA Coel. 1228).

TYPE LOCALITY. — *"Siboga"* stn 212: 5°54.5'S, 120°19.2'E (Flores Sea), 462 m.

DIAGNOSIS. — Corallum cylindrical, with virtually parallel thecal faces and parallel, rounded thecal edges. No edge spines. Calice elliptical, the specimen reported herein 9.2 mm in GCD, with a basal scar of approximately the same size as the calice. Shape of calice often asymmetrical, one thecal face being slightly less curved and having more septa than the other face. Theca white, engraved with shallow, vertical striae that delimit wide, flat costae. Septa hexamerally arranged in 4 cycles ($S_{1-2}>S_3>S_4$), the 4th often incomplete, resulting in 40 septa. All septa relatively thin and widely spaced. Fossa deep and elongate, containing a well-developed, elongate trabecular columella that occupies medial 1/3 of fossa.

REMARKS. — ALCOCK (1902b, c) chose a relatively small specimen (*"Siboga"* stn 212) as the holotype of this species, not even mentioning the larger, better-preserved specimen reported herein from *"Siboga"* stn 297. It is possible that ALCOCK did not have access to the entire *"Siboga"* collection when he wrote his report on the corals from that expedition, as many other large, well-preserved *"Siboga"* specimens are reported herein for the first time.

Placotrochides scaphula is more fully described by CAIRNS (1989a, 1994) and CAIRNS & PARKER (1992).

DISTRIBUTION. — *Philippines*: Verde Island Passage; Sulu Archipelago; 520-522 m. *Indonesia*: Flores Sea (southwestern Sulawesi); Timor Sea; 462-1628 m. *Elsewhere*: Japan (Honshu, Ryukyu Islands); southwest Indian Ocean; Victoria, Australia; 80-1360 m. Plio-Pleistocene of Taiwan (Hu, 1987).

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

Placotrochus laevis H. Milne Edwards & Haime, 1848

Placotrochus laevis H. Milne Edwards & Haime, 1848a: 283, pl. 8, figs 15, 15a. — SEMPER, 1872: 251-252, pl. 18, figs 11-13. — FAUSTINO, 1927: 61-62, pl. 5, figs 7-10. — CAIRNS, 1989a: 75-76, pl. 39, figs c-g (synonymy).
Placotrochus candeanus H. Milne Edwards & Haime, 1848a: 283-284. — ALCOCK, 1902c: 33.

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 91, 1 (ZMA Coel. 1234). — Stn 116, 2 (ZMA Coel. 1310-1311). — Stn 133, 1 (ZMA Coel. 1312). — Stn 273, 1 (ZMA). — Stn 279, 1 (ZMA Coel. 1313).
DEKI: stn 10, 9 (NNM 22599). — Stn 18, 1 (NNM 22600). — Stn 44, 1 (NNM 22601). — Stn 64, 3 (NNM 22602). — Stn 65, 2 (NNM 22603). — Stn 66, 1 (NNM 22604). — Stn 69, 1 (NNM 22605). — Stn 89, 1 (NNM 22606). — Stn 91, 1 (NNM 22607). — Stn 110, 4 (NNM). — Stn 116, 12 (NNM 22608).
SNELLIUS 2: stn 4.232, 1 (NNM 22596). — Stn 4.234, 1 (NNM 22597). — Stn 4.235, 1 (NNM 22598).
KARUBAR: stn 65, 5 anthocyathi (USNM 97554).

TYPE LOCALITY. — Philippines (depth not given).

DIAGNOSIS. — Angle of thecal edges 40°-72°; angle of thecal faces 20°-33°. Thecal edges narrow, rounded (not ridged or carinate); 1 pair of thecal edge spines near basal scar. Largest Indonesian specimen (KARUBAR stn 65) 10.3 x 19.7 mm in calicular diameter and 18.6 mm in height, with a basal scar diameter of 3.6 x 6.8 mm. C_{1-3} slightly ridged; corallum white. Septa hexamerally arranged in 5 complete cycles: $S_{1-3}>S_4>>S_5$ (96 septa). Columella lamellar, the lamellae sometimes subdivided into many smaller elements.

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

DISTRIBUTION. — *Philippines*: Bataan Peninsula; Sulu Sea (Basilan, Mindanao, and Sulu Archipelago); 35-69 m. *Indonesia*: Makassar Strait; Molucca Sea (Talaud Islands, Gulf of Tomini); Banda Sea (Kai, Aru, Barat Daya Islands); Arafura Sea (southeast of Tanimbar Islands); Flores Sea (Selayar Island); Bali Sea; Sunda Strait, Java Sea; 12-289 m, but most records less than 100 m. *Elsewhere*: "South China Sea"; Australia (Arnhem Land; Cape Jaubert, northwestern Australia; Queensland); India (Gulf of Mannar); 22-24 m.

Suborder DENDROPHYLLIINA

Family DENDROPHYLLIIDAE Gray, 1847

Genus *BALANOPHYLLIA* Searles Wood, 1844

Balanophyllia carinata (Semper, 1872)

Rhodopsammia carinata Semper, 1872: 257, pl. 19, figs 6a-b.
Rhodopsammia amoena Semper, 1872: 258, pl. 19, figs 5a-b.
Balanophyllia parallela - VAN DER HORST, 1922: 62. — UMBGROVE, 1938: 272. [Not *Rhodopsammia parallela* Semper, 1872].
Balanophyllia carinata - ZIBROWIUS, 1985: 235-238, figs 15-24 (synonymy). — ZIBROWIUS & GRYGIER, 1985: 127, figs 30-35.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5134, 1 (USNM 97555). — Stn 5139, 5 (USNM 97556). — Stn 5151, 1 (USNM 97557). — Stn 5152, 4 (USNM 97558). — Stn 5156, 2 (USNM 97559). — Stn 5164, 17 (USNM 97560).
SIPHILEXP: stn 78-T14, 1 (USNM 77314).

Indonesia. *"Siboga"*: stn 240, 5 (ZMA Coel. 567) (*B. parallela* of VAN DER HORST, 1922).

DEKI: unnumbered station, Komkir, 75-90 m, 3 (ZMUC). — Stn 10, 20 (NNM 17352). — Stn 14, 2 (NNM 17357). — Stn 18, 20 (NNM 17358). — Stn 20, 4 (NNM 17353). — Stn 24, 1 (NNM 17355). — Stn 31, 2 (NNM 17354). — Stn 38, 1 (NNM 17351). — Stn 64, 20 (NNM 17345). — Stn 70, 7 (NNM 17346). — Stn 82, 20 (NNM 17347). — Stn 84, 4 (NNM 17364).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 82 (ZMUC). — Stn 6, 3 (ZMUC). — Stn 8, 6 (ZMUC).

CORINDON 2: stn 292, 1 (MNHN).

SNELLIUS 2: stn 4.228, 1 (NNM 17363). — Stn 4.234, 4 (NNM 17361).

TYPE LOCALITY. — Bohol near Pandonon, Philippines, 55 m.

DIAGNOSIS. — Corallum unattached, straight to slightly curved, and compressed, the elliptical calice having a GCD:LCD range of 1.15-1.55. Corallum edges sharp and slightly keeled, small buds asexually generating from the edges. Once a bud detaches, a small irregularity may persist on thecal edge of parent. Because predominant mode of reproduction appears to be by asexual budding, the base of most specimens is usually an open fracture about 1 mm in diameter, revealing the 6 protosepta. Most specimens small, rarely over 10-11 mm in GCD, but ZIBROWIUS (1985) reported a specimen 20 mm in GCD, and another listed above (SIPHILEXP stn 78-T14) measures 14.2 x 21.6 mm in calicular diameter and 33.1 mm in height. Septa hexamerally arranged in 4 cycles in a Pourtalès plan, only larger specimens (GCD>19 mm) having pairs of S_5, the largest specimen having 88 septa. S_{1-2} independent, slightly exsert, and relatively narrow, with smooth inner edges. Remaining septal cycles have laciniate inner edges. Columella well developed and elongate, flat on top, and fused to lower, inner edges of the S_{1-2}.

REMARKS. — Few specimens have been collected with attached buds, the buds apparently detaching at a relatively small size.

This species has been found to host the petrarcid ascothoracidan *Zibrowia auriculata* Grygier, 1985, the gall of which causes the columella to become larger and more porous than normal (ZIBROWIUS & GRYGIER, 1985). *B. carinata* is more fully described and illustrated by ZIBROWIUS (1985).

DISTRIBUTION. — *Philippines*: Visayan Sea; Bohol Sea; Sulu Sea (Basilan and Sulu Archipelago); 33-84 m. *Indonesia*: Makassar Strait; Pleistocene of Talaud (UMBGROVE, 1938); Banda Sea (Banda and Kai Islands); Flores Sea (Selayar Island); Bali Strait; Sunda Strait, Java Sea; 45-100 m. *Elsewhere*: tropical Indo-West Pacific, including Somalia, northern Indian Ocean, and Chesterfield Islands; 55-95 m.

Balanophyllia stimpsonii (Verrill, 1865)

Eupsammia stimpsonii Verrill, 1865: 150.
Eupsammia stimpsoniana Verrill, 1866: 29, pl. 2, figs 3, 3a.
Rhodopsammia socialis Semper, 1872: 260-261, pl. 20, figs 1-4. — FAUSTINO, 1927: 229, pl. 75, figs 9-12.
Rhodopsammia affinis Semper, 1872: 261-262, pl. 19, figs 7a-b.
Rhodopsammia incerta Semper, 1872: 264, pl. 19, figs 8a-b. — FAUSTINO, 1927: 231, pl. 75, figs 3-4.
Leptopsammia conica van der Horst, 1922: 68-69, pl. 8, figs 14-15.
Balanophyllia affinis - FAUSTINO, 1927: 228-232, pl. 75, figs 1-2. — VAN DER HORST, 1922: 62.
Balanophyllia stimpsonii - ZIBROWIUS, 1985: 234-235, figs 1-14 (synonymy). — CAIRNS & KELLER, 1993: 274.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5133, 17 (USNM 97561). — Stn 5137, 1 (USNM 97562). — Stn 5143, 2 (USNM 97563). — Stn 5156, 1 (USNM 97564). — Stn 5164, 12 (USNM 97565).

MUSORSTOM 2: stn 9, 1 (MNHN).

Indonesia. DEKI: stn 10, 1 (NNM 17375). — Stn 14, 2 (NNM 17376). — Stn 18, 10 (NNM 17377). — Stn 30, 1 (ZMA Coel. 5479). — Stn 64, 4 (NNM 17369). — Stn 68, 1 (NNM 17368). — Stn 82, 100+ (NNM 17370). — Stn 84, 1 (NNM 17389). — Stn 100, 1 (NNM 17372).

MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 14 (ZMUC). — Stn 8, 2 (ZMUC).

"Te Vega": stn 1-54, 12 (USNM 97566).

SNELLIUS 2: stn 4.228, 2 (NNM 17384). — Stn 4.232, 2 (NNM 17383). — Stn 4.234, 10 (NNM 17382). — Stn 4.235, 4 (NNM 17381).

TYPE LOCALITY. — "North China Sea" (depth not given).

DIAGNOSIS. — Corallum unattached, straight to slightly curved, and ceratoid. Calice circular to elliptical: GCD:LCD = 1.0-1.4. Thecal faces evenly rounded (corallum not highly compressed or keeled), bearing buds (some up to 20 mm in height), that originate randomly on theca. Tip of broken base 1.3-1.6 mm in diameter. Most specimens 9-10 mm in GCD, but ZIBROWIUS (1985) reported a specimen 15 mm in GCD. Septa hexamerally arranged in 4 complete cycles, only larger specimens having some pairs of S_5 (up to a total of 66 septa). S_1 largest septa: slightly exsert and broad, having smooth, vertical inner edges. S_2 about 3/4 width of an S_1, having smooth inner edges. S_3 only 1/4 width of an S_2, having dentate to laciniate inner edges, each pair bending toward their common S_2. S_4 rudimentary, each pair bending slightly toward their common S_3. Fossa deep; columella small, composed of several twisted laths.

REMARKS. — *Balanophyllia stimpsonii* differs from the other unattached western Pacific species, *B. carinata* (Semper, 1872) in having a less compressed corallum (*i.e.*, a lower GCD:LCD and no thecal keels); budding from the entire circumference of the corallum, not just from keeled thecal edges; and S_2 that are smaller than S_1. *B. stimpsonii* is more fully described and illustrated by ZIBROWIUS (1985).

Like *B. carinata*, *B. stimpsonii* is also known to be a host for the petrarcid ascothoracidan genus *Zibrowia* Grygier, 1985, which produces a gall in the columella (ZIBROWIUS & GRYGIER, 1985).

DISTRIBUTION. — *Philippines*: Lubang Island; Bohol Sea; Sulu Sea (Mindanao and Sulu Archipelago); 18-70 m. *Indonesia*: Halmahera Sea (Gulf of Kau); Banda Sea (Kai Islands and southeastern Sulawesi); Flores Sea (Sumbawa and Selayar Island); Bali Strait; 35-75 m. *Elsewhere*: widespread throughout tropical Indo-West Pacific, from southwestern Indian Ocean to Chesterfield Islands; 18-95 m.

Balanophyllia desmophyllioides Vaughan, 1907

Figs 23 g-h

Balanophyllia desmophyllioides Vaughan, 1907: 149-150, pl. 45, fig. 1.
Balanophyllia desmophylloides - CAIRNS, 1984: 26.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 3, 1 (MNHN). — Stn 63, 1 (MNHN). — Stn 65, 5 (USNM 97568).
MUSORSTOM 2: stn 17, 1 (USNM 97569). — Stn 33, 10 (MNHN).
Indonesia. *"Galathea"*: stn 488, 1 (ZMUC).
"Hakuho Maru": stn KH85-1-A2, 2 (USNM 97571).
CORINDON 2: stn 266, 2 (MNHN).
KARUBAR: stn 13, 1 (MNHN). — Stn 18, 3: 2 (MNHN), 1 (USNM 97570). — Stn 32, 2 (MNHN). — Stn 49, 1 (POLIPI).

TYPE LOCALITY. — *"Albatross"* stn 4061: 20°16'10"N, 155°53'20"W (Hawaii), 44-152 m.

DESCRIPTION. — Corallum elongate-conical to trochoid, the adult tending to become strongly compressed (GCD:LCD = 1.37-1.90) on a robust, cylindrical pedicel (PD:GCD = 0.24-0.39). Largest known specimen (MUSORSTOM 1 stn 3) 18.1 x 35.1 mm in calicular diameter and 42.0 mm in height, with a pedicel diameter of 11.0 mm. Profile of thecal face highly arched. Costae of lower corallum well defined by deep, narrow intercostal striae, but costal definition less clear in upper corallum, the theca being highly porous and granular in texture. No epitheca.

Septa hexamerally arranged in 5 cycles, the 5th complete at a GCD of 15-19 mm. S_{1-3} of mature specimens independent, slightly exsert (about 2.2 mm), and quite thick and porous at their upper edges. Inner edges of S_{1-3} smooth in upper 1/2 of fossa, changing to coarsely dentate in lower 1/2 of fossa. Dentition regular, each rectangular tooth about 0.3 mm wide. S_4 smallest septa, about 1.3 mm exsert, 0.6 mm thick, having a smooth inner margin that attenuates about 1/2 distance down fossa. S_5 and S_4 equally exsert and thick, a pair of S_5 fusing

before each S_4 high in fossa and extending to the columella as 1 septum. Lower inner edge of combined S_5 dentate like the S_{1-3}. Fossa deep and spacious. Columella small in relation to size of corallum, composed of a narrow (about 1.7 mm wide), elongate field of many, small (0.15 mm diameter) papillae that are weakly swirled in a clockwise vortex. Columella low, but discrete and slightly convex.

REMARKS. — *Balanophyllia desmophyllioides* is distinguished from other species by its highly arched calice; its coarsely dentate S_{1-3} and S_5; and the fusion of each pair of S_5 high in the calice before their common S_4. Some of the specimens reported above are much larger than the holotype and subsequently reported specimens (CAIRNS, 1984), the holotype being only 15.0 mm in GCD and somewhat irregular in shape.

In our opinion, the species name was originally incorrectly formed, being derived from the root *Desmophyllum*, and thus should be *desmophylloides*. However, according to the ICZN (Article 32dii) the original spelling cannot be changed.

DISTRIBUTION. — *Philippines*: Lubang Island and Verde Island Passage, Luzon; 122-194 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); Arafura Sea (east of Tanimbar Islands); Flores Sea (southwestern Sulawesi); Bali Strait; 95-393 m. *Elsewhere*: Hawaiian Islands; 101-658 m.

Balanophyllia cornu Moseley, 1881

Figs 24 d-f

Balanophyllia cornu Moseley, 1881: 192-193, pl. 12, figs 11-15. — ALCOCK, 1902c: 41. — CAIRNS, 1994: 82-83, pl. 35, figs f-i (synonymy).
Not *Balanophyllia cornu* Sokolow, 1894: 88-91 (junior primary homonym).
Not *Balanophyllia cornu* - CAIRNS, 1984: 26 (= ? *B. gigas* Moseley, 1881).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5110, 5 (USNM 97573). — Stn 5268, 1 (USNM 97573). — Stn 5280, 3 (USNM 97574). — Stn 5281, 1 (USNM M230138). — Stn 5367, 1 (USNM 97575). — Stn 5391, 16 (USNM 97576). — Stn 5392, 100+ (USNM 97577). — Stn 5393, 1 (USNM 97578).

MUSORSTOM 1: stn 3, 3 (USNM 97579). — Stn 14, 1 (MNHN). — Stn 61, 1 (MNHN). — Stn 63, 2 (USNM 97580).

MUSORSTOM 2: stn 15, 4 (USNM 97582). — Stn 32, 7 (MNHN). — Stn 68, 1 (MNHN).

MUSORSTOM 3: stn 88, 7 (MNHN). — Stn 96, 1 (MNHN). — Stn 100, 1 (MNHN). — Stn 102, 4 (MNHN). — Stn 105, 5 (MNHN). — Stn 108, 6: 1 (MNHN), 5 (USNM 97584). — Stn 120, 1 (USNM 97585). — Stn 126, 1 (USNM 97586). — Stn 133, 1 (USNM 97587).

Indonesia. *"Challenger"*: stn 192, 4 syntypes (BMNH 1880.11.25.143).

"Siboga": stn 297, 1 (ZMA 5482).

DEKI: stn 7, 2 (ZMA Coel. 5484). — Stn 48, 4 (NNM 17332). — Stn 49, 30 (NNM 17532).

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

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

"Hakuho Maru": stn KH72-1-28, 2 (USNM 97590). — Stn KH85-1-A2, 1 (USNM 97591).

KARUBAR: stn 7, 5 (POLIPI). — Stn 16, 1 (USNM 97588). — Stn 18, 4 (MNHN). — Stn 61, 3 (MNHN).

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

DESCRIPTION. — Corallum elongate-conical, with a slightly compressed calice (GCD:LCD = 1.1-1.3). Two growth forms occur: one having a straight, firmly attached (PD:GCD = 0.32-0.46) corallum, characteristic of the type series; the other a curved (ceratoid), usually free corallum (PD:GCD = 0.12-0.21). The straight form has a broadly encrusting base, whereas the curved form is either unattached or attached to a small object, such as a small gastropod shell. The differences in growth form may simply be the result of the kind of substratum available on which to settle, the costal and calicular characteristics being otherwise the same. Largest straight form (MUSORSTOM 3 stn 105) 19.5 x 23.1 mm in calicular diameter and 34.6 mm in height, with a pedicel diameter of 7.9 mm; largest specimen of ceratoid form (*"Albatross"* stn 5313) 22.9 x 27.5 mm in calicular diameter and 36.9 mm in height, with a pedicel diameter of 4.5 mm. Costae flat, 0.5-0.7 mm in width, and well defined by deep, narrow (about 0.1 mm) intercostal striae. Costae a reticulum covered by small, irregularly-shaped granules. Lateral faces of costae also bear small granules that project into intercostal striae. Usually no epitheca, but when present, restricted to lower pedicel.

Septa hexamerally arranged in up to 5 cycles: the 3rd (24 septa) complete at a GCD of about 8 mm; the 4th (48 septa) at 11-12 mm GCD; half of the 5th cycle (72 septa) at a GCD of 15-19 mm; and a full 5th cycle (96 septa) at about 24 mm GCD. S_{1-2} essentially the same size, only slightly exsert, having smooth, vertical inner edges that extend to the columella. S_3 about 2/3 width of S_{1-2}, also having smooth inner edges, which do not reach the columella. In a corallum with 72 septa, which is the most common complement, the quarter-systems adjacent to each S_2 contain only 1 S_4, whereas the quarter-systems adjacent to the S_1 contain 3 septa: 1 S_4 and a pair of S_5. S_4 adjacent to S_2 are approximately the same size as the S_5 adjacent to S_1 in the same half-system, the inner edges of these 2 septa fusing near the columella. Inner edges of higher cycle septa also smooth. Fossa of moderate depth, containing a well-developed, convex (discrete), elongate columella composed of many short lamellar elements swirled in a clockwise direction. In some specimens the inner edges of the 4 lateral S_1 constrict the elongate columella into 3 connected nodes.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Samar Sea; Sulu Sea (Semirara Islands); 185-368 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (east and southeast of Tanimbar Islands); Timor Sea (south of Leti Islands and southwestern Timor); Flores Sea (southwestern Sulawesi); Bali Strait; 196-520 m. *Elsewhere*: South China Sea (north of Pratas Islands); Formosa Strait; Japan (Honshu and Kyushu); 60-274 m.

Balanophyllia gemma (Moseley, 1881)

Figs 24 g-i

Thecopsammia gemma Moseley, 1881: 195, pl. 15, figs 8a-b.
Balanophyllia (Thecopsammia) gemma - ALCOCK, 1902c: 42. — FAUSTINO, 1927: 223-224, pl. 73, figs 5-7.
Balanophyllia sp. - VAN DER HORST, 1922: 64 (in part: 1 of 3 specimens from *"Siboga"* stn 95).
Not *Balanophyllia gemma* - VAN DER HORST, 1926: 50, pl. 3, figs 12-13. — CAIRNS & KELLER, 1993: 221 (= *Balanophyllia* sp.).

MATERIAL EXAMINED. — **Philippines**. *"Challenger"*: stn 201, holotype (BMNH 1880.11.25.147).
"Siboga": stn 95, 1 (ZMA Coel. 1166a).
"Albatross": stn 5135, 3 (USNM 97592).
MUSORSTOM 2: stn 33, 3 (USNM 97593).
Indonesia. DEKI: stn 46, 1 (NNM 17612). — Stn 59, 2 (NNM 17335).
KARUBAR: stn 49, 2 (POLIPI). — Stn 50, 8 (MNHN).

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

DESCRIPTION. — Corallum cylindrical, straight, and firmly attached through a thick pedicel (PD:GCD = 0.70-0.75) and slightly expansive base. Largest known specimen (*"Albatross"* stn 5135) 8.7 x 9.6 mm in calicular diameter and 17.4 mm in height. A thick transversely corrugated epitheca extends to within 2-5 mm of calicular edge. Costae equal in width (0.5-0.6 mm), flat, and highly porous, each costa uniformly covered with small spines. Intercostal striae thin (0.05-0.10 mm), straight, and shallow.

Septa hexamerally arranged in 4 complete cycles, all 48 septa equally nonexsert, having smooth inner edges. S_{1-2} equal in width, extending to columella. S_3 about 1/2 width of S_{1-2}. S_4 that are adjacent to S_1 fuse to that S_1 at calicular edge, their inner edges extending to the columella. Conversely, S_4 that are adjacent to S_2 also fuse to that S_2, each S_4 bending toward the other S_4 within its half-system, but not fusing with it and not quite reaching the columella. Fossa shallow. Columella a discrete, elongate structure composed of short lamellae swirled in a clockwise direction.

REMARKS. — *Balanophyllia gemma* resembles a small, firmly attached specimen of *B. cornu* Moseley, 1881, but can be distinguished by its well-developed epitheca, shallow fossa, and nonexsert septa.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Sulu Sea (Zamboanga Peninsula, Mindanao; Sulu Archipelago); Basilan Strait; 137-294 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); Timor Sea (southwestern Timor); 185-522 m.

Balanophyllia parvula Moseley, 1881

Figs 23 i, 24 a

Balanophyllia parvula Moseley, 1881: 194-195, pl. 15, figs 9, 9a. — Alcock, 1902c: 41. — Faustino, 1927: 234, pl. 73, figs 3-4.

Material examined. — **Philippines**. *"Challenger"*: stn 201, 2 syntypes (BMNH).
Musorstom 2: stn 32, 1 (MNHN).
Musorstom 3: stn 108, 6 (MNHN).
Indonesia. *"Siboga"*: stn 251, 1 (NNM 22429).
Deki: stn 46, 1 (NNM 17334).
Karubar: stn 18, 1 (MNHN). — Stn 49, 9: 4 (MNHN), 5 (USNM 97596).
South China Sea. *"Albatross"*: stn 5310, 1 (USNM 97594).

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

Description. — Corallum elongate-conical and straight, having a slightly compressed calice (GCD:LCD = 1.14-1.23) and attached by a robust pedicel (PD:GCD = 0.32-0.49). Largest known specimen (Karubar stn 49) 10.9 x 13.4 mm in calicular diameter and 18.4 mm in height, with a pedicel diameter of 4.4 mm. Costae quite porous and well defined by narrow intercostal striae; however, lower 1/4 to 1/3 of corallum covered by a thin epitheca.

Septa hexamerally arranged in 4 complete cycles in a strongly developed Pourtalès plan. S_1 highly exsert (up to 3.0 mm), remarkably thick (up to 1.6 mm at calicular edge), having smooth, vertical inner edges that attain the columella. S_2 less exsert (up to 2.0 mm), only about 1/2 thickness of S_1, and about 3/4 width of S_1. Inner edges of S_2 also entire but do not quite attain the columella. S_3 rudimentary, only about 0.7 mm exsert, 0.4 mm in thickness, and about 1/4 width of an S_2. S_4 dimorphic in size: those adjacent to S_1 highly exsert (up to 2.8 mm), fused to adjacent S_1 in robust triangular lancets; S_4 adjacent to S_2 slightly less exsert (up to 1.2 mm), also fused to adjacent S_2 but in less prominent lancets. Pairs of S_4 unite before their common S_3 high in fossa and extend to the columella, sometimes fusing with inner edges of other S_4 within their system near the columella. Inner edges of S_4 laciniate, bearing tall, regularly spaced teeth up to 0.6 mm tall. Fossa deep; columella rudimentary.

Remarks. — *Balanophyllia parvula* is distinguished from other Indo-West Pacific congeners by its remarkably thick and exsert S_1, which contribute to form tall, triangular calicular lancets. It is also distinguished in having a strongly developed Pourtalès plan, laciniate S_4, and a rudimentary columella.

Moseley (1881) reported 3 specimens (syntypes) from *"Challenger "* stn 201 in his original description of *Balanophyllia parvula*, 2 juveniles and 1 adult, the adult of GCD 8.0 mm being the figured specimen. Both juveniles were present at the BMNH in 1994, but the adult specimen could not be found. Judging from Moseley's figure, *B. parvula* is a distinctive species represented by additional specimens reported above, but the 2 smaller juvenile (GCD 4.4 and 4.8 mm) syntypes appear to be a different species, perhaps founder corallites of a *Rhizopsammia*. Because of the possibility of 2 species being represented in Moseley's type-series, the large figured specimen is designated as the lectotype, even though it could not be found in 1994. Alcock (1902c) reported 1 specimen of *B. parvula* from *"Siboga"* stn 251. A specimen at the NNM from this station fits Moseley's figured *B. parvula*, but another *Balanophyllia* (species indet.) is also known from that station (ZMA).

Distribution. — *Philippines*: Verde Island Passage; Sulu Sea (Zamboanga Peninsula); 192-195 m. *Indonesia* : Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 206-300 m. *Elsewhere*: South China Sea (north of Pratas Islands); 183 m.

Balanophyllia crassiseptum sp. nov.

Figs 25 a-c

Material examined/types. — **Philippines**. Musorstom 1: stn 32, 3 paratypes (MNHN).

Indonesia. DEKI: stn 7, 1 paratype (ZMA). — Stn 63, 1 paratype (NNM 17333).
KARUBAR: stn 49, 74 paratypes: 27 (MNHN), 3 (POLIPI), 44 (USNM 97654). — Stn 50, holotype (MNHN) and 32 paratypes (MNHN).

TYPE LOCALITY. — KARUBAR stn 50: 7°59'09"S, 133°01'56"E (Arafura Sea southeast of Tanimbar Islands), 184-185 m.

ETYMOLOGY. — The species name *crassiseptum* (Latin *crassus*, thick + *septum*, literally fence or bar), alludes to the thick septa of this species. The name is treated as a noun in apposition.

DESCRIPTION. — Corallum elongate-conical, straight, and compressed (GCD:LCD = 1.15-1.45). Pedicel robust : PD:GCD = 0.45-0.55. Largest known specimen (holotype) 10.2 x 14.8 mm in calicular diameter, 17.0 mm in height, and 8.2 mm in pedicel diameter. Costae flat and porous, of variable width, and separated by thin intercostal striae that sharply mark the costal boundaries. A thin epitheca covers basal 20-50% of corallum, which is usually highly encrusted. Corallum white to light purple, the latter colour caused by an endolithic microorganism.

Septa hexamerally arranged in 4 complete cycles. S_1 remarkably thick, as much as 1.5 mm at calicular edge. S_1 quite exsert (up to 2.3 mm), porous, having a smooth inner edge that attains the columella. S_2 also quite thick (up to 0.9 mm) but only 1/2 as much as the S_1. S_2 up to 1.3 mm exsert, also porous, their inner edges also attaining the columella. S_{3-4} 0.5-0.6 mm thick. S_3 rudimentary. S_4 adjacent to S_1 more exsert than S_2, but S_4 adjacent to S_2 are as exsert as S_3. Inner edges of S_4 finely dentate. Fossa shallow, containing a well-developed, discrete papillose columella.

REMARKS. — *Balanophyllia crassiseptum* is very similar to *B. parvula* Moseley, 1881, both species having very thick S_{1-2} and sometimes are found at the same stations. *B. crassiseptum* differs in having a larger columella, less dentate inner edges of S_4, and S_2 that extend completely to the columella, not only 1/2 that distance as in *B. parvula*.

The corallum of the holotype is bored by an acrothoracidan cirripede (Fig. 25 c) (see GRYGIER & NEWMAN, 1985).

DISTRIBUTION. — *Philippines*: Lubang Island; 183-193 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (southeast of Tanimbar Islands); 185-250 m.

Balanophyllia rediviva Moseley, 1881

Figs 25 d-f

Balanophyllia rediviva Moseley, 1881: 193-194, pl. 15, figs 10-12. — VAN DER HORST, 1922: 59.
? *Balanophyllia rediviva* UMBGROVE, 1938: 273.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 3, 1 (MNHN). — Stn 57, 1 (MNHN).
MUSORSTOM 2: stn 33, 6 (MNHN).
MUSORSTOM 3: stn 117, 3 (USNM 97598).
Indonesia. *"Challenger"*: stn 192, syntypes (BMNH 1880.11.25.145).
CORINDON 2: stn 248, 1 (MNHN).
KARUBAR: stn 22, 1 (MNHN).

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

DESCRIPTION. — Largest known corallum (KARUBAR stn 22) cylindrical, elongate and slightly bent: 8.3 x 9.5 mm in calicular diameter and 71 mm in length, having 3 episodes of rejuvenescence. Epitheca extends to within 9-10 mm of calicular edge, but most of theca worn and covered with foraminifera and serpulid tubes. Theca highly porous. C_{1-3} thin (about 0.3 mm) and slightly ridged, whereas C_4 are much broader (about 0.7 mm) and flat.

Septa hexamerally arranged in 4 complete cycles. S_1 highly exsert (2.1 mm), having smooth inner edges that extend to columella. S_2 much less exsert (0.7 mm), about 4/5 width of an S_1, also having entire inner edges. S_3 little exsert (0.3 mm), only about 1/3 width of an S_2, having entire inner edges. S_4 adjacent to S_1 highly exsert (about 1.3 mm), at the calicular edge strongly fused to adjacent S_1 in triangular lancets. S_4 adjacent to S_2 considerably less exsert (0.3 mm) than those adjacent to S_1, the inner edges of each pair of S_4 within a half-system fusing before its common S_3 near the columella. Inner edges of S_4 regularly dentate. Fossa of moderate depth, containing a discrete, elongate, spongy columella that is sometimes constricted by the lower, inner edges of the 4 lateral S_1.

REMARKS. — *Balanophyllia rediviva* is similar to *B. laysanensis* Vaughan, 1907, in calicular features, but can be distinguished by its elongate, cylindrical corallum; slightly ridged C_{1-3}; and dentate S_4.

Only 3 of MOSELEY's 4 syntypes could be located at the BMNH in 1994: the specimen illustrated as MOSELEY's (1881) pl. 15, figs 10a-b is the only well-preserved corallum and is here designated as the lectotype.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Mindoro Strait; 97-183 m. *Indonesia*: Makassar Strait; Banda Sea (Kai Islands); 90-235 m. ? Holocene of Talaud Islands (UMBGROVE, 1938).

Balanophyllia gigas Moseley, 1881

Balanophyllia gigas Moseley, 1881: 193. — VAN DER HORST, 1922: 58-59, pl. 8, fig. 22. — CAIRNS, 1994: 83, pl. 35, figs j-l (synonymy); 1995: 119-120, pl. 40, figs f-h (synonymy).

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 1, 1 (MNHN). — Stn 27, 1 (USNM 97600).
Indonesia. DEKI: stn 50, 1 (NNM).
KARUBAR: stn 13, 1 (POLIPI).

TYPE LOCALITY. — Japan (depth not given).

DIAGNOSIS. — Corallum ceratoid, often bent (up to 90°), and quite large. Largest Indonesian specimen (VAN DER HORST, 1922) 30 x 24 mm in calicular diameter, but some New Zealand specimens (CAIRNS, 1995) are larger still. Pedicel robust: PD:GCD = 0.30-0.57. Basal 1/2 to 2/3 of theca epithecate and usually covered with encrusting organisms. Costae flat, quite porous, and equal in width. Septa hexamerally arranged in 5 cycles in a Pourtalès plan, the 5th cycle rarely complete. S_{1-2} are 2-4 mm exsert, along with adjacent higher cycle septa forming 12 triangular calicular lancets. S_3 about 3/4 width of S_{1-2}, the septa of all 3 cycles being independent, smooth-edged, and reaching the columella; S_{4-5} have laciniate inner edges. Fossa deep. Columella discrete, composed of short, swirled lamellar elements.

REMARKS. — This species is characterised by attaining a large size (up to 79 mm in height and 33 mm in calicular diameter), having epitheca, and usually having a bent corallum. It is more fully described and illustrated by CAIRNS (1994, 1995).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; 100-188 m. *Indonesia*: Banda Sea (Kai Islands); 90-393 m. *Elsewhere*: Japan (Honshu and Kyushu); Hawaiian Islands; New Zealand; 90-640 m.

Balanophyllia serrata sp. nov.

Figs 24 b-c

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 1: stn 27, 2 paratypes (USNM 97601). — Stn 63, 1 paratype (MNHN). — Stn 65, 4 paratypes (USNM 97602). — Stn 69, holotype (MNHN).
MUSORSTOM 3: stn 108, 1 paratype (MNHN).

TYPE LOCALITY. — MUSORSTOM 1 stn 69: 13°58.8'N, 120°17.3'E (north of Lubang Island, Philippines), 187-199 m.

ETYMOLOGY. — The species name (Latin *serratus*, toothed like a saw) refers to the jagged calicular edge of this species.

DESCRIPTION. — Corallum large, elongate-conical to trochoid, straight, and slightly flared distally. Largest specimen (the holotype) 34.1 x 27.1 mm in calicular diameter and 45 mm in height, with a pedicel diameter of 17.3 mm. Pedicel robust: PD:GCD = 0.27-0.51; base encrusting. Calice elliptical: GCD:LCD = 1.17-1.37. Costae 0.7-0.9 mm wide, flat, and covered with small spines arranged 3 or 4 across the width of each costa. Intercostal striae thin (0.2 mm) and deep, contributing to a highly porous theca. No epitheca, but lower pedicel of large specimens covered with a solid stereome, obscuring the porous nature of the theca. No encrusting organisms noted on stereome.

Septa hexamerally arranged in 5 cycles, a specimen of 27 mm GCD having a complete 5th cycle, but the largest specimen of 34 mm GCD with only 88 septa (4 pairs of S_5 not formed). S_{1-2} highly exsert: S_1 4.0-5.5 mm exsert, S_2 3-4 mm exsert. Both S_1 and S_2 are independent septa, quite thick at the calicular edge (up to 1.9 mm), having smooth inner edges that extend inward to the columella. S_3 much less exsert, about 3/4 width of the S_{1-2}, not reaching the columella. S_4 approximately 1/2 width of an S_3. S_5 adjacent to lower order septa highly exsert, fusing at the calicular margin to their adjacent lower order septa, and forming calicular lancets. Lower, inner edges of the 2 S_5 within each half-system that are adjacent to S_{1-2} meet and fuse near columella. Conversely, the 2 S_5 within each half-system that are adjacent to S_3 are the smallest septa (less wide than an S_4) and little exsert, their inner edges bending toward and often fusing to adjacent S_4. S_5 usually porous near the theca, having coarsely dentate inner edges. Fossa of moderate depth. Columella rudimentary, elongate, and constricted by lower, inner edges of lateral S_1. Columella discrete, composed of short lamellae.

REMARKS. — This species has a large corallum and septal arrangement similar to that of *B. gigas* Moseley, 1881. It differs in having no epitheca, a slightly flared calice with more highly exsert S_{1-2}, and a straight corallum.

DISTRIBUTION. — *Philippines*: north of Lubang Island; 190-194 m.

Balanophyllia generatrix sp. nov.

Figs 25 g-i, 26 a-b

MATERIAL EXAMINED/TYPES. — **Philippines**. *"Siboga"*: stn 102, 1 corallum, paratype (ZMA Coel. 5483).
"Albatross": stn 5543, 1 quasicolony, paratype (USNM 97603).
Indonesia. *"Siboga"*: stn 41, 1 quasicolony (ZMA Coel. 5538) and several isolated corallites (ZMA Coel. 5489), paratypes.
DEKI: stn 12, 1 quasicolony, paratype (NNM). — Stn 58, 2 quasicolonies, paratypes (ZMA Coel. 5493).
KARUBAR: stn 16, 1 quasicolony, paratype (MNHN). — Stn 82, 1 quasicolony (holotype, MNHN) and 1 additional quasicolony and several isolated coralla, paratypes (USNM 97604).

TYPE LOCALITY. — KARUBAR stn 82: 9°30'00"S, 131°02'41"E (Arafura Sea south of Tanimbar Islands), 215-218 m.

ETYMOLOGY. — The species name (*generatrix*, Latin for "the one that produces offspring") was the unpublished museum (ZMA) name used by VAN DER HORST, who believed the species to be truly colonial. In fact, the quasicolony results from contiguous independent planular settlement.

DESCRIPTION. — Corallum elongate-conical, usually occurring in a quasicolonial structure, *i.e.*, individual planulae settle close to one another, usually on the theca of an older or dead conspecific corallum, not as the result of budding. The central individual may release the planulae that eventually colonize its theca, but in no case does a corallum appear to bud from the theca of another living corallum. The bases of closely adjacent coralla often

coalesce (fuse) appearing as though they have a common basal coenosteum, but this is not due to coloniality. The holotype is such a quasicolony consisting of a dead central corallum 20.1 x 33.7 mm in calicular diameter and 56 mm in height, on which 28 individual coralla have settled, one as tall as 45 mm. Coralla may attain a height of 70 mm (*"Siboga"* specimens) but never bud additional coralla. The calice is circular to elliptical in cross section (GCD:LCD = 1.1-1.95), the more elliptical calices characteristic of larger coralla. Pedicel robust, the PD:GCD being about 0.33. Costae poorly defined, most of the porous theca covered with a fine spination; no epitheca.

Septa hexamerally arranged in 5 full cycles, passing through the 4 cycle stage at a GCD of 6-9 mm. S_{1-2} equal in size, only very slightly exsert (about 1 mm), having finely dentate lower, inner edges. S_3 similar to S_{1-2}, also being independent, but their inner edges do not reach quite as far into the fossa as the S_{1-2}. S_4 rudimentary. Pairs of S_5 fuse fairly high in the fossa, having coarsely dentate inner edges that extend as far toward the columella as do those of the S_{1-2}. Fossa quite deep, containing an elongate, discrete columella composed of many very small papillae.

REMARKS. — *Balanophyllia generatrix* is similar to *B. gigas* Moseley, 1881, both having large coralla and 5 cycles of septa, but *B. generatrix* is distinguished by its quasicolonial habit, very deep fossa, finer columella, and coarse dentition of the S_5.

One quasicolony from *"Siboga"* stn 41 and 2 from DEKI stn 58 were found with VAN DER HORST labels reading *Dendrophyllia generatrix*, the specimen from the *"Siboga"* station labelled as the "type", the others as a "cotype". Independently, specimens from the *"Albatross"* and KARUBAR expeditions had been segregated by the first author as an unidentified species. VAN DER HORST's unpublished manuscript name is adopted for it herein. It is understandable that VAN DER HORST considered this species to be a colony resulting from budding and thus called it a *Dendrophyllia*, but for reasons explained in the species description it is here described as a *Balanophyllia*.

DISTRIBUTION. — *Philippines*: Bohol Sea; Sulu Archipelago; 296-535 m. *Indonesia*: Banda Sea (Kai Islands); Arafura Sea (south of Tanimbar Islands); Flores Sea; 96-385 m.

Balanophyllia imperialis Saville Kent, 1871

Figs 26 c-f

Balanophyllia imperialis Saville Kent, 1871: 284, pl. 23, figs 5a-b. — VAN DER HORST, 1922: 60-61 (in part: *"Siboga"* stn 153, pl. 8, fig. 25). — FAUSTINO, 1927: 224. — ZOU, 1988: 78, pl. 3, figs 1-14, pl. 4, figs 2a, 6a, 10a, 12a.
? *Balanophyllia imperialis* - HARRISON & POOLE, 1909: 905-906, pl. 86, figs 5a-c. — UMBGROVE, 1938: 272.
Balanophyllia sp. - ZIBROWIUS & GRYGIER, 1985: 128, fig. 37.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5133, 1 (USNM 97605). — Stn 5146, 4 (USNM 97606). — Stn 5174, 1 (USNM 97607).
MUSORSTOM 3: stn 142, 5 (MNHN).
Indonesia. *"Te Vega"*: stn 1-54, 7 (USNM 97609).
"Hakuho Maru": stn KH72-1-30, 8 (USNM 97608).
CORINDON 2: stn 248, 1 (MNHN).
South China Sea. Holotype (BMNH 1984.4.27.3).

TYPE LOCALITY. — Singapore, South China Sea (depth not given).

DESCRIPTION. — Corallum elongate-conical, straight to slightly curved, and attached by a slender pedicel: PD:GCD = 0.09-0.18. Calice elliptical: GCD:LCD = 1.27-1.49. Largest known specimen (the holotype) 22.6 x 33.7 mm in calicular diameter and 40.7 mm in height, with a pedicel diameter of 3.3 mm. Costae well defined by narrow, porous intercostal striae; C_5 usually slightly wider than C_{1-4}. Costae slightly convex and covered with small spines. Usually no epitheca.

Septa hexamerally arranged in 5 cycles, but 5th cycle occasionally incomplete by a few to several pairs of S_5, even in large coralla. S_{1-2} independent, having smooth inner edges. S_1 about 2.1 mm exsert, S_2 about 1.5 mm exsert, neither forming calicular lancets. Septa arranged in a Pourtalès plan, the inner edges of S_3 smooth, those of

the S_{4-5} laciniate. Fossa deep, containing a discrete, elongate, robust (up to 2.8 mm in width) columella consisting of tightly fused lamellar elements swirled in a clockwise direction.

REMARKS. — The large size (GCD > 30 mm) and septal number of *B. imperialis* invites comparison with 2 other species that have large coralla: *B. gigas* Moseley, 1881 and *B. serrata* sp. nov. *B. imperialis* differs in having a much narrower pedicel and in lacking calicular lancets. It is also characterised by having a very deep fossa and a robust columella.

DISTRIBUTION. — *Philippines*: Visayan Sea; Sulu Sea (Zamboanga Peninsula and Sulu Archipelago); 27-70 m. *Indonesia*: Makassar Strait; Halmahera Sea; Timor Sea; 55-170 m; ? Holocene of Talaud Islands (UMBGROVE, 1938). *Elsewhere*: South China Sea (Singapore); ? Mergui Archipelago; 18-38 m.

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

Endopachys grayi H. Milne Edwards & Haime, 1848

Endopachys grayi H. Milne Edwards & Haime, 1848b: 82-83, pl. 1, figs 2, 2a. — SEMPER, 1872: 267. — VAN DER HORST, 1922: 68. — FAUSTINO, 1927: 240-241, pl. 77, figs 1-2. — UMBGROVE, 1950: 648-650, pl. 82, figs 1-10, pl. 83, fig. 7. — ZIBROWIUS & GRYGIER, 1985: 128, figs 39-42. — ZOU *et al.*, 1988: 195. — CAIRNS, 1991: 24-25, pl. 10, figs i-j, pl. 11, figs a-b; 1994: 84-85, pl. 36, figs e, h, pl. 37, fig. i (synonymy); 1995: 121-122, pl. 41, figs c-h (synonymy). — CAIRNS & KELLER, 1993: 276.
Endopachys weberi Alcock, 1902a: 109-110 **[new synonym]**.
Endopachys sp. - VAN DER HORST, 1922: 68, pl. 8, fig. 4 (same specimen as ALCOCK's *E. weberi*).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5133, 6 (USNM 97610). — Stn 5268, 1 (USNM 97611). — Stn 5357, 1 (USNM 97612). — Stn 5593, 1 (USNM 97613).
MUSORSTOM 1: stn 57, 2 (USNM 97614).
MUSORSTOM 2: stn 29, 1 (MNHN).
MUSORSTOM 3: stn 102, 1 (MNHN). — Stn 131, 3 (MNHN).
Indonesia. *"Siboga"*: stn 51, 1 (holotype of *E. weberi*, ZMA Coel. 7734).
DEKI: stn 49, 2 (NNM 22714). — Unnumbered station, Ambon, 25-100 m, 3 (NNM 22715-17).
MORTENSEN'S JAVA-S.A. EXPEDITION: stn 5, 6 (ZMUC). — Stn 6, 4 (ZMUC). — Stn 8, 1 (ZMUC).
KARUBAR: stn 2, 1 (USNM 97616).

TYPE LOCALITY. — Unknown.

DIAGNOSIS. — Attached young stage rarely observed (holotype of *E. weberi*). Species best known from the unattached flabellate corallum, which results from budding. Corallum triangular in face view, the edge angle (exclusive of lateral crests) 50°-80° and the face angle changing from a narrow 15°-28° basally to a more open 42°-57° distally. Largest known specimen 38.9 mm in GCD and 34 mm in height (CAIRNS & KELLER, 1993); largest Philippine corallum (MUSORSTOM 2 stn 29) 12.3 x 16.9 mm in calicular diameter and 15.2 mm in height. Edge crests delicate, about 0.5 mm in thickness and up to 4 mm in height, occasionally bearing 1 or more small buds. Costae and intercostal spaces not well defined; costae unridged. Septa hexamerally arranged in 5 cycles in a Pourtalès plan. S_{1-2} up to 2.5 mm exsert. Pairs of S_5 within each quarter-system fuse before their common S_4, bearing a paliform lobe at this junction. Fossa deep; columella elongate, nondiscrete, and spongy.

REMARKS. — The face angle of *E. grayi* is low initially and broadens with height, whereas that of *E. bulbosa* is high as a juvenile and decreases with height. Other difference between the only two Recent species in this genus are given in the Remarks of *E. bulbosa*. A more complete description and illustrations of *E. grayi* are found in CAIRNS (1991, 1994, 1995).

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (west of Panay, Zamboanga Peninsula, and Balabac Island); 70-192 m. *Indonesia*: Halmahera Sea; Banda Sea (Kai and Ambon Islands); Bali Sea

(Bali Strait and Madura Bay); 50-245 m. *Elsewhere*: Malaysia (Celebes Sea off Sabah); common in tropical and warm temperate regions from southwest Indian Ocean to the Gulf of California, including South China Sea, Japan, New Zealand, and the Hawaiian Islands; 37-386 m.

Endopachys bulbosa sp. nov.

Figs 27 a-g

MATERIAL EXAMINED/TYPES. — **Indonesia**. KARUBAR: stn 62, holotype and 1 paratype (MNHN) and 1 paratype (USNM 97617). — Stn 67, 1 paratype (USNM 97618). — Stn 79, 1 paratype (MNHN).

TYPE LOCALITY. — KARUBAR stn 62: 9°02'10"S, 132°43'05"E (Arafura Sea southeast of Tanimbar Islands), 239-250 m.

ETYMOLOGY. — The species name (Latin *bulbosa*, bulbous or swollen) refers to the thick basal pads on the corallum base.

DESCRIPTION. — Corallum unattached, flabellate (GCD:LCD = 1.32-1.41), and massive, the largest specimen (the holotype) 33.7 x 45.7 mm in calicular diameter and 38.5 mm in height. Shape of corallum varies characteristically with age, the theca of lower 1/3 to 1/2 of a large corallum being exceptionally thick (up to 4 mm) and having an edge angle of 142°-155° and a face angle of 90°-104°. However, 10-14 mm above base the theca thins to about 1 mm, the edge angle decreases to 50°-55°, and the face angle to 40°-45°. Edge costae crested as high as 7 mm, being 1.5 mm thick on lower corallum. All 12 C_{1-2} highly ridged (up to 1.7 mm) in upper corallum, but flat and very broad in region of basal thickening, the C_1 being as much as 8 mm wide, the C_2 as much as 1.5 mm wide. C_{3-4} of thickened region only 0.3-0.5 mm wide; C_{3-5} of upper theca poorly defined. Asexual budding not observed in type series.

Septa hexamerally arranged in 5 cycles. S_{1-2} highly exsert (up to 5 mm), with thick (2 mm) upper edges and straight inner edges that attain the columella. S_3 not exsert, about 2/3 width of an S_{1-2}, their inner edges extending almost to columella. S_4 rudimentary, each S_4 flanked by a pair of S_5 that fuse before the S_4 and extend to the columella as 1 septum where each fuses with the other S_5 within its half-system. No paliform lobes. Fossa of moderate depth. Columella an elongate, discrete structure composed of many short lamellae swirled in a clockwise direction.

REMARKS. — The massive basal thecal thickening of this species is solid, not the exterior of an overly enlarged internal cavity, and thus has the effect of weighting the corallum as though with ballast, which might facilitate an upright or near-upright posture for the corallum. This basal thickening is not a characteristic of all larger coralla of *Endopachys*, since large coralla of *E. grayi* H. Milne Edwards & Haime, 1848, of GCD 40 mm do not have it. *E. bulbosa* also differs from *E. grayi* in having: well-defined, ridged C_{1-2}; much more exsert S_{1-2}; a larger discrete, convex columella; and in lacking paliform lobes. *E. maclurii* (Lea, 1833), known from the Eocene of southeastern U.S., has 6 strongly produced C_1, but nothing resembling the basal thickening of *E. bulbosa*.

DISTRIBUTION. — *Indonesia*: Arafura Sea (south and southeast of Tanimbar Islands); 233-251 m.

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

Leptopsammia stokesiana H. Milne Edwards & Haime, 1848

Figs 26 g-i

Leptopsammia stokesiana H. Milne Edwards & Haime, 1848b: 90, pl. 1, figs 4, 4a. — VAN DER HORST, 1922: 68, pl. 8, fig. 5. — FAUSTINO, 1927: 242, pl. 77, figs 3-4.

Balanophyllia stokesiana - SEARLES, 1956: 25, pl. 42, fig. c.

MATERIAL EXAMINED. — **Philippines**. MORTENSEN'S PACIFIC EXPEDITION: Jolo Island, Sulu Archipelago, 46 m, 19 March 1914, 1 (NNM). Holotype, (BMNH 1855.12.27.1).
Strait of Malacca. Malacca, depth unknown, BELCHER collection, 1 (BMNH 1842.11.28.10).

TYPE LOCALITY. — Philippines (depth not given).

DESCRIPTION (Philippine specimen). — Corallum elongate-conical, straight, and firmly attached by a broad pedicel: 7.3 x 9.1 mm in calicular diameter, 13.0 mm in height, and 4.6 mm in pedicel diameter. Porous theca covered with low, rounded, granular costae; no epitheca. Septa hexamerally arranged in 5 cycles, the 5th incomplete (a total of 54 septa): $S_{1-2}>S_3>S_4>S_5$. S_{1-2} nonexsert, having straight, smooth, vertical inner edges that attain the columella. S_3 about 3/4 width of S_{1-2}, having straight, finely dentate inner edges. S_4 about 1/3 width of S_3, having laciniate inner edges. S_5 rudimentary. Columella discrete, composed of several tightly-fused and twisted elements.

REMARKS. — Only 5 specimens of this species are known: the holotype (BMNH 1855.12.27.1, GCD = 10 mm), a specimen reported by VAN DER HORST (1922) deposited at the ZMA (GCD = 17.6 mm), one reported by SEARLE (1956) deposited at the USNM (78603), and the 2 specimens noted above. All 5 specimens are remarkably similar in morphology.

DISTRIBUTION. — *Philippines*: Sulu Archipelago; 46 m. *Indonesia*: Flores Sea (Sumbawa); 69 m. *Elsewhere* : Malacca; depth unknown.

Leptopsammia crassa van der Horst, 1922

Figs 27 h-i

Leptopsammia crassa van der Horst, 1922: 69, pl. 8, figs 11-12.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5130, 1 (USNM 97621).
Indonesia. *"Siboga"*: stn 258, holotype (ZMA Coel. 8462).

TYPE LOCALITY. — *"Siboga"* stn 258: 5°26.6'S, 132°32.4'E (Kai Islands, Banda Sea), 22 m.

DIAGNOSIS (specimen from *"Albatross"* stn 5130). — Corallum 10.3 x 8.6 mm in calicular diameter, 9.7 mm in height, and 4.2 mm in pedicel diameter. Costae not well-defined. Porous theca 0.7 mm thick; no epitheca. Septa hexamerally arranged in 4 cycles according to formula: $S_{1-2}>S_3>>S_4$. S_{1-2} nonexsert, having straight, vertical, smooth inner edges. S_3 2/3 width of S_{1-2}, having laciniate inner edges. S_4 rudimentary, having laciniate inner edges that do not fuse with adjacent septa. Fossa of moderate depth, containing a small elongate columella composed of several twisted elements.

REMARKS. — The *"Albatross"* specimen was compared directly to the holotype (ZMA Coel. 8642) and considered to be conspecific despite several differences. The *"Albatross"* specimen is slightly smaller, has thinner theca, and has fewer septa, the holotype having a septal complement of: 15:15:30 (60 septa), which is thought to be an aberration of a hexameral plan. Most other characters are the same.

Leptopsammia crassa differs from *L. poculum* (Alcock, 1902) (Figs 28 a-b), in having indistinct costae (the C_{1-2} of *L. poculum* are slightly raised) and in having a stouter corallum. *L. stokesiana* H. Milne Edwards & Haime, 1848, appears to differ from *L. crassa* in having some S_5 and a costate theca. However, so few specimens of *Leptopsammia* are known from the Indo-Pacific that a clear distinction among species is wanting.

DISTRIBUTION. — *Philippines*: Sulu Sea (Zamboanga Peninsula); 187 m. *Indonesia*: Banda Sea (Kai Islands); 22 m.

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

Endopsammia philippensis H. Milne Edwards & Haime, 1848

Figs 28 c-e

Endopsammia philippensis H. Milne Edwards & Haime, 1848b: 91, pl. 1, figs 5, 5a; 1860: 108. — FAUSTINO, 1927: 243-244, pl. 77, figs 5-6. — PILLAI & SCHEER, 1976: 71-72.
Thecopsammia regularis Gardiner, 1899: 169-170, pl. 19, fig. 8.
Balanophyllia regularis - VAN DER HORST, 1922: 63; 1926: 50, pl. 3, figs 10-11.
Endopsammia philippinensis (sic) - WELLS, 1964: 118, pl. 2, figs 12-13. — CAIRNS, 1991: 26. — CAIRNS & KELLER, 1993: 221.

MATERIAL EXAMINED. — **Philippines**. Holotype, BMNH 1855.12.27.25.
Indonesia. DEKI: unnumbered station, Damar Besar Island, Jakarta Bay, 4 (NNM 17518). — Unnumbered station, Nyamuk Kecil Island, Jakarta Bay, 4 (NNM 17519). — Unnumbered station, Nuhucut Island, Kai Islands, 2-3 m, 5 (NNM 17520). — Unnumbered station, Sebesi Island, Lampung, Sumatra, Sunda Strait, 33 (NNM 17521).
SNELLIUS 1: Potilyan Island, Pelokang, southwestern Sulawesi, 3 (NNM 17613).
SNELLIUS 2: stn 4.070, 2 (NNM 17517).
Papua New Guinea: *"Alpha Helix"*: stn M26, 1 (USNM 86818). — Stn M48, 2 (USNM 80018). — Stn M59, 1 (USNM 88322).
Australia: Heron Island, Queensland, intertidal, 2 (USNM 83006).

TYPE LOCALITY. — Philippines (depth not given).

DESCRIPTION. — Corallum subcylindrical and relatively small, the largest known specimen (USNM 83006) 8.4 x 9.3 mm in calicular diameter and 7.7 mm in height. Calice only slightly elliptical (GCD:LCD = 1.05-1.15); pedicel robust (PD:GCD = 0.68-0.77). Lower 3/4 of corallum usually covered with a thin epitheca, which is often encrusted by algae or foraminifera. Theca near calicular edge highly porous and usually not costate.

Septa hexamerally arranged in 4 cycles but pairs of S_4 often missing in smaller specimens. S_1 about 0.8 mm exsert, having a smooth upper edge, which is dentate adjacent to columella. S_2 less exsert, 1/2 to 2/3 width of an S_1, having slightly coarser inner edge dentition. S_3 almost as wide as S_2, having coarse to laciniate inner edges, each pair of S_3 within a half-system bending toward its common S_2 and forming a loose fusion with that septum adjacent to columella. S_4 rudimentary, usually represented by only a row of tall spines that project from inner theca. Fossa shallow to moderate in depth. Columella a well-developed, elliptical, spongy mass; nondiscrete, often with a slightly concave upper surface.

REMARKS. — H. MILNE EDWARDS & HAIME (1848b) undoubtedly intended to name this species *philippinensis* (for the Philippine Islands), not *philippensis* (for Philippe), but according to the ICZN (Article 32cii), the original spelling cannot be changed.

DISTRIBUTION. — *Philippines*: unspecified locality and depth (H. MILNE EDWARDS & HAIME, 1848b). *Indonesia*: Banda Sea (Kai Islands); Flores Sea (Lintah Strait and Pelokang Island); Java Sea (Jakarta Bay); 2-10 m. *Elsewhere*: tropical Indian Ocean; Loyalty Islands (Lifu); Queensland; Papua New Guinea (Bismarck, Solomon, and Coral Seas); 0-73 m.

Genus *RHIZOPSAMMIA* Verrill, 1870

Rhizopsammia verrilli van der Horst, 1922

Figs 28 f-g

Rhizopsammia verrilli van der Horst, 1922: 64-65, pl. 8, figs 1-2. — ?WELLS, 1983: 241-242. — CAIRNS, 1991: 25, pl. 11, figs C-E (synonymy).

Dendrophyllia gracilis - CAIRNS, 1991: 23 (in part: USNM 78535). [Not *Dendrophyllia gracilis* H. Milne Edwards & Haime, 1848].

MATERIAL EXAMINED. — **Philippines**: Cocos Island, 18 km east of Zamboanga, 6 m, 4 colonies (USNM 78534).
Indonesia. SNELLIUS 1: unnumbered station, Binongko, Tukangbesi Islands, 6-10 m, 7 March 1930, 1 colony (NNM 22749).
West Pacific: Ngell Channel, Palau, 9 m, 3 colonies (USNM 78636).

TYPE LOCALITY. — *"Siboga"* stns 220 and 282: Indonesia, 54-278 m.

DIAGNOSIS. — Colony reptoid, most corallites well separated from one another but interconnected by costate stolons semi-circular in cross section, up to 6 mm in width, 1-3 stolons issuing from base of each attached corallite. Additional corallites also bud from theca of erect corallites. Corallites up to 45 mm in height and 9 mm in GCD. Costae equal and well defined; intercostal spaces highly porous. Septa hexamerally arranged in 5 cycles, the 5th cycle always incomplete. S_{1-2} independent; septa arranged in a well-developed Pourtalès plan. Inner edges of highest cycle septa laciniate. Fossa deep; columella discrete and spongy.

REMARKS. — The distinctive basal stolons distinguish this genus from other dendrophylliid genera, and the large size of the corallites distinguish *R. verrilli* from the other Indonesian species, *R. minuta* van der Horst, 1922 and *R. nuda* van der Horst, 1926. It differs from the central Pacific *R. chamissoi* Wells, 1954, in having larger corallites with more septa. Previously reported specimens of *R. verrilli* had not been known to have corallites budding from the theca of other corallites, which led CAIRNS (1991) to identify at least one colony as *Dendrophyllia gracilis*, the latter species having budding from both corallite edges as well as a common basal coenosteum.

As VAN DER HORST (1922) cautioned, a corallite of *R. verrilli* broken from its base could easily be mistaken for a species of *Balanophyllia* or a *Cladopsammia*. Thus, complete coralla are required for accurate identification. A more complete description of this species is given by CAIRNS (1991).

DISTRIBUTION. — *Philippines*: Sulu Sea (Zamboanga); 6 m. *Indonesia*: Banda Sea (Timor and Tukangbesi Islands); 5-278 m. *Elsewhere*: Gulf of Thailand; Pelau; Galápagos Islands; Cocos Island (eastern Pacific); 6-20 m.

Rhizopsammia nuda van der Horst, 1926

Rhizopsammia nuda van der Horst, 1926: 50-51, pl. 2, figs 10-12.
Rhizopsammia (?) *minuta*- GARDINER & WAUGH, 1939: 241. [Not *Rhizopsammia minuta* van der Horst, 1922].

MATERIAL EXAMINED. — **Philippines**. Marigondon Cave, Mactan Island, Cebu, 25-30 m, 1 colony (NNM 17526).
Indonesia. DEKI: stn 74, 1 colony (NNM 17503, 22779). — Stn 104, many corallites (NNM 17504, 22780).
SNELLIUS 2: stn 4.100, 2 corallites (NNM 17511). — Stn 4.105, 1 colony (NNM 22783).

TYPE LOCALITY. — Singapore, South China Sea (depth not given).

DIAGNOSIS. — Colony reptoid, corallites united basally by thin (2.0-2.5 mm wide), flat stolons. Corallites elongate-conical, up to 10 mm in height and 5 mm in GCD. Calice elliptical. Theca porous; no epitheca. Septa hexamerally arranged in 4 cycles in a Pourtalès plan. Inner edges of S_{1-2} dentate. No paliform lobes; columella spongy.

REMARKS. — *Rhizopsammia nuda* is similar to *R. minuta* van der Horst, 1922 (Fig. 28 h), the only apparent difference being that the corallites of *R. nuda* are about twice as tall as those of *R. minuta*. Although VAN DER HORST described both species, he did not compare them. A syntype of *R. nuda* is deposited at the ZMA (Coel. 5525) and 3 more colonies labelled as syntypes are deposited at the BMNH (1939.7.20.852, 853, and 855). This accounts for 4 of the 5 colonies mentioned in the original description.

DISTRIBUTION. — *Philippines*: Mactan Island, Cebu; 25-30 m. *Indonesia*: Lindah Strait (between Flores and Sumbawa); Java Sea (Sunda Strait); 30-105 m. *Elsewhere*: Singapore (type locality, 9-22 m); Tanzania; 113-220 m (GARDINER & WAUGH, 1939).

Genus *EGUCHIPSAMMIA* Cairns, 1994

Eguchipsammia gaditana (Duncan, 1873)

Balanophyllia gaditana Duncan, 1873: 333.
Balanophyllia fistula - VAN DER HORST, 1922: 59 (in part, *"Siboga"*: stn 310). [Not *Balanophyllia fistula* Alcock, 1902].
Dendrophyllia gaditana - CAIRNS, 1979: 181-182, pl. 36, figs 5-10 (synonymy). — ZIBROWIUS, 1980: 176-178, pl. 89, figs A-N (synonymy). — CAIRNS & KELLER, 1993: 279-280.
Eguchipsammia gaditana - CAIRNS, 1994: 85-86, pl. 37, figs d-f, h; 1995: 122-123, pl. 42, figs a-c.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5249, 4 branches (USNM 97622).
Indonesia. *"Siboga"*: stn 310, 1 (ZMA).
DEKI: stn 73, 4 (NNM 22750).
KARUBAR: stn 18, 10 branches (MNHN).

TYPE LOCALITY. — *"Porcupine"* stn 29: 36°20'20"N, 6°47'W (Ibero-Moroccan Gulf), 417 m.

DIAGNOSIS. — Corallum consists of an elongate, cylindrical axial corallite from which secondary corallites bud at right angle. Axial corallite unattached to substratum and often irregularly bent. Although some coralla achieve a length of 53 mm (CAIRNS, 1994) and a GCD of 5.5 mm (ZIBROWIUS, 1980), the specimens reported above are smaller, the longest only 15 mm and the calicular diameter ranging from 2-3 mm. Theca usually covered with a thin epitheca giving lower corallum a porcellanous texture. Septa arranged in 3-4 cycles (depending on calicular diameter) in a Pourtalès plan. S_1 independent; each pair of S_3 fuse before its common S_2 high in the fossa. Columella a small, nondiscrete, concave, spongy mass.

REMARKS. — *Eguchipsammia gaditana* is described and figured in greater detail by ZIBROWIUS (1980) and CAIRNS (1979, 1994, 1995). It is compared to *E. wellsi* in the account of that species.

DISTRIBUTION. — *Philippines*: Davao Gulf; 42 m. *Indonesia*: Banda Sea (Kai Islands); Flores Sea (Sumbawa); Java Sea (Sunda Strait); 30-212 m. *Elsewhere*: widespread in tropical and temperate regions of world oceans, except for eastern Pacific, but including north of New Zealand and Japan; 57-988 m.

Eguchipsammia wellsi (Eguchi, 1968)

Dendrophyllia (Alcockia) wellsi Eguchi, 1968: C63-64.
Eguchipsammia wellsi - CAIRNS, 1994: 86-87, pl. 37, figs a-c, g (synonymy).

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5248, 5 (USNM 97624). — Stn 5249, 2 (USNM 97625). — Stn 5357, 2 (USNM 97626).
MUSORSTOM 3: stn 137, 3 (MNHN). — Stn 142, 1 (MNHN).

TYPE LOCALITY. — *"Soyo Maru"* stn 210: 33°29'N, 135°28'E (Kii Peninsula, Honshu, Japan), 165 m.

DIAGNOSIS. — Corallum similar in shape to that of *E. gaditana*. Largest specimen reported herein (*"Albatross"* stn 5248) 44 mm in length and 4.3 mm in GCD, which is typical for the species. Theca costate; no epitheca. Septa hexamerally arranged in 3-4 cycles (up to 36 septa) in a Pourtalès plan. Inner edges of S_{3-4} smooth. Columella a discrete, convex structure composed of numerous small lamellae.

REMARKS. — Although similar to *E. gaditana* (Duncan, 1873) in corallum shape, *E. wellsi* differs in having a discrete, convex columella; having smooth inner septal edges that do fuse among themselves at a lower level in the fossa; and in lacking epitheca. The species is more fully described and illustrated by CAIRNS (1994).

DISTRIBUTION. — *Philippines*: Sibuyan Sea; Visayan Sea; Davao Gulf; Sulu Sea (Balabac Island); 32-124 m. *Elsewhere*: Japan (Honshu, Kyushu, and northern Ryukyu Islands); 110-196 m.

Genus ***CLADOPSAMMIA*** Lacaze-Duthiers, 1897

Cladopsammia echinata Cairns, 1984

Fig. 29 d

Cladopsammia echinata Cairns, 1984: 26-27, pl. 5, figs F-G.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 86, 2 colonies: 1 (MNHN), 1 (USNM 97628).

TYPE LOCALITY. — SANGO 2 stn 4: 21°48'N, 160°09.1'W (Hawaiian Islands), 298-408 m.

DIAGNOSIS. — Corallum irregularly and densely branched, resulting in a bushy clump of corallites. The attachments of the colonies reported above are missing, all corallites budding from the theca of parent corallites and occasionally merging with one another. Larger KARUBAR colony reported above 8 cm in height, 9 cm across, and 5 cm deep, consisting of about 120 corallites. Corallites elongate-conical to subcylindrical, and elliptical in cross section, ranging from 3.2 to 8.4 mm in GCD. C_{1-2} ridged near calice; otherwise theca uniformly covered with small (0.15 mm height), slender, pointed spines, which are particularly well developed near pedicel and bases of corallites. Septa hexamerally arranged in 4 complete cycles in a Pourtalès plan, the S_{1-2} independent. Paliform lobes absent. Columella spongy and relatively small.

REMARKS. — Species previously known only from the Hawaiian Islands; original description more detailed.

DISTRIBUTION. — *Indonesia*: Arafura Sea (south of Tanimbar Islands); 222-226 m. *Elsewhere*: Hawaiian Islands (Kauai, Nihoa, and Brooks Banks); 295-470 m.

Genus ***DENDROPHYLLIA*** Blainville, 1830

Dendrophyllia **sp.** cf. ***D. ijimai*** Yabe & Eguchi, 1934b

Fig. 29 e

Dendrophyllia minuscula - VAN DER HORST, 1922: 51-52, pl. 8, fig. 30. [Not *Dendrophyllia minuscula* Bourne, 1905].
Dendrophyllia sp. - ZIBROWIUS & GRYGIER, 1985: 123, 126, figs 22-23.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 2: stn 33, 1 branch (MNHN).
MUSORSTOM 3: stn 117, 2 branches (MNHN).
Indonesia. *"Siboga"*: stn 49a, 1 (ZMA Coel. 5407, *D. minuscula* of VAN DER HORST, 1922).
KARUBAR: stn 30, 6 colonies: 3 (MNHN), 3 (USNM 97629).
Tasman Sea. *"Tangaroa"*: stn Q47, 3 colonies (USNM 94236).

DESCRIPTION. — Coralla relatively small (up to 90 mm in height), consisting of a continuous, vertical, slender (pedicel diameter 8 mm), founder axial corallite from which a variable number of secondary corallites bud at right angle around circumference. Short tertiary buds occasionally form from the secondaries. Largest Indonesian

colony (KARUBAR stn 30) 8 cm in height, bearing 16 corallites, the axial corallite tapering from 6.1 mm in basal diameter to 3.4 mm distally. Corallites slightly elliptical in cross section and 3.2-5.8 mm in GCD, the axial calices usually being the largest. Costae well developed, about 0.35 mm wide, and slightly convex; theca porous near calicular edge.

Septa hexamerally arranged in 4 cycles, the 4th cycle complete usually only in axial corallites; other corallites have 36-42 septa, pairs of S_4 often missing from various half-systems. S_1 exsert (up to 0.7 mm), having smooth lower, inner edges that reach the columella. S_2 not exsert, 3/4 width of an S_1, also having smooth inner edges. S_3 small, each flanked by a pair of S_4 that meet, fusing before inner edge of their common S_3 and extend as 1 septum to the columella. Inner edges of all septa entire, not laciniate or dentate. Fossa of moderate depth, containing a large discrete columella composed of tightly fused, swirled lamellae.

REMARKS. — This species belongs to a group (see CAIRNS, 1994) of about 5 species within the genus *Dendrophyllia* characterised by having arborescent colonies with most budding occurring perpendicularly from a central axial corallite: *D. ramea* (Linnaeus, 1758); *D. minuscula* Bourne, 1905; *D. indica* Pillai, 1967; *D. velata* Crossland, 1952; and *D. ijimai* Yabe & Eguchi, 1934. Its growth form, calicular diameter, and septal number is similar to *D. ijimai*, but because its corallites are uniformly 1-2 mm smaller in diameter and because the type of *D. ijimai* is not available for comparison, only a tentative identification is suggested.

DISTRIBUTION. — *Philippines*: Verde Island Passage; Mindoro Strait; 97-130 m. *Indonesia*: Banda Sea (Kai Islands); Flores Sea; 69-111 m. *Elsewhere*: Taupo Seamount, Tasman Sea; 135 m. *D. ijimai* is known from Japan and the western Indian Ocean; 10-366 m (CAIRNS & KELLER, 1993).

Dendrophyllia arbuscula van der Horst, 1922

Figs 29 a-c

Dendrophyllia micranthus - VAN DER HORST, 1922: 50 (in part: *"Siboga"* stn 277). [Not *Oculina micranthus* Ehrenberg, 1834].
Dendrophyllia arbuscula van der Horst, 1922: 53 (in part: *"Siboga"* stn 277; pl. 8, fig. 6). — EGUCHI, 1968: C55-56, pl. C21, figs 5, 13. — PILLAI & SCHEER, 1974: 462, fig. 7a. — BETTERTON, 1981: 242, figs 197-198. — CAIRNS, 1994: 90-91, pl. 38, figs i-l (synonymy); 1995: 125-126, pl. 43, figs e-f.
Dendrophyllia subcornigera Eguchi, 1968: C64, pl. C32, figs 3-4.
Dendrophyllia subcornigera cylindrica Eguchi, 1968: C64-65, pl. C32, figs 1-2.
Dendrophyllia horsti Gardiner & Waugh, 1939: 237-238, pl. 2, figs 5-6.
? *Dendrophyllia erecta* Nemenzo, 1960: 19, pl. 10, fig. 1.
Dendrophyllia sp. cf. *D. horsti* - CAIRNS & KELLER, 1993: 278, pl. 13, figs F, I.
Not *Dendrophyllia arbuscula* - SCHEER & PILLAI, 1974: 64.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5279, 6 colonies (USNM 97630). — Stn 5280, 2 colonies (USNM 97631).

MUSORSTOM 3: stn 131, 7 (MNHN).

Indonesia. *"Siboga"*: stn 277, 1 (ZMA).

DEKI: stn 3, many colonies: (ZMA Coel. 7344), 2 (USNM 97633). — Stn 7, 2 colonies (NNM 22677). — Stn 24, 1 (NNM 22678).

KARUBAR: stn 86, 6 colonies: 2 (MNHN), 4 (USNM 97632).

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

DIAGNOSIS. — Corallum dendroid, attached by a thick base, which firmly anchors the primary axial corallite. A variable number of secondary corallites bud at right angle to the axial, and tertiary corallites may also be present. The early colony stage, represented by the axial and several secondary corallites, was described as *D. horsti* by GARDINER & WAUGH (1939), but the more fully developed colony containing secondary and tertiary branches was first illustrated by VAN DER HORST (1922: pl. 8, fig. 6) as the typical form. When secondary and tertiary corallites are elongate (up to 5 cm) a more open corallum results, described as *D. subcornigera cylindrica*

by EGUCHI (1968). The largest Philippine specimen (*"Albatross"* stn 5279) is a highly branched corallum (as illustrated by VAN DER HORST, 1922) 7 cm wide, 5.5 cm in height, and 13.4 mm in pedicel diameter, consisting of 20 corallites. Corallites elliptical in cross section: up to 12.2 mm in GCD. Costae broad (0.6-0.7 mm), flat, and quite porous, separated by narrow (0.1 mm), shallow intercostal striae. Edge zone extends only about 1 cm below calicular edge, below which the theca is usually encrusted. Septa hexamerally arranged in 4 cycles in a Pourtalès plan, the septa of the first 2 cycles independent and exsert. Fossa shallow, containing a well-developed, well-delimited, compact columella consisting of many small lamellae that are tightly fused together in a clockwise swirl. Columella massive, up to 3 mm in width, and often constricted into a central and 2 narrower lateral parts by the 4 lateral S_1.

REMARKS. — VAN DER HORST's (1922, pl. 8, fig. 6) illustrated specimen from *"Siboga"* stn 277 (ZMA Coel. 5477) is a colony 80 mm in height bearing corallites 5-6 mm in GCD. One of the other 2 syntypes from *"Siboga"* stn 260 (ZMA Coel. 1254) is *Eguchipsammia fistula*. We therefore designate the specimen from *"Siboga"* stn 277 as the lectotype, the 2 from *"Siboga"* stn 260 as paralectotypes.

In their description of *D. horsti*, GARDINER & WAUGH (1939) noted its resemblance to *D. arbuscula*, assuming that their colonies were "genetic dwarfs" in comparison. The growth series represented in *"Albatross"* stn 5279 suggests that it is more likely that *D. horsti* simply represents the early growth stage of a larger colony.

Dendrophyllia arbuscula belongs to CAIRNS' (1994) "second group" of *Dendrophyllia* species, *i.e.*, species having relatively small, bushy colonies with irregular branching from an axial corallite. The *horsti*-stage of this species is more fully described by CAIRNS (1994).

DISTRIBUTION. — *Philippines*: Lubang Island; Sulu Sea (west of Panay; ? Luminusa Island); 122-353 m. *Indonesia*: Banda Sea (Kai, Damar, and Barat Daya Islands); 45-245 m. *Elsewhere*: southwestern Indian Ocean to Strait of Malacca; northern New Zealand region (Norfolk and Kermadec Islands); Japan (Honshu, East China Sea); 40-259 m.

Dendrophyllia alcocki (Wells, 1954)

Sclerhelia alcocki Wells, 1954: 465-466, pl. 177, figs 1-2.
Dendrophyllia palita Squires & Keyes, 1967: 28-29, pl. 6, figs 9-10.
Dendrophyllia alcocki - ZIBROWIUS, 1974a: 570-573, figs 10-14. — CAIRNS, 1995: 126-127, pl. 43, figs g-i, pl. 44, figs a-b (synonymy).

MATERIAL EXAMINED. — **Indonesia**. *"Albatross"*: stn 5586, 1 fragment (USNM 97635).
KARUBAR: stn 18, 2 fragments (MNHN).
South China Sea. *"Albatross"*: stn 5311, 1 fragment (USNM 97634).
"Hakuho Maru": stn KH73-2-44-2, 1 branch (USNM 97636).

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

DIAGNOSIS. — Uniplanar or arborescent colonies formed by regular, extratentacular, sympodial branching. Potential growth to at least a height of 11 cm (CAIRNS, 1995). Specimens reported above only small branch fragments, each about 1 cm in length comprising only 4 or 5 corallites, with calices 4-5 mm in diameter. Coenosteum dense and solid, slightly porous only near calicular edge. Theca covered with blunt spines that are usually aligned on branch axis. Septa hexamerally arranged in 3 complete cycles: $S_1 > S_2 \geq S_3$. Each pair of S_3 meets before its common S_2 to form a large palus (P_2). Columella spongy.

REMARKS. — According to the partial revision of the genus (CAIRNS, 1994), *D. alcocki* is one of at least 8 species in the "third group", characterised by having large, sympodially branched coralla. *D. alcocki* is more fully described and figured by CAIRNS (1995).

DISTRIBUTION. — *Indonesia*: Celebes Sea (Darvel Bay); Banda Sea (Kai Islands); 205-616 m. *Elsewhere*: Maldives; throughout New Zealand region; Tasman Sea; New Caledonia region; Solomon Islands; Marshall Islands; South China Sea (north of Pratas Islands); 118-570 m.

Genus *ENALLOPSAMMIA* Michelotti, 1871

Enallopsammia pusilla (Alcock, 1902)

Fig. 29 f

Dendrophyllia (Coenopsammia) pusilla Alcock, 1902a: 113; 1902c: 44, pl. 5, figs 38, 38a.
Dendrophyllia (Coenopsammia) profunda - ALCOCK, 1902c: 43. [Not *Diplohelia profunda* Pourtalès, 1867].
Coenopsammia profunda - MARENZELLER, 1904a: 313-314, pl. 18, fig. 24. [Not *Diplohelia profunda* Pourtalès, 1867].
Enallopsammia marenzelleri Zibrowius, 1973: 49-51 (in part: pl. 1, figs 1-7, only Indo-Pacific specimens, including holotype); 1980: 204-205 (in part: only Indo-Pacific specimens) [**new synonym**].
Enallopsammia sp. cf. *E. marenzelleri* - CAIRNS, 1982: 57-58, pl. 18, figs 5-6; 1995: 128-129, pl. 44, figs g-h.

MATERIAL EXAMINED. — **Philippines**. *"Siboga"*: stn 95, holotype and paratype of *D. pusilla* (ZMA Coel. 1196, 589, respectively).
"Hakuho Maru": stn KH72-1-20, 4 branches (USNM 97638).
Indonesia. *"Siboga"*: stn 266, holotype and paratype of *E. marenzelleri* (ZMA Coel. 6902, 588, respectively).
DEKI: stn 1, 4 branches (ZMUC), 6 branches (NNM 22735). — Stn 12, 1 (NNM 22739). — Stn 59, 2 (BMNH 1939.7.20.316), 10 (NNM 22736, 22740). — Stn 61, 1 (NNM 22737).
SNELLIUS 2: Stn 4.144, 1 (NNM).
KARUBAR: stn 25, 7 colonies: 5 (MNHN), 1 (POLIPI), 1 (USNM 97640).
South China Sea: *"Albatross"*: stn 5317, 3 branches (USNM 97637).
"Hakuho Maru": stn KH73-2-44-2, 8 branches: 6 (USNM 97639), 2 (ORI).

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

DESCRIPTION. — Extratentacular budding (and branching) occurs in an irregular manner leading to a massive, irregularly shaped colony with occasional branch anastomosis. Budding often sympodial on distal, small-diameter branches, but buds may occur on all branch faces, producing a 3-dimensional corallum. Largest known colony (KARUBAR stn 25) 160 mm in height and 290 mm in width, consisting of 7 main vertical branches originating from a common base 27 mm in diameter. Corallites slightly elliptical (GCD:LCD = 1.02-1.24), up to 4.7 mm in GCD, standing up to 3 mm above branch coenosteum. Costae convex and well developed over entire branch coenosteum. On small-diameter branches, costae about 0.3 mm wide, bearing only 1 costal spine across their width, and are flanked by deep, highly porous intercostal striae about 0.2 mm wide. On large-diameter branches, costae are broader (up to 0.6 mm), bear 2 or 3 small spines across their width, and are flanked by narrower (about 0.1 mm), less porous intercostal striae. Intercostal pores of large-diameter branches gradually filled in with stereome, resulting in a very dense corallum.

Septa hexamerally arranged in 3 cycles in an indistinct Pourtalès plan. All septa nonexsert. S_1 independent and quite narrow (about 0.5 mm), having smooth inner edges that reach the columella. S_2 equal to S_1 in size and shape. S_3 narrower than S_{1-2}, having dentate inner edges, each pair of S_3 within a system bending toward its common S_2 and fusing with that septum near the columella. Fossa deep and spacious. Columella a circular, concave, nondiscrete, spongy mass.

REMARKS. — *Enallopsammia pusilla* was described on the basis of what now appear to be 2 relatively short distal branches of a larger corallum - a total of 25 corallites (see ZIBROWIUS, 1973). Additional larger specimens are now available from near to the type locality (*"Hakuho Maru"* KH72-1-20) as well as near the type locality of *E. marenzelleri* (KARUBAR stn 25). These colonies strongly suggest that the holotype of *E. marenzelleri* is simply a larger, more robust colony of *E. pusilla*.

DISTRIBUTION. — *Philippines*: Sulu Sea (Sulu Archipelago); 514-522 m. *Indonesia*: Banda Sea (Kai and Selayar Islands); 325-730 m. *Elsewhere*: Macquarie Ridge; Nicobar Islands, Bay of Bengal; South China Sea (north of Pratas Island and southern Formosa Strait); 371-805 m.

Enallopsammia rostrata (Pourtalès, 1878)

Amphihelia rostrata Pourtalès, 1878: 204, pl. 1, figs 4-5.
Dendrophyllia (Coenopsammia) amphelioides Alcock, 1902a: 112-113; 1902c: 43-44, pl. 5, figs 37, 37a.
Anisopsammia rostrata - MARENZELLER, 1904a: 314-315, pl. 18, fig. 23.
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; 1995: 127-128, pl. 44, figs c-f. — CAIRNS & PARKER, 1992: 52-53, pl. 18, figs e-i.

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5428, 3 branches (USNM 97642). — Stn 5499, 5 branches (USNM 97643).
Indonesia. KARUBAR: stn 13, 7 branches: 3 (MNHN), 1 (POLIPI), 3 (USNM 97644).

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

REMARKS. — *Enallopsammia rostrata* differs from *E. pusilla* in having unifacial corallites (*i.e.*, calices confined to one face of the corallum, anterior by convention), arranged uniserially on small-diameter branches. The corallites of most specimens of *E. rostrata* also bear a prominent septocostal rostrum; however, some specimens lack this structure, these referred to as the *"amphelioides"* form by CAIRNS (1982). Of the 3 lots reported above, specimens from *"Albatross"* stns 5428 and 5429 have septocostal rostra, whereas those from KARUBAR stn 13 do not. The rostrate specimens have small corallites (3 mm GCD), consistent with the "delicate" specimens reported by CAIRNS (1995) from New Zealand, whereas the nonrostrate specimens have massive coralla.

DISTRIBUTION. — *Philippines*: Sulu Sea (Palawan); Bohol Sea; 1013-2021 m. *Indonesia*: Halmahera Sea; Ceram Sea; Banda Sea (Kai Islands); 417-1633 m. *Elsewhere*: cosmopolitan, except for eastern Pacific and continental Antarctica; 110-2165 m.

Genus *TUBASTRAEA* Lesson, 1829

Tubastraea micranthus (Ehrenberg, 1834)

Oculina micranthus Ehrenberg, 1834: 304.
Dendrophyllia nigrescens Dana, 1846: 387. — VAUGHAN, 1918: 143-144, pl. 60, figs 1, 1a. — SEARLES, 1956: 24, pl. 39A.
Coenopsammia viridis H. Milne Edwards & Haime, 1848b: 110.
Coenopsammia aequiserialis H. Milne Edwards & Haime, 1848b: 110-111. — SEMPER, 1872: 267.
Dendrophyllia micranthus - VAN DER HORST, 1922: 49-51 (in part: not *"Siboga"* stn 277, synonymy); 1926: 43-44, pl. 2, figs 6-7. — FAUSTINO, 1927: 218-220, pl. 72, figs 1-2. — NEMENZO, 1960: 16-17, pl. 8, fig. 2. — SCHEER & PILLAI, 1974: 63, pl. 29, fig. 3. — BETTERTON, 1981: 242, figs 199-200.
Dendrophyllia micranthus var. *grandis* Crossland, 1952: 173, pl. 55, fig. 1, pl. 56, fig. 1.
Tubastraea micranthus - ZIBROWIUS & GRYGIER, 1985: 130. — SCHUHMACHER, 1984: 94, figs 1a-b, 4.
Tubastrea micranthus - LATYPOV, 1990: 68, pl. 26, figs 1-2.
Tubastraea micrantha - CAIRNS & KELLER, 1993: 282.
Not *Dendrophyllia micranthus* - EGUCHI, 1968: C66 [= *Dendrophyllia ijimai* Yabe & Eguchi, 1934].

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5554, 1 (USNM 97648).
SIPHILEXP: stn 78-CAC 189, 1 (USNM 97646).
Cocos Island, east of Zamboanga, 9 m, 1 colony (USNM 83685).
"Southern Philippines", depth unknown, 200+ branches (USNM 91088).
Indonesia. *"Siboga"*: stn 240, 1 (ZMA Coel. 235).
DEKI: stn 4, 1 (ZMA Coel. 5450). — Stn 10, several colonies (NNM).
"Alpha Helix": stn 1769, 1 (USNM 78551). — Stn 79-M122, 3 (USNM 97647).

TYPE LOCALITY. — Unknown.

DESCRIPTION. — Corallum dendroid, but more or less uniplanar, achieved by profuse extratentacular budding from a relatively small number (2-8) of massive axial corallites. Coralla may attain a large size: *e.g.*, 1 m in height and 5 cm in basal diameter. Corallites of small-diameter distal branches generally occur only on branch edges, but on larger-diameter branches corallites more uniformly distributed on all branch faces. Corallites usually project upward at a 45° angle from axial branch and stand 5-7 mm above branch coenosteum. Corallites usually 6-8 mm in GCD, but NEMENZO (1960) reported giant calices 10-12 mm in GCD. Costae well defined, 0.4-0.5 mm in width, convex to ridged, bearing 1-3 low granules across their width at any point. Intercostal furrows long and continuous, 0.15-0.20 mm wide, and occasionally punctuated with circular pores about 0.3 mm in diameter that penetrate deeper into branch core. Branch porosity greatest in distal parts, the pores becoming infilled and thus more dense with age (SCHUHMACHER, 1984). Corallum white; live tissues a striking dark green or brown-black.

Septa hexamerally arranged in 3 cycles: $S_1>S_2>>S_3$. S_1 nonexsert, having straight inner edges that attain the columella. S_2 3/4 width of an S_1, also having straight inner edges that attain the columella. S_3 usually rudimentary, represented by a very narrow dentate to laciniate lamella. Fossa deep, especially in axial corallites. Columella rudimentary, composed of a solid, elongate fusion of lower, inner edges of the S_{1-2}.

REMARKS. — *Tubastraea micranthus* is the only species in the genus to have a tree-like, dendroid growth form. Being a common, shallow-water species, it has received various names, including several alluding to its tissue colour.

As defined by SCHUHMACHER & ZIBROWIUS (1985), *T. micranthus* belongs to a unique ecological category among the Scleractinia, *i.e.*, azooxanthellate, yet constructional and hermatypic. In other words, although it lacks zooxanthellae, it produces large colonies that contribute to a reef structure. According to SCHUHMACHER (1984), *T. micranthus* does not grow as fast as other branching zooxanthellate corals, but because it reinforces its branch strength through secondary calcification, it remains competitive with other reef corals.

DISTRIBUTION. — *Philippines*: Negros and Bohol; Sulu Sea (Zamboanga Peninsula and Sulu Archipelago); 7-46 m. *Indonesia*: Molucca Sea (Halmahera); Banda Sea (Ambon, Banda, Kai, and Damar Islands); 0.5-60 m. *Elsewhere*: widespread in tropical Indo-West Pacific from southwestern Indian Ocean to Fiji (most corals referred to this species from Japan are *Dendrophyllia*); 0-50 m.

Tubastraea diaphana (Dana, 1846)

Dendrophyllia diaphana Dana, 1846: 389, pl. 27, fig. 3. — VAUGHAN, 1918: 144-145, pl. 60, figs 2-3.
Dendrophyllia aequiserialis - QUELCH, 1886: 147. [Not *Coenopsammia aequiserialis* H. Milne Edwards & Haime, 1848].
Dendrophyllia micranthus var. *fruticosa* Nemenzo, 1960: 17-18, pl. 9, fig. 1.
Tubastraea diaphana - SCHEER & PILLAI, 1983: 174, pl. 41, figs 1-4 (synonymy). — CAIRNS & KELLER, 1993: 284, pl. 13, fig. H.
Dendrophyllia sibogae van der Horst, 1922: 56-57, pl. 8, figs 18-19.
Tubastraea sp. - GUELLA *et al.*, 1988: 780.

MATERIAL EXAMINED. — **Philippines**. Santa Cruz, Zamboanga, 1 (USNM 78522).
Dumaran Passage, Palawan, 3 m, 6 colonies (USNM 80822), 4 colonies (BMNH 1987.12.23.1-4) mentioned by GUELLA *et al.*, 1988.
SIPHILEXP: stn 78SP-1-1, 5 (USNM 77162)

TYPE LOCALITY. — Singapore, South China Sea (depth not given).

DIAGNOSIS. — Colonies phaceloid, forming small, bushy clusters of corallites rarely more than 5 cm in height or width. Colony results from closely spaced budding from a broad base. Corallites 6-11 mm in GCD and up to 22 mm in length. Costae well defined, as in *T. micranthus*. Theca thin and quite porous, especially near calicular margin. Colour of tissue green-brown. Septa hexamerally arranged in up to 4 cycles, the 4th cycle rarely complete : $S_1>S_2>>S_3>S_4$. S_1 nonexsert, rather narrow near calicular edge, having smooth inner edges. S_2 about 3/4 width of an S_1, also having smooth inner edges. S_3 usually present but represented only as low dentate ridges.

In large coralla, traces of S_4 occur in some half-systems near calicular margin. Fossa deep and spacious; columella rudimentary.

REMARKS. — This species is more fully described and illustrated by VAUGHAN (1918) and NEMENZO (1960), by the latter as *T. micranthus* var. *fruticosa*.

DISTRIBUTION. — *Philippines*: west coast of Mindoro; Sulu Sea (Dumaran Passage, northeast Palawan; Zamboanga Peninsula); Negros; 1-5 m. *Indonesia*: Savu Sea; eastern Timor (VAN DER HORST, 1922); 27-54 m. *Elsewhere*: widespread throughout tropical Indo-West Pacific from southwestern Indian Ocean to Fiji and Samoa; 1-15 m.

Tubastraea coccinea Lesson, 1829

Tubastraea coccinea Lesson, 1829: 93. — WELLS, 1983: 243-244, pl. 18, figs 1-2 (synonymy). — CAIRNS, 1991: 26-27, pl. 12, figs c-e (synonymy); 1994: 93-94, pl. 39, figs g-i (synonymy). — CAIRNS & KELLER, 1993: 282-284.
Lobophyllia aurea Quoy & Gaimard, 1833: 195, pl. 15, figs 7-11.
Coenopsammia willeyi Gardiner, 1899: 359, pl. 34.
Dendrophyllia willeyi - VAUGHAN, 1918: 143-144, pl. 60, figs 4, 4a.
Dendrophyllia aurea - VAN DER HORST, 1926: 46-48 (in part: pl. 2, figs 2-4, 8-9).
Tubastraea aurea - BOSCHMA, 1953: 111-118 (in part: pl. 10, figs 2, 6, pl. 11, figs 2, 4-6, pl. 12, figs 1-6). — SEARLES, 1956: 24, pl. 38B. — BETTERTON, 1981: 242-243, fig. 201. — SCHEER & PILLAI, 1983: 173-174, pl. 40, fig. 8. — SCHUHMACHER, 1984: 94-95. — LATYPOV, 1990: 65-66, pl. 27, fig. 4, pl. 32, fig. 5.
? *Dendrophyllia turbinata* Nemenzo, 1960: 18-19, pl. 9, fig. 2.
Tubastrea coccinea - LATYPOV, 1990: 66-67, pl. 27, fig. 1, pl. 32, fig. 3.

MATERIAL EXAMINED. — **Philippines**. Santa Cruz, Zamboanga Peninsula, 4 colonies (USNM 83645, 83652, 83667).
SIPHILEXP: stn 78-CAC194, 3 colonies (USNM 97645).
Indonesia. *"Siboga"*: stn 231, 1 (ZMA Coel. 586).

TYPE LOCALITY. — Bora Bora, Society Islands (depth not given).

DIAGNOSIS. — Corallum plocoid, forming spherical to mound-shaped colonies up to 10 cm in diameter. Most corallites originate from a common basal coenosteum, only rarely budding from the wall of another corallite. Corallites short and squat: 10-13 mm in GCD and rarely over 10 mm in height. Costae similar to those of *T. diaphana*. Tissue usually bright orange, but may also be yellow, pink, or purple. Septa hexamerally arranged in 4 cycles, the 4th usually incomplete: $S_1>S_2>>S_3>S_4$. Septal arrangement also similar to that of *T. diaphana*. Fossa of moderate depth, containing a rudimentary crispate columella. Endothecal dissepiments occasionally present.

REMARKS. — WELLS (1983) listed 18-19 junior synonymys of *T. coccinea* and recognised a total of 6 valid species in the genus. The synonymy given above is therefore incomplete but gives most of the Indonesian records. A more complete description of this species can be found in CAIRNS (1994).

Four species of *Tubastraea* occur in the Indonesian region, 3 of which have similar corallite characteristics but are distinguished by their colony size and shape: *T. micranthus*, large and arborescent; *T. diaphana*, small and phaceloid; and *T. coccinea*, medium-sized and plocoid. The 4th species, *T. faulkneri* Wells, 1982, is similar to *T. coccinea* in growth form but has very widely-spaced corallites that are sunken in thick coenosteum, and S_4 that pair before their common S_3. WELLS (1982) reported *T. faulkneri* from Pelau, the Banda Sea (Banda and Ambon Islands), Mindoro, and the Galápagos Islands at 3-8 m. According to WELLS (1983), only 2 other species of *Tubastraea* are valid: *T. tagusensis* Wells, 1982, and *T. floreana* Wells, 1982, both from the Galápagos Islands and distinguished by their septal characteristics (CAIRNS, 1991: table 4).

DISTRIBUTION. — *Philippines*: Mindoro and Zamboanga Peninsula, Mindanao; 3-6 m. *Indonesia*: Banda Sea (Kai and Ambon Islands); 40 m. *Elsewhere*: cosmopolitan in tropical shallow water, including warm temperate region of Japan; 1.5-110 m.

INCERTAE SEDIS

Figs 29 g-i

MATERIAL EXAMINED. — **Philippines**. *"Albatross"*: stn 5179, 5 colony fragments, including SEM stub 813 (USNM 97651).

Indonesia. DEKI: unnumbered station near Banda, 3 June 1922, 30 m, 1 colony (ZMUC).

DESCRIPTION. — Small colonies formed by sparse intratentacular budding. Corallites sometimes budded in series, resulting in a unifacial arrangement or budded sympodially, resulting in a loose, bushy corallum with anastomosing branches. Calice circular: 2.1-3.3 mm in diameter. Corallum completely epithecate, only 60 µm thick at calicular edge. Epitheca composed of narrow (20-45 µm wide) horizontal bands that encircle the corallites. Septal symmetry and size classes not clearly defined: 20-24 septa per calice. Septa highly porous, the larger septa composed of 4 or 5 trabecular spines, having clavate, tuberculate tips about 0.12 mm in diameter. Most septa are connected to their adjacent septa by narrow synapticulae. Columella composed of 3 or 4 granular rods, each up to 0.17 mm in diameter.

REMARKS. — We can find no scleractinian family in which to convincingly place the species described above. Its epitheca and size are similar to those of *Culicia* (Rhizangiidae), but it differs in budding mode and septal construction. Its septal structure is similar to that of the Micrabaciidae, but it differs in having a solid epitheca and being colonial. Until more specimens are examined, we reserve judgment on the family affinities of this unusual coral.

DISTRIBUTION. — *Philippines*: Sibuyan Sea; 68 m. *Indonesia*: Banda Sea (off Banda Island); 30 m.

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The scanning electron photomicrographs were taken in the SEM Laboratory, NMNH. The Department of Photography of the NNM provided the negatives of the holotype of *Madrepora minutiseptum.*

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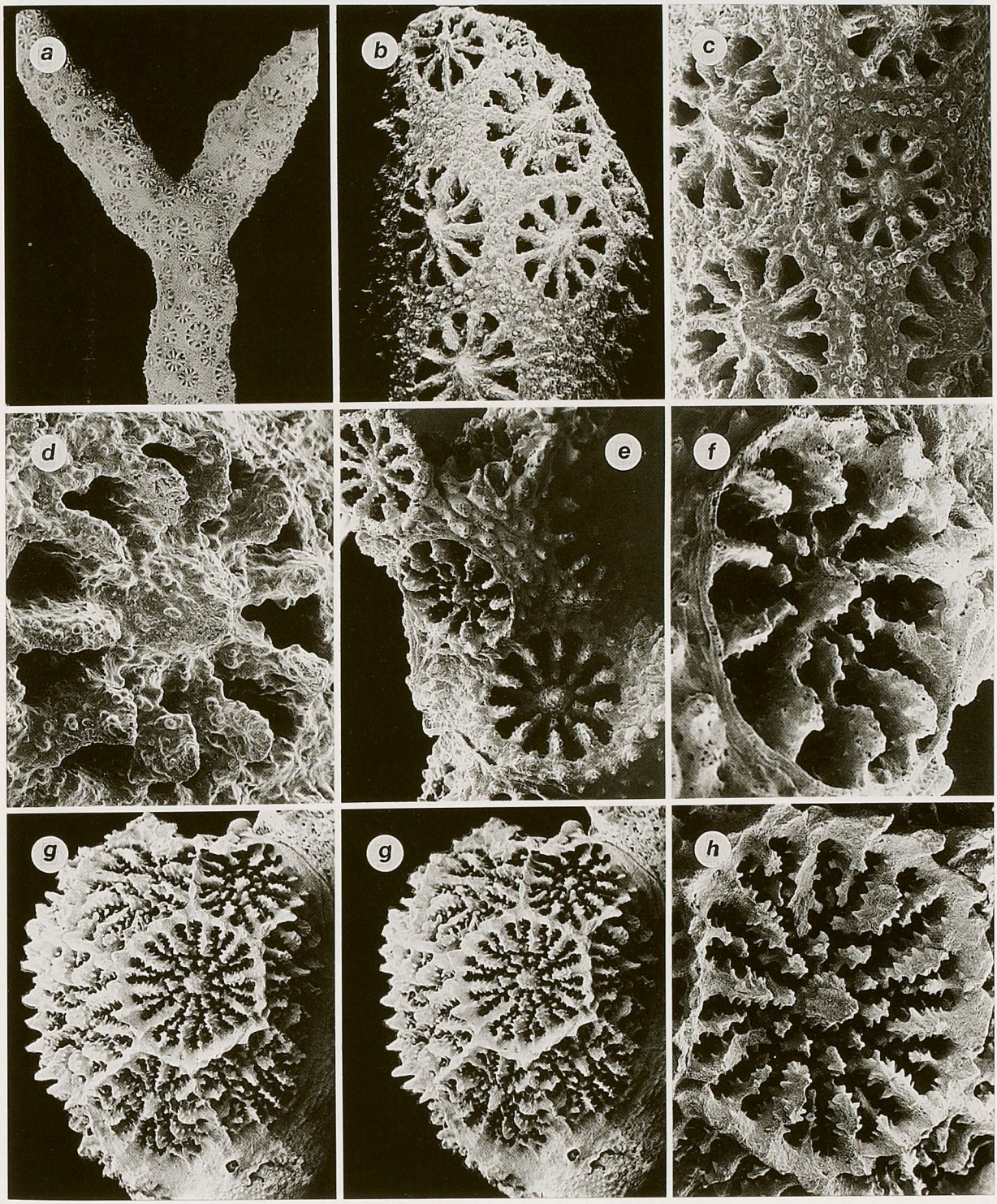

FIG. 1 a-d. — *Madracis asanoi* Yabe & Sugiyama, 1936: **a**, *"Albatross"* stn 5381 (USNM 96672), distal branch, x 1.9. — **b-d**, *"Albatross"* stn 5277, USNM 96671: **b**, branch tip, x 11.9; **c**, unequal-sized corallites, x 17.3; **d**, calice, x 40.
FIG. 1 e-f. — *Madracis* sp. A, CORINDON 2 stn 248 (USNM 96684): **e**, branch, x 12.3; **f**, calice, x 36.
FIG. 1 g-h. — *Madracis* sp. cf. *M. pharensis*, MUSORSTOM 3 stn 117 (USNM 96676): **g**, stereo view of a small encrusting colony, x 13.5; h, calice, x 35.4.

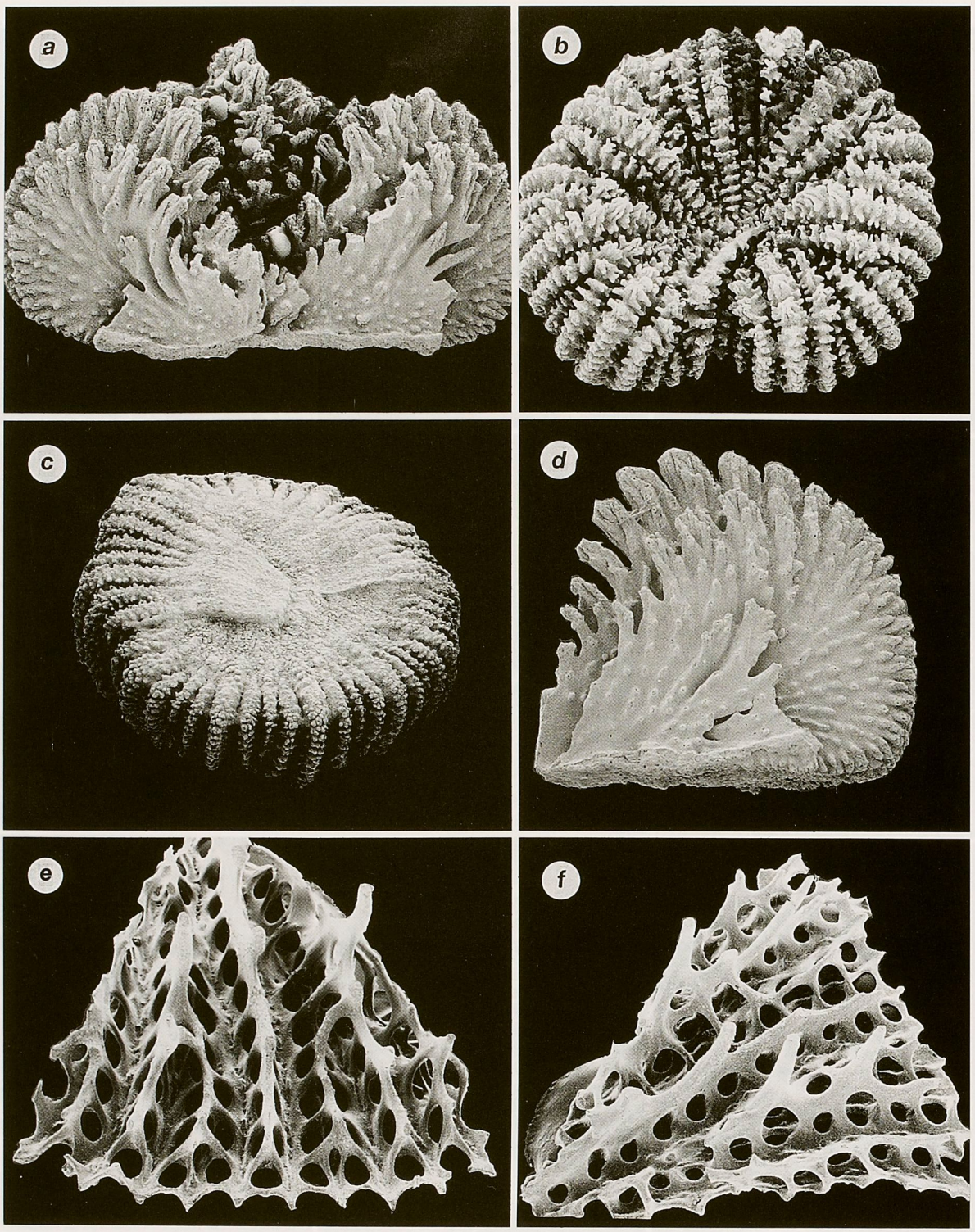

FIG. 2 a-d. — *Fungiacyathus fissidiscus* sp. nov., paratypes, KARUBAR stn 7 (USNM 96725): **a**, fracture showing septal spines, x 21.8; **b**, calice, x 15; **c**, base showing regeneration from parent fragment, x 15.8; **d**, fracture showing septal face granulation, x 24.8.

FIG. 2 e-f. — *Leptopenus* sp. A, KARUBAR stn 7 (MNHN): **e-f**, two views of the same corallum fragment, x 25.5, x 21.8, respectively.

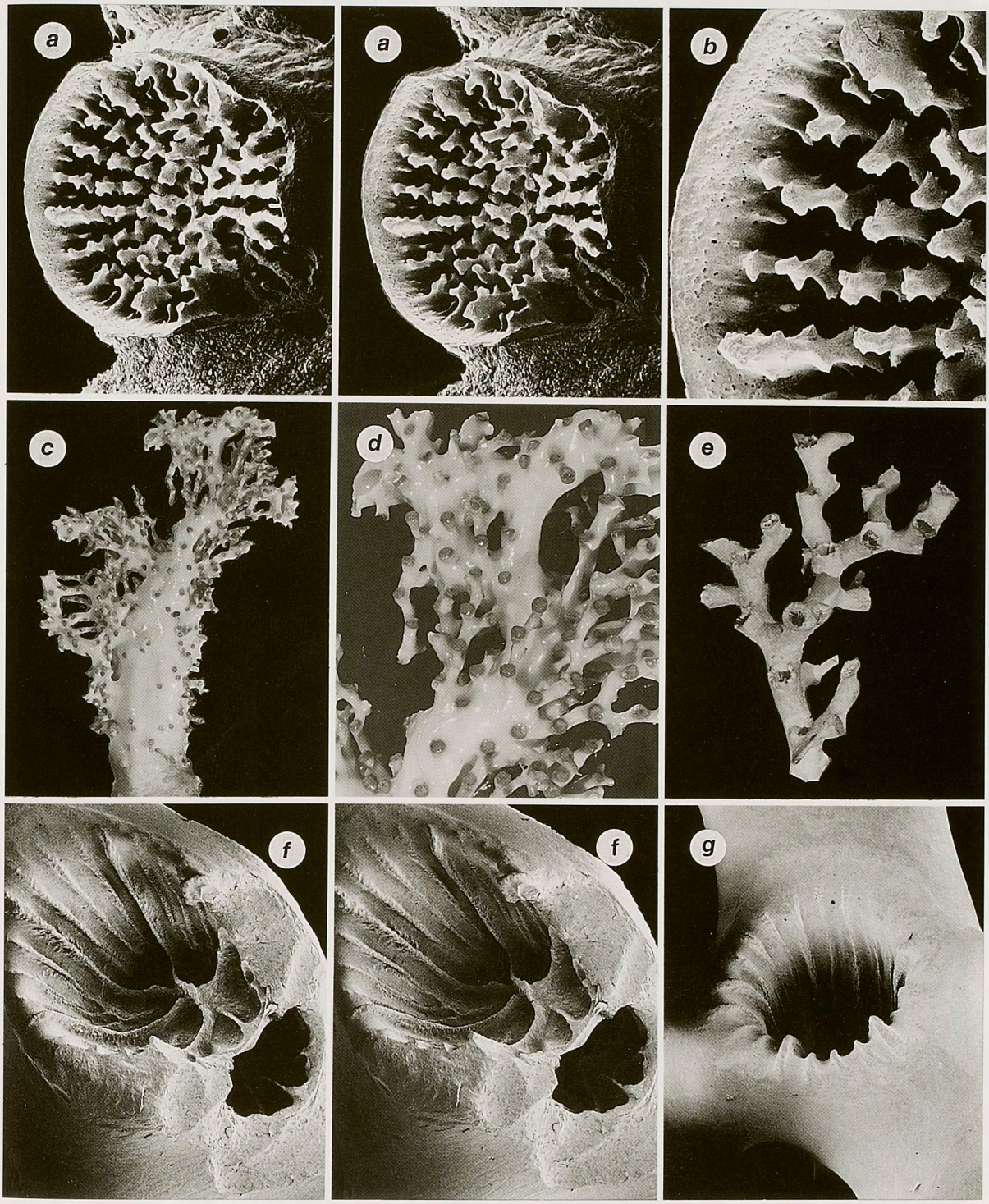

FIG. 3 a-b. — *Culicia stellata* Dana, 1846, *"Alpha Helix"* stn 79-M140 (USNM 80029): **a**, stereo calicular view, x 17.1; **b**, enlargement of thecal lip and septal dentition, x 41.

FIG. 3 c-g. — *Madrepora arbuscula* (Moseley, 1881): **c-d**, **f-g**, MUSORSTOM 3 stn 126 (USNM 96750): **c-d**, corallum and corallites of a massive specimen, x 0.25, x 0.62, respectively; **f**, stereo view of a fractured corallite illustrating lower septa, columella, and dissepiment, x 15; **g**, calice and smooth coenosteum, x 12.8. — **e**, holotype, *"Challenger"* stn 194 (BMNH 1880.11.25.96), x 1.2.

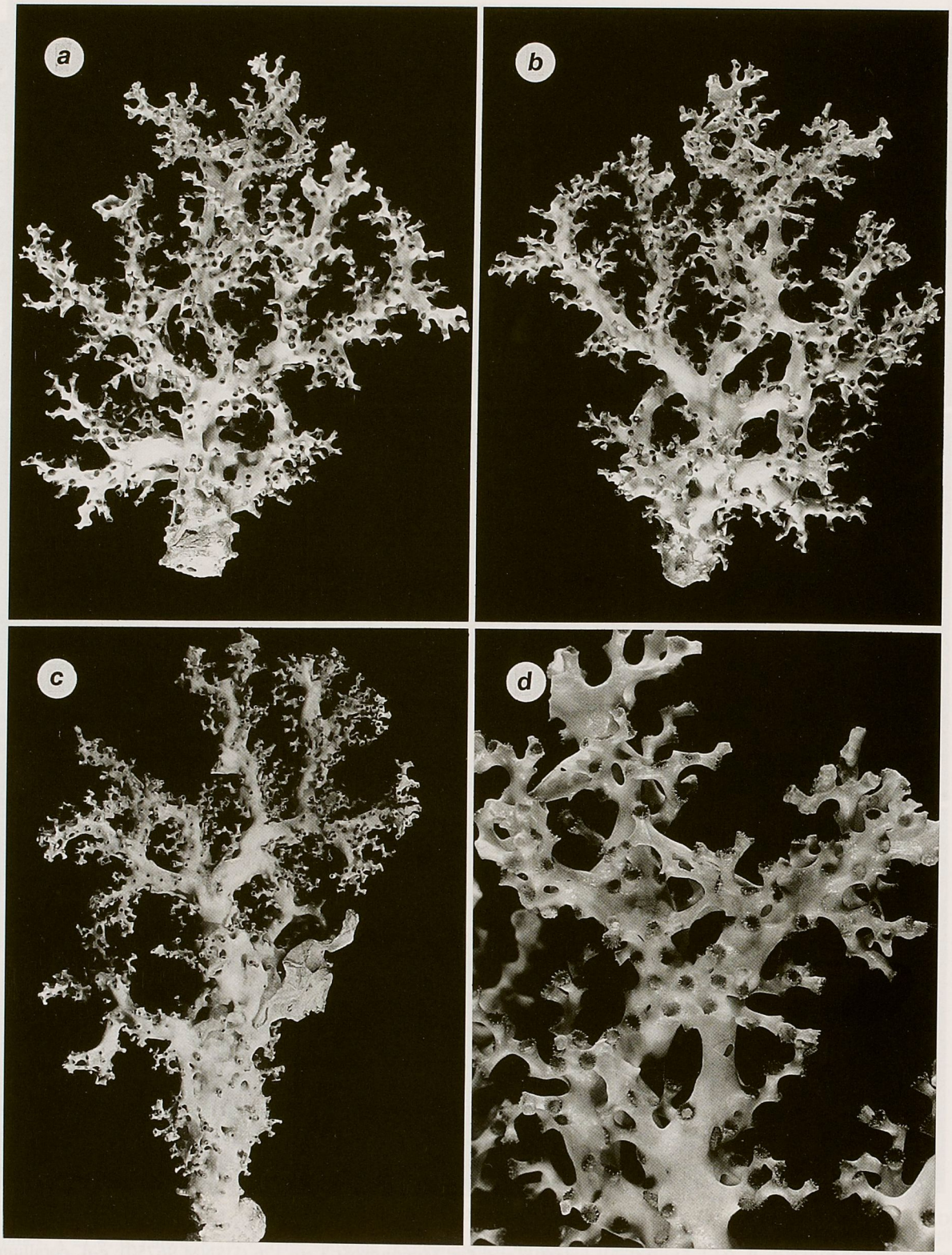

FIG. 4 a-d. — *Madrepora minutiseptum* sp. nov.: **a-b**, **d**, holotype, SNELLIUS 2 stn 4.196 (NNM 22734): **a-b**, anterior and posterior surfaces of colony, both x 0.38; **d**, enlargement showing anastomosing branches, x 0.91. — **c**, paratype, "off Japan" (USNM 96754, ex ZMA 137), colony, x 0.38.



FIG. 5 a-b. — *Madrepora minutiseptum* sp. nov., paratype, "off Japan" (USNM 96754): **a**, stereo view of a fractured corallite showing septal dentition, x 23.5; **b**, two septa, x 105.

FIG. 5 c-e, g-h. — *Neohelia* sp. cf. *N. porcellana*: **c**, SNELLIUS 2 stn 4.104 (USNM 96765), colony, x 1.05. — **d**, *"Siboga"* stn 305 (ZMA), branch, x 14.5. — **e**, *"Siboga"* stn 289 (USNM 96766), calice, x 37. — **g-h**, DEKI (Ambon, 91 m) (ZMUC): **g**, coenosteal papillae, x 175; **h**, calice, x 58.

FIG. 5 f. — *Neohelia porcellana* Moseley, 1881, syntype, *"Challenger"* stn 177 (BMNH 1880.11.25.89), x 1.5.

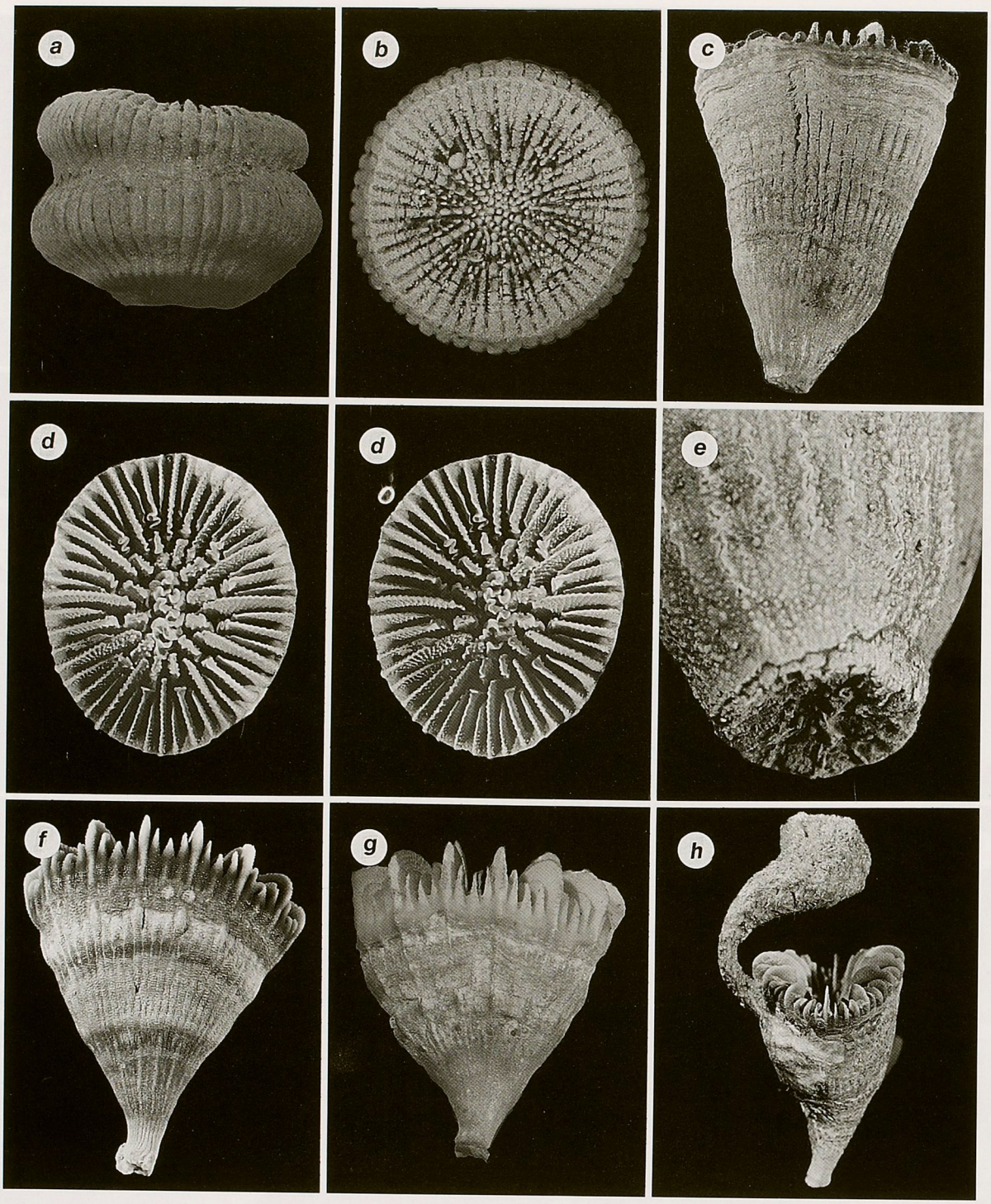

FIG. 6 a-b. — *Anthemiphyllia frustum* Cairns, 1994, KARUBAR stn 15 (USNM 96776): **a**, lateral view of 2 anthocyathi that remained attached, x 5.4; **b**, calice of same specimen, x 6.1.

FIG. 6 c-e. — *Caryophyllia secta* sp. nov., holotype, *"Albatross"* stn 5265 (USNM 96787): **c-e**, side, stereo calicular view, and basal scar, x 2.9, x 3.4, x 14.3, respectively.

FIG. 6 f-h. — *Caryophyllia transversalis* Moseley, 1881: **f**, **h**, KARUBAR stn 79 (POLIPI): **f**, side view, x 2.2; **h**, edge view with attached suberitid sponge, x 1.8. — **g**, syntype, *"Challenger"* stn 192 (BMNH 1880.11.25.23), side view, x 2.7.

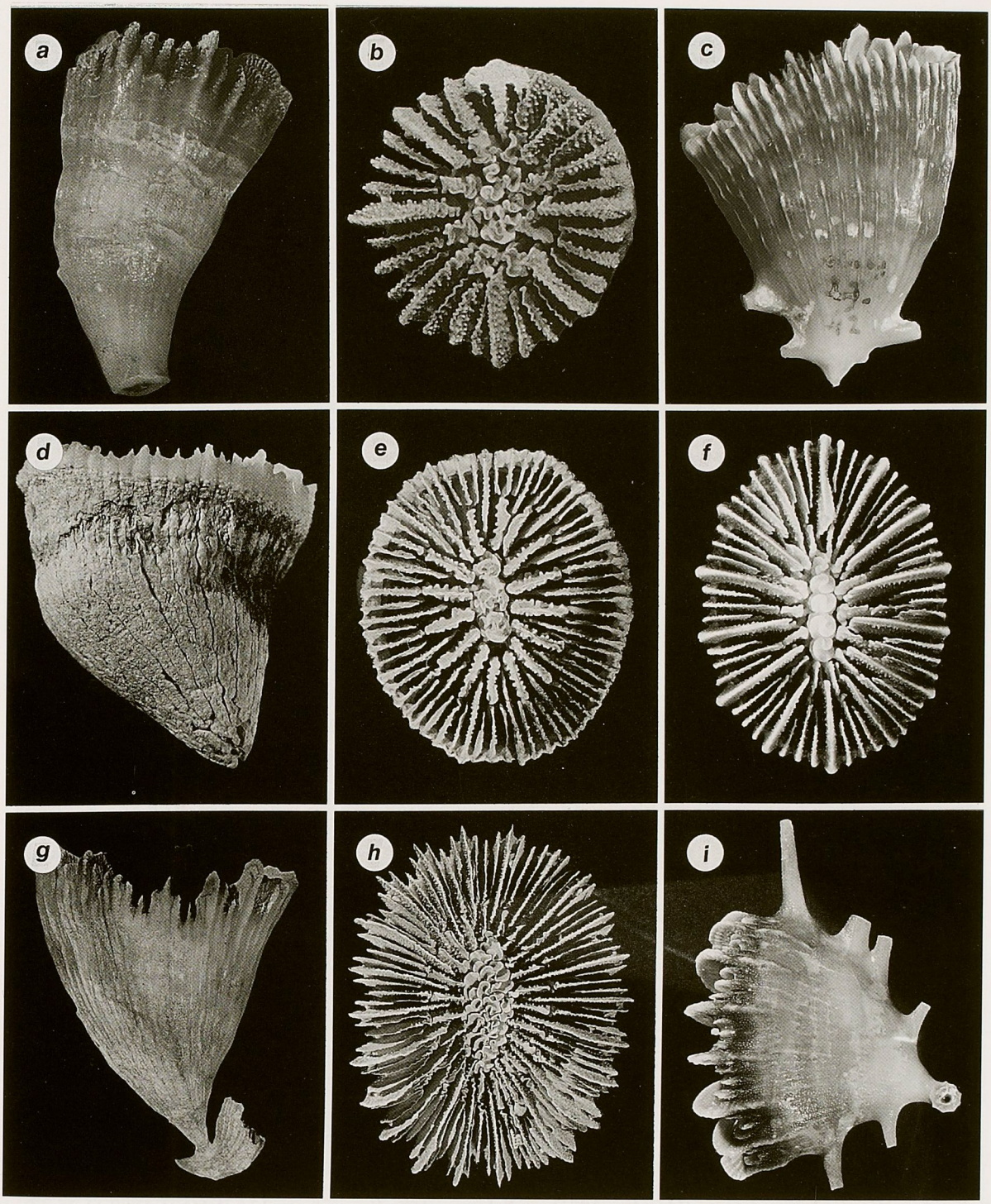

FIG. 7 a-b. — *Caryophyllia octonaria* sp. nov., holotype, MUSORSTOM 1 stn 64 (MNHN), side and calicular views, x 4.5, x 6.1, respectively.

FIG. 7 c, f, i. — *Caryophyllia grayi* (H. Milne Edwards & Haime, 1848): **c**, syntype, Japan (BMNH 1840.9.29.42), side view, x 2.1. — **f, i**, MUSORSTOM 1 stn 56 (MNHN): **f**, calicular view, x 2.5; **i**, side view showing edge spines, x 2.4.

FIG. 7 d-e. — *Caryophyllia cornulum* sp. nov., holotype, CORINDON 2 stn 220 (MNHN), side and calicular views, x 2.7.

FIG. 7 g-h. — *Caryophyllia grandis* Gardiner & Waugh, 1938, KARUBAR stn 59 (MNHN), edge and calicular views of corallum with 24 pali, x 1.1, x 1.3, respectively.

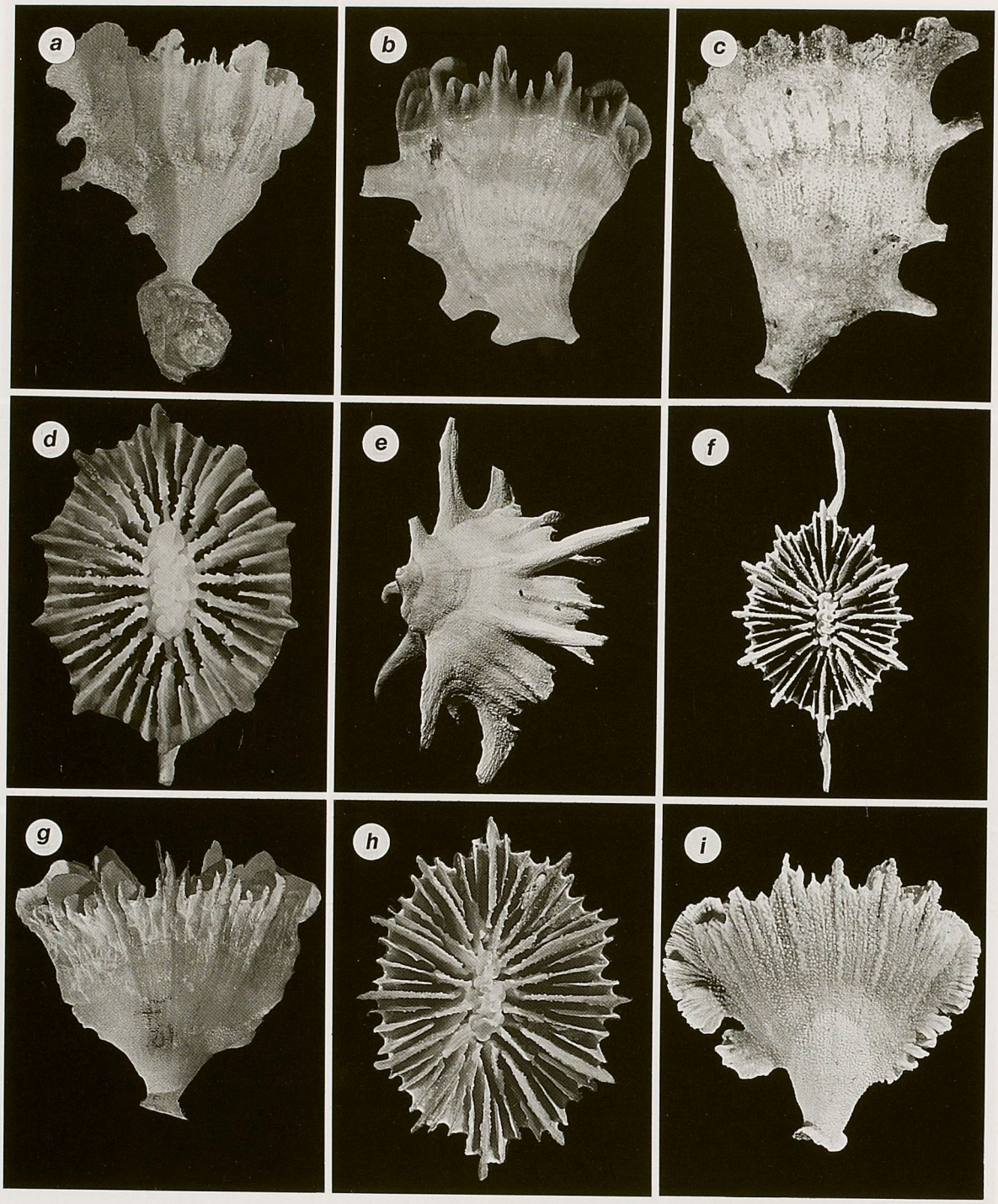

FIG. 8 a-d. — *Caryophyllia dentata* (Moseley, 1881): **a**, holotype, *"Challenger"* stn 174 (BMNH 1880.11.25.42), side view, x 2.9. — **b**, **d**, DEKI stn 3 (USNM 96858), side and calicular views of a decameral specimen, x 3.4, x 4.3, respectively. — **c**, DEKI (Neira) (NNM 23076), side view of hexameral specimen, x 2.8.

FIG. 8 e-f. — *Caryophyllia spinigera* (Saville Kent, 1871) *"Albatross"* stn 5371 (USNM 92690): **e**, corallum with prominent C_1 spines, x 2; **f**, calicular view, x 2.

FIG. 8 g-i. — *Caryophyllia spinicarens* (Moseley, 1881): **g-h**, holotype, *"Challenger"* stn 210 (BMNH 1880.11.25.43), side and calicular views, x 3.1, x 3.3, respectively. — **i**, *"Albatross"* stn 5256 (USNM 96903), small corallum with delicate edge crests, x 3.6.

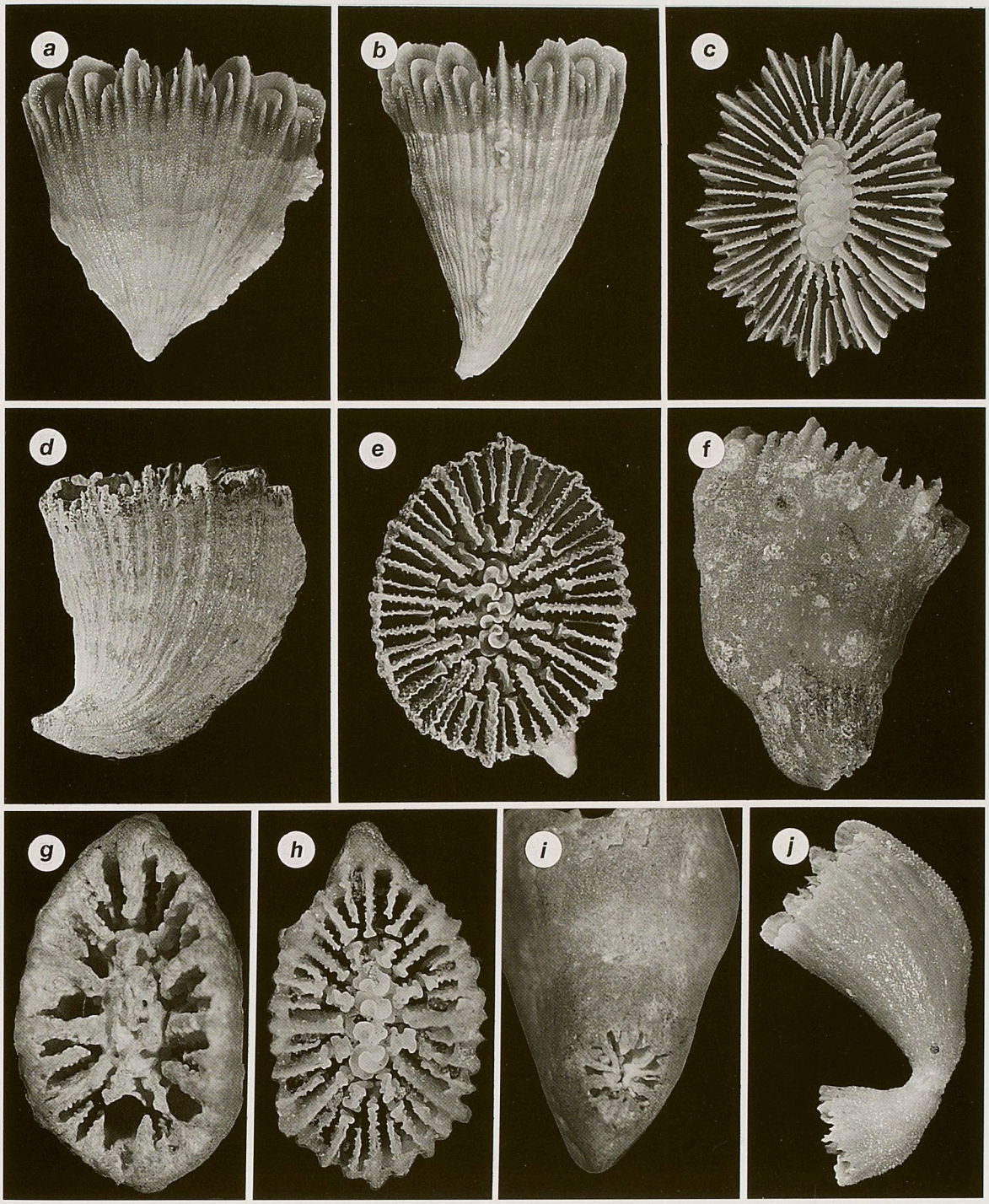

FIG. 9 a-c. — *Caryophyllia karubarica* sp. nov., holotype, KARUBAR stn 58 (MNHN), side, edge, and calicular views, x 2.0, x 2.15, x 2.15, respectively.

FIG. 9 d-e. — *Caryophyllia unicristata* sp. nov., holotype, KARUBAR stn 7 (MNHN), side and calicular views, x 3.1, x 4.1, respectively.

FIG. 9 f-j. — *Premocyathus dentiformis* (Alcock, 1902): **f**, **h**, *"Albatross"* stn 5217 (USNM 62708), side and calicular views, x 6.4, x 7.8, respectively. — **g**, **i**, holotype, *"Siboga"* stn 59 (ZMA Coel. 1093), calicular and basal views, x 9.4, x 8.4, respectively. — **j**, KARUBAR stn 15 (MNHN), specimen showing regeneration from basal region, x 7.1.

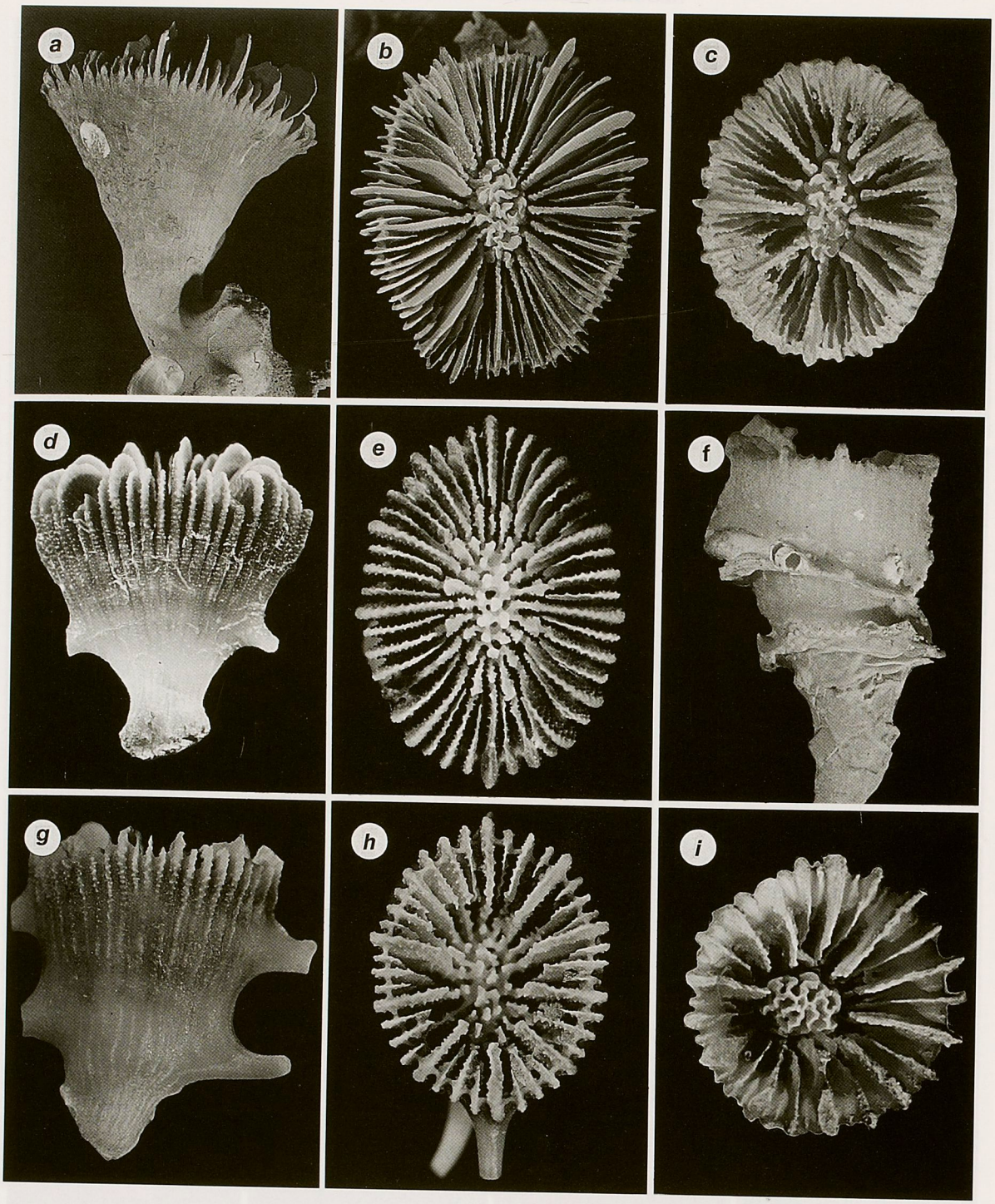

FIG. 10 a-c. — *Crispatotrochus rubescens* (Moseley, 1881): **a-b**, *"Albatross"* stn 5519 (USNM 60586), side and calicular views of a large corallum, x 1.4, x 1.6, respectively. — **c**, *"Siboga"* stn 105 (ZMA Coel. 579), syntype of *Cyathoceras tydemani*, calice, x 4.6.

FIG. 10 d-e. — *Trochocyathus philippinensis* Semper, 1872, MUSORSTOM 1 stn 72 (MNHN), side and calicular views of corallum with costal spines, x 4.3, x 6, respectively.

FIG. 10 f, i. — *Labyrinthocyathus* sp. A, KARUBAR stn 36 (MNHN), side and calicular views, x 4.4, x 5.6, respectively.

FIG. 10 g-h. — *Trochocyathus semperi* sp. nov., holotype, CORINDON 2 stn 251 (MNHN), side and calicular views, x 6.4, x 7.5, respectively.

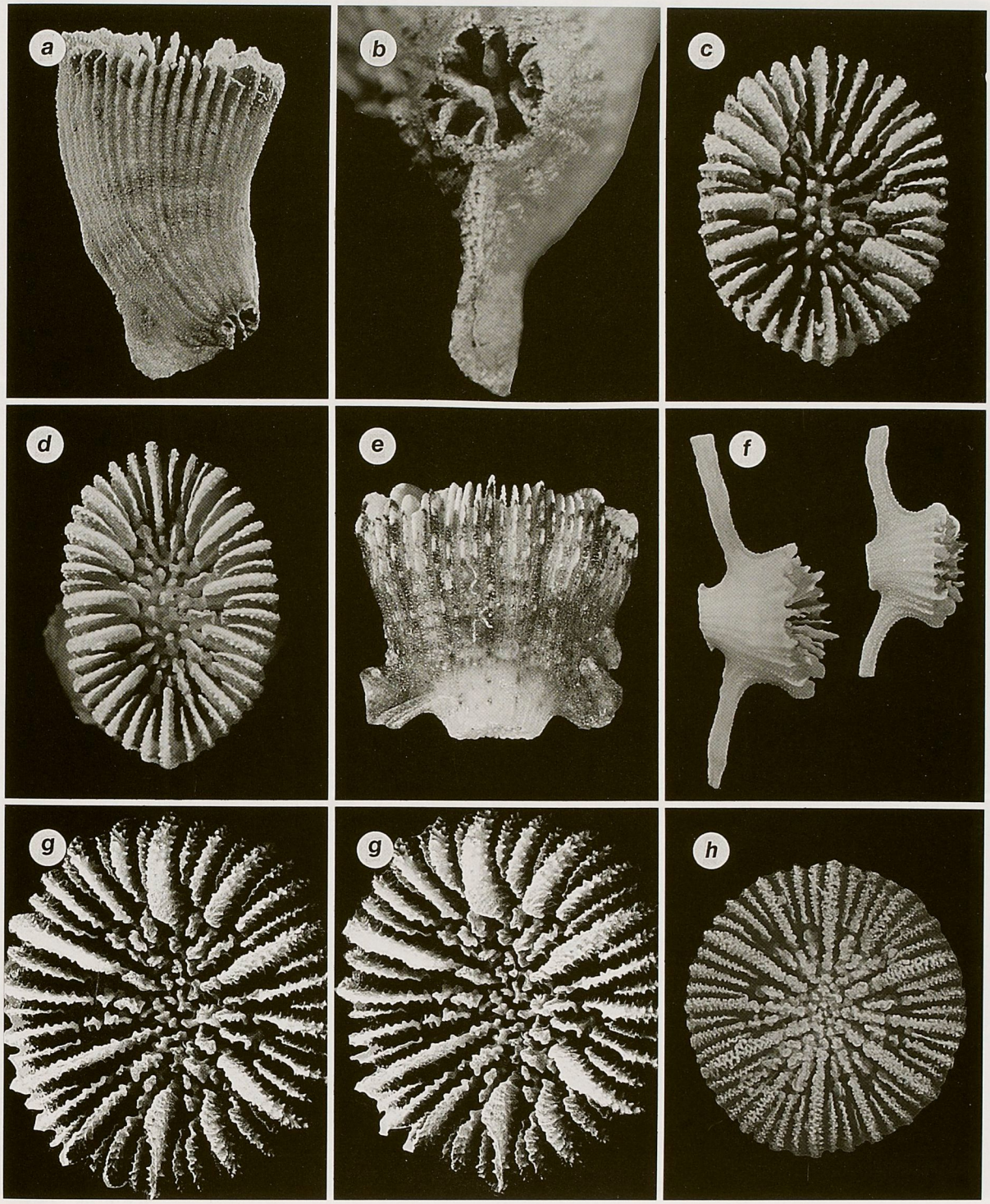

FIG. 11 a-d. — *Trochocyathus apertus* sp. nov.: **a-c**, holotype, *"Albatross"* stn 5164 (USNM 97087), side, open base, and calicular views, x 5.2, x 13, x 7.2, respectively. — **d**, paratype, MORTENSEN'S JAVA EXP., stn 9 (ZMUC), calice, x 5.3.
FIG. 11 e. — *Trochocyathus cooperi* (Gardiner, 1905), MUSORSTOM 2 stn 47 (MNHN), side view of an anthocyathus, x 4.
FIG. 11 f. — *Trochocyathus semperi* sp. nov., CORINDON 2 stn 251 (POLIPI), 2 small coralla with costal spines, x 5.6.
FIG. 11 g-h. — *Trochocyathus discus* sp. nov.: **g**, paratype, KARUBAR stn 3 (USNM 97105), stereo calicular view, x 7.5. — **h**, holotype, KARUBAR stn 3 (MNHN), calice, x 5.

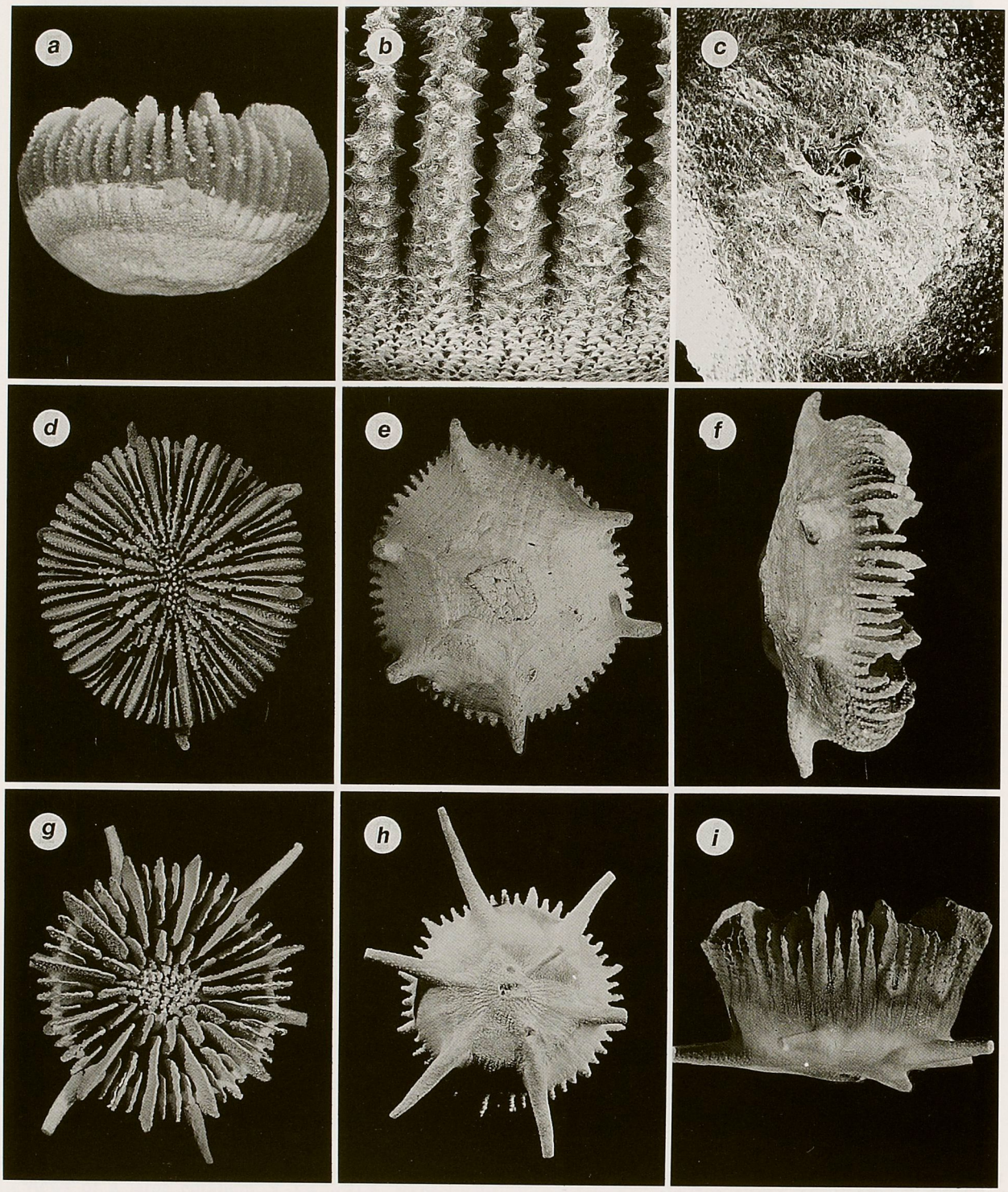

FIG. 12 a-c. — *Trochocyathus discus* sp. nov.: **a**, holotype, KARUBAR stn 3 (MNHN), side view, x 5.2. — **b-c**, paratype, KARUBAR stn 3 (USNM 97105): **b**, costal granulation at calicular edge, x 25; **c**, basal scar, x 14.

FIG. 12 d-f. — *Trochocyathus brevispina* sp. nov., holotype, KARUBAR stn 3 (MNHN), calicular, basal, and side views, x 2.1, x 2.1, x 2.5, respectively.

FIG. 12 g-i. — *Trochocyathus longispina* sp. nov., holotype, MUSORSTOM 1 stn 50 (MNHN), calicular, basal, and edge views, x 2.6, x 2.1, x 2.8, respectively.

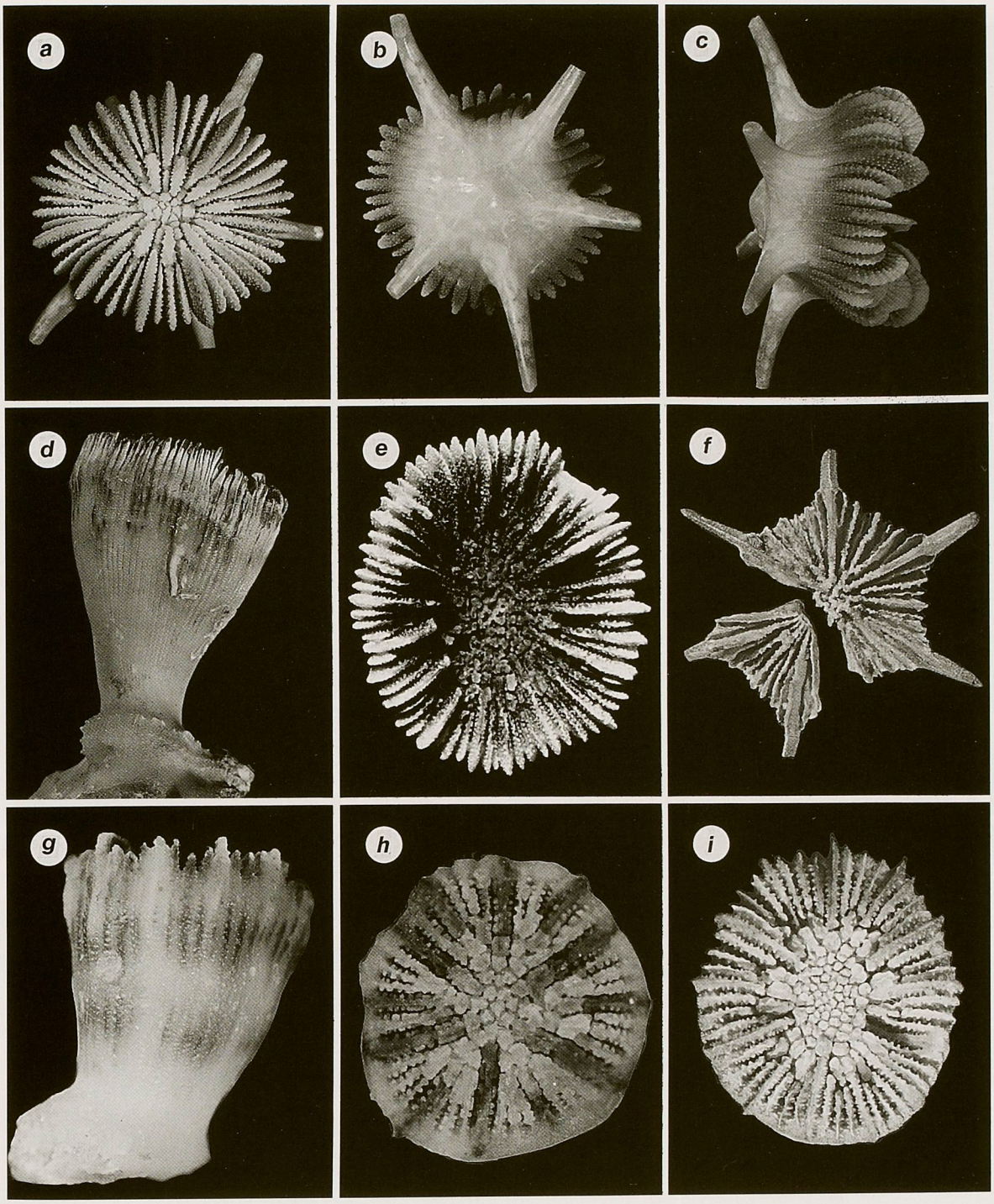

FIG. 13 a-c. — *Trochocyathus hastatus* Bourne, 1903, syntype, Tutanga (BMNH 1903.12.1.2), calicular, basal, and edge views, all x 3.4.

FIG. 13 d-e. — *Paracyathus rotundatus* Semper, 1872: **d**, *"Alpha Helix"* stn 79-M21 (USNM 80015), side view, x 2.6. — **e**, holotype, Philippines (NMW 8177), calice, x 4.2.

FIG. 13 f. — *Stephanocyathus spiniger* (Marenzeller, 1888), *"Siboga"* stn 159 (ZMA Coel. 1305), holotype of *Odontocyathus stella*, x 3.2.

FIG. 13 g-i. — *Paracyathus* sp.: **g**, *"Challenger"* stn 190 (BMNH), side view, x 9.2. — **h**, DEKI (Ambon) (NNM), calice, x 13. — **i**, *"Siboga"* stn 256 (ZMA Coel. 1306), calice, x 5.3.

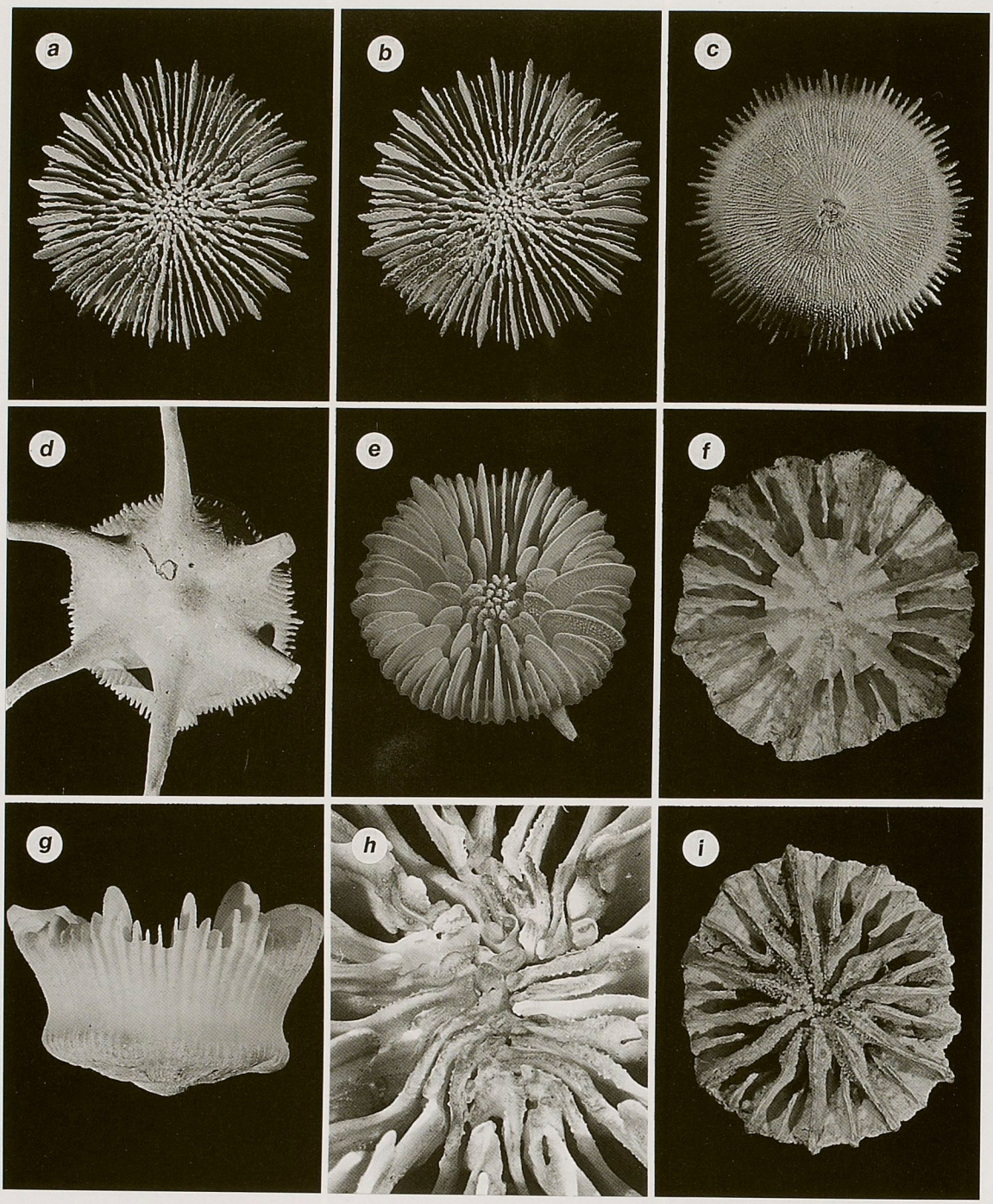

FIG. 14 a-c. — *Stephanocyathus regius* sp. nov., holotype, *"Hakuho Maru"* stn KH 72-1-26 (USNM 97122), stereo calicular and basal views, both x 1.7.

FIG. 14 d. — *Stephanocyathus spiniger* (Marenzeller, 1888), *"Siboga"* stn 156 (ZMA Coel. 1304), base of syntype of *Odontocyathus sexradii*, x 1.

FIG. 14 e. — *Stephanocyathus explanans* (Marenzeller, 1904), KARUBAR stn 40 (MNHN), oblique calicular view, x 2.

FIG. 14 f. — *"Sabinotrochus" bipatella* Alcock, 1902, holotype, *"Siboga"* stn 284 (ZMA Coel. 1322), x 6.

FIG. 14 g-h. — *Stephanocyathus weberianus* (Alcock, 1902): **g**, syntype, *"Siboga"* stn 284 (ZMA Coel. 1322), side, x 2. — **h**, KARUBAR stn 91 (MNHN), labyrinthiform columella, x 2.

FIG. 14 i. — *"Sabinotrochus" flatiliseptis* Alcock, 1902, holotype, *"Siboga"* stn 211 (ZMA Coel. 1315), x 4.4.

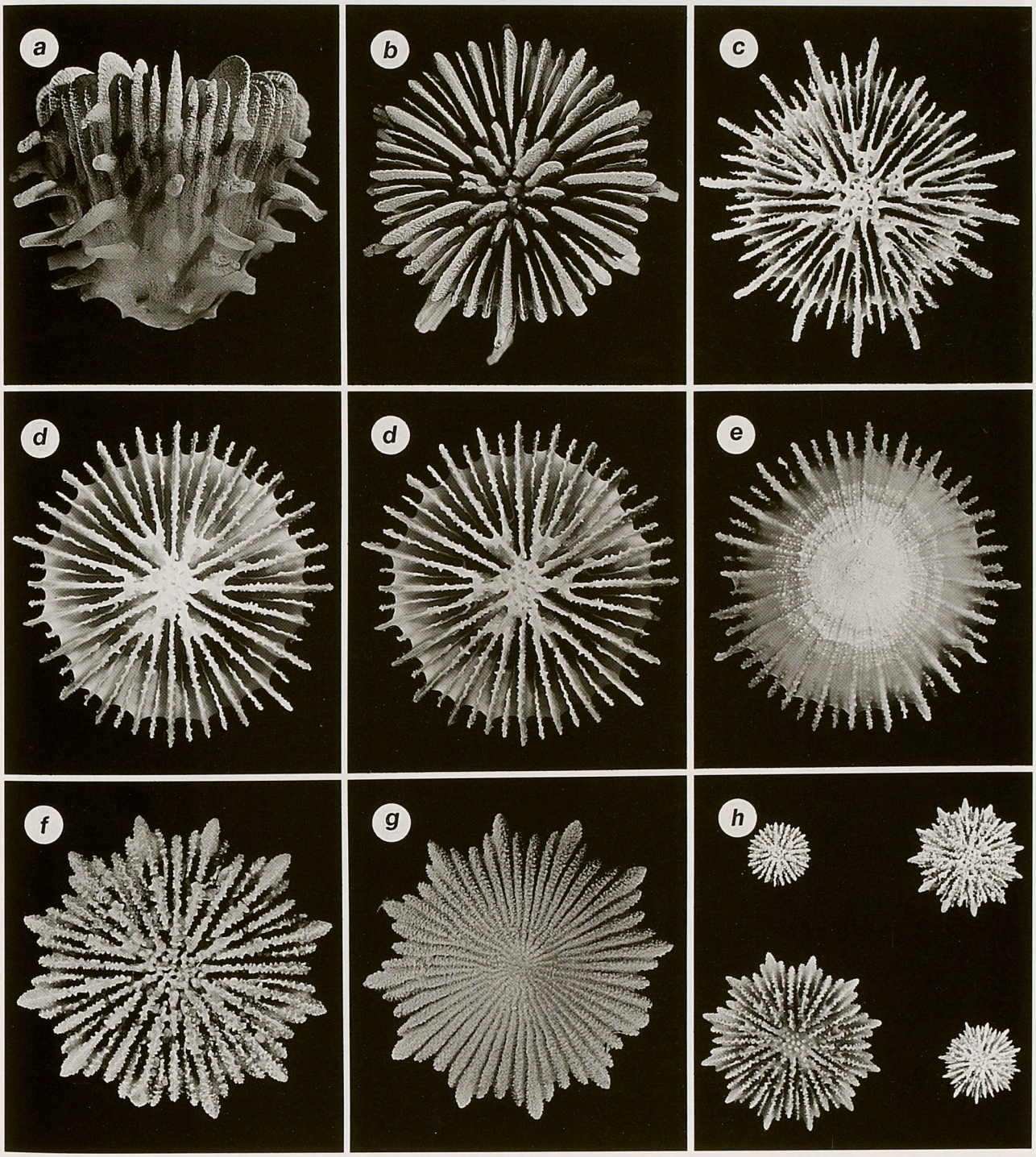

FIG. 15 a-b. — *Ericiocyathus echinatus* sp. nov., holotype, *"Albatross"* stn 5425 (USNM 97169), side and calicular views, both x 2.4.

FIG. 15 c. — *Deltocyathus andamanicus* Alcock, 1898, *"Albatross"* stn 5417 (USNM 97185), calicular view, x 2.5.

FIG. 15 d-e. — *Deltocyathus philippinensis* sp. nov., holotype, *"Albatross"* stn 5506 (USNM 97178), stereo calicular and basal views, both x 3.6.

FIG. 15 f-h. — *Deltocyathus stella* sp. nov.: **f-g**, holotype, KARUBAR stn 1 (MNHN), calicular and basal views, both x 4.2. — **h**, paratypes, KARUBAR stn 1 (MNHN), 4 coralla showing growth stages, x 3.

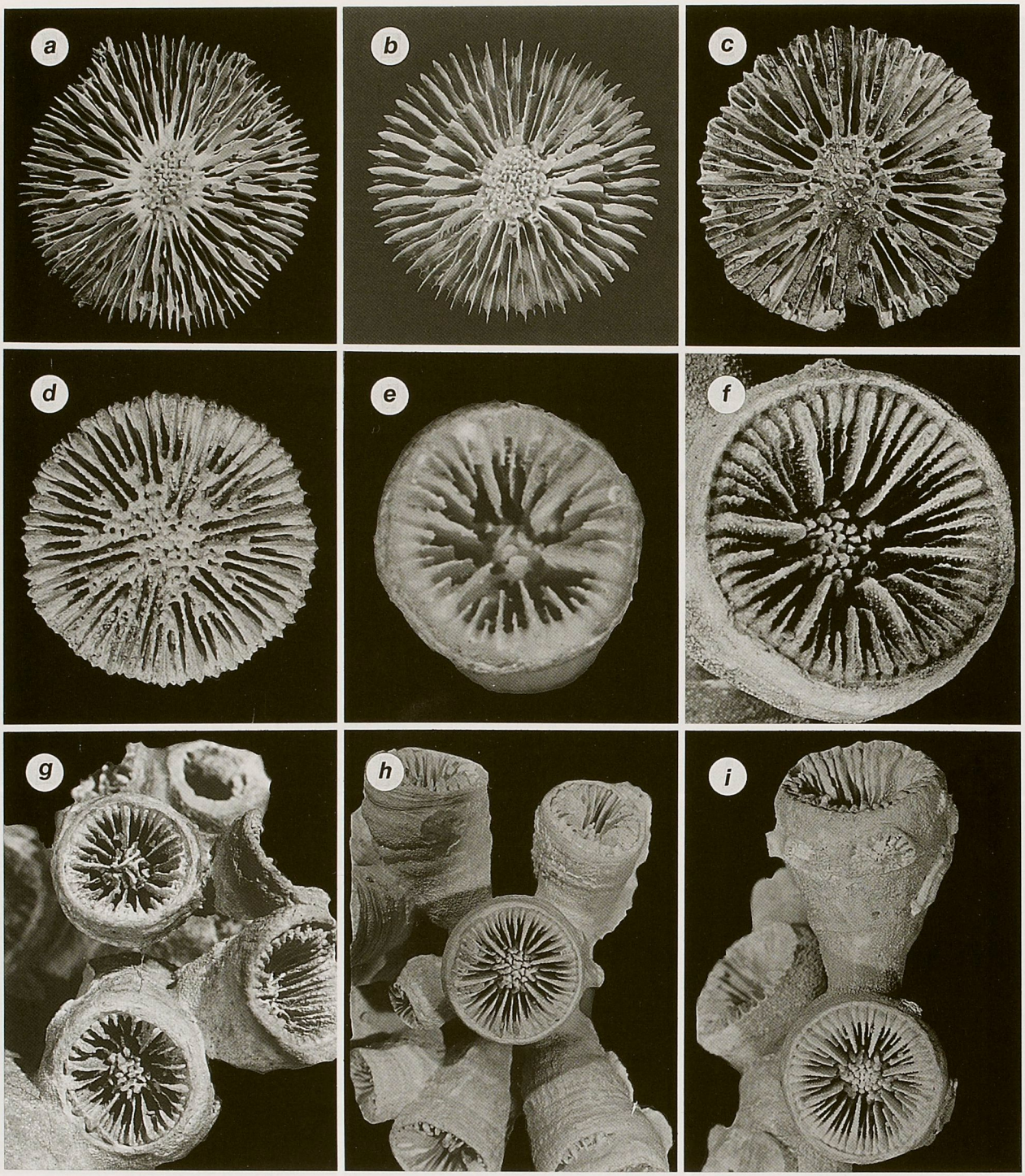

FIG. 16 a-c. — *Deltocyathus rotulus* (Alcock, 1898): **a**, *"Albatross"* stn 5582 (USNM 92727), corallum having P_{1-4}, x 1.4. — **b**, *"Albatross"* stn 5585, corallum with very small P_{1-3} (USNM 97207), x 1.6. — **c**, *"Siboga"* stn 45 (ZMA), a worn syntype of *D. fragilis*, x 2.8.

FIG. 16 d. — *Deltocyathus suluensis*, Alcock, 1902, syntype, *"Siboga"* stn 95 (ZMA Coel. 5442), x 3.6.

FIG. 16 e. — *Conotrochus brunneus* Moseley, 1881, holotype, *"Challenger"* stn 194 (BMNH 1880.11.25.62), x 10.1.

FIG. 16 f-i. — *Lochmaeotrochus oculeus* Alcock, 1902: **f**, **h-i**, KARUBAR stn 13 (MNHN): calice and corallites from same colony, x 5.6, x 2.5, x 2.5, respectively. — **g**, syntype, *"Siboga"* stn 259 (ZMA Coel. 700), x 3.4.

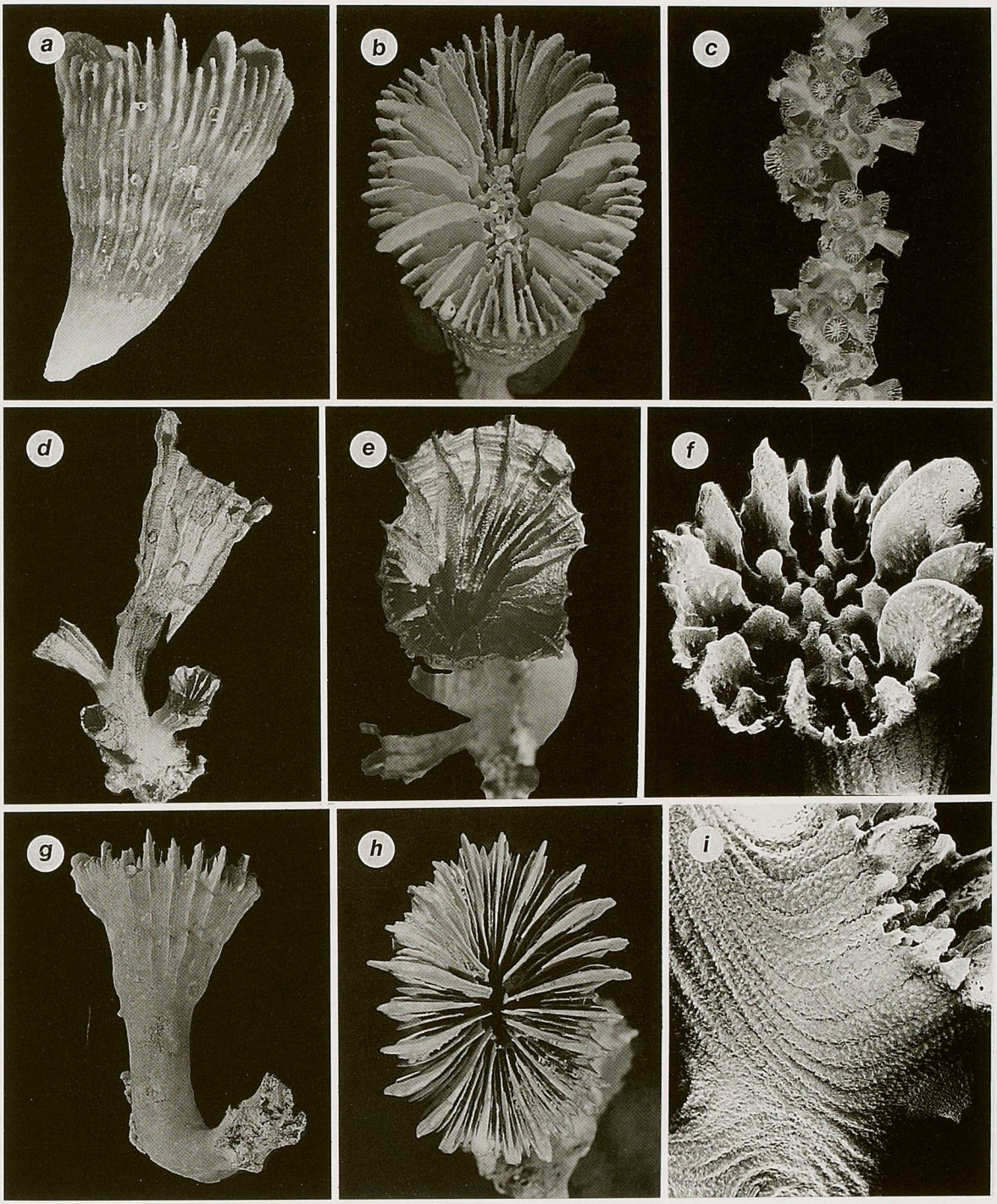

FIG. 17 a-b. — *Asterosmilia marchadi* (Chevalier, 1966), MORTENSEN'S JAVA EXP., stn 8 (ZMUC): **a**, side of corallum showing several detachment scars, x 3.4; **b**, oblique calicular view, x 3.4.

FIG. 17 c, f, i. — *Phyllangia papuensis* Studer, 1878, MUSORSTOM 2 stn 47 (MNHN), colony, calice, and costal granulation, x 0.75, x 11.3, x 12.1, respectively.

FIG. 17 d-e. — *Thalamophyllia tenuescens* (Gardiner, 1899), CORINDON 2 stn 248 (MNHN), side and calicular views of a colony, x 1.6, x 2.7, respectively.

FIG. 17 g-h. — *Desmophyllum dianthus* (Esper, 1794), *"Siboga"* stn 259 (ZMA Coel. 1242), side and calicular views, x 1.2, x 2, respectively.

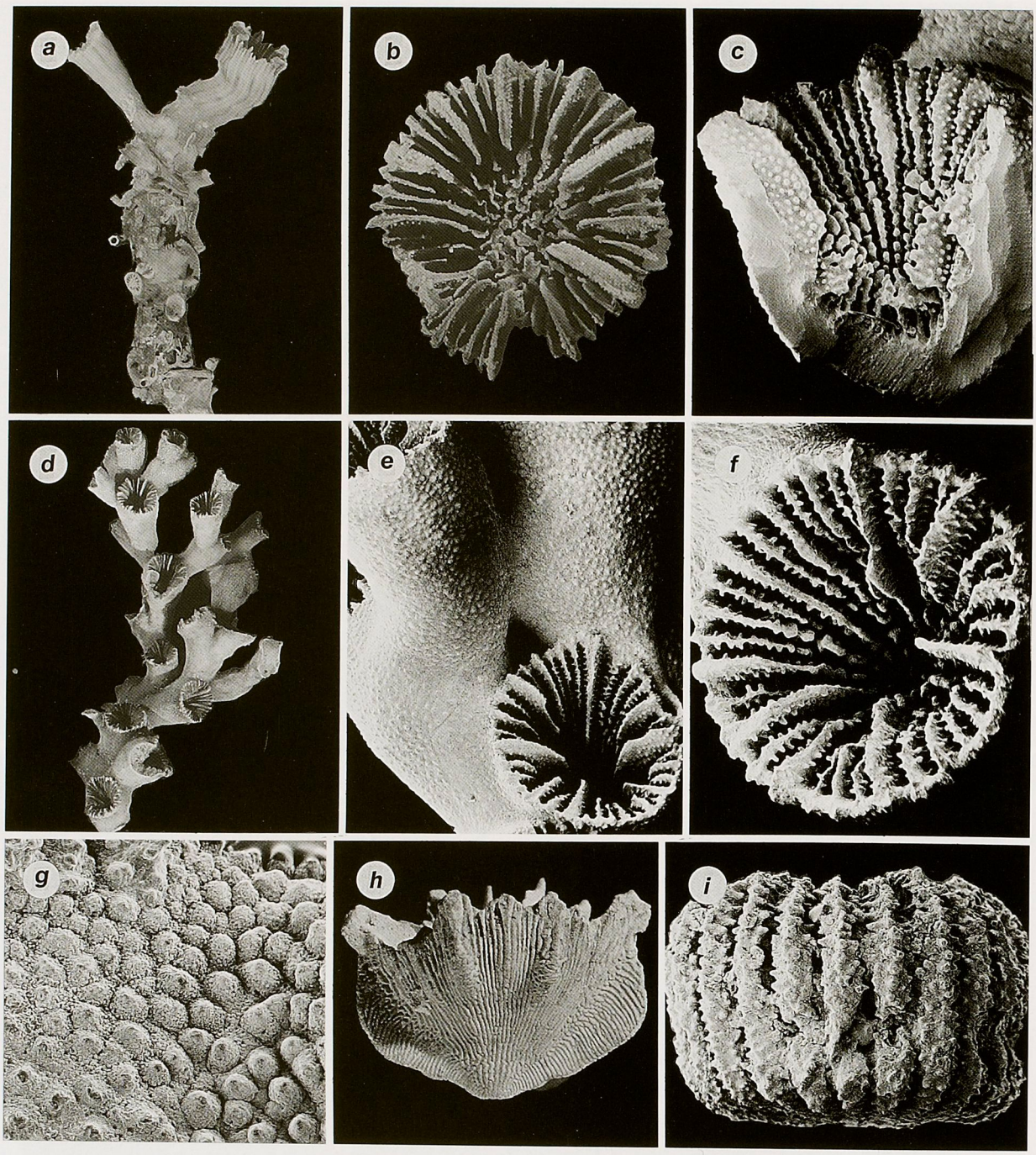

FIG. 18 a-b. — *Rhizosmilia elata* sp. nov., holotype, *"Albatross"* stn 5244 (USNM 97304), corallum and calice, x 0.83, x 4, respectively.

FIG. 18 c-g. — *Sympodangia albatrossi* sp. nov.: **c**, **g**, paratypes, KARUBAR stn 18 (USNM 97311): **c**, longitudinal fracture showing septal dentition, x 15.1; **g**, costal granulation over a barnacle, x 43. — **d**, holotype, *"Albatross"* stn 5398 (USNM 97308), x 1.8. — **e-f**, paratypes, *"Albatross"* stn 5398 (USNM 97309), branch and calice, x 10.1, x 23, respectively.

FIG. 18 h. — *Alatotrochus rubescens* (Moseley, 1876), MUSORSTOM 3 stn 102 (MNHN), side view showing enlarged C_1, x 2.5.

FIG. 18 i. — *Peponocyathus minimus* (Yabe & Eguchi, 1937), *"Albatross"* stn 5586 (USNM 97360), side view showing incipient transverse division, x 22.

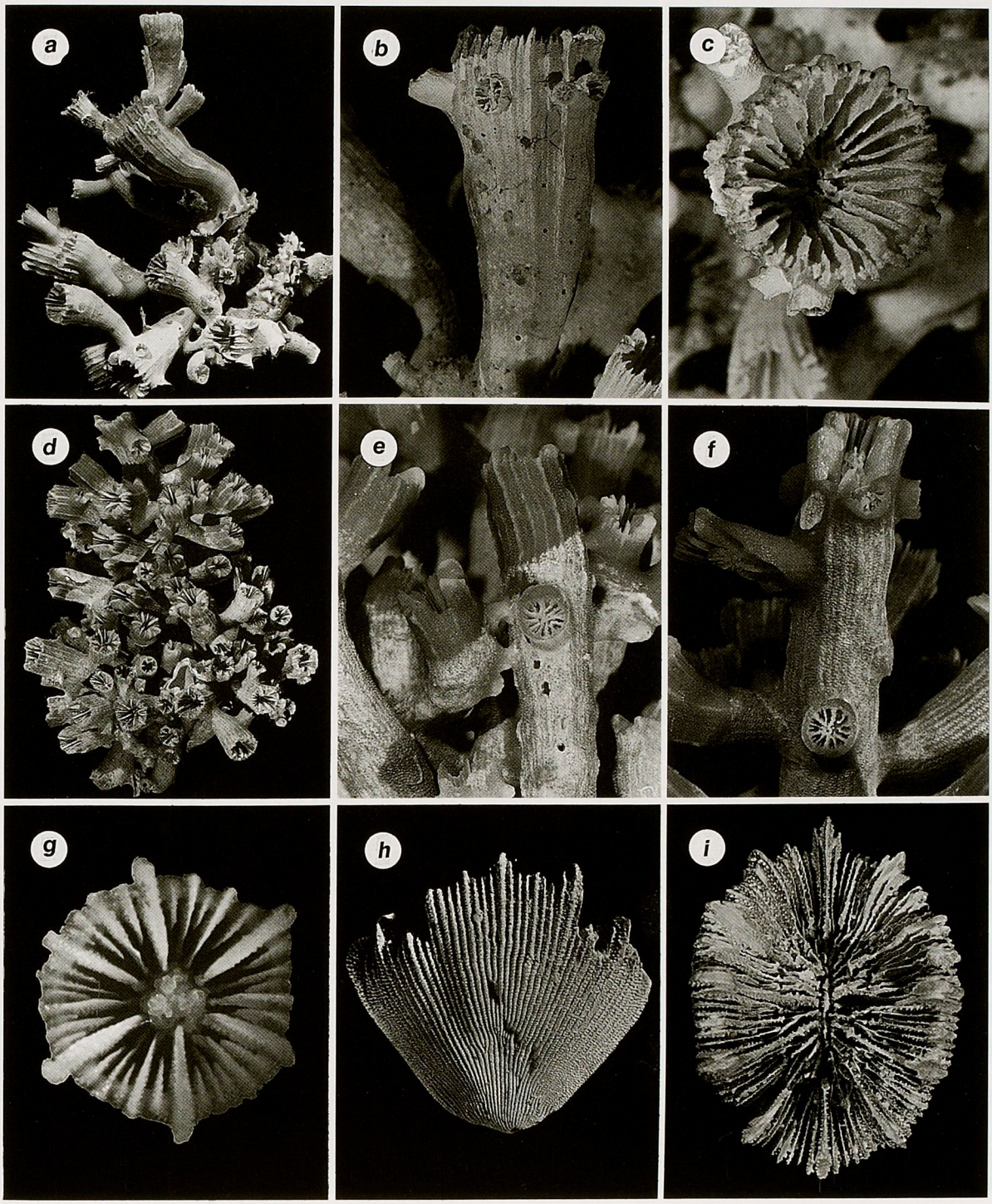

FIG. 19 a-c. — *Coenosmilia arbuscula* Pourtalès, 1874, *"Albatross"* stn 5543 (USNM 97312), colony, corallite with small buds, and calice, x 0.8, x 2.1, x 3.2, respectively.

FIG. 19 d-g. — *Confluphyllia juncta* sp. nov.: **d-f**, holotype, KARUBAR stn 25 (MNHN): **d**, colony, x 0.8; **e**, corallites united by coenosteal bridges, x 2.4; **f**, distal branch, x 2.4. — **g**, paratype, KARUBAR stn 25 (USNM 97316), calice showing columella, x 7.5.

FIG. 19 h-i. — *"Tropidocyathus" pileus* (Alcock, 1902), KARUBAR stn 2 (POLIPI), side and calicular views of corallum with S_5, x 2, x 2.3, respectively.

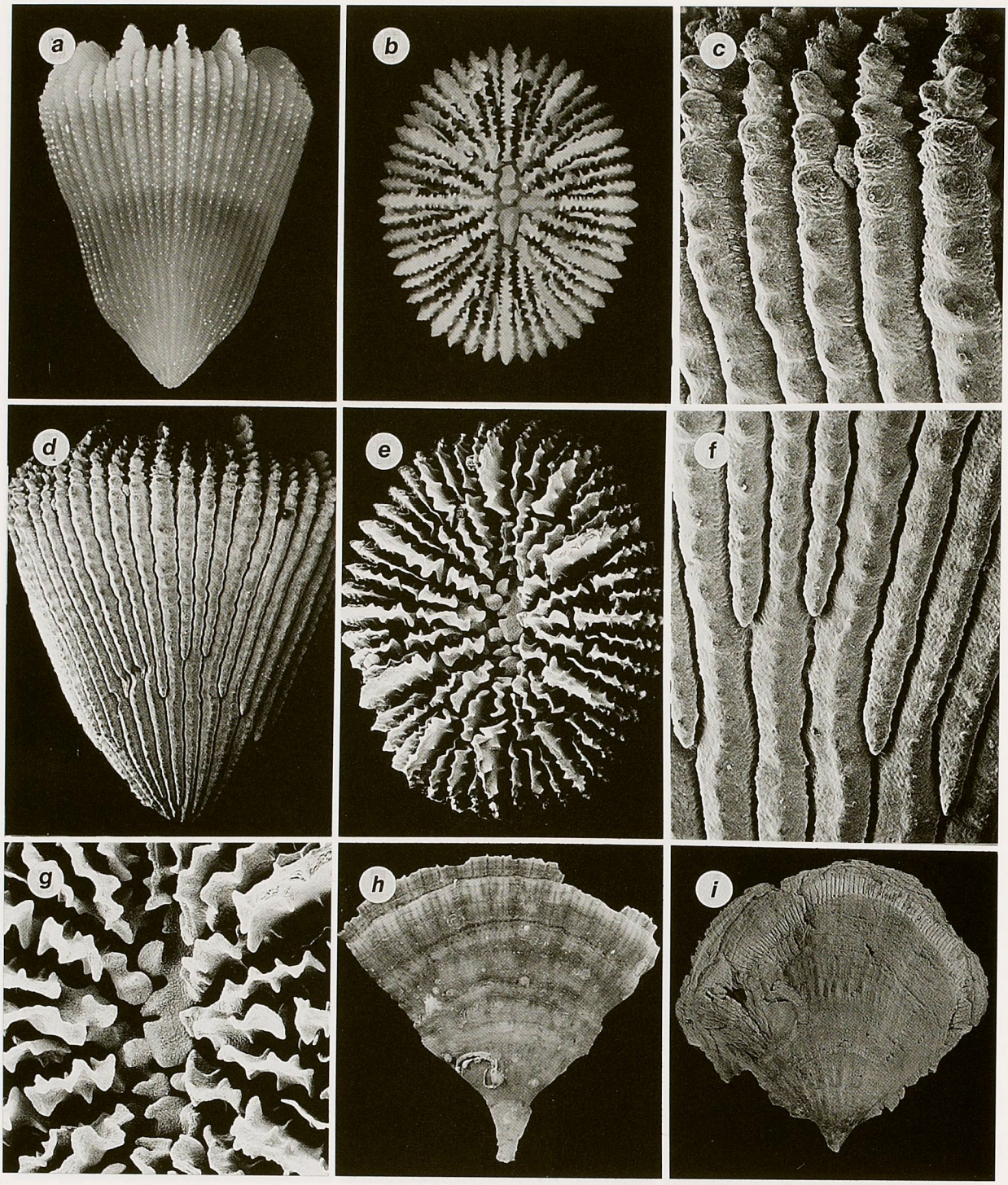

FIG. 20 a-g. — *"Tropidocyathus" labidus* sp. nov.: **a-b**, holotype, KARUBAR stn 2 (MNHN), side and calicular views, x 5.4, x 6.6, respectively. — **c-g**, paratypes, KARUBAR stn 2 (MNHN): **c**, costal granulation near calice, x 30.5; **d-e**, side and calicular views, x 9.1, x 9.8, respectively; **f**, higher cycle costal origins near base, x 30.5; **g**, enlargement of pali and columella, x 20.

FIG. 20 h. — *Flabellum pavoninum* Lesson, 1831, MUSORSTOM 3 stn 131 (USNM 97455), side view, x 2.1.

FIG. 20 i. — *Flabellum patens* Moseley, 1881, KARUBAR stn 31 (MNHN), side of corallum showing band of discolouration (erosion) caused by *Lumbrineris* polychaete, x 1.

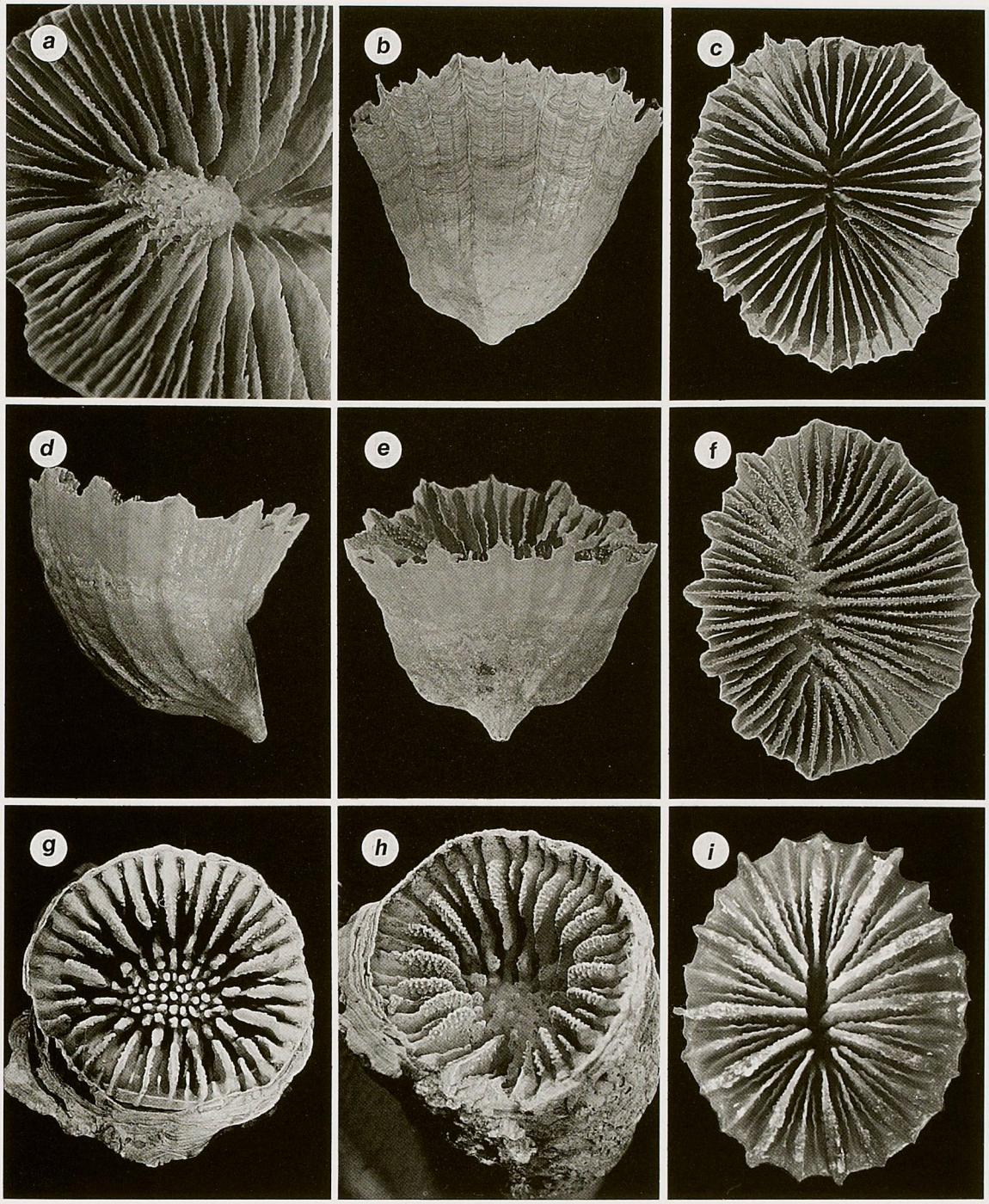

FIG. 21 a. — *Flabellum lamellulosum* Alcock, 1902, MUSORSTOM 1 stn 71 (MNHN), columellar gall of a petrarcid ascothoracidan crustacean, x 3.

FIG. 21 b-c. — *Flabellum conuis* Moseley, 1881, *"Hakuho Maru"* stn KH72-1-8 (USNM 97472), side and calicular views, x 1, x 1.1, respectively.

FIG. 21 d-f. — *Flabellum* sp., MUSORSTOM 2 stn 78 (MNHN), edge, side, and calicular views, x 1.7, x 1.6, x 1.8, respectively.

FIG. 21 g-h. — *Gardineria paradoxa* (Pourtalès, 1868): **g**, Barbados (USNM 80893), calice, x 4.1. — **h**, KARUBAR stn 5 (MNHN), calice, x 4.1.

FIG. 21 i. — *Javania pachytheca* Cairns, 1995, *"Albatross"* stn 5634 (USNM 97496), calicular view, x 6.3.

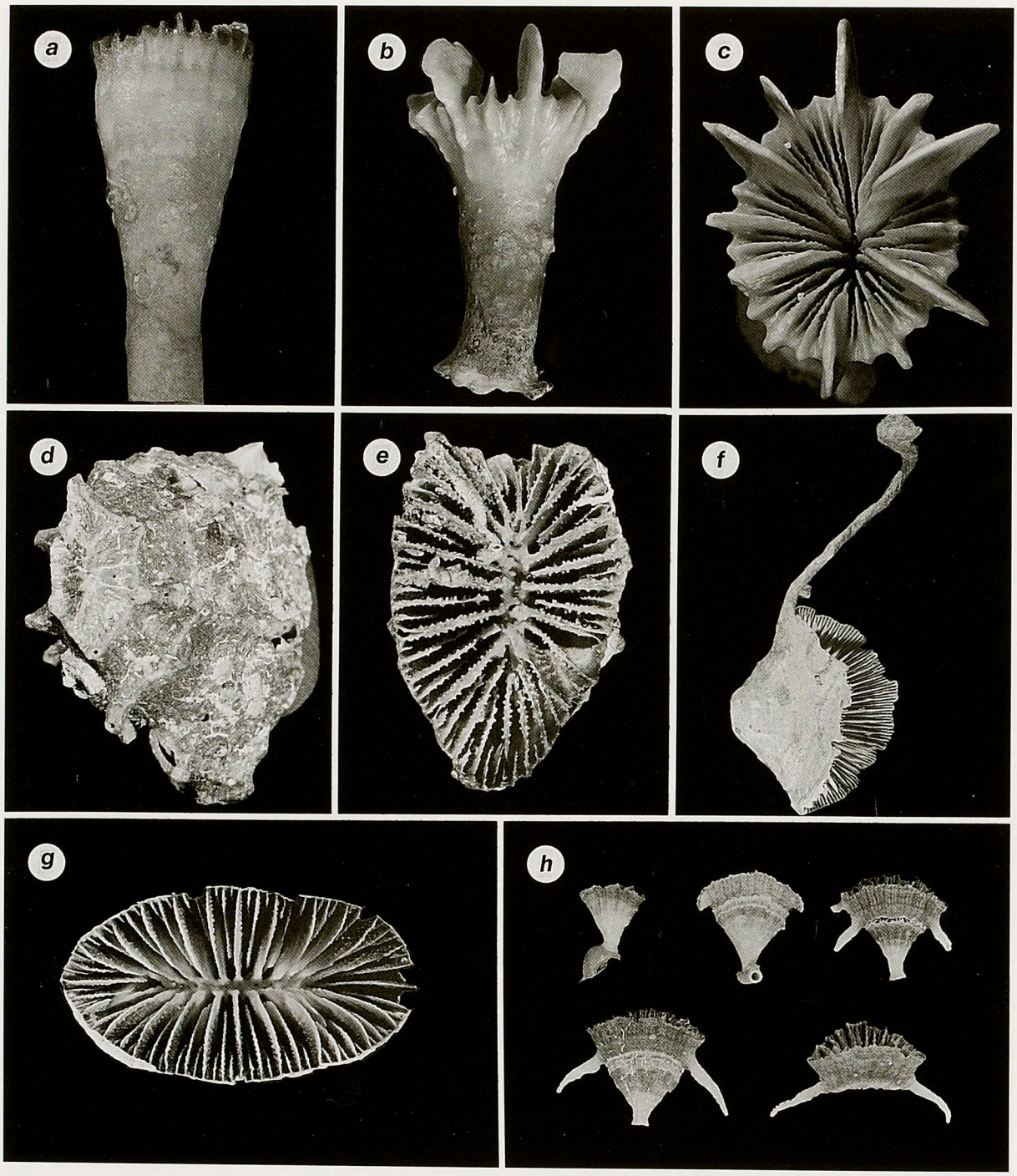

FIG. 22 a. — *Javania pachytheca* Cairns, 1995, *"Albatross"* stn 5634 (USNM 97486), side view, x 3.1.
FIG. 22 b-c. — *Javania* sp., KARUBAR stn 44 (MNHN), side and calicular views, x 1.9, x 3.4, respectively.
FIG. 22 d-e. — *Rhizotrochus "typus"* H. Milne Edwards & Haime, 1848, DEKI stn 25 (NNM 23096): **d**, oblique view of base showing scar of transverse division, x 2.9; **e**, calice, x 2.9.
FIG. 22 f. — *Truncatoflabellum paripavoninum* (Alcock, 1894), KARUBAR stn 71 (MNHN), corallum with suberitid sponge attached, x 0.52.
FIG. 22 g-h. — *Truncatoflabellum mortenseni* sp. nov.: **g**, holotype, MORTENSEN'S JAVA EXP. stn 5 (ZMUC), calice, x 3.3. — **h**, paratypes, MORTENSEN'S JAVA EXP. stn 5 (USNM 97522), 5 small coralla illustrating stages of the transverse division process, x 1.7.

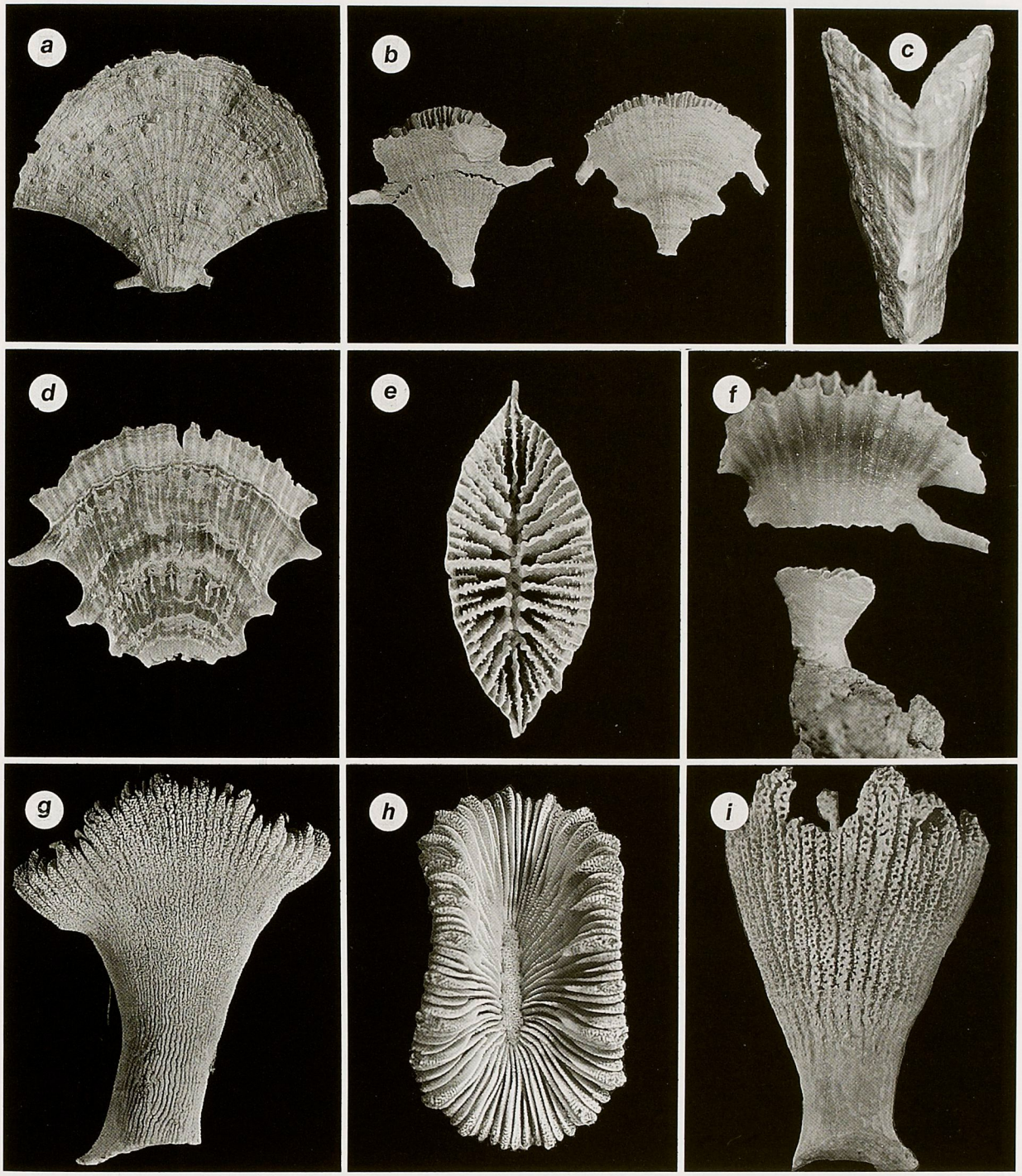

FIG. 23 a-b. — *Truncatoflabellum spheniscus* (Dana, 1846), *"Hakuho Maru"* stn KH72-1-30 (USNM 97501): **a**, side view, x 1.1; **b**, 2 anthocauli, one in process of dividing, x 1.8.

FIG. 23 c-f. — *Truncatoflabellum angustum* sp. nov.: **c-e**, holotype, MUSORSTOM 3 stn 143 (MNHN), edge, side, and calicular views, x 4.5, x 3.3, x 3.7, respectively. — **f**, paratype, MUSORSTOM 3 stn 130 (MNHN), anthocyathus and anthocaulus of same specimen, x 5.8.

FIG. 23 g-h. — *Balanophyllia desmophyllioides* Vaughan, 1907, MUSORSTOM 1 stn 3 (MNHN), side and calicular views, x 1.5, x 1.7, respectively.

FIG. 23 i. — *Balanophyllia parvula* Moseley, 1881, KARUBAR stn 49 (MNHN), side view, x 3.3.

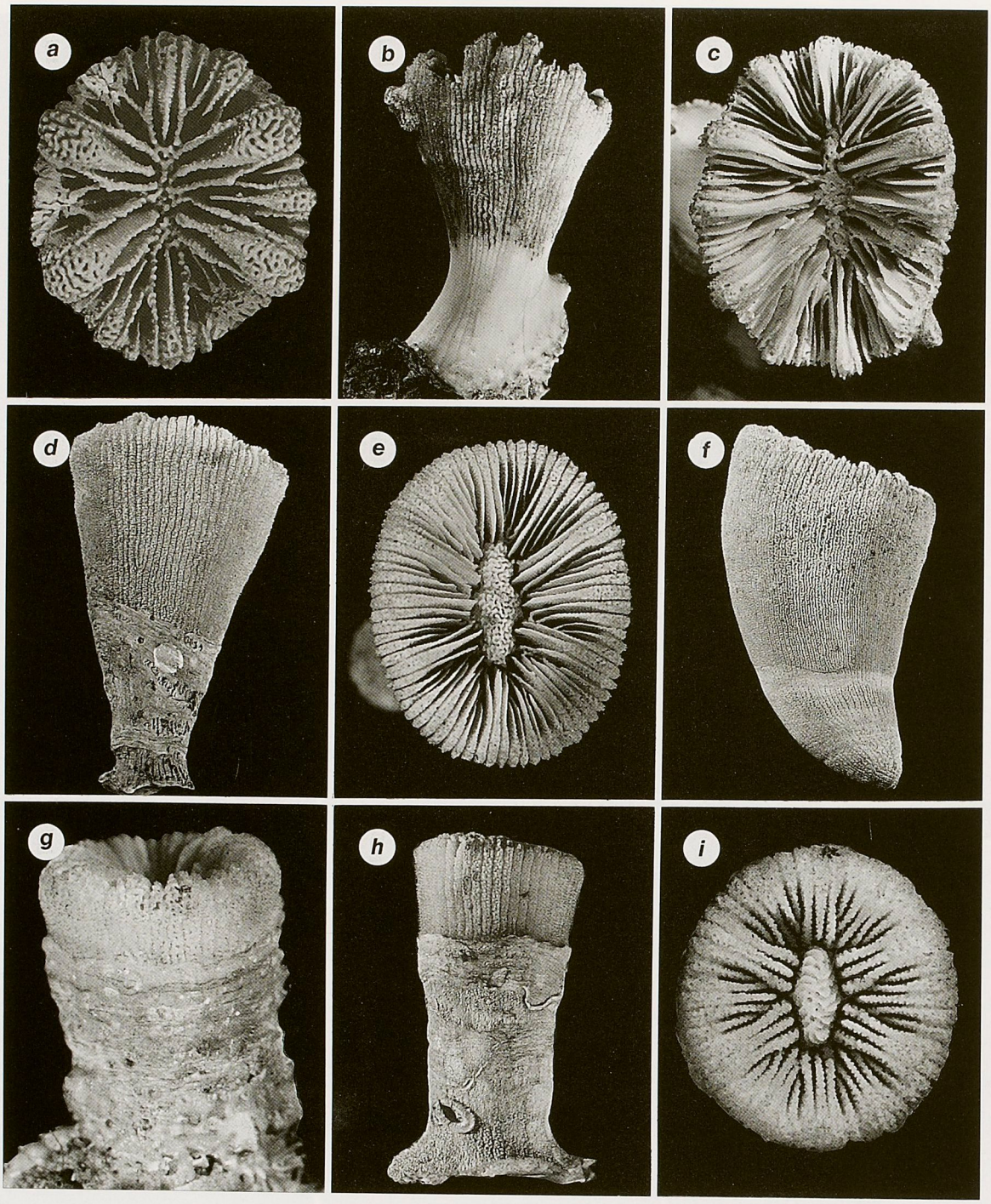

FIG. 24 a. — *Balanophyllia parvula* Moseley, 1881, KARUBAR stn 49 (MNHN), calice, x 4.7.

FIG. 24 b-c. — *Balanophyllia serrata* sp. nov., holotype, MUSORSTOM 1 stn 69 (MNHN), side and calicular views, x 1.1, x 1.6, respectively.

FIG. 24 d-f. — *Balanophyllia cornu* Moseley, 1881: **d-e**, *"Albatross"* stn 5280 (USNM 97574), side and calicular views of attached form, x 2.1, x 3.1, respectively. — **f**, *"Albatross"* stn 5313 (USNM 92880), side view of curved form, x 1.4.

FIG. 24 g-i. — *Balanophyllia gemma* (Moseley, 1881): **g, i**, holotype, *"Challenger"* stn 201 (BMNH 1880.11.25.147), side and calicular views, x 5.2, x 6.6, respectively. — **h**, *"Albatross"* stn 5135 (USNM 97592), side view showing epitheca.

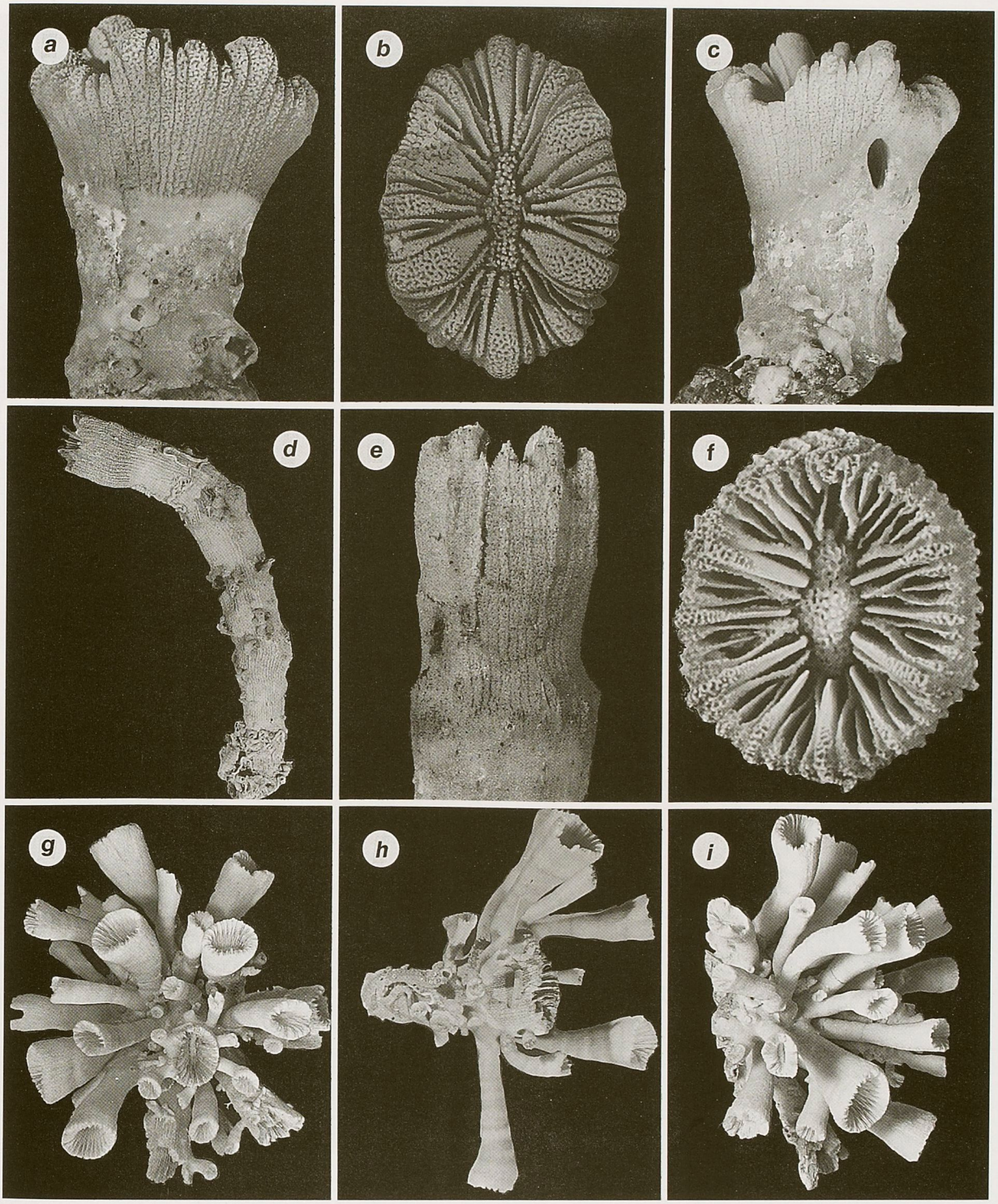

FIG. 25 a-c. — *Balanophyllia crassiseptum* sp. nov., holotype, KARUBAR stn 50 (MNHN): **a-b**, side and calicular views, x 3.2, x 3.8, respectively; **c**, other side showing boring of an acrothoracican cirripede, x 2.9.

FIG. 25 d-f. — *Balanophyllia rediviva* Moseley, 1881, KARUBAR stn 22 (MNHN), corallum, costae, and calice of same specimen, x 1.1, x 3.2, x 6.5, respectively.

FIG. 25 g-i. — *Balanophyllia generatrix* sp. nov.: **g, i**, paratype, *"Siboga"* stn 41 (ZMA 5538), top and side view of same pseudocolony, both x 0.6. — **h**, holotype, KARUBAR stn 82 (MNHN), x 0.6.

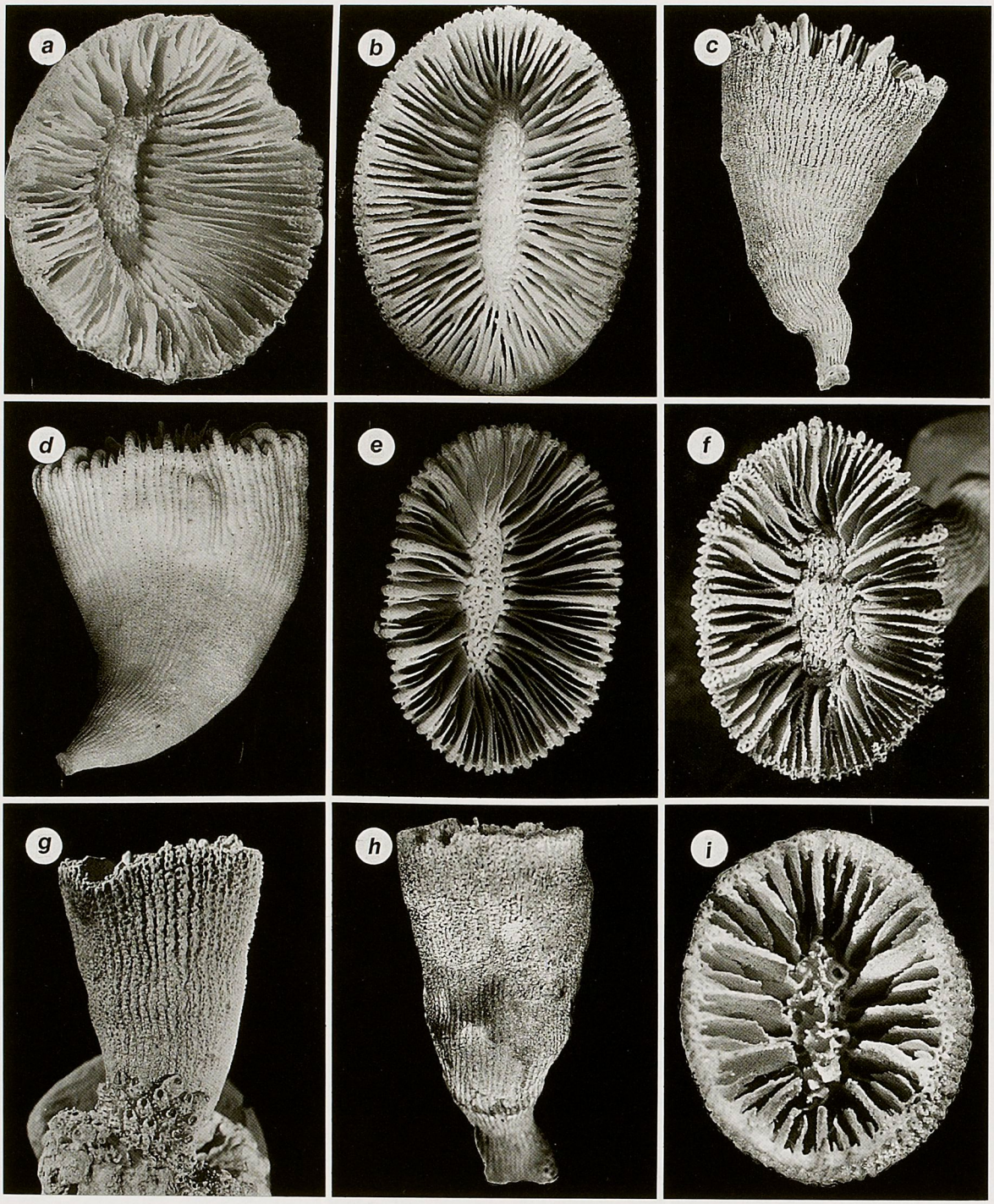

FIG. 26 a-b. — *Balanophyllia generatrix* sp. nov., paratype, *"Siboga"* stn 41 (ZMA Coel. 5538), 2 calicular views, both x 3.4.

FIG. 26 c-f. — *Balanophyllia imperialis* Saville Kent, 1871: **c**, **f**, *"Hakuho Maru"* stn KH72-1-30 (USNM 97608), side and calicular views, x 2, x 3.8, respectively. — **d-e**, holotype, Singapore (BMNH 1984.4.27.3), side and calicular views, x 1.4, x 1.7, respectively.

FIG. 26 g-i. — *Leptopsammia stokesiana* H. Milne Edwards & Haime, 1848: **g**, MORTENSEN'S PACIFIC EXP. (Jolo Island) (NNM), side view, x 3.8. — **h-i**, holotype, Philippines (BMNH 1855.12.27.1), side and calicular views, x 2.9, x 5.5, respectively.

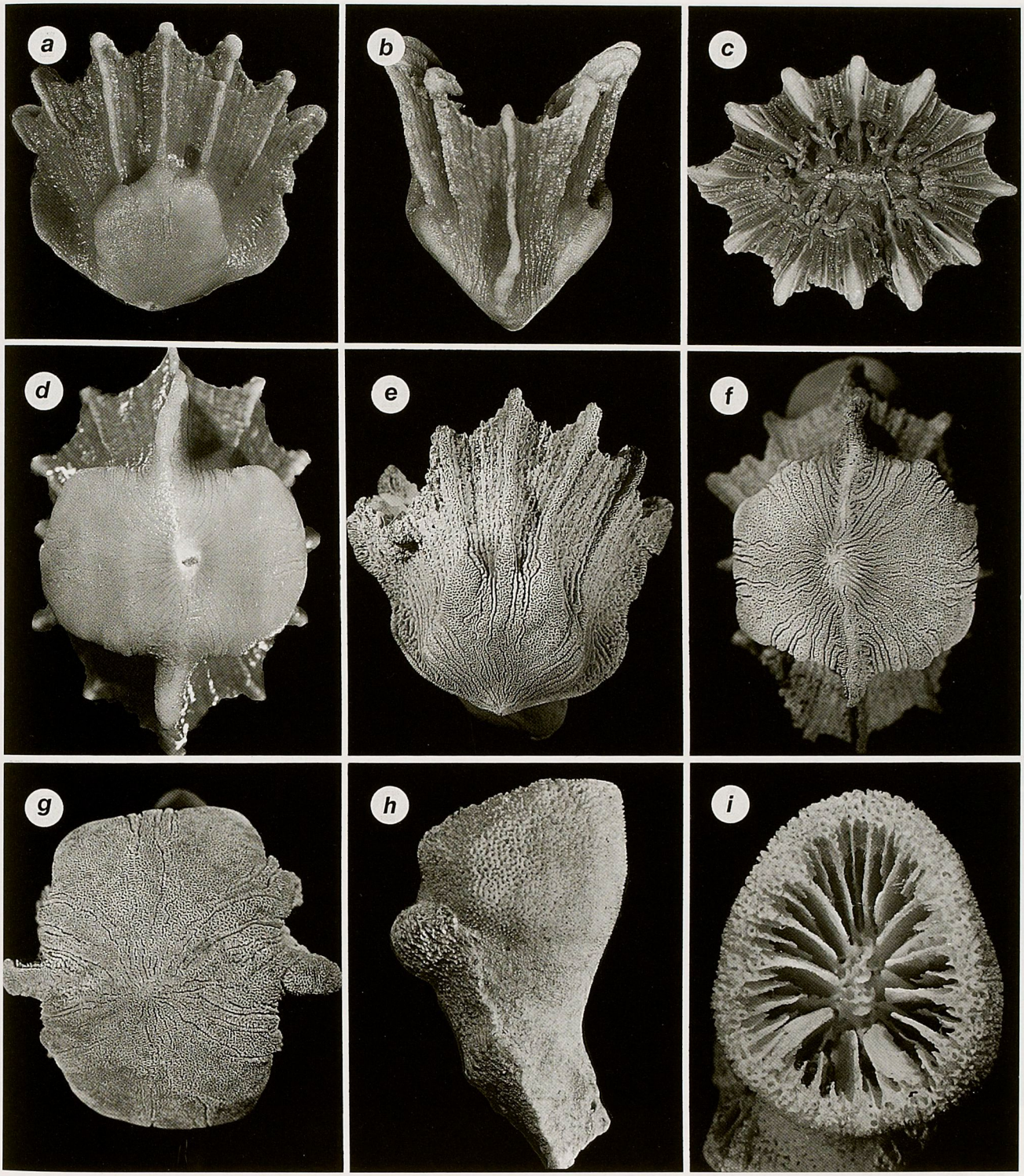

FIG. 27 a-g. — *Endopachys bulbosa* sp. nov.: **a-d**, holotype, KARUBAR stn 62 (MNHN), side, edge, calicular, and basal views, x 1.1, x 1.2, x 1.15, x 1.4, respectively; **e-g**, paratypes, KARUBAR stn 62 (MNHN): **e-g**, side and 2 basal views showing basal thickening and broad C_{1-2}, x 1.3, x 1.8, x 1.9, respectively.

FIG. 27 h-i. — *Leptopsammia crassa* van der Horst, 1922, holotype, *"Siboga"* stn 258 (ZMA Coel. 8462), side and calicular views, x 2.8, x 4.5, respectively.

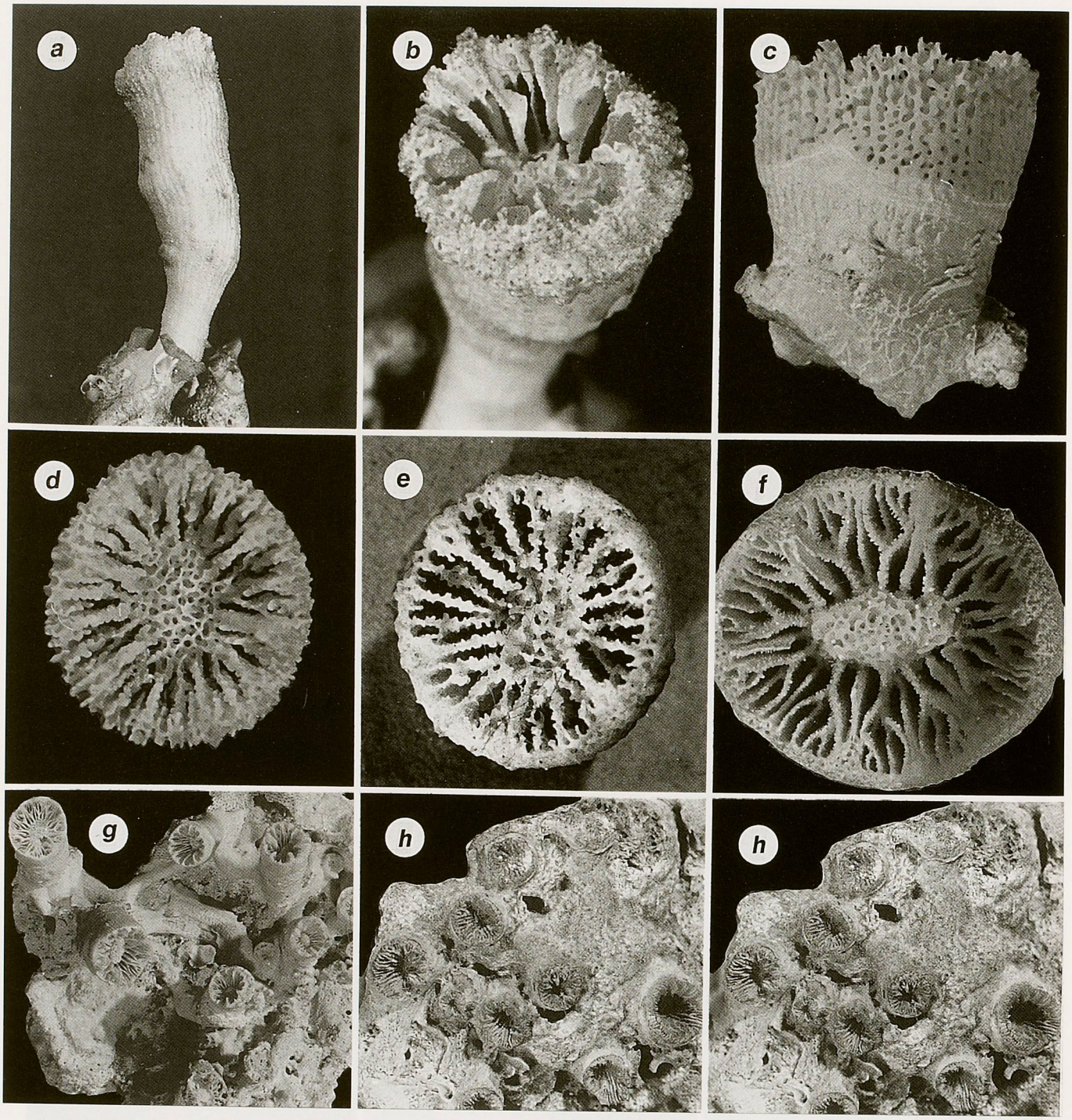

FIG. 28 a-b. — *Leptopsammia poculum* (Alcock, 1902), holotype, *"Siboga"* stn 260, side and calicular views, x 2.6, x 7, respectively.

FIG. 28 c-e. — *Endopsammia philippensis* H. Milne Edwards & Haime, 1848, *"Siboga"* stn 213 (ZMA Coel. 568), (*Balanophyllia regularis* of van der Horst, 1922), side and calicular views, x 5.8, x 6, x 6.8, respectively.

FIG. 28 f-g. — *Rhizopsammia verrilli* van der Horst, 1922, syntype, *"Siboga"* stn 282 (ZMA Coel. 5478), calice and reptoid colony, x 6.1, x 1, respectively.

FIG. 28 h. — *Rhizopsammia minuta* van der Horst, 1922, holotype, *"Siboga"* stn 279, ZMA Coel. 6896, stereo view of colony, x 1.7.

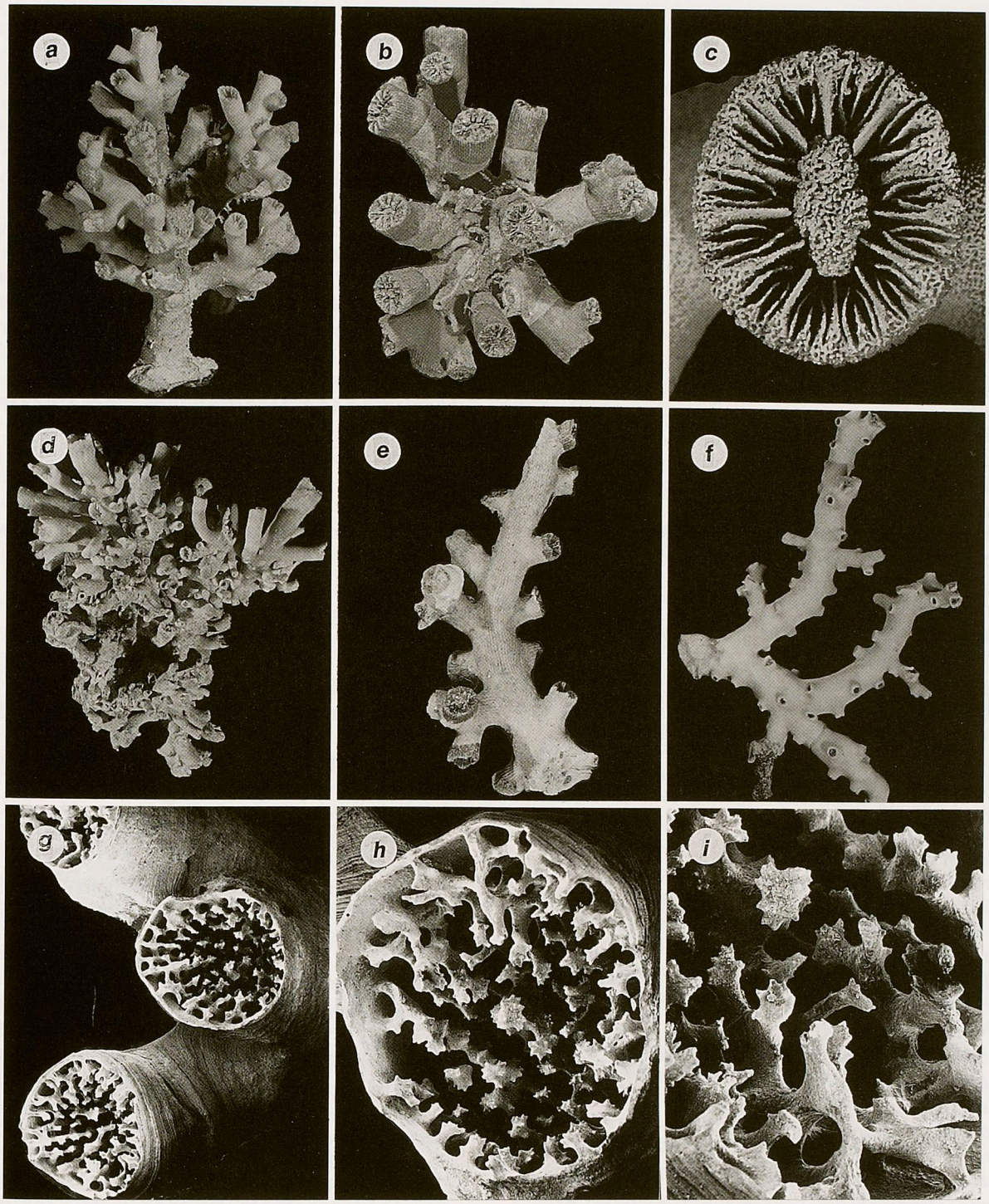

FIG. 29 a-c. — *Dendrophyllia arbuscula* van der Horst, 1922: **a**, syntype, *"Siboga"* stn 277 (ZMA Coel. 5477), x 0.75. — **b-c**, *"Albatross"* stn 5279 (USNM 97630), colony and calice, x 0.81, x 4.4, respectively.
FIG. 29 d. — *Cladopsammia echinata* Cairns 1984, KARUBAR stn 86 (USNM 97628), colony, x 0.55.
FIG. 29 e. — *Dendrophyllia* sp. cf. *D. ijimai*, *"Siboga"* stn 49a (ZMA Coel. 5467), branch, x 1.
FIG. 29 f. — *Enallopsammia pusilla* (Alcock, 1902), KARUBAR stn 25 (MNHN), colony fragment, x 0.36.
FIG. 29 g-i. — Incertae Sedis, *"Albatross"* stn 5179: **g**, 3 corallites and epitheca, x 9.7; **h**, calice, x 22; **i**, enlargement of septa and columella, x 42.

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Generic (and subgeneric) names used herein in combination with specific (or subspecific) names, or in citation, are given between brackets. / separates variant spellings; spelling retained herein in first position.

Taxa of generic and specific level that receive full taxonomic treatment herein are in **bold**.

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