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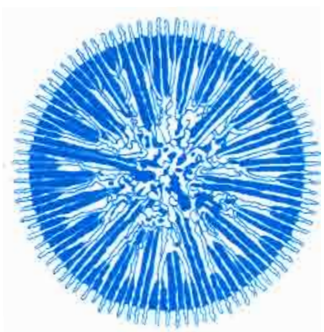
Résultats des Campagnes MUSORSTOM

Volume 16

CAMPAGNE FRANCO-INDONÉSIENNE KARUBAR



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Alain CROSNIER & Philippe BOUCHET

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Ce volume des Résultats des Campagnes MUSORSTOM est dédié à M. Jean-Michel CHASSERIAUX qui, alors Délégué aux Affaires Internationales au Ministère de la Recherche et de la Technologie, a assuré de 1989 à 1993 la présidence française du Comité mixte franco-indonésien en océanologie.

Pendant cette période, il s'est attaché au développement de cette coopération et a soutenu l'organisation de nombreuses campagnes à la mer, dont la campagne KARUBAR, sur les navires "Baruna Jaya" qui venaient d'être livrés par la France à l'Indonésie.

Professeur d'Université en mathématiques, Jean-Michel CHASSERIAUX est actuellement Directeur des Relations Internationales de l'INRIA (Institut National de Recherche en Informatique et en Automatique).

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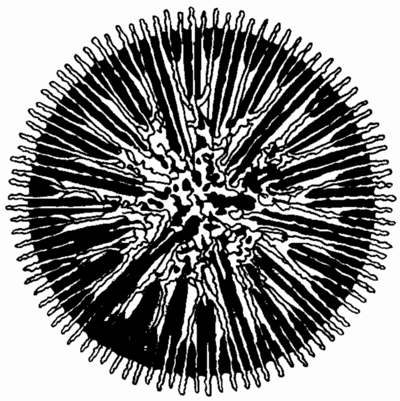

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CAMPAGNE FRANCO-INDONÉSIENNE KARUBAR

Coordonné par

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SOMMAIRE

CONTENTS

1

La campagne KARUBAR en Indonésie, au large des îles Kai et Tanimbar

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RÉSUMÉ

La campagne franco-indonésienne KARUBAR, faite à bord du navire de recherche indonésien *"Baruna Jaya 1"*, s'est déroulée dans l'est de l'indonésie, en mer de Banda et d'Arafura, au large des îles Kai et Tanimbar. Les prospections ont porté sur la faune bathyale. Quatre-vingt-onze dragages et chalutages, à des profondeurs comprises entre 200 et 1200 m, ont été effectués.

ABRIDGED ENGLISH VERSION

The KARUBAR cruise in Indonesia, off the Kai and Tanimbar Islands.

Despite a long-established scientific reputation as a hotspot of marine species richness, the seas of Indonesia remain poorly known in terms of their deep-sea fauna. Since the landmark *"Siboga"* expedition a century ago, comparatively little additional deep-sea exploration has been carried out in the archipelago. A remarkable exception was the Danish Expedition to the Kei [now spelled Kai] Islands, conducted in 1922 by an equally remarkable man, Professor Th. MORTENSEN, on board the *"Amboina"*, an "old, deep-draught, primitively equipped vessel" (WOLFF, 1967). MORTENSEN's main purpose was to find a suitable location for the establishment of a Scandinavian tropical station. When he found that stalked crinoids, elasipods and other deep-sea creatures occurred as shallow as 200-400 m around the Kai Islands, he suggested that this was an ideal place to build a marine laboratory to study the abyssal fauna. MORTENSEN's project was never realised, but his dream has remained alive in the heart of many marine zoologists to this day.

CROSNIER, A., RICHER DE FORGES, B. & BOUCHET, P., 1997. — La campagne KARUBAR en Indonésie, au large des îles Kai et Tanimbar. *In* : A. CROSNIER & P. BOUCHET (eds), Résultats des campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172** : 9-26. Paris ISBN 2-85653-506-2.

In the 1980s, new opportunities for collaborative oceanographic research in partnership with Indonesian scientists were formalised through a joint agreement between the Indonesian and French governments. A series of three research vessels, *"Baruna Jaya"* 1, 2 and 3 were built in France and became operational in Indonesia in 1990-91. As we submitted to the ad hoc committee a proposal for deep-sea biological exploration, our suggestion to target the Kai Islands met the approval of the Indonesian government, which insisted that the seas of Eastern Indonesia had to receive special attention. The KARUBAR (a contraction of the names of the Kai, Aru and Tanimbar Islands) project was thus born.

The purpose of the expedition was to:

(a) document the composition of the deep-sea fauna and

(b) investigate potential economic resources in the untapped deep-sea benthos, with special emphasis on shrimps.

This dual goal was reflected in the composition of the scientific staff, which included zoologists as well as fisheries biologists from several Indonesian and French institutions: Pusat Penelitian dan Pengembangan Oseanologi LIPI (P3O LIPI) [Institute of Oceanology of the Indonesian Academy of Sciences], Balai Penelitian Perikanan Laut (BALITKANLAUT) [Indonesian Institute of Fisheries], Badan Pengkajian dan Penerapan Teknologi (BPPT) [Indonesian Ministry of Science and Technology], the Institut Français de Recherche Scientifique pour le Développement en Coopération (ORSTOM) [French Institute of scientific Research for Development through Cooperation], and the Muséum National d'Histoire Naturelle (MNHN) [French National Museum of Natural History]. A total of 15 Indonesian and 7 French staff took part in the expedition, with Dr K. MOOSA (P3O LIPI) as senior scientist and Lt. Col. HANDOKO the commanding captain (see Appendix 1 for composition of staff).

The expedition was initially planned to depart from Ambon on October 7, 1991 and last 27 days. However, a series of incidents, partly technical, delayed departure until October 21 and, as a result, only 13 days of work were available. Hence our initial programme could not be carried out in full and we had to cancel the transects near the Aru Islands. A total of 91 stations, of which 85 were successful, were carried out near the Kai and Tanimbar Islands, at depths between 200 and 1200 m: 18 dredge hauls and 19 trawls near Kai, 10 dredges and 44 trawls near Tanimbar (List of stations: Appendix 2). Incidentally, this is exactly the same number of hauls carried out by the *"Siboga"* expedition at depths below 200 m, which points to the importance of the KARUBAR expedition, despite its short duration. It should be noted, however, that the *"Siboga"* sampled many more stations in very deep water: 30 *"Siboga"* stations are deeper than 1000 m, versus only 5 KARUBAR stations at such depths.

The 13 papers included in the present volume provide much new information about Cnidaria (Scleractinia), Mollusca (Bivalvia, Gastropoda and Cephalopoda), Crustacea (Decapoda) and Echinodermata (Crinoidea). In addition, over 20 papers published elsewhere are based wholly or in part on the zoological collections made during KARUBAR (List of publications: Appendix 3). Undoubtedly, they are many more to come, which will document and describe the still little-known fauna of the Indonesian archipelago. From a zoological point of view, KARUBAR can therefore be considered to have been very successful, and we may only wish for further such cruises and volumes of expedition reports.

From the point of view of fisheries, however, the results of the Karubar expedition have been somewhat disappointing. Considering the general geomorphology of the region, we did not expect vast trawlable bottoms near the Kai islands, but the bathyal slope East of the Tanimbars appeared much more promising, especially in the context of commercial fisheries off the Australian northwest shelf. Indeed, we encountered extensive flat areas suited for commercial trawling. However, populations of echinoderms (holothurians, echinoids and ophiuroids) are so abundant that they constitute the main catch. Furthermore, the very soft muddy bottoms and strong currents do not facilitate trawling operations. We did encounter a number of potentially valuable commercial species of crustaceans (peneids: *Aristeus*, *Penaeopsis*, *Haliporoides*, *Metapenaeopsis*, *Hymenopenaeus*, *Hadropenaeus*; and pandalids: *Heterocarpus*, *Plesionika*), but they are apparently never abundant. One exception might be species of *Metanephrops* at depths between 250 and 300 m, but our initial results need to be confirmed by commercial deep-sea trawlers.

As noted above, MORTENSEN (1923) had suggested that the Kai Islands would be "an ideal place" for a tropical marine laboratory, because of the "rich and varied fauna of genuine abyssal forms [occuring] over the whole of the large plateau of 2-400 m depth". Are the results of the KARUBAR expedition in line with MORTENSEN's enthusiasm? At this stage, only part of the zoological material has been studied and the results are rather contrasting. For instance, CAIRNS & ZIBROWIUS (this volume) report the highest regional diversity of azooxanthellate Scleractinia: 125 species were collected near the Kai Islands versus 69 species, for example, near Lubang Island, Philippines, which has been intensively sampled during the MUSORSTOM 1, 2 and 3 expeditions. Also, considering the difference in sampling effort, the diversity in species of Pectinoidea (Mollusca, Bivalvia) appears greater in the Arafura Sea than in New Caledonia (DIJKSTRA, this volume). Conversely, several nominal species of pentacrinid crinoids previously recorded from the area are now shown to be ecophenotypes and the pentacrinid crinoid fauna consequently appears less diverse than that recorded elsewhere in Indonesia (AMÉZIANE, this volume). Probably such contrasting patterns of species richness in different zoological groups only reflect preferences for different bottom types.

The occurrence of stalked crinoids in comparatively shallow water, which had so much impressed MORTENSEN, is confirmed by the KARUBAR expedition, with the shallowest record of *Saracrinus* at 290 m (245 m by MORTENSEN). This is admittedly very shallow by temperate North Atlantic standards, but is not exceptional in tropical waters. For instance, pentacrinids occur from 290 m and deeper in New Caledonia (BOURSEAU *et al.*, 1991) and from 185 m and deeper in the

Philippines (BOURSEAU & ROUX, 1989). In fact, we suspect that the Kai Islands appeared so exceptional to MORTENSEN because, despite being a much-travelled marine biologist, he had only limited experience of tropical deep-sea faunal assemblages. In the eyes of a European zoologist, stalked crinoids were abyssal animals and their occurence in shallow waters called for a special explanation. Instead, we suggest that the occurrence of stalked crinoids, as well as other markers of the deep-sea fauna, such as elasipods and echinothurids, in the 200-500 m depth interval is the norm at tropical latitudes in the Indo-Pacific. The pectinoid bivalves provide limited evidence that the shallowest occurrence of certain species is shallower in the Arafura Sea than in New Caledonia, through the opposite is true for other species. In conclusion, based on the evidence available and our own field experience in other tropical Indo-Pacific regions, we regard the Kai Islands as a rich, but not exceptional, place.

FIG. 1. — Le *"Baruna Jaya I"*.

La campagne KARUBAR, appellation provenant d'une contraction des noms des îles Kai, Aru et Tanimbar, toutes situées en mers de Banda et d'Arafura dans lesquelles s'est effectuée la campagne, a été programmée dans le cadre de la coopération franco-indonésienne en océanographie et cofinancée par les deux parties.

Les objectifs principaux de cette campagne étaient l'étude de la faune bathyale et une première estimation des ressources de la pente continentale en crevettes et poissons commercialisables, dans l'est de l'Indonésie.

La campagne, prévue pour 27 jours, s'est faite sur le navire indonésien de recherches *"Baruna Jaya I"*, magnifique unité construite en France par la CMN, de 60 m de longueur, jaugeant 700 tx, et dont c'était la première campagne de recherche en biologie.

Le navire pouvant embarquer, sans difficulté, une vingtaine de scientifiques, l'équipe indonésienne était nombreuse et regroupait quatre chercheurs du BBPT (Badan Pengkajian dan Penerapan Teknologi) que l'on peut assimiler à notre Ministère de la Recherche et de la Technologie, six du BALITKANLAUT (Balai Penelitian Perikanan Laut) qui correspond à notre ancien Office des Pêches et cinq du P30 LIPI (Pusat Penelitian dan Pengembangan Oseanologi LIPI) qui est l'Institut d'Océanologie dépendant de l'Académie des Sciences indonésienne, plus un de la Direction des Pêches.

Du côté français, on trouvait trois chercheurs de l'ORSTOM et trois chercheurs du Muséum national d'Histoire naturelle, à Paris, plus un maître d'équipage de l'ORSTOM venu mettre son savoir-faire à la disposition de l'équipage indonésien pour le gréement et la manœuvre des engins de pêches (dragues, chaluts à perche et chalut à panneaux). La présence de ce dernier devait se révéler d'autant plus utile que l'équipage du navire était exclusivement composé de militaires, le navire étant armé par la Marine nationale indonésienne.

FIG. 2. — Quelques-uns des membres de l'équipage et de l'équipe scientifique. De gauche à droite : Kapten DARYENTO commandant en second; Kasim MOOSA, chef de mission; Mayor GOENADI, chef mécanicien; à moitié caché Kapten SARWONO; Dwi Listyo RAYAHU, carcinologiste; Yunus SOSELISA, ichtyologiste; Lt. Col. HANDOKO, commandant; Zaenal ARIFIN; BURHANUDIN, ichtyologiste; W.W. KASTORO, malacologiste; de dos Michel POTIER, ichtyologiste; Alain CROSNIER, responsable de l'équipe française; MASHIWARA; Ali KUSNIN; Albert LE CROM, maitre d'équipage.

DÉROULEMENT DE LA CAMPAGNE

À l'origine le *"Baruna Jaya 1"* devait appareiller de Jakarta le 2 octobre et rejoindre Ambon en cinq jours de mer. La mission scientifique devait embarquer alors et la campagne débuter le 7 octobre.

Mais il n'en a pas été ainsi à la suite de toute une série de contre-temps : défaillance d'un transitaire livrant le matériel envoyé de France avec 19 jours de retard, lenteurs administratives pour l'obtention du visa de travail du maître d'équipage venu de Nouvelle-Calédonie, petits problèmes matériels divers avec les engins du bord (poulie compteuse, treuil, sondeurs) ont retardé l'appareillage de Jakarta jusqu'au 12 octobre. Il était alors décidé que deux des chercheurs français et le maître d'équipage feraient la traversée Jakarta-Ambon à bord du *"Baruna Jaya I"*, afin d'assurer la mise en place de tout le matériel durant la traversée.

Le 17 octobre, le *"Baruna Jaya 1"* arrivait à Ambon et l'équipe embarquée était complète le 19 octobre au matin, avec l'arrivée du chef de l'équipe indonésienne. L'appareillage était alors prévu pour le soir même à 17h00.

Cependant des problèmes d'avitaillement en eau et en vivres, ainsi qu'une aimable invitation du Commandant de la Marine à Ambon, le 19 au soir, obligeaient de remettre à nouveau l'appareillage qui, ne pouvant avoir lieu un dimanche, était alors fixé au 21 et à 7h00 du matin, les appareillages de nuit étant interdits.

Finalement cet appareillage, un peu laborieux, avait bien lieu à cette date et à cette heure.

Lors de l'établissement du programme de campagne 27 jours de mer avaient été prévus, mais une fois en mer, le Commandant nous prévenait que le navire ne pouvait rester plus de 14 jours en mer, car au delà l'eau douce viendrait à manquer. Si l'on enlevait les 3 jours de mer nécessaires aux transits, la durée de travail utile se trouvait ramenée à 11 jours, ce qui était loin du programme établi. Finalement un rationnement de l'eau étant accepté, la durée de la sortie était portée à 19 jours, ce qui permettait d'avoir 16 jours de travail en mer.

En fait cette durée a, par la suite, été ramenée à 13 jours, un message de l'Amirauté indonésienne ayant demandé au Commandant de se dérouter, lors du retour, sur Timor pour y récupérer un engin suspect trouvé en mer (qui s'est révélé être un courantomètre enregistreur).

Durant ces 13 jours, nous avons bénéficié d'une mer pratiquement toujours calme, ce qui a considérablement facilité les opérations de dragages et de chalutages, qui étaient nouvelles pour l'équipage.

Plusieurs types d'engins ont été utilisés :

— drague Warén,
— drague épibenthique,
— chalut à perche,
— chalut à crevettes à panneaux.

Le travail débutait à 5h00 le matin pour s'arrêter, au moins en ce qui concernait l'équipage, à 22h00.

FIG. 3. — Un chalut vient d'être remonté : premiers tris sur la plage arrière. Au premier plan, de gauche à droite : Ali KUSNIN, Albert LE CROM, Michel POTIER, Alain CROSNIER, Aznam AZIS, Philippe BOUCHET, Lt. Col. HANDOKO.

Le 22 octobre à 8h00, ayant bénéficié de courants favorables et la machine ayant été un peu poussée, le *"Baruna Jaya 1"* parvenait aux îles Kai, au sud de l'île Taam, et nous effectuions le premier dragage, entre 156 et 305 m, au voisinage des stations 192 du *"Challenger"* et 46 de l'expédition danoise aux îles Kai, faite en 1922 et dirigée par le Professeur MORTENSEN. Ces stations ont été signalées comme ayant permis des récoltes zoologiques particulièrement riches. En fait, le fond composé de sable détritique grossier avec des débris de coraux et de nombreux articles d'*Halimeda,* nous fournissait une faune intéressante mais pas aussi riche que celle récoltée par le *"Challenger"* et MORTENSEN.

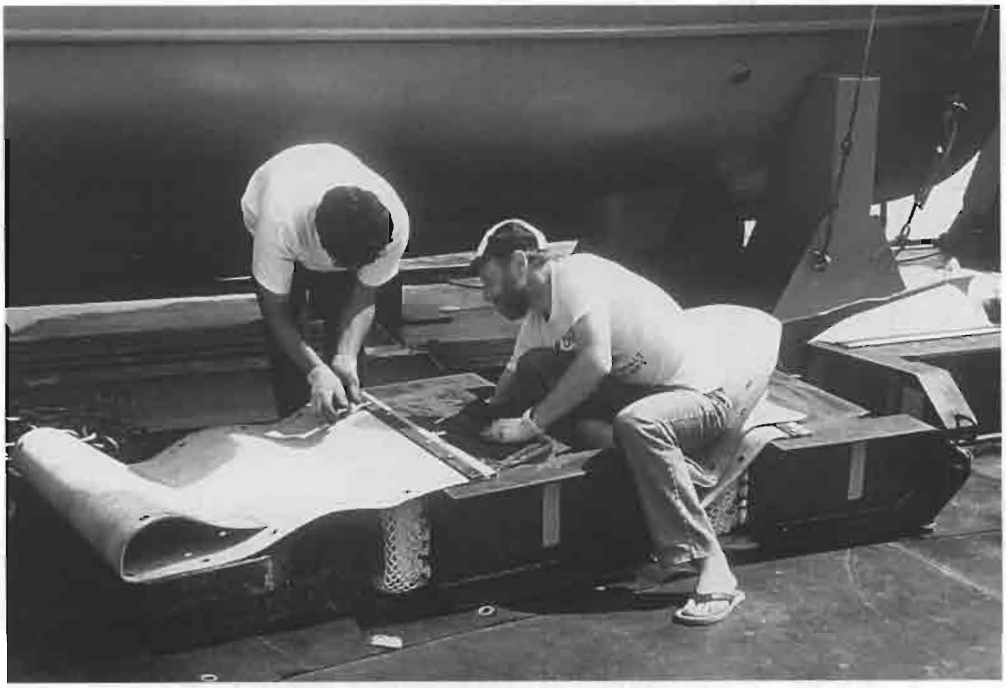

FIG. 4. — Bernard MÉTIVIER grèe une drague Warén.

On peut d'ailleurs mentionner ici que nos récoltes n'ont que très rarement correspondu à celles indiquées par MORTENSEN. En particulier dans des zones signalées comme riches par MORTENSEN, il nous a souvent été impossible de mettte un engin à l'eau, compte tenu de la nature tourmentée des fonds. Ceci est-il dû à des positionnements peu exacts ?

La journée du 22 octobre était consacrée à une série de sept dragages et chalutages à perche dans cette zone. Les fonds s'y révélaient assez rugueux mais possibles à travailler, encore que les traits de chalut à perche n'aient guère pu excéder 15 minutes.

Durant la nuit, nous empruntions le chenal séparant les îles Tayandu des Petites Kai qui se montrait très accidenté et reconnaissions, au sondeur, la zone située au nord de ce chenal. Une cuvette chalutable de 10 milles sur 10 milles, à des profondeurs variant de 300 à 400 mètres, y était repérée; elle est toutefois parcourue, vers 132°35'E, par une faille nord-sud dont la profondeur atteint 80 m et qui doit donc être évitée.

La journée du 23 octobre était consacrée à l'exploration de cette cuvette. Le chalutage s'y révélait facile (nous avons pu y effectuer un trait de chalut à panneaux d'une heure sans problème). Les récoltes y ont été diversifiées mais si, en particulier, de nombreux crustacés commercialisables : langoustines (*Metanephrops*), crevettes pénéides (*Penaeopsis*, *Haliporoides*, *Metapenaeopsis*, *Hymenopenaeus*, *Hadropenaeus*), Pandalidae (*Heterocarpus*, *Plesionika*) y étaient bien représentées, aucune espèce n'a été trouvée en abondance.

Les 24 et 25 octobre, nous allions vers l'est et explorions la zone se trouvant au nord du chenal séparant les Petites Kai de la Grande Kai (6 dragages dont 1 épibenthique, 4 chalutages à perche, 1 chalutage à panneaux). Cette zone se montre aisément dragable et chalutable par endroits et plus difficilement à d'autres. Parfois la présence d'énormes buttes de vase, notamment vers 600 m, a provoqué l'interruption du trait. Cette zone ne fournissait pas d'indices plus encourageants que la précédente en ce qui concerne les espèces commercialisables; bien entendu, comme elle s'étend à des profondeurs supérieures à la précédente, les grosses crevettes pénéides (*Aristeus*) y sont présentes, de même que l'énorme langoustine *Metanephrops neptunus*, mais pas, d'après ce que nous avons pu voir, en quantités commerciales.

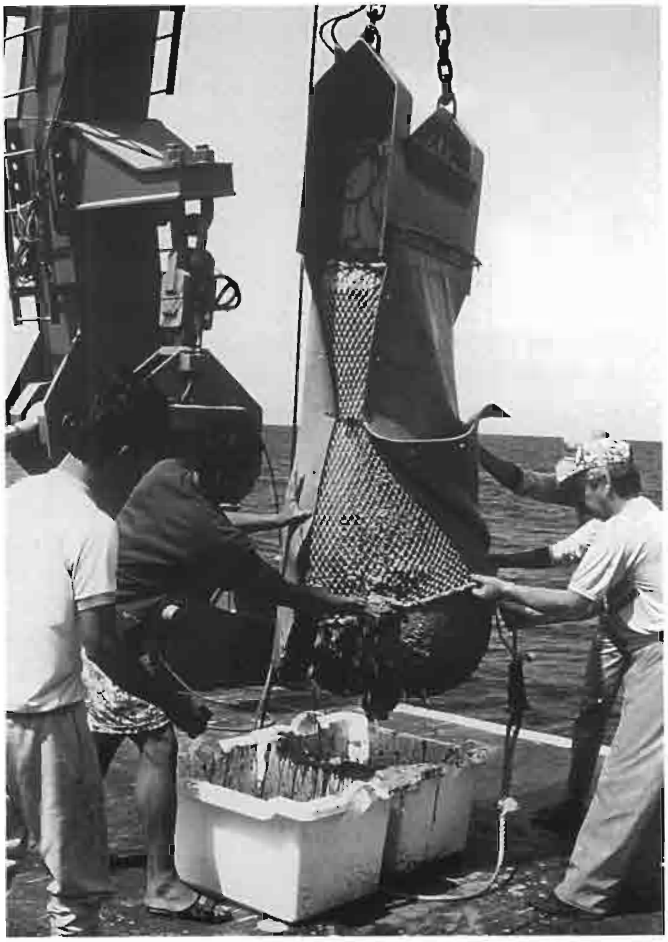

FIG. 5. — Arrivée sur le pont d'une drague Warèn pleine de vase.

Le 26 octobre, nous explorions le grand chenal séparant les Petites Kai de la Grande Kai (6 dragages, 3 chalutages à perche), dont la profondeur, dans sa partie la plus resserrée, n'excède pas 400 m. Les fonds, couverts d'une vase gluante avec souvent des affleurements rocheux, se montrèrent peu intéressants. Par ailleurs de forts courants, variables, rendirent les manœuvres difficiles ne nous incitant pas à persévérer dans cette zone. Lors de cette journée, la drague, crochée, ne put être récupérée qu'après plus d'une heure d'efforts.

La journée du 27 octobre était consacrée à une série de 5 chalutages à perche dans le sud des îles Kai, sur des fonds souvent assez accidentés et peu faciles à travailler, mais aussi, parfois, réguliers. C'est ainsi que les chalutages CP 35 et CP 36 ont pu durer une heure chacun, à des profondeurs variant entre 390 et 500 m pour le premier et 210 à 270 m pour le second, permettant d'excellentes et abondantes captures. De même que dans le chenal, de forts courants ont, dans cette zone, perturbé les opérations.

Les journées passant, il était alors décidé de rallier les îles Tanimbar, seconde zone dont l'exploration nous avait été assignée. Ce transit était effectué dans la nuit du 27 au 28 octobre.

Trois radiales étaient prévues dans la zone s'étendant au sud-est de ces îles.

Les fonds y diffèrent totalement de ceux rencontrés aux îles Kai. D'une manière générale, aux profondeurs explorées (200 à 1550 m, maximum de la profondeur dans cette zone) nous nous trouvions devant une pente douce et régulière, avec toutefois quelques variations notamment entre 850 et 1200 m où la pente devient fréquemmeent plus raide. Si les fonds étaient durs aux profondeurs les plus faibles, ils étaient recouverts de vase à partir de 250-310 m. Cette vase, grise, est souvent très molle et rend les chalutages difficiles, d'autant que de forts courants (jusqu'à 2,7 nœuds) dont la force se modifie rapidement, rendent difficiles le maintien du cap et surtout de la vitesse du navire. Ces variations de vitesse ont d'ailleurs provoqué la perte de tout un train de chalutage, les panneaux s'étant enfouis dans la vase à la suite d'une diminution trop importante de la vitesse.

Dix dragages, dont 3 épibenthiques, et 44 chalutages, dont 6 à panneaux, ont été effectués dans cette zone.

Parmi les fonds les plus spectaculaires, on peut citer ceux à *Virgularia* (Pennatulacea) vers 290 m, ceux à brachiopodes et scléractiniaires trouvés entre 350 et 450 m essentiellement et ceux à échinodermes, très nombreux et diversifiés. Vers 400-450 m, les holothuries, dont les molpadides et les élasipodes, étaient particulièrement abondantes, tandis que vers 800-1000 m on trouvait de très nombreux oursins (Echinidae, Echinothuridae, Cidaridae Spatangidae) et vers 1000 m des fonds à ophiures (Ophiuridae) et *Hyalonoecia* (Polychaeta).

Les crinoides (*Saracrinus*), célèbres dans la littérature par les récoltes du *"Challenger"* aux îles Kai, retrouvés dans ces mêmes îles par l'expédition KARUBAR jusquà 430 m de profondeur, n'ont été trouvés au large des îles Tanimbar que jusqu'à 300 m de profondeur, ceci s'expliquant sans doute par la nature des fonds, une vase très molle, au delà de cette profondeur.

Dans toute la vaste plaine de vase ainsi explorée, de nombreuses espèces de crustacés qui pourraient être commercialisés ont été récoltés, notamment plusieurs espèces de langoustines (*Metanephrops arafurensis*, *M. neptunus*, *M. sibogae*, *M. velutinus*), mais aucune n'a malheuseusement été prise en quantité significative.

Le 5 novembre au soir le travail en mer se terminait, comme nous l'avons mentionné plus haut, plus tôt que prévu. Le 6 novembre le *"Baruna Jaja 1"* était de retour à Ambon et les équipes scientifiques débarquaient.

RÉSULTATS

Quatre-vingt-onze chalutages et dragages, dont quatre-vingt-cinq ont été réussis, ont été faits entre 200 et 1200 m.

Du point de vue des pêches commerciales, les résultats sont décevants. S'il était peu évident de trouver des zones chalutables suffisamment étendues aux îles Kai, compte tenu de la géomorphologie de cette zone, on pouvait espérer, par contre, que la pente bathyale prolongeant le plateau continental de l'Irian Jaya, à l'est des îles Tanimbar, serait prometteuse. Certes les zones chalutables y sont vastes, mais la présence d'une vase grise souvent molle et gluante, l'existence de forts courants et la présence de très importantes concentrations d'échinodermes (holothuries, oursins et ophiures) encombrant les fonds et colmatant les chaluts, ne sont pas faits pour rendre rentable une pêche industrielle. Des espèces intéressantes se trouvent sur ces fonds, mais il semblerait que ce soit toujours en quantité assez faible. Ce n'est que dans la partie sud de la zone prospectée que des apparences de langoustines, peut-être un peu plus encourageantes, ont été observées sur les fonds de 250 à 300 m. Ceci dit, il ne faut pas oublier les conditions dans lesquelles nous avons travaillé et il est bien certain qu'une campagne faite par un chalutier mené par des professionnels de la pêche profonde, comme il en existe en Australie, serait maintenant souhaitable.

FIG. 6. — Récolte faite au chalut.

Si les résultats ont été décevants au plan du développement des pêches, il n'en est pas de même au plan de la connaissance de la faune bathyale.

Avant nous plusieurs grandes expéditions ont travaillé sur la faune d'eau profonde de l'Indonésie : celles du *"Challenger"* (1872-1876), de la *"Siboga"* (1899-1900), de la *"Galathea"* (1950-1952), de MORTENSEN aux îles Kai (1922), sans oublier la campagne CORINDON (1980) et l'expédition SNELLIUS 2 en 1984. Beaucoup de ces expéditions n'ont fait que traverser l'Indonésie, en y effectuant un nombre réduit d'opérations de pêche. Quant à la *"Siboga"* qui est la plus connue en ce qui concerne l'Indonésie, elle n'a effectué qu'un nombre de pêches profondes comparable à celui atteint par la campagne KARUBAR. Cette simple comparaison situe bien l'apport de la campagne KARUBAR à notre connaissance de la faune bathyale indonésienne, encore qu'il faille la nuancer : si la *"Siboga"* n'a pas fait, durant son périple de près de deux ans, plus de stations au delà de 200 m que nous en 13 jours, elle a effectué environ 30 stations à plus de 1000 m contre 5 seulement en ce qui concerne KARUBAR.

Le matériel récolté a été réparti de la manière suivante :

— la totalité des poissons ainsi, dans les échinodermes, que la totalité des astéries ont été conservées par les chercheurs indonésiens.

— le reste du matériel a été expédié pour tri et étude au Muséum national d'Histoire naturelle, étant entendu qu'après étude une partie significative des récoltes serait renvoyée, identifiée, en Indonésie pour servir de collection de référence.

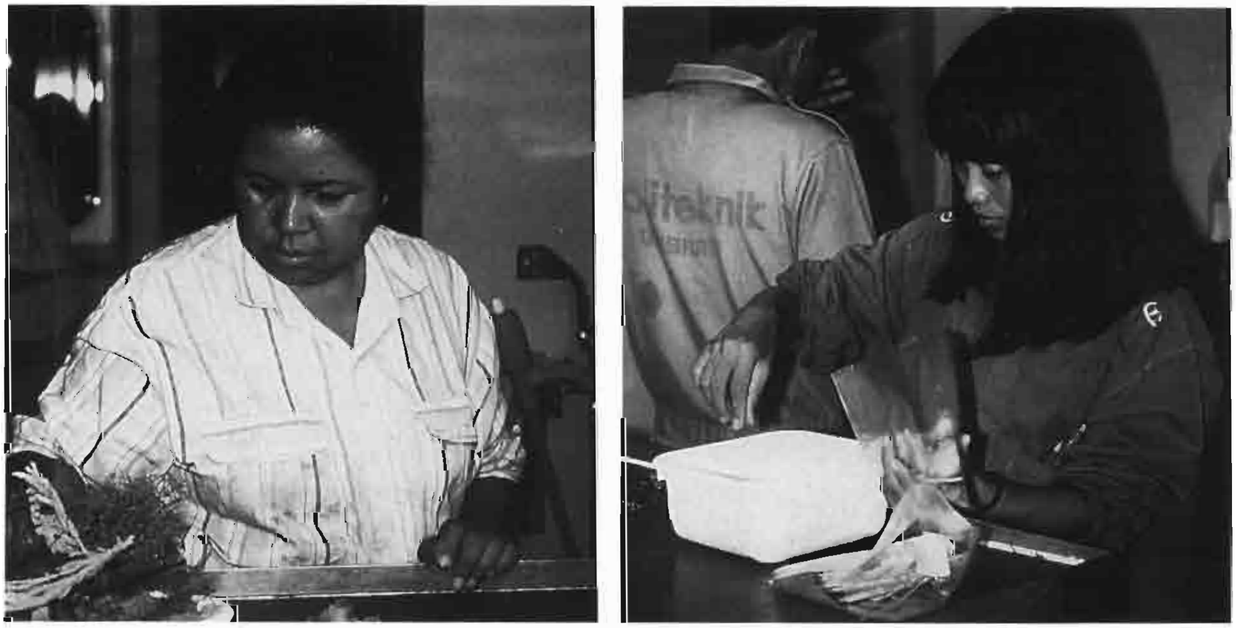

FIG. 7. — Deux trieuses acharnées : W.W. KASTORO à gauche, Dwi Listyo RAHAYU à droite.

Les venues en France de chercheurs indonésiens pour participer aux tris et aux études étaient programmées. Au moment où nous écrivons ces lignes, deux chercheurs sont ainsi venus, l'un à deux reprises.

Dès avant la publication du présent volume, de nombreux travaux, essentiellement sur les crustacés, ont déjà été consacrés, en tout ou partie, à l'étude des récoltes de la campagne KARUBAR. Les 25 articles parus, dont la liste figure en annexe, confirment l'originalité et l'intérêt de la faune récoltée. S'y ajoutent maintenant les 13 articles composant ce volume. D'autres travaux sont en cours de rédaction et des collections triées attendent des preneurs pour être étudiées. Dans quelques années, l'impact de la campagne KARUBAR quant à la connaissance de la faune bathyale indonésienne apparaîtra pleinement.

MORTENSEN (1923) avait suggéré que les îles Kai serait un endroit idéal pour un laboratoire consacré à la biologie marine tropicale, à cause de "the rich and varied fauna of genuine abyssal forms [occuring] over the whole of the large plateau of 2-400 m depth". Les résultats de la campagne KARUBAR appuient-ils cet enthousiasme de

MORTENSEN ? Actuellement seule une partie des récoltes zoologiques ont été étudiées et les résultats sont quelque peu contradictoires. Par exemple CAIRNS et ZIBROWIUS (dans ce volume) mentionnent le grand nombre d'espèces de scléractiniaires sans zooxanthelles trouvées dans cette région : 125 espèces ont été récoltées près des îles Kai contre environ 69 au voisinage de l'île de Lubang, aux Philippines, où de nombreuses récoltes ont été faites lors

FIG. 8. — Quelques-uns des participants à la campagne. De gauche à droite : 1. Le Let. Kol. HANDOKO, Alain CROSNIER et Mohammad Kasim MOOSA. — 2. Le Professeur Jacques FOREST et Dwi Listyo RAYAYU examinant le rare pagure *Tisea grandis*. — 3. Philippe BOUCHET et W.W. KASTORO. — 4. Aznam AZIS, Michel POTIER & Mohammad Kasim MOOSA. — 5. Bertrand RICHER DE FORGES, au fond à gauche le Pr Jacques FOREST. — Zaenal ARIFIN et Albert LE CROM.

des campagnes MUSORSTOM 1, 2 et 3. De même, si l'on considère les densités différentes de récoltes, le nombre des espèces de Pectinoidea (mollusques bivalves) parait plus grand en mer d'Arafura qu'en Nouvelle-Calédonie (DIJKSTRA, dans ce volume). Par contre, il a été montré (AMÉZIANE dans ce volume) que plusieurs espèces de crinoïdes pédonculés (pentacrines) signalées de la région de îles Kai n'étaient en fait que des écophenotypes, si bien que la faune de ce groupe, autour des îles Kai, apparaît moins diversifiée que dans d'autres régions de l'Indonésie. Il est vraisemblable que ces résultats sont, en fait, largement en liaison avec la présence de fonds de nature plus ou moins diversifiée.

La présence de crinoïdes pédonculés dans des eaux relativement peu profondes, qui avait tellement impressionné MORTENSEN, est confirmée par la campagne KARUBAR avec la récolte de *Saracrinus* à 290 m (245 m par MORTENSEN). De telles profondeurs sont très faibles si l'on se réfère à ce que l'on observe dans l'Atlantique Nord, mais n'ont rien d'exceptionnel en mers tropicales. Par exemple des pentacrines ont été trouvés à partir de 290 m en Nouvelle-Calédonie (BOURSEAU *et al.*, 1991) et de 185 m aux Philippines (BOURSEAU & ROUX, 1989). Il est vraisemblable que MORTENSEN s'était si fortement enthousiasmé pour les îles Kai parce que, malgré ses nombreux voyages en tant que biologiste marin, il n'avait qu'une expérience limitée de la faune d'eau profonde tropicale. Aux yeux d'un zoologiste européen, les crinoïdes pédonculés étaient des animaux abyssaux et leur présence en eaux relativement peu profondes nécessitait une explication particulière, alors que leur présence de même que celle d'autres marqueurs de la faune d'eau profonde, tels que les élasipodes et les échinothurides, est la norme entre 200 et 500 m dans l'Indo-Pacifique tropical. Les mollusque bivalves Pectinoidea ne fournissent pas d'évidence nette : certaines espèces se trouvent à des profondeurs moindres en mer d'Arafura qu'en Nouvelle-Calédonie, mais c'est le contraire qui est observé pour d'autres. En définitive, en se basant sur les résultats disponibles, et également sur notre expérience d'autres régions tropicales de l'Indo-Pacifique, nous sommes amenés à considérer les îles Kai comme une région riche mais non exceptionnelle.

En forme de conclusion, nous aimerions exprimer le souhait que la campagne KARUBAR ne demeure pas une opération, somme toute bien réussie, mais unique. A la demande des autorités indonésiennes, une demande de campagne KARUBAR 2 en mer de Timor a été établie en octobre 1993. Évaluée favorablement du côté français, il semblerait qu'elle intéresse toujours nos partenaires indonésiens. Si le présent volume, en attirant à nouveau l'attention sur l'intérêt de l'étude de la faune bathyale indonésienne, pouvait donner une nouvelle dynamique à ce projet, il aurait alors joué un rôle au delà de toutes nos espérances.

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ANNEXES

LISTE DES PARTICIPANTS À LA CAMPAGNE KARUBAR

Partie indonésienne

Chef de mission: M. Kasim MOOSA (P30-LIPI).

Autres participants :

Appartenant au P30-LIPI :

Chercheurs : Aznam AZIS, BURHANUDIN, W.W. KASTORO, Dwi Listyo RAYAYU.

Appartenant au Balitkanlut :

Chercheurs : Bambang SUMIONO, MAHISWARA, Yunus SOSELISA.
Techniciens : Zaenal ARIFIN, Nasir MADJID.
Patron de Pêche : Ali KUSNIN.

Appartenant au BPPT :

Chercheurs : Djunaedi MULJAWAN.
Techniciens : Abdul HARIS, SURATMAN, Tri SETIADI.

Appartenant à la direction des Pêches :

AZMI

Partie française

Appartenant à l'ORSTOM : Alain CROSNIER, Michel POTIER, Bertrand RICHER DE FORGES, Albert LE CROM (maitre d'équipage).

Appartenant au Muséum national d'Histoire naturelle, Paris : Philippe BOUCHET, Jacques FOREST, Bernard MÉTIVIER.

Officiers indonésiens de l'équipage du *"Baruna Jaya 1"*

Let. Kol. HANDOKO, commandant; Mayor GOENADI, chef mécanicien; Kapten DARYANTO, commandant en second; Kapten SARWONO; Lettu Ishak ISKANDAR; Letda Budi SISWANTO; Letda NURYADI; Letda Agus MARYONO; Letda SUPENDI; Serka Wachid MULLAH.

LISTE DES STATIONS DE LA CAMPAGNE KARUBAR

Les majuscules se trouvant avant le numéro de la station indiquent l'engin utilisé : DW : Drague Warén; ED : drague épibenthique; CP : chalut à perche; CC : chalut à panneaux (crevettes)

N° station	Date (1991)	Heure locale (engin au fond)	Profondeur	Latitude	Longitude
Iles Kai					
DW 01	22.10	8h09	156-305 m	05°46'S	132°10'E
DW 02	22.10	10h10	209-240 m	05°47'S	132°13'E
DW 03	22.10	11h33	301-278 m	05°48'S	132°13'E
CP 04	22.10	13h35	335-347 m	05°50'S	132°16'E
CP 05	22.10	15h00	296-299 m	05°49'S	132°18'E
CP 06	22.10	18h00	298-287 m	05°49'S	132°21'E

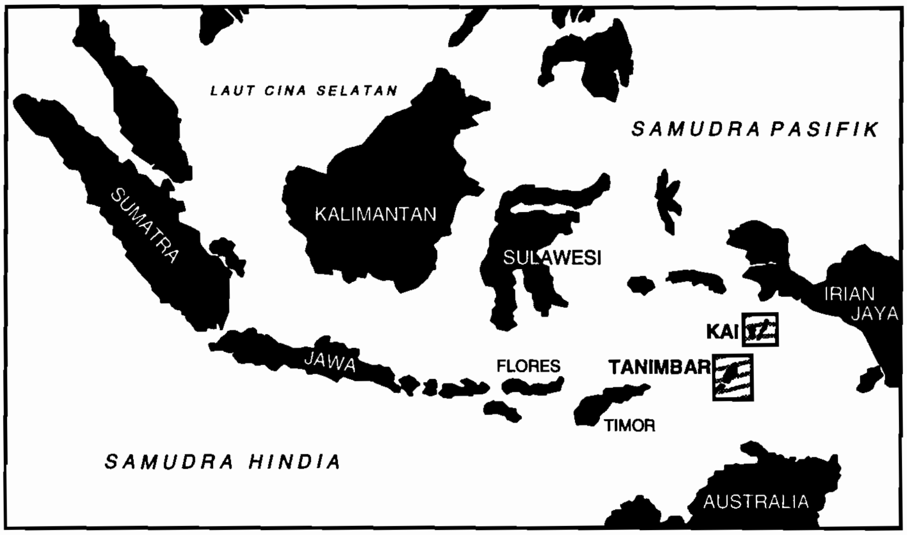

FIG. 9. — Zones (hachurées) prospectées lors de la campagne KARUBAR.

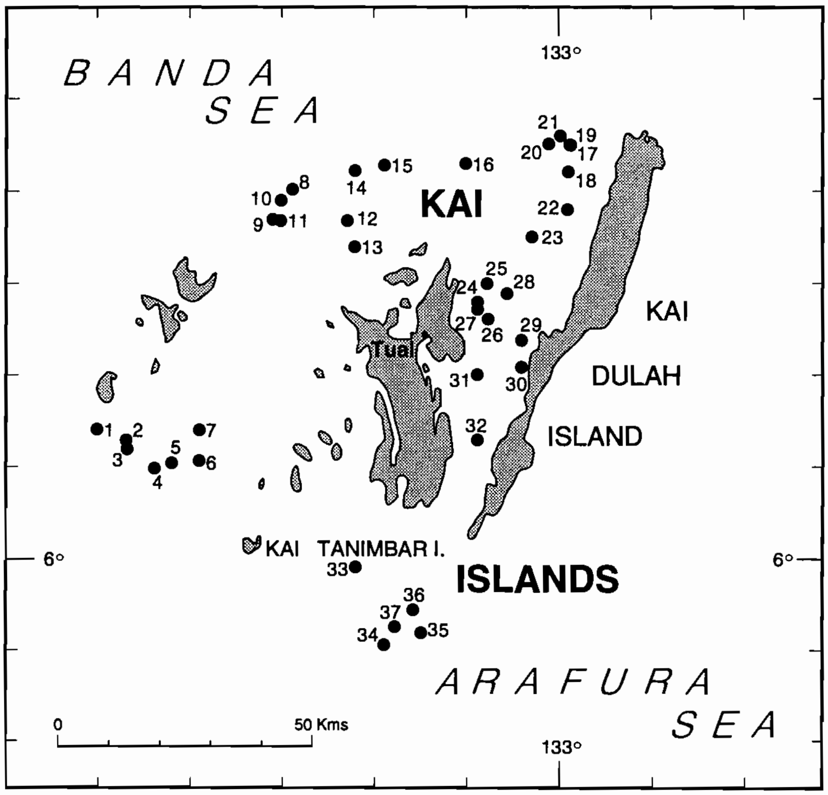

FIG. 10. — Positions des stations effectuées autour des îles Kai.

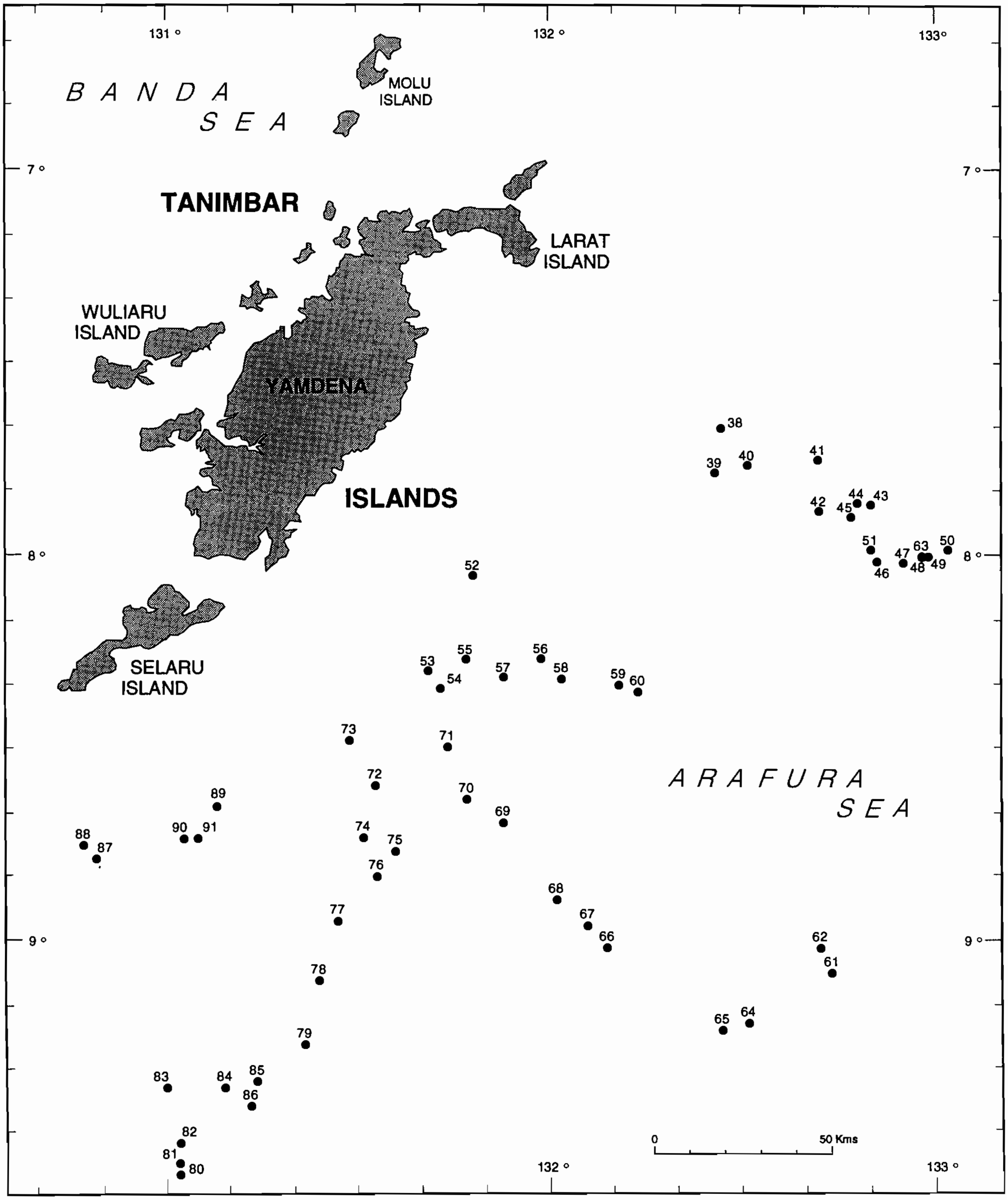

FIG. 11. — Positions des stations effectuées autour des îles Tanimbar.

N° station	Date (1991)	Heure locale (engin au fond)	Profondeur	Latitude	Longitude
Iles Kai					
DW 07	22.10	19h53	283-285 m	05°46'S	132°21'E
DW 08	23.10	6h52	358-360 m	05°20'S	132°31'E
CP 09	23.10	8h18	368-389 m	05°23'S	132°29'E
CC 10	23.10	10h55	329-389 m	05°21'S	132°30'E
ED 11	23.10	14h45	368-360 m	05°23'S	132°30'E
CP 12	23.10	19h43	436-413 m	05°23'S	132°37'E
DW 13	24.10	7h33	417-425 m	05°26'S	132°38'E
DW 14	24.10	10h03	245-246 m	05°18'S	132°38'E
DW 15	24.10	11h28	212-221 m	05°17'S	132°41'E
CP 16	24.10	14h11	315-349 m	05°17'S	132°50'E
CP 17	24.10	18h07	459-439 m	05°15'S	133°01'E
DW 18	24.10	20h22	205-212 m	05°18'S	133°01'E
CP 19	25.10	6h40	605-576 m	05°15'S	133°01'E
CP 20	25.10	9h53	769-809 m	05°15'S	132°59'E
CC 21	25.10	13h45	688-694 m	05°14'S	133°00'E
DW 22	25.10	16h50	82 m	05°22'S	133°01'E
ED 23	25.10	18h45	538-546 m	05°25'S	132°57'E
DW 24	26.10	6h10	243-230 m	05°32'S	132°51'E
CP 25	26.10	7h32	336-346 m	05°30'S	132°52'E
CP 26	26.10	9h05	265-302 m	05°34'S	132°52'E
CP 27	26.10	10h15	304-314 m	05°33'S	132°51'E
DW 28	26.10	11h58	448-467 m	05°31'S	132°54'E
DW 29	26.10	13h53	181-184 m	05°36'S	132°56'E
DW 30	26.10	14h50	118-111 m	05°39'S	132°56'E
DW 31	26.10	16h48	288-289 m	05°40'S	132°51'E
DW 32	26.10	18h30	170-206 m	05°47'S	132°51'E
CP 33	27.10	8h18	307-311 m	06°05'S	132°38'E
CP 34	27.10	11h28	435-445 m	06°09'S	132°41'E
CP 35	27.10	13h32	390-502 m	06°08'S	132°45'E
CP 36	27.10	16h58	268-210 m	06°05'S	132°44'E
CP 37	27.10	19h00	363-241 m	06°07'S	132°42'E
Iles Tanimbar					
CP 38	28.10	7h04	620-666 m	07°40'S	132°27'E
CP 39	28.10	9h59	477-466 m	07°47'S	132°26'E
CC 40	28.10	12h42	443-468 m	07°46'S	132°31'E
CC 41	28.10	15h53	401-393 m	07°45'S	132°42'E
CC 42	28.10	19h20	354-350 m	07°53'S	132°42'E
ED 43	29.10	6h02	290-283 m	07°52'S	132°50'E
DW 44	29.10	7h35	291-295 m	07°52'S	132°48'E
CP 45	29.10	8h53	302-305 m	07°54'S	132°47'E
CP 46	29.10	10h58	271-273 m	08°01'S	132°51'E
CP 47	29.10	12h15	246-235 m	08°01'S	132°55'E
CP 48	29.10	13h35	223-218 m	08°00'S	132°58'E
DW 49	29.10	14h43	210-206 m	08°00'S	132°59'E
DW 50	29.10	15h58	184-186 m	07°59'S	133°02'E
CP 51	29.10	17h50	255-270 m	07°59'S	132°50'E
CP 52	30.10	8h02	1244-1266 m	08°03'S	131°48'E
CP 53	30.10	12h20	1026-1053 m	08°18'S	131°41'E

N° station	Date (1991)	Heure locale (engin au fond)	Profondeur	Latitude	Longitude
Iles Tanimbar					
CP 54	30.10	16h11	836-869 m	08°21'S	131°43'E
ED 55	30.10	19h30	854-852 m	08°16'S	131°47'E
CC 56	31.10	6h30	552-549 m	08°16'S	131°59'E
CC 57	31.10	9h56	603-620 m	08°19'S	131°53'E
CC 58	31.10	13h48	457-461 m	08°19'S	132°02'E
CP 59	31.10	17h03	405-399 m	08°20'S	132°11'E
DW 60	31.10	18h43	389-387 m	08°21'S	132°14'E
DW 61	01.11	5h24	236-235 m	09°05'S	132°44'E
CP 62	01.11	6h32	246-253 m	09°01'S	132°42'E
CP 63	01.11	9h24	215-214 m	09°00'S	132°58'E
DW 64	01.11	13h28	180-179 m	09°13'S	132°31'E
CP 65	01.11	14h16	176-174 m	09°14'S	132°27'E
CP 66	01.11	17h07	211-217 m	09°01'S	132°09'E
CP 67	01.11	18h23	233-146 m	08°58'S	132°06'E
ED 68	01.11	19h55	280-296 m	08°54'S	132°01'E
CP 69	02.11	6h35	356-368 m	08°42'S	131°53'E
CP 70	02.11	9h10	413-410 m	08°41'S	131°47'E
CP 71	02.11	11h48	477-480 m	08°38'S	131°44'E
CP 72	02.11	15h16	699-676 m	08°36'S	131°33'E
CP 73	02.11	19h00	855-840 m	08°29'S	131°33'E
CC 74	03.11	5h45	520-518 m	08°44'S	131°31'E
CP 75	03.11	8h45	452-451 m	08°46'S	131°36'E
CP 76	03.11	11h06	401-400 m	08°50'S	131°33'E
CP 77	03.11	13h29	352-346 m	08°57'S	131°27'E
CP 78	03.11	15h47	295-284 m	09°06'S	131°24'E
CP 79	03.11	18h09	250-239 m	09°16'S	131°22'E
DW 80	04.11	6h03	199-201 m	09°37'S	131°02'E
CP 81	04.11	7h20	200-207 m	09°35'S	131°02'E
CP 82	04.11	10h26	219-215 m	09°32'S	131°02'E
CP 83	04.11	13h01	285-297 m	09°23'S	131°00'E
CP 84	04.11	15h13	275-246 m	09°23'S	131°09'E
CP 85	04.11	16h42	245-240 m	09°22'S	131°14'E
CP 86	04.11	18h16	225-223 m	09°26'S	131°13'E
CP 87	05.11	6h53	1017-1024 m	08°47'S	130°49'E
CP 88	05.11	9h31	1188-1178 m	08°45'S	130°47'E
CP 89	05.11	14h04	1084-1058 m	08°39'S	131°08'E
CP 90	05.11	17h19	913-897 m	08°44'S	131°03'E
CP 91	05.11	20h03	884-891 m	08°44'S	131°05'E

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2

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*.

CONTENTS

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 **Ka**i, **Aru**, and Tanim**bar** Islands.
MUSORSTOM	Cruises organized jointly by the **Mus**éum 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.*

MUSORSTOM 3, *"CORIOLIS"*

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). [Not *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 porcellaneous 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: $S_{1-2}>S_3>S_4$; only 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 faces covered with small, pointed granules arranged in closely-spaced, parallel rows in a fan system radiating from the thecal wall. An elliptical crown on 12 lamellar P_3 encircle the elongate columella, each palus having a slightly sinuous inner and outer edge and measuring 1.0-1.3 mm in width. Fossa shallow to moderate in depth. Columella consists of 4-9 slender, twisted lamellae.

REMARKS. — The nature of the base of *C. secta* is unique within *Caryophyllia*. If only one specimen were 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 are assumed to have resulted from transverse division from a small, attached anthocaulus stage; however, no such stage has yet been identified for this species.

DISTRIBUTION. — *Philippines*: Lubang Island; Verde Island Passage; Sulu Sea (Semirara Islands and 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. 10, 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 ($S_{1\text{-}2}>S_3>S_4>S_5$), the 4th cycle (48 septa stage) attained at a GCD of 7-9 mm. Inner edges of $S_{1\text{-}2}$ 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 $C_{1\text{-}2}$ 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: $S_{1\text{-}2}>S_4\geq S_3>S_5$. $S_{1\text{-}2}$ 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 $S_{1\text{-}2}$, each S_3 also bordered by a palus of equivalent size to a $P_{1\text{-}2}$ 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 ($P_{1\text{-}4}$) 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 $P_{1\text{-}4}$, 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 S_3, 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. $S_{1\text{-}2}$ 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 $S_{1\text{-}2}$, 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 $P_{1\text{-}2}$ 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 $P_{1\text{-}2}$.

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*, S_3 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 S_8. 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: $S_{1\text{-}3}>S_4>S_5$ (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 $S_{3\text{-}4}$ 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 $S_{1\text{-}2}$, 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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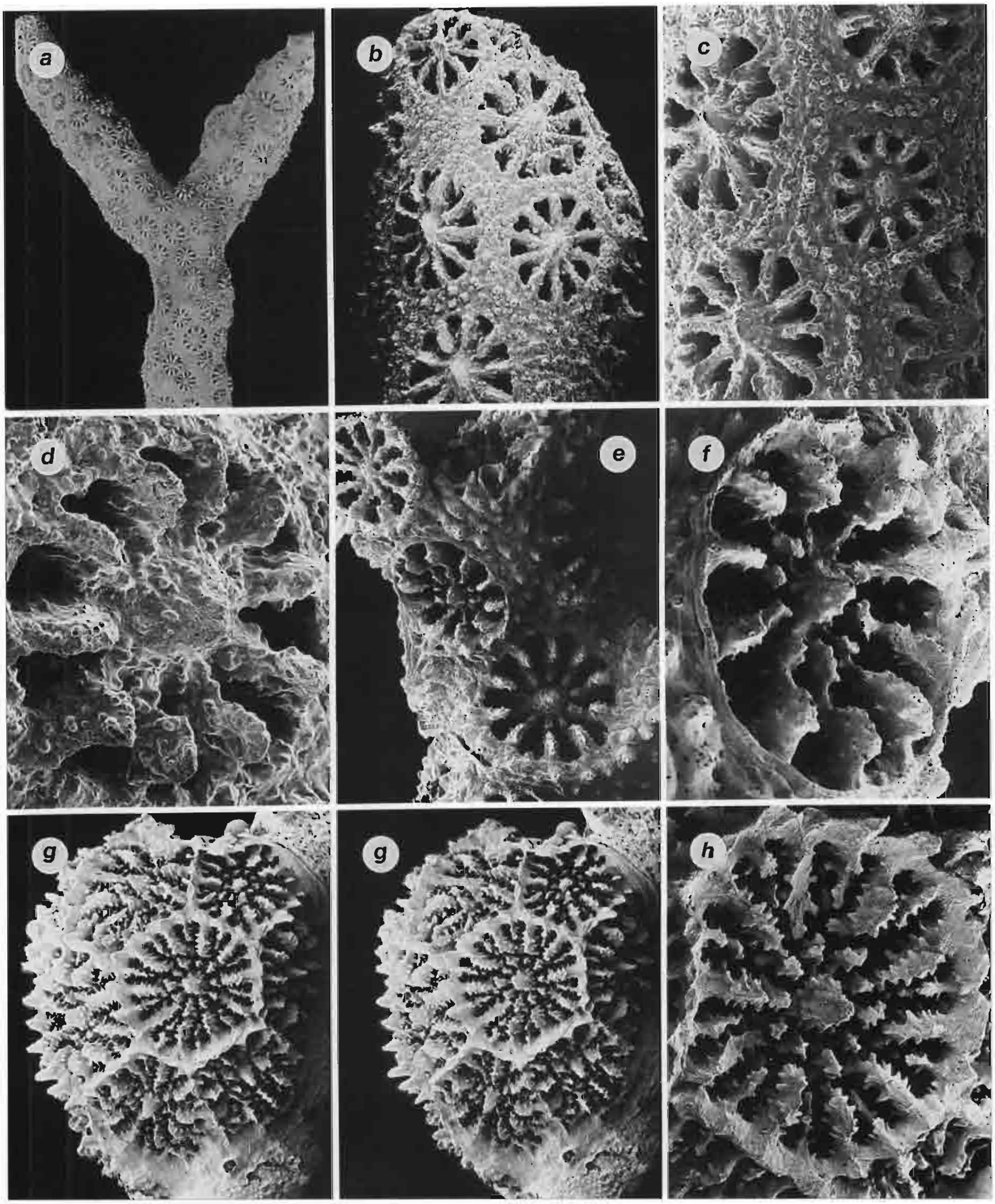

FIG. 1 a-d. — *Madracis asanoi* Yabe & Sugiyama, 1936: **a**, *"Albatross"* stn 5381 (USNM 96672), distal branch, x 1.9. — **b-d**, *"Albatross"* stn 5277, USNM 96671: **b**, branch tip, x 11.9; **c**, unequal-sized corallites, x 17.3; **d**, calice, x 40.

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.

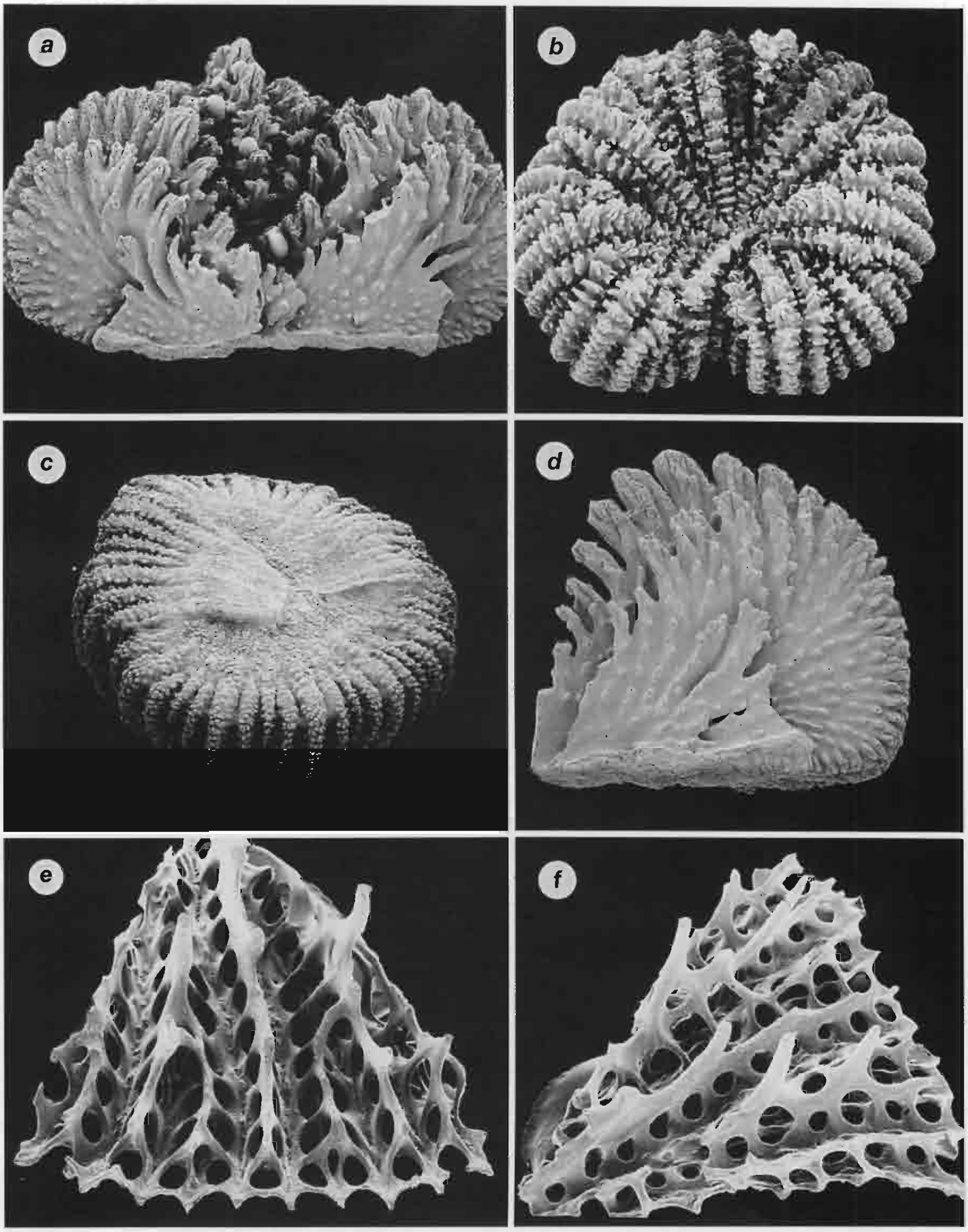

FIG. 2 a-d. — *Fungiacyathus fissidiscus* sp. nov., paratypes, KARUBAR stn 7 (USNM 96725): **a**, fracture showing septal spines, x 21.8; **b**, calice, x 15; **c**, base showing regeneration from parent fragment, x 15.8; **d**, fracture showing septal face granulation, x 24.8.

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.

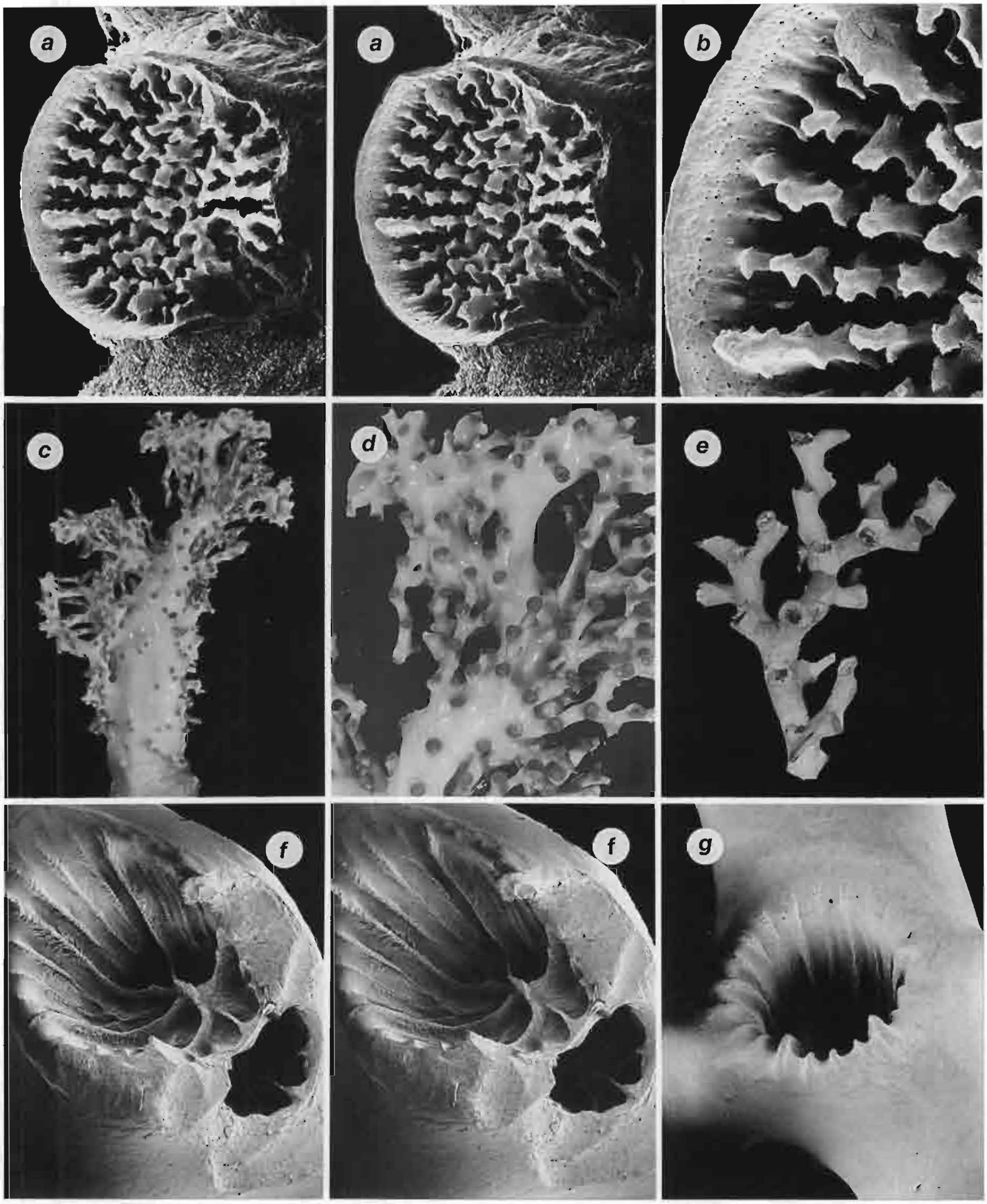

FIG. 3 a-b. — *Culicia stellata* Dana, 1846, *"Alpha Helix"* stn 79-M140 (USNM 80029): **a**, stereo calicular view, x 17.1; **b**, enlargement of thecal lip and septal dentition, x 41.

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.

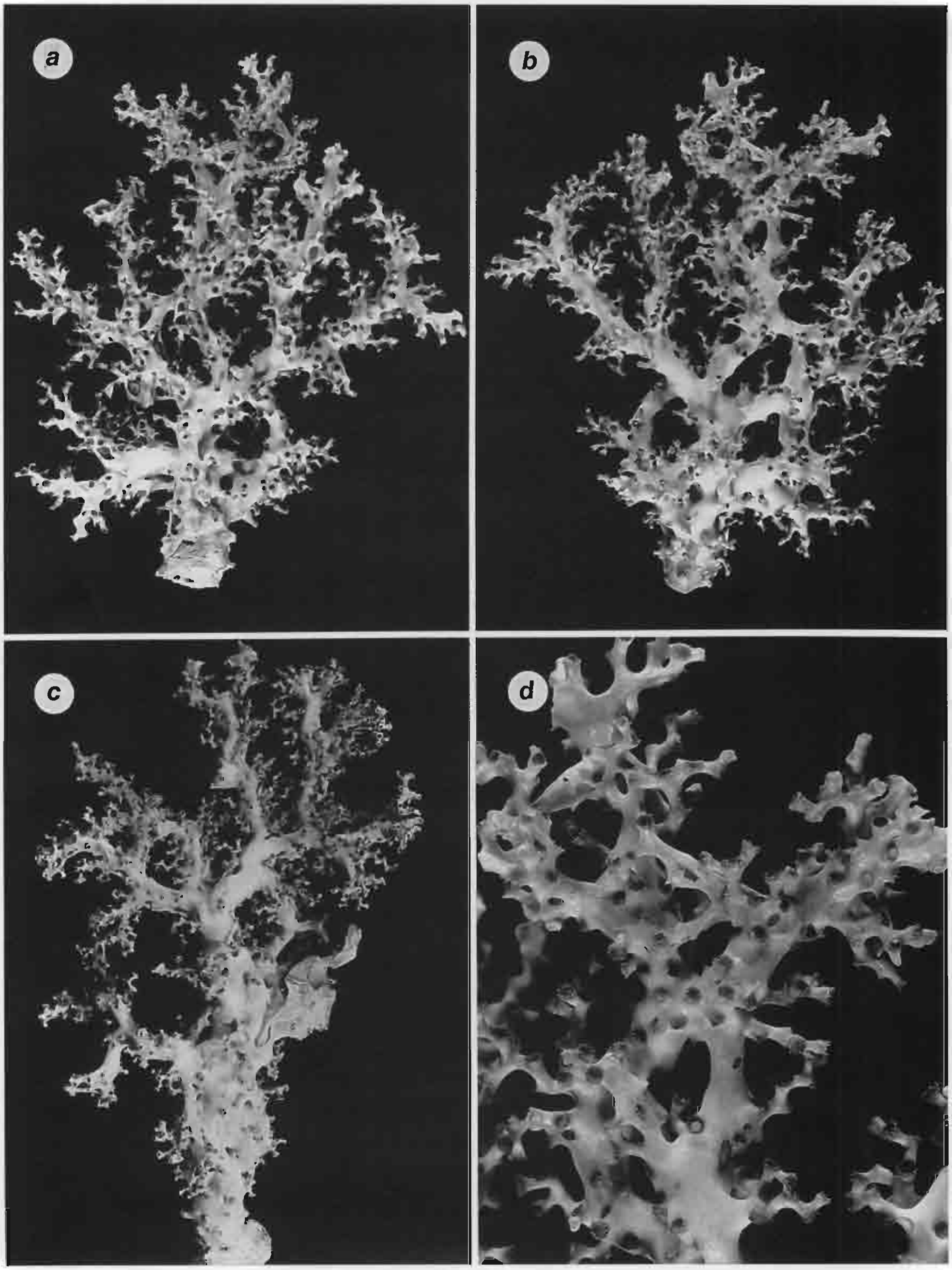

FIG. 4 a-d. — *Madrepora minutiseptum* sp. nov.: **a-b**, **d**, holotype, SNELLIUS 2 stn 4.196 (NNM 22734): **a-b**, anterior and posterior surfaces of colony, both x 0.38; **d**, enlargement showing anastomosing branches, x 0.91. — **c**, paratype, "off Japan" (USNM 96754, ex ZMA 137), colony, x 0.38.

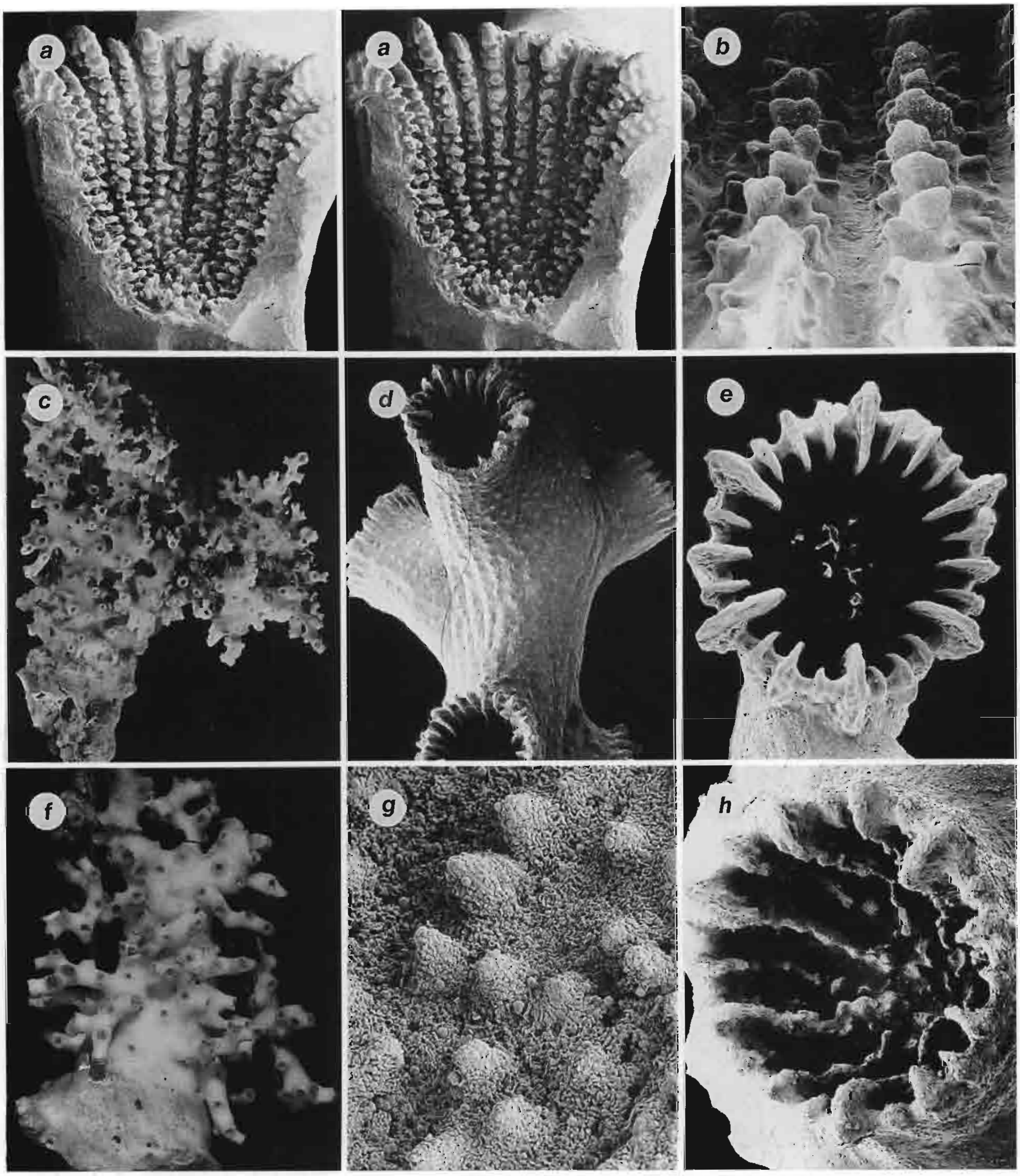

FIG. 5 a-b. — *Madrepora minutiseptum* sp. nov., paratype, "off Japan" (USNM 96754): **a**, stereo view of a fractured corallite showing septal dentition, x 23.5; **b**, two septa, x 105.

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.

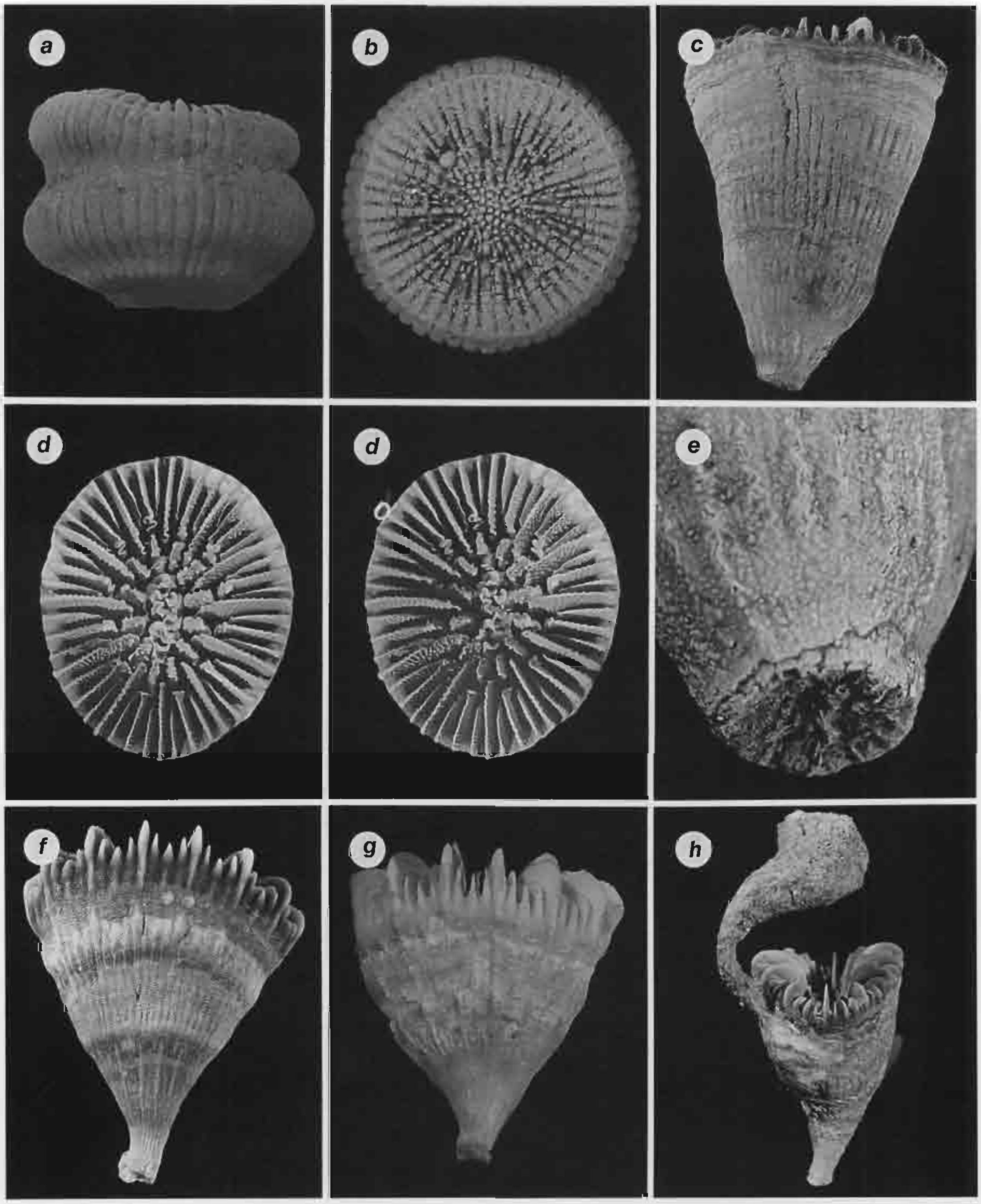

FIG. 6 a-b. — *Anthemiphyllia frustum* Cairns, 1994, KARUBAR stn 15 (USNM 96776): **a**, lateral view of 2 anthocyathi that remained attached, x 5.4; **b**, calice of same specimen, x 6.1.

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.

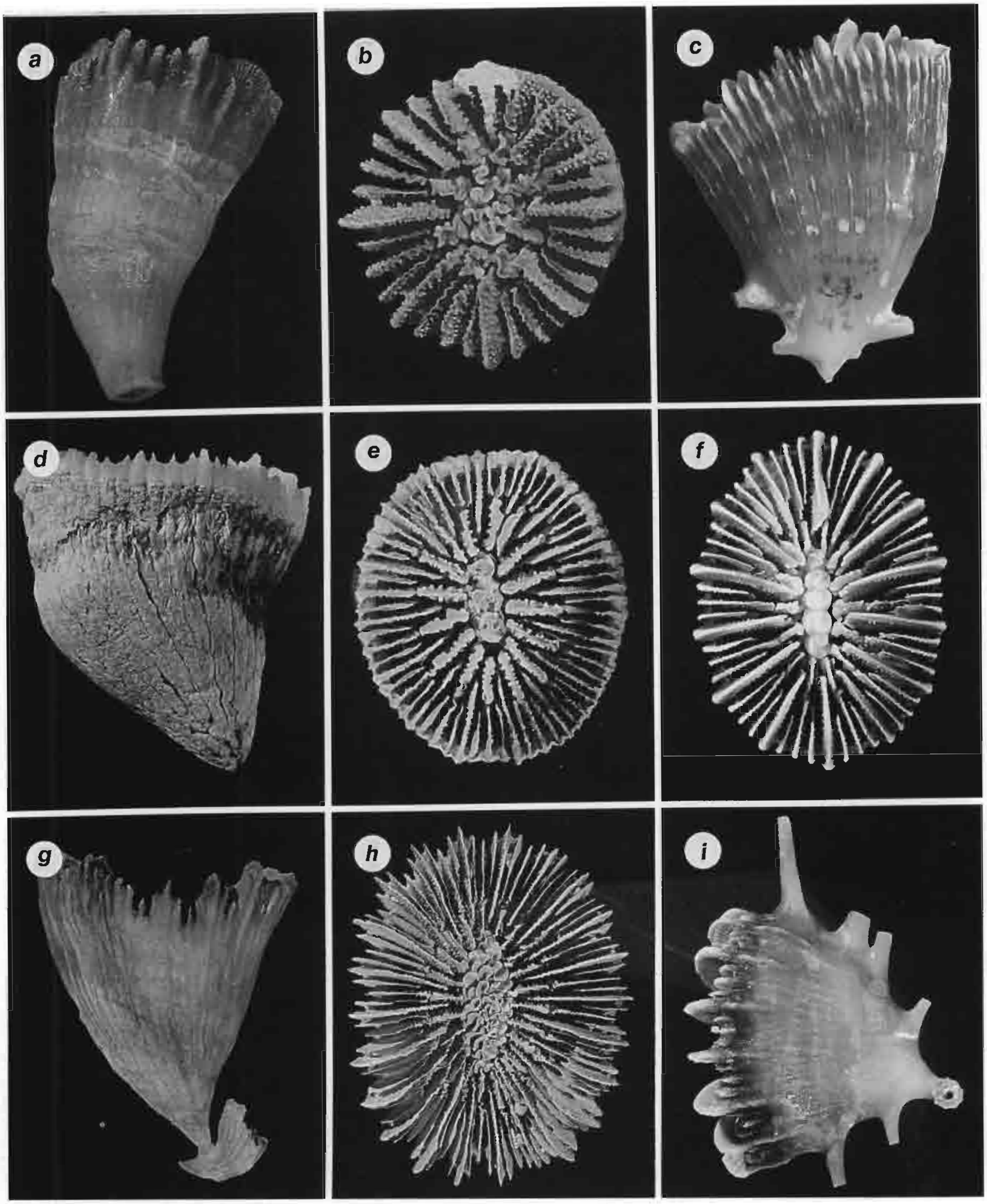

FIG. 7 a-b. — *Caryophyllia octonaria* sp. nov., holotype, MUSORSTOM 1 stn 64 (MNHN), side and calicular views, x 4.5, x 6.1, respectively.

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.

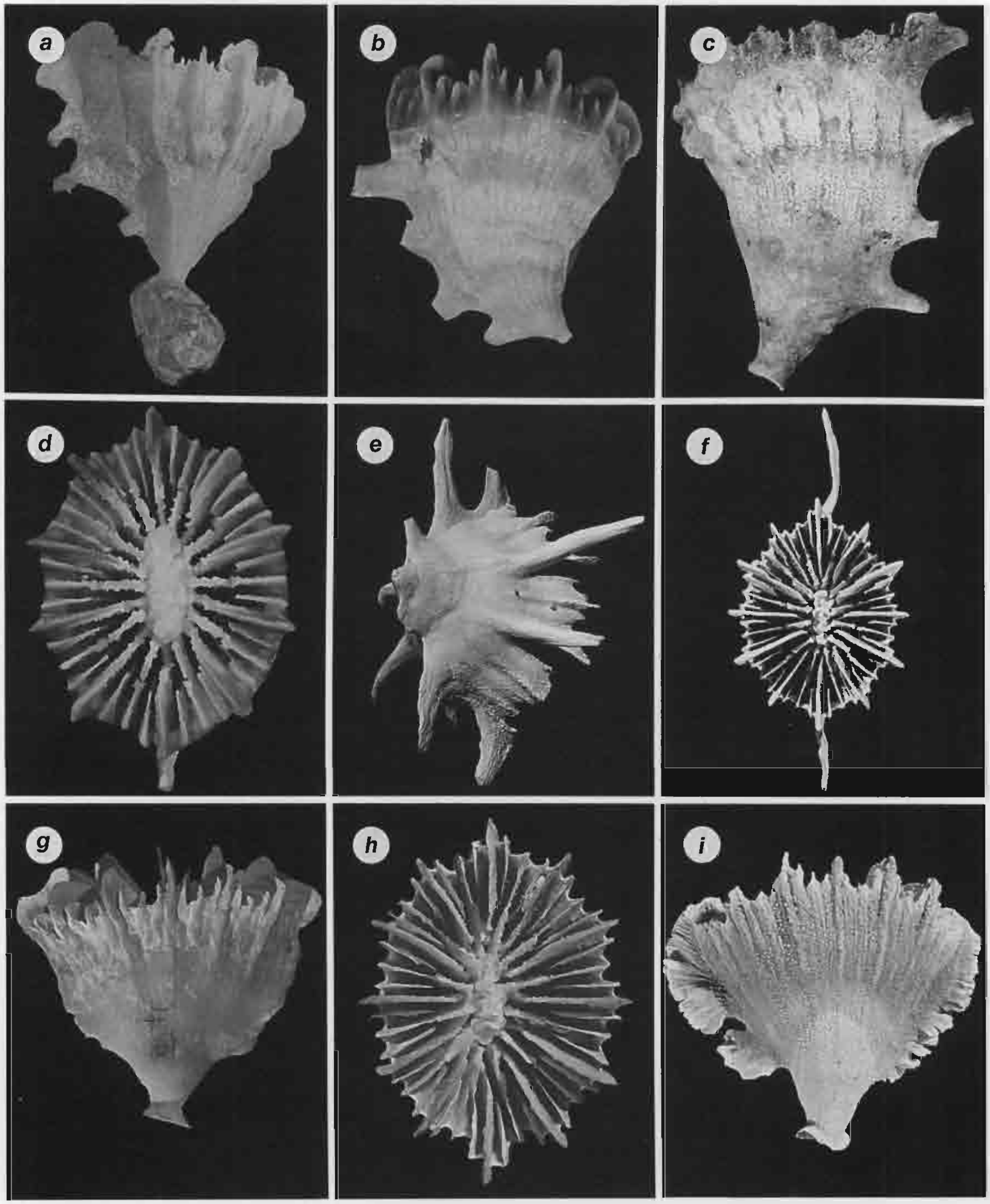

FIG. 8 a-d. — *Caryophyllia dentata* (Moseley, 1881): **a**, holotype, *"Challenger"* stn 174 (BMNH 1880.11.25.42), side view, x 2.9. — **b**, **d**, DEKI stn 3 (USNM 96858), side and calicular views of a decameral specimen, x 3.4, x 4.3, respectively. — **c**, DEKI (Neira) (NNM 23076), side view of 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.

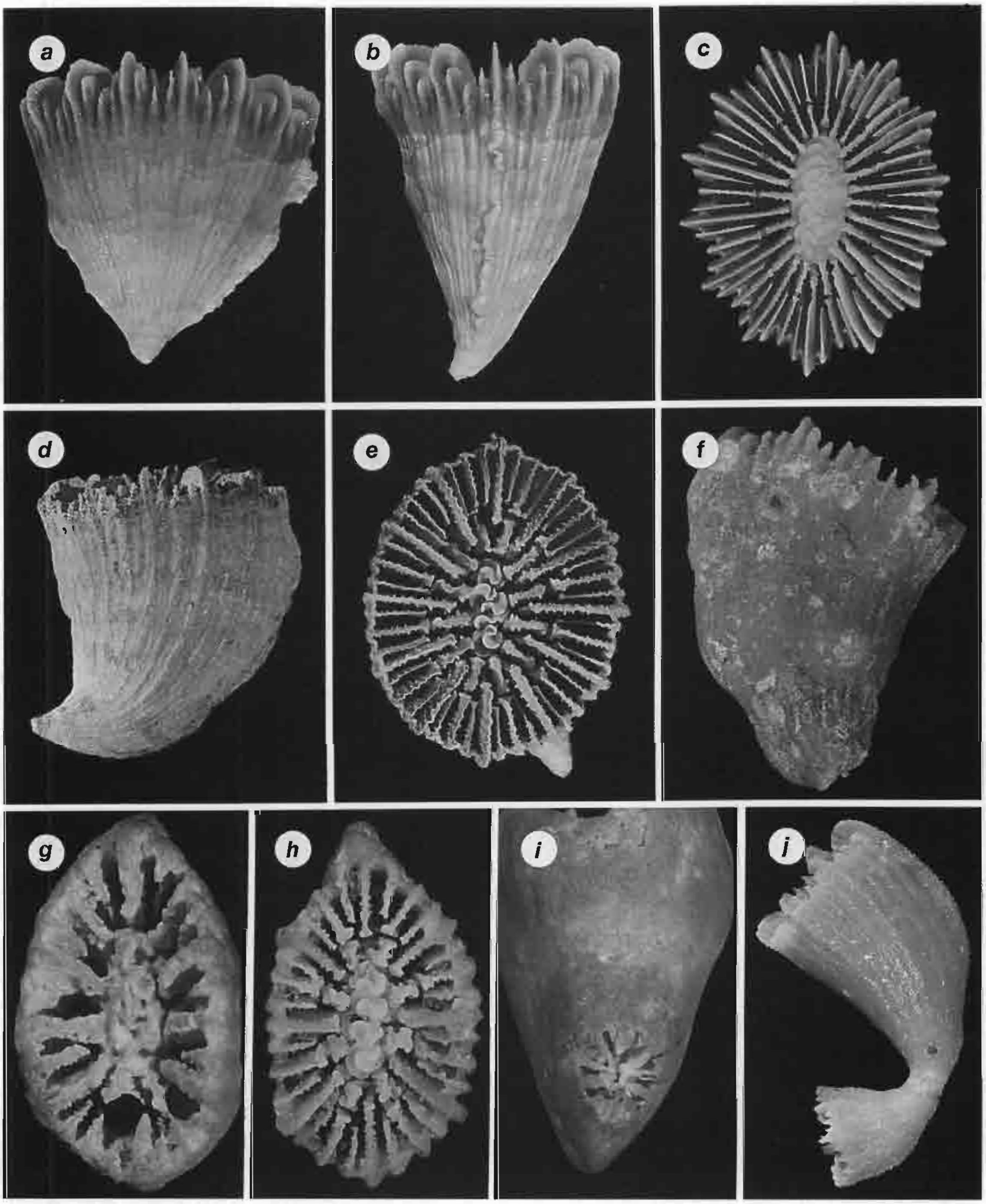

FIG. 9 a-c. — *Caryophyllia karubarica* sp. nov., holotype, KARUBAR stn 58 (MNHN), side, edge, and calicular views, x 2.0, x 2.15, x 2.15, respectively.

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.

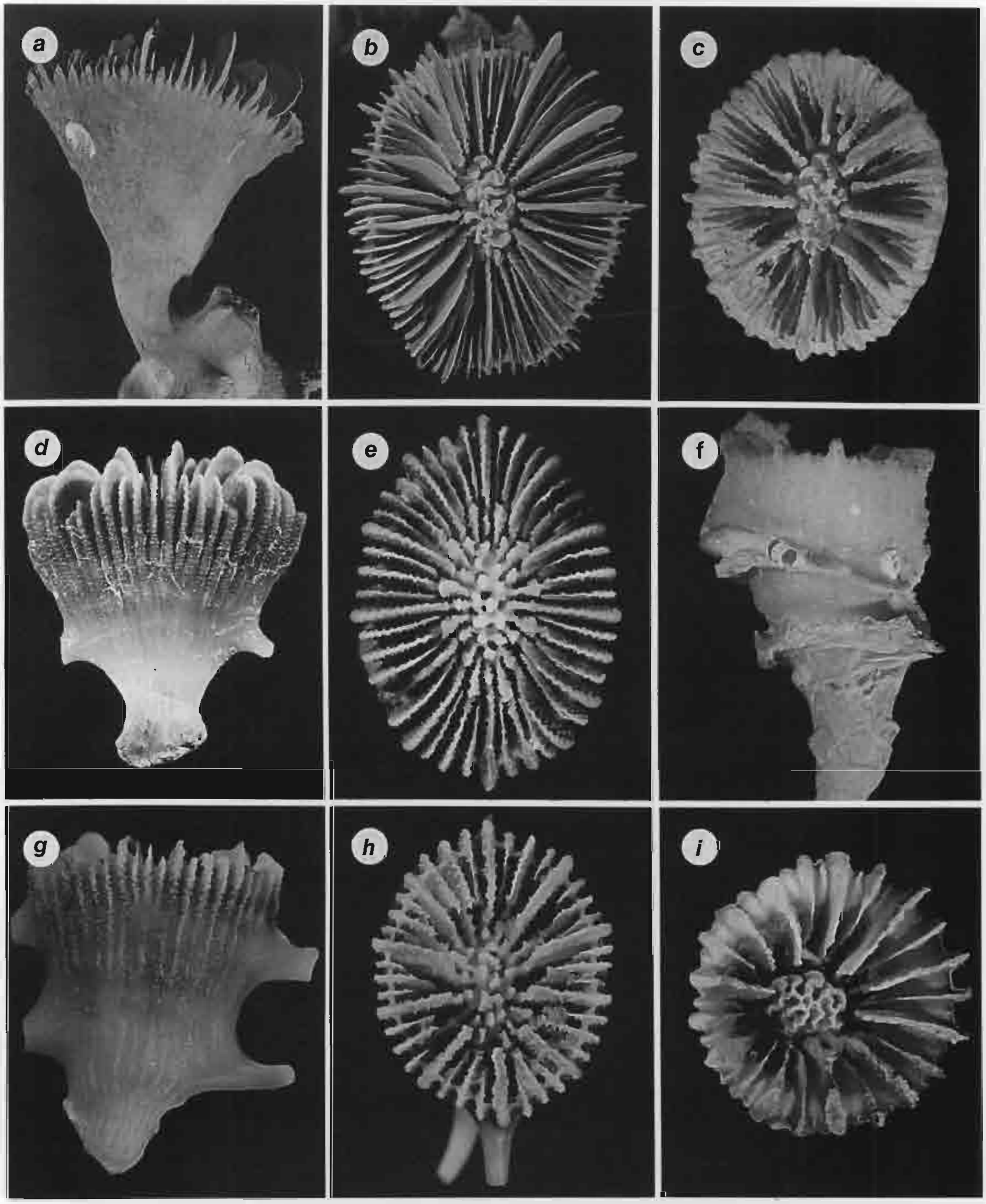

FIG. 10 a-c. — *Crispatotrochus rubescens* (Moseley, 1881): **a-b**, *"Albatross"* stn 5519 (USNM 60586), side and calicular views of a large corallum, x 1.4, x 1.6, respectively. — **c**, *"Siboga"* stn 105 (ZMA Coel. 579), syntype of *Cyathoceras tydemani*, calice, x 4.6.

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.

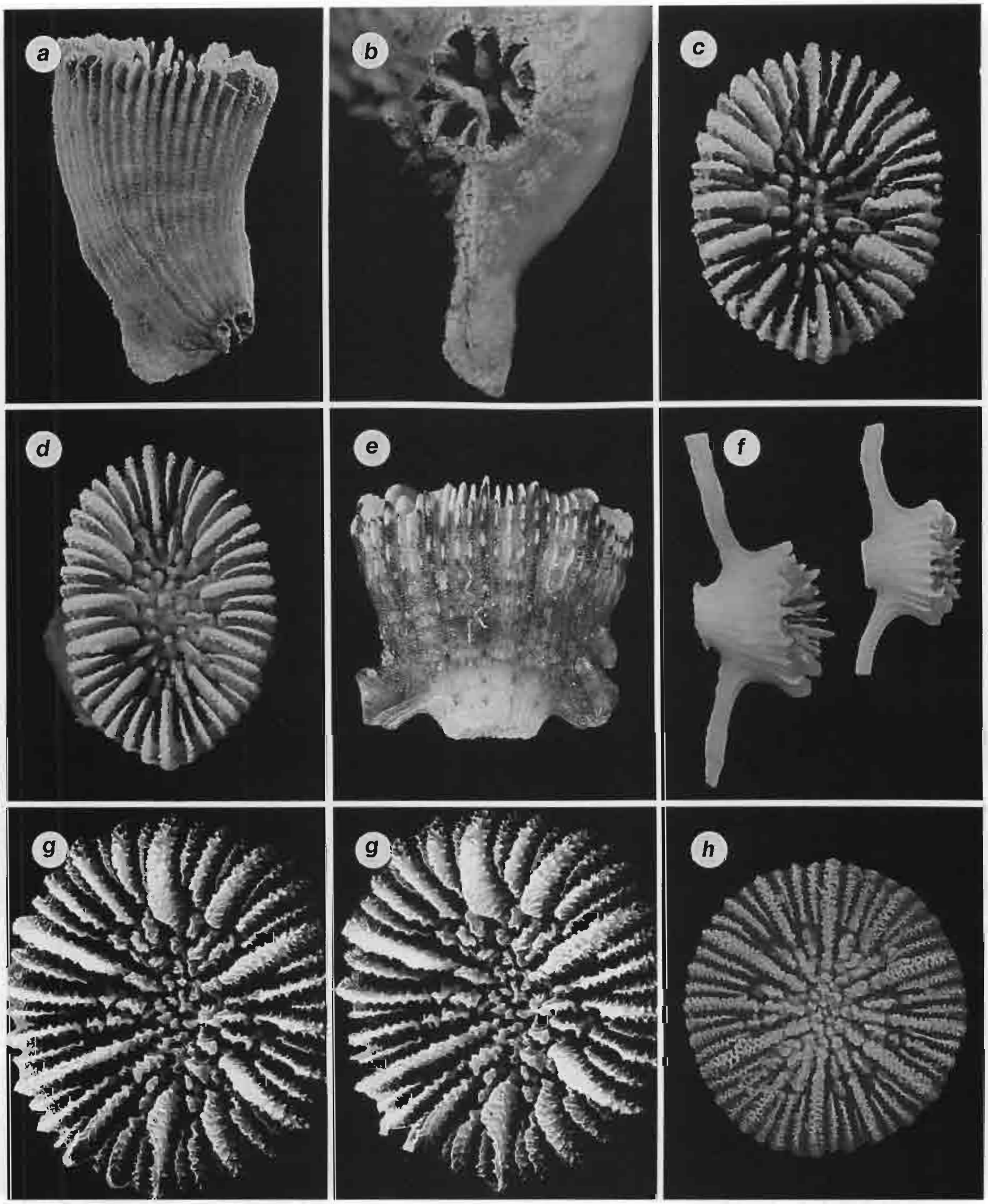

FIG. 11 a-d. — *Trochocyathus apertus* sp. nov.: **a-c**, holotype, *"Albatross"* stn 5164 (USNM 97087), side, open base, and calicular views, x 5.2, x 13, x 7.2, respectively. — **d**, paratype, MORTENSEN'S JAVA EXP., stn 9 (ZMUC), calice, x 5.3.
FIG. 11 e. — *Trochocyathus cooperi* (Gardiner, 1905), 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.

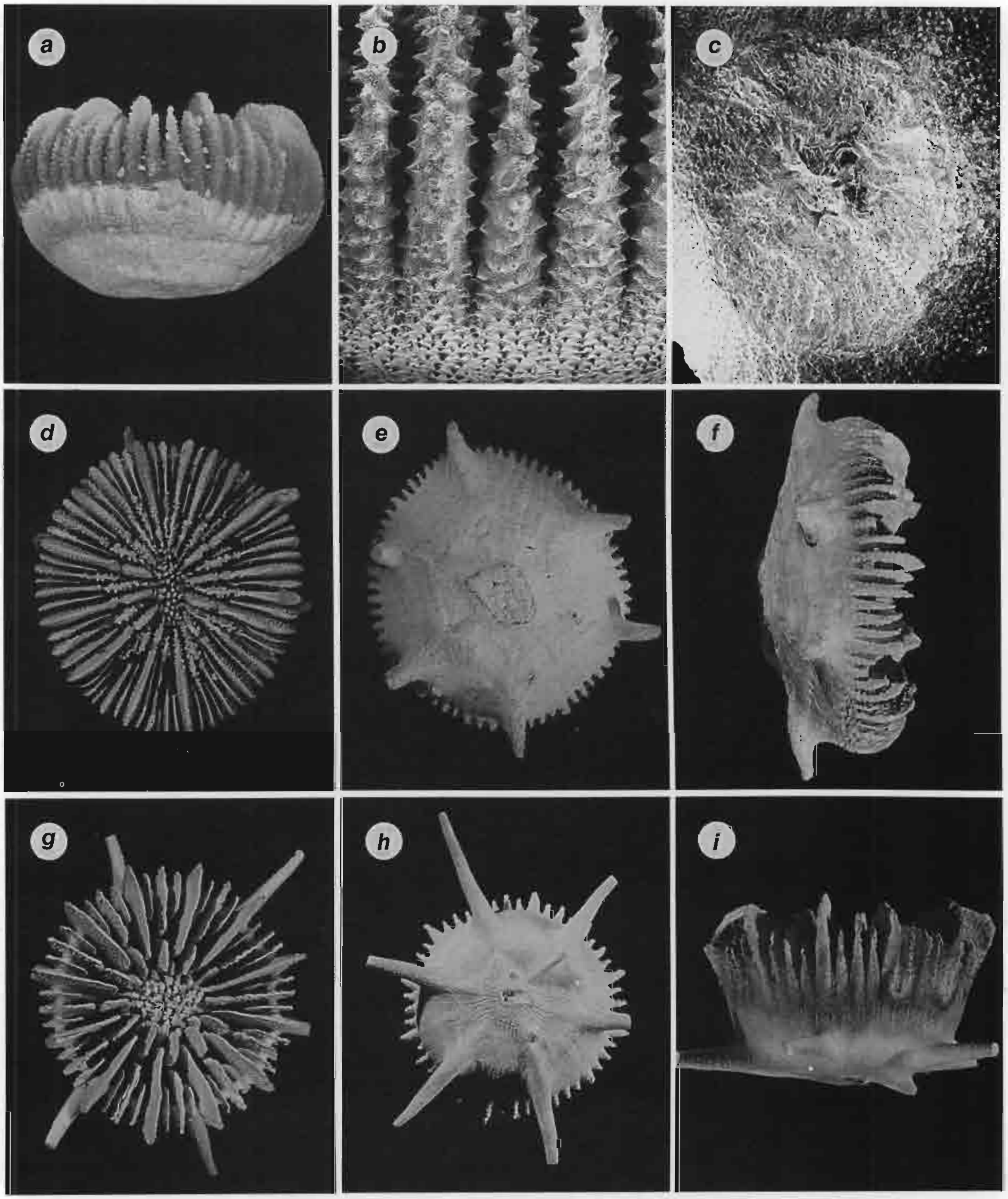

FIG. 12 a-c. — *Trochocyathus discus* sp. nov.: **a**, holotype, KARUBAR stn 3 (MNHN), side view, x 5.2. — **b-c**, paratype, KARUBAR stn 3 (USNM 97105): **b**, costal granulation at calicular edge, x 25; **c**, basal scar, x 14.

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.

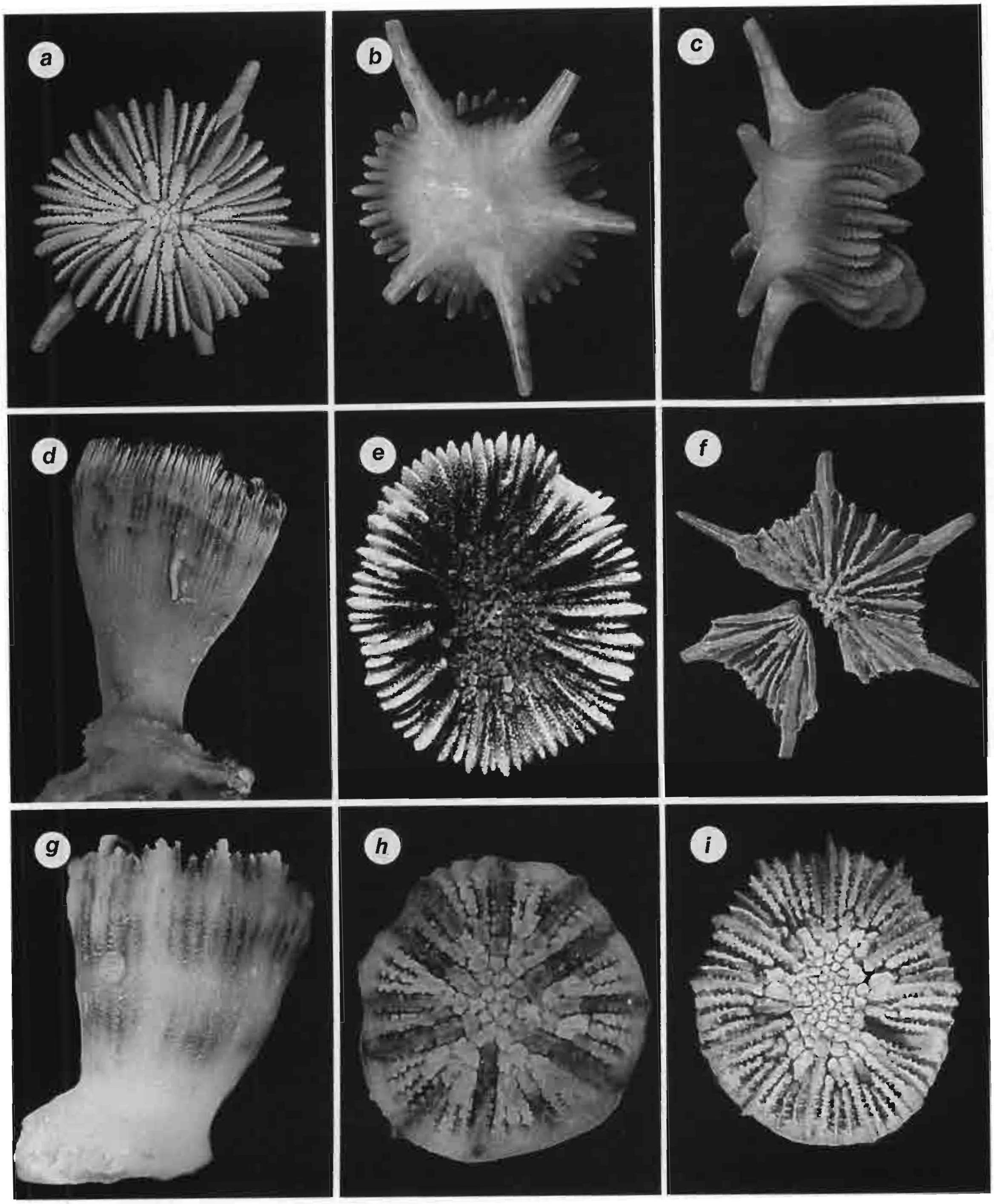

FIG. 13 a-c. — *Trochocyathus hastatus* Bourne, 1903, syntype, Tutanga (BMNH 1903.12.1.2), calicular, basal, and edge views, all x 3.4.

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.

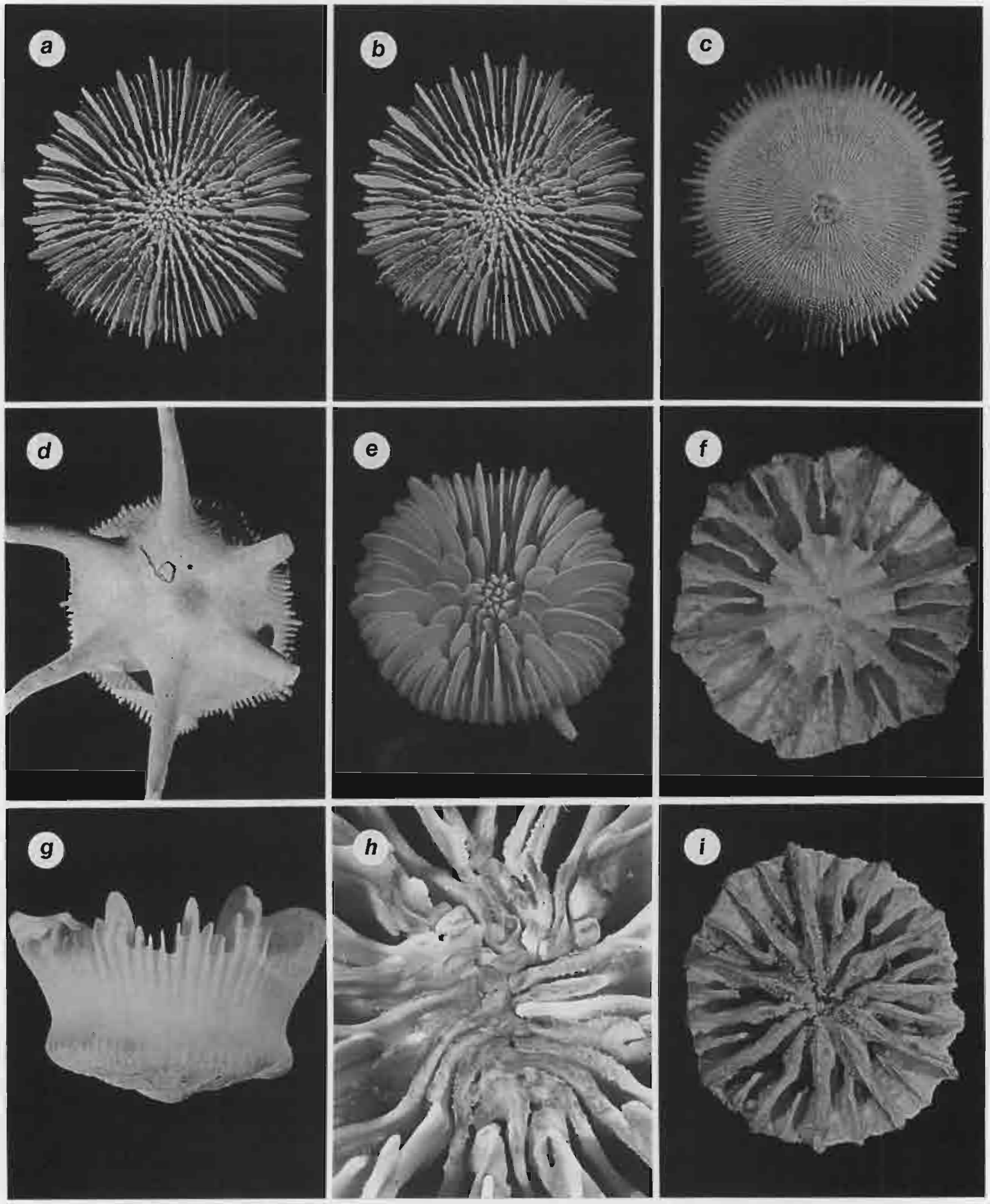

FIG. 14 a-c. — *Stephanocyathus regius* sp. nov., holotype, *"Hakuho Maru"* stn KH 72-1-26 (USNM 97122), stereo calicular and basal views, both x 1.7.

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.

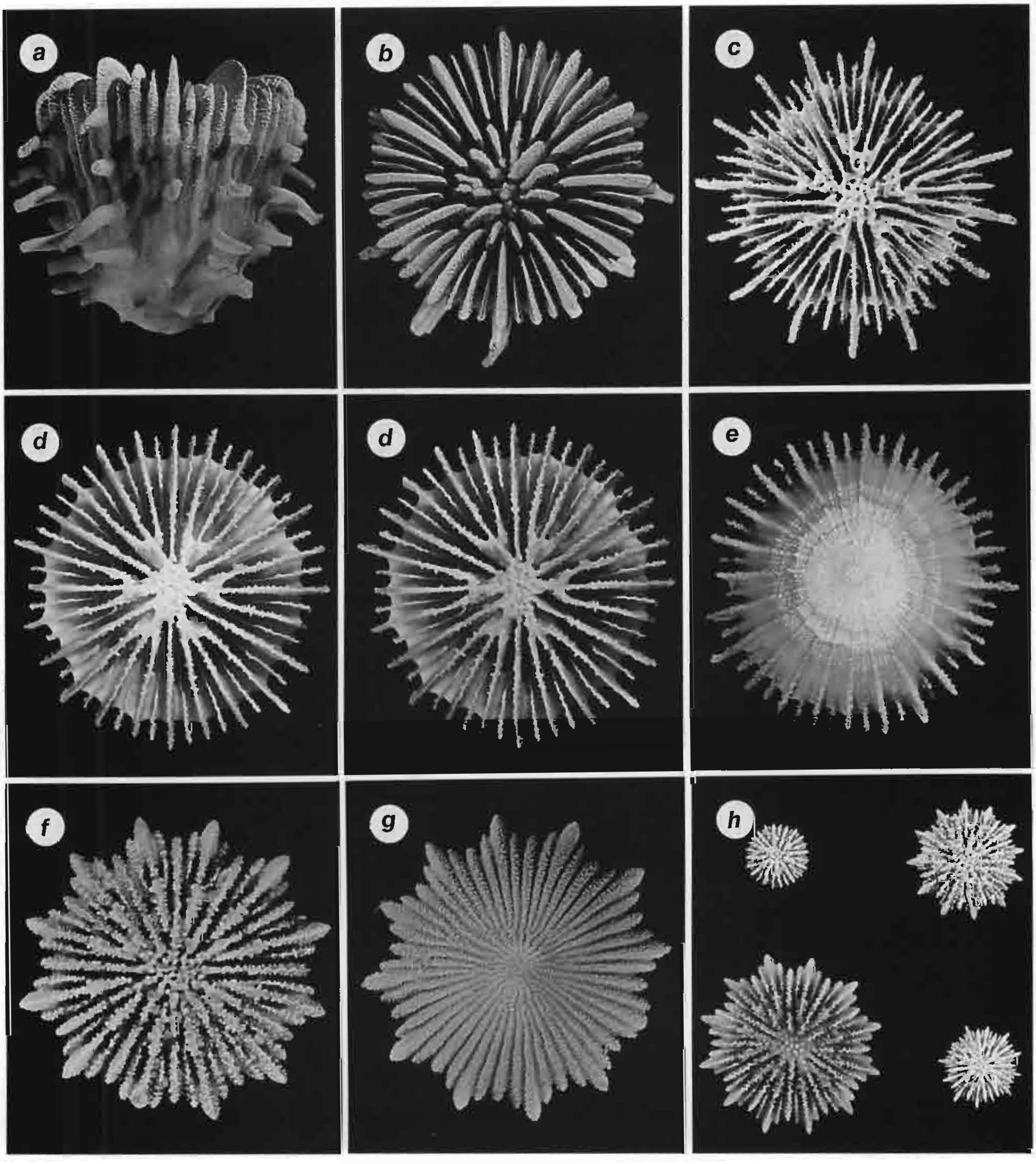

FIG. 15 a-b. — *Ericiocyathus echinatus* sp. nov., holotype, *"Albatross"* stn 5425 (USNM 97169), side and calicular views, both x 2.4.

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.

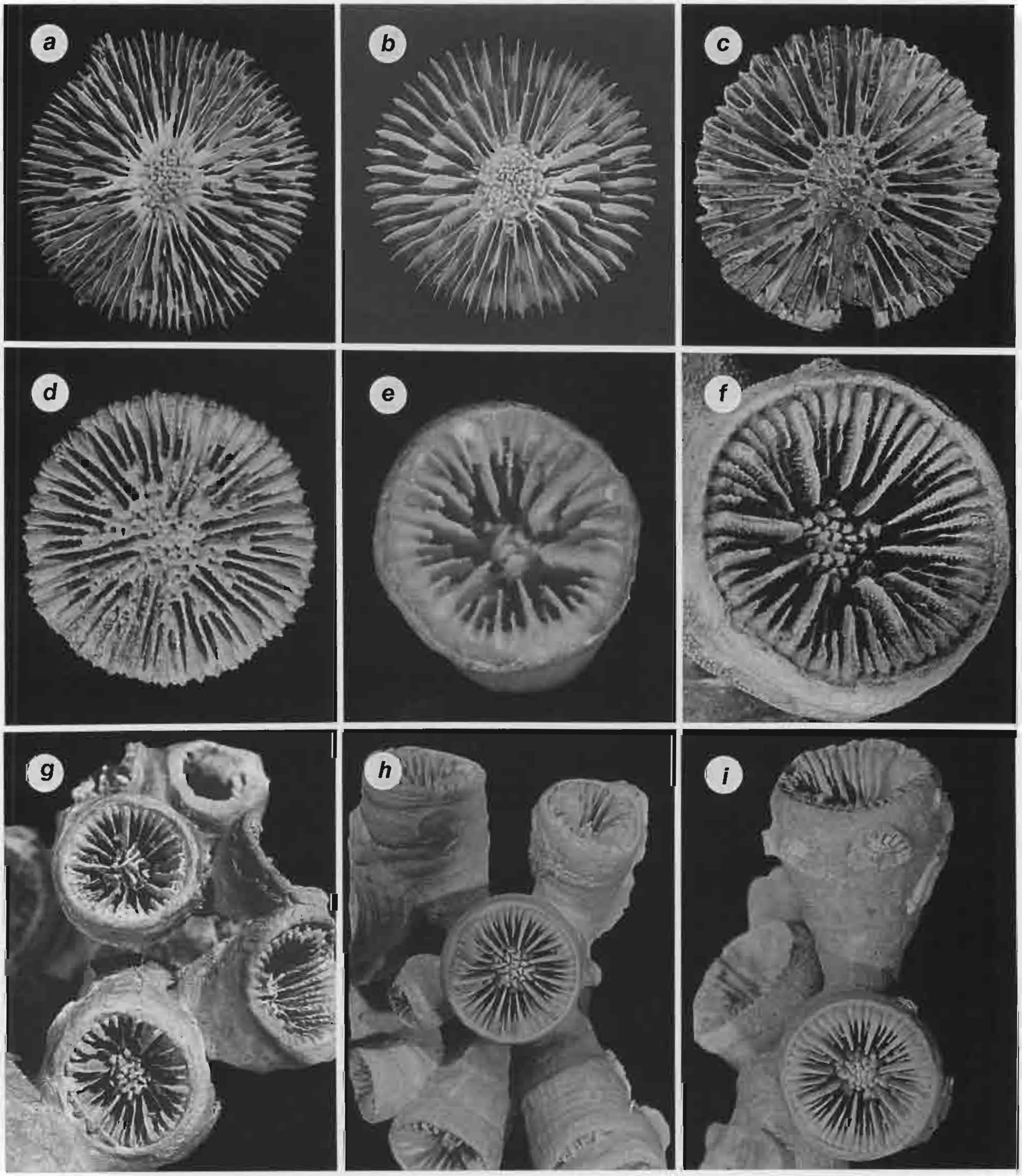

FIG. 16 a-c. — *Deltocyathus rotulus* (Alcock, 1898): **a**, *"Albatross"* stn 5582 (USNM 92727), corallum having P_{1-4}, x 1.4. — **b**, *"Albatross"* stn 5585, corallum with very small P_{1-3} (USNM 97207), x 1.6. — **c**, *"Siboga"* stn 45 (ZMA), a worn syntype of *D. fragilis*, x 2.8.

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.

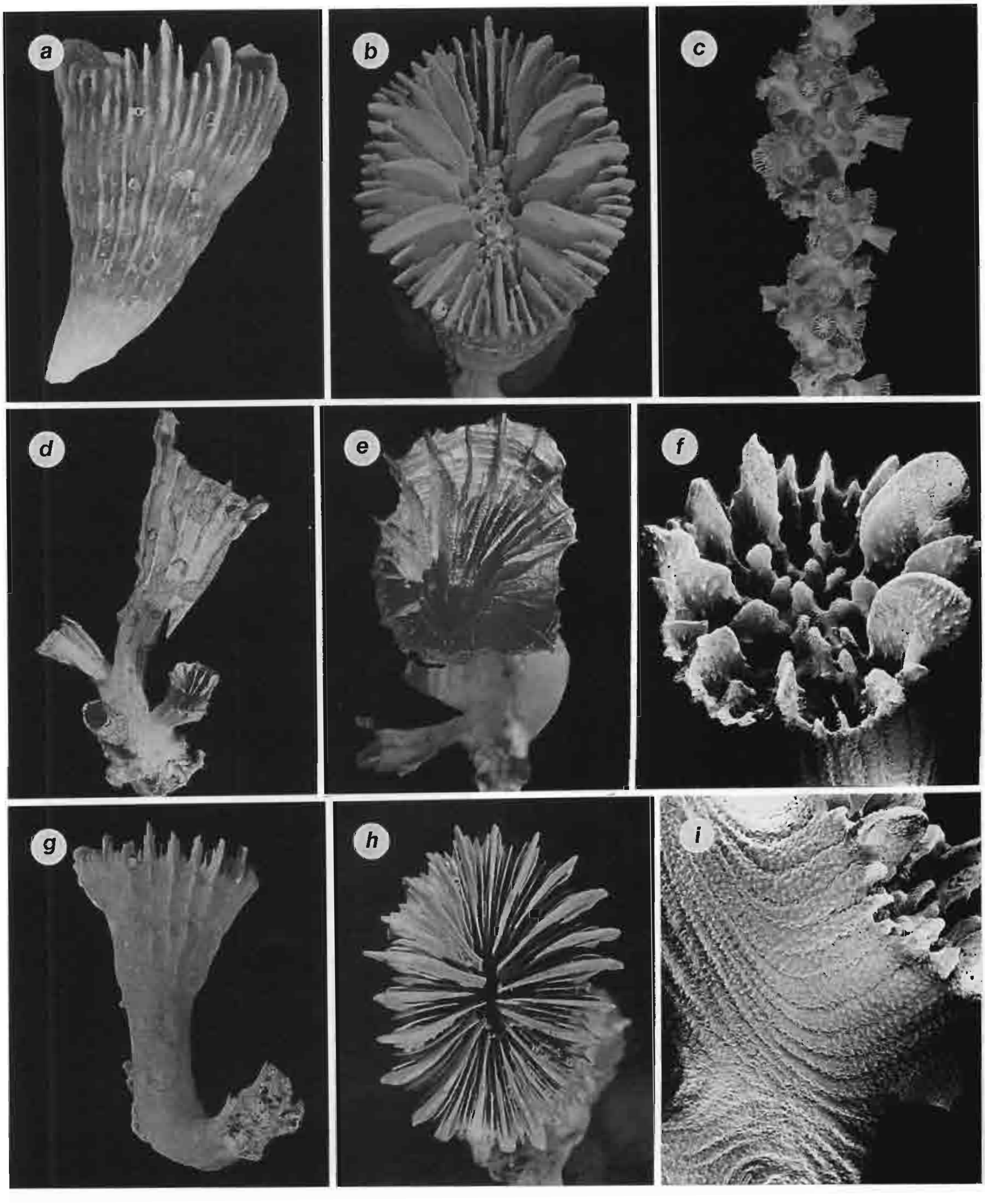

FIG. 17 a-b. — *Asterosmilia marchadi* (Chevalier, 1966), MORTENSEN'S JAVA EXP., stn 8 (ZMUC): **a**, side of corallum showing several detachment scars, x 3.4; **b**, oblique calicular view, x 3.4.

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.

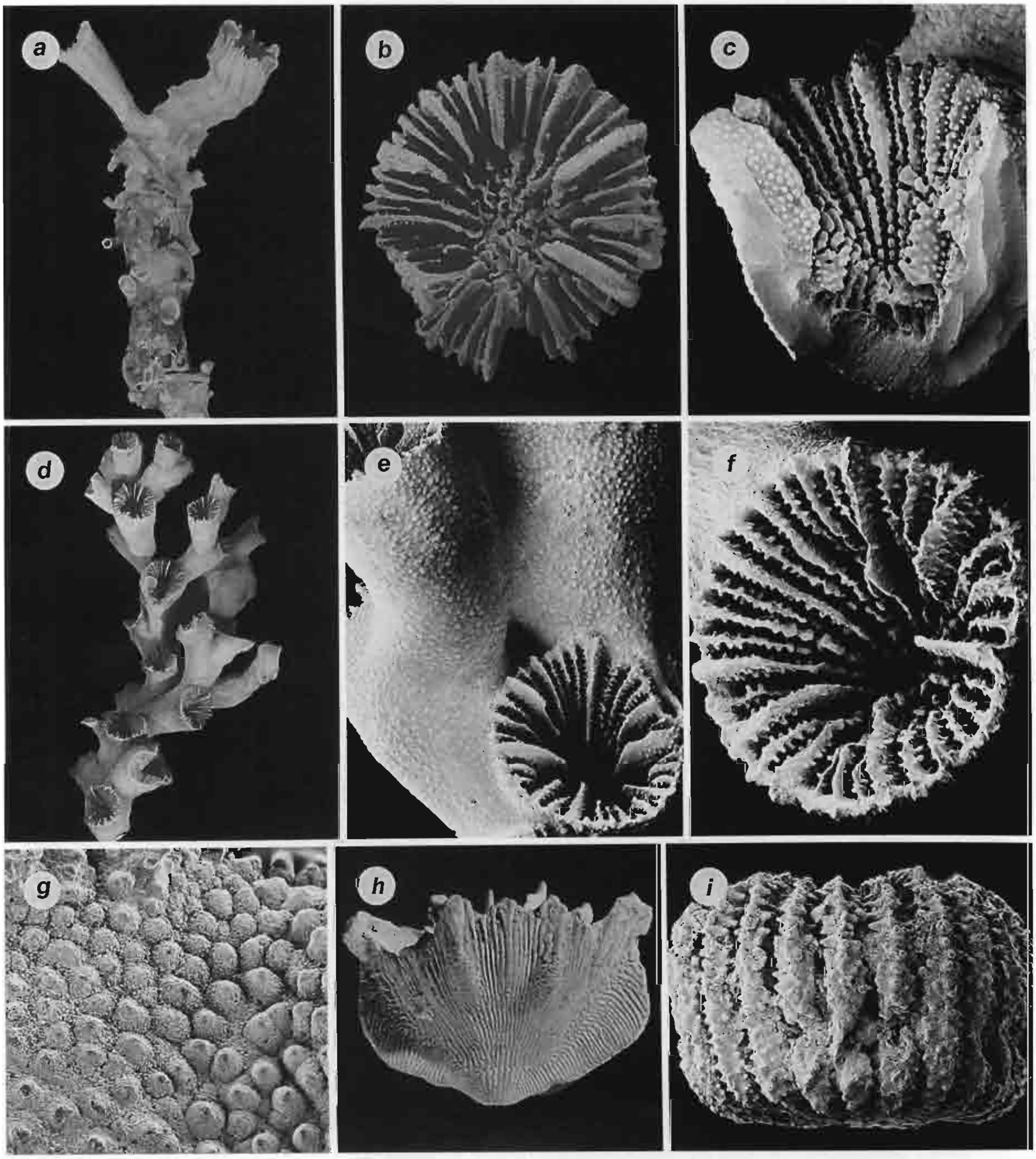

FIG. 18 a-b. — *Rhizosmilia elata* sp. nov., holotype, *"Albatross"* stn 5244 (USNM 97304), corallum and calice, x 0.83, x 4, respectively.

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.

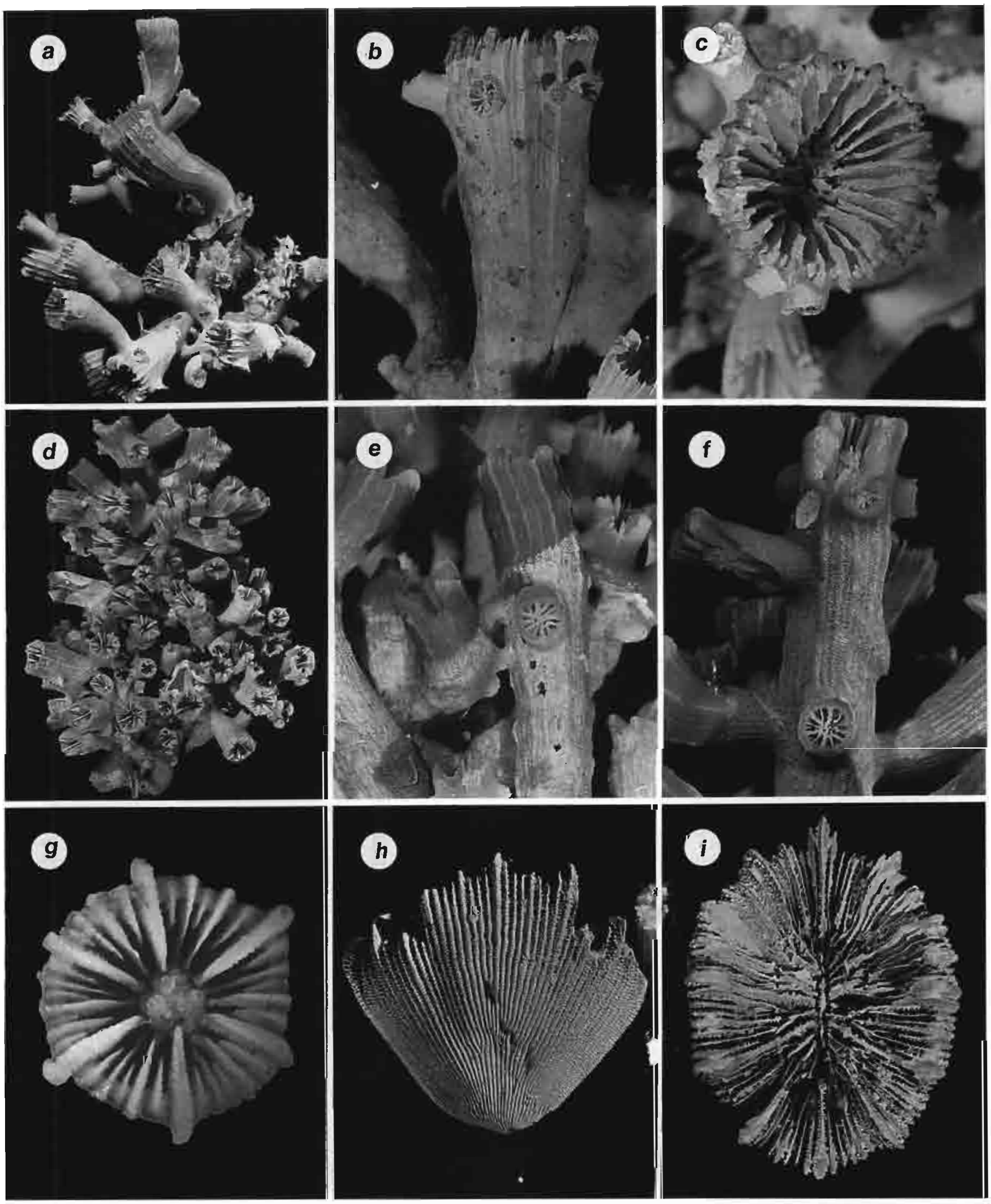

FIG. 19 a-c. — *Coenosmilia arbuscula* Pourtalès, 1874, *"Albatross"* stn 5543 (USNM 97312), colony, corallite with small buds, and calice, x 0.8, x 2.1, x 3.2, respectively.

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.

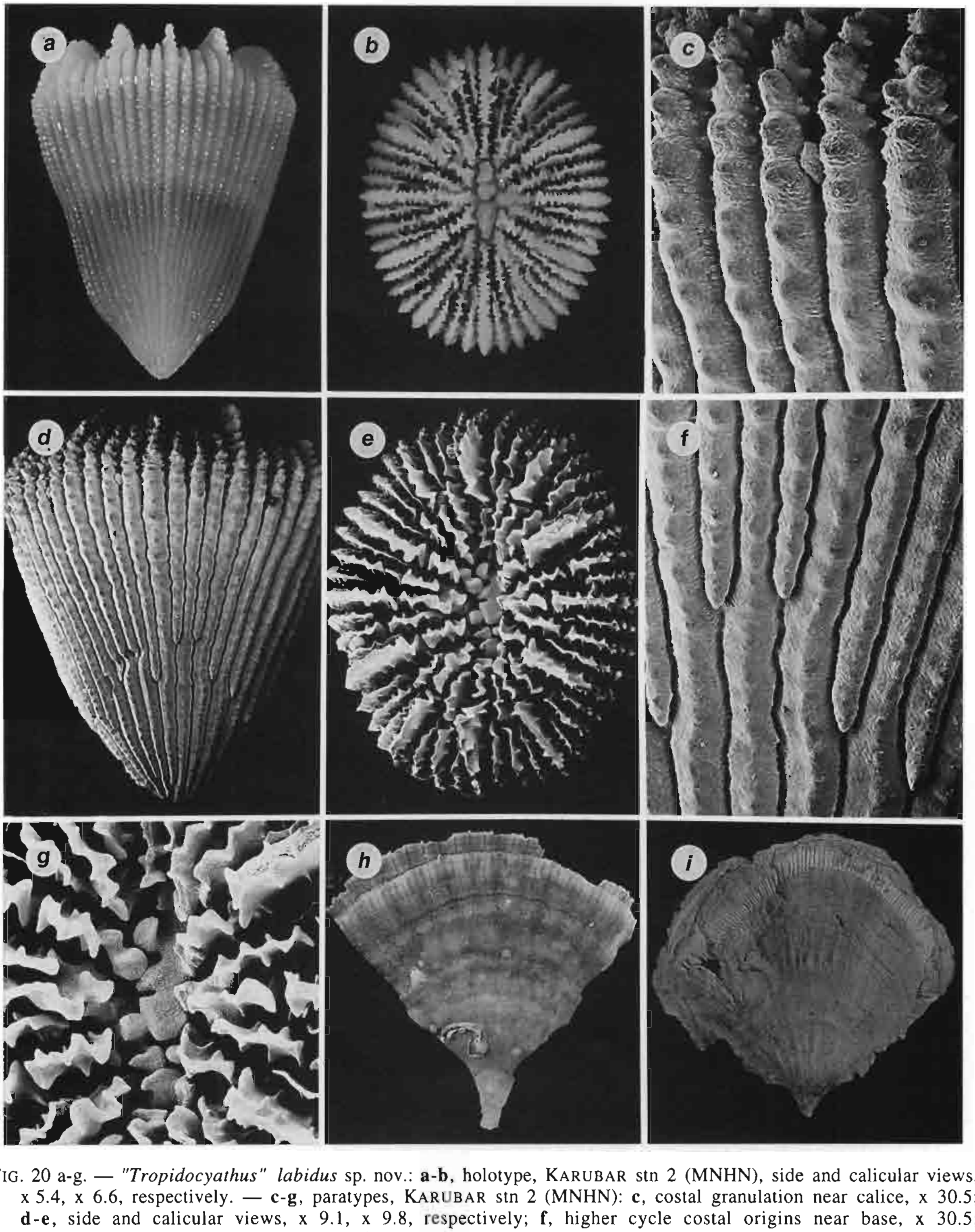

FIG. 20 a-g. — *"Tropidocyathus" labidus* sp. nov.: **a-b**, holotype, KARUBAR stn 2 (MNHN), side and calicular views, x 5.4, x 6.6, respectively. — **c-g**, paratypes, KARUBAR stn 2 (MNHN): **c**, costal granulation near calice, x 30.5; **d-e**, side and calicular views, x 9.1, x 9.8, respectively; **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.

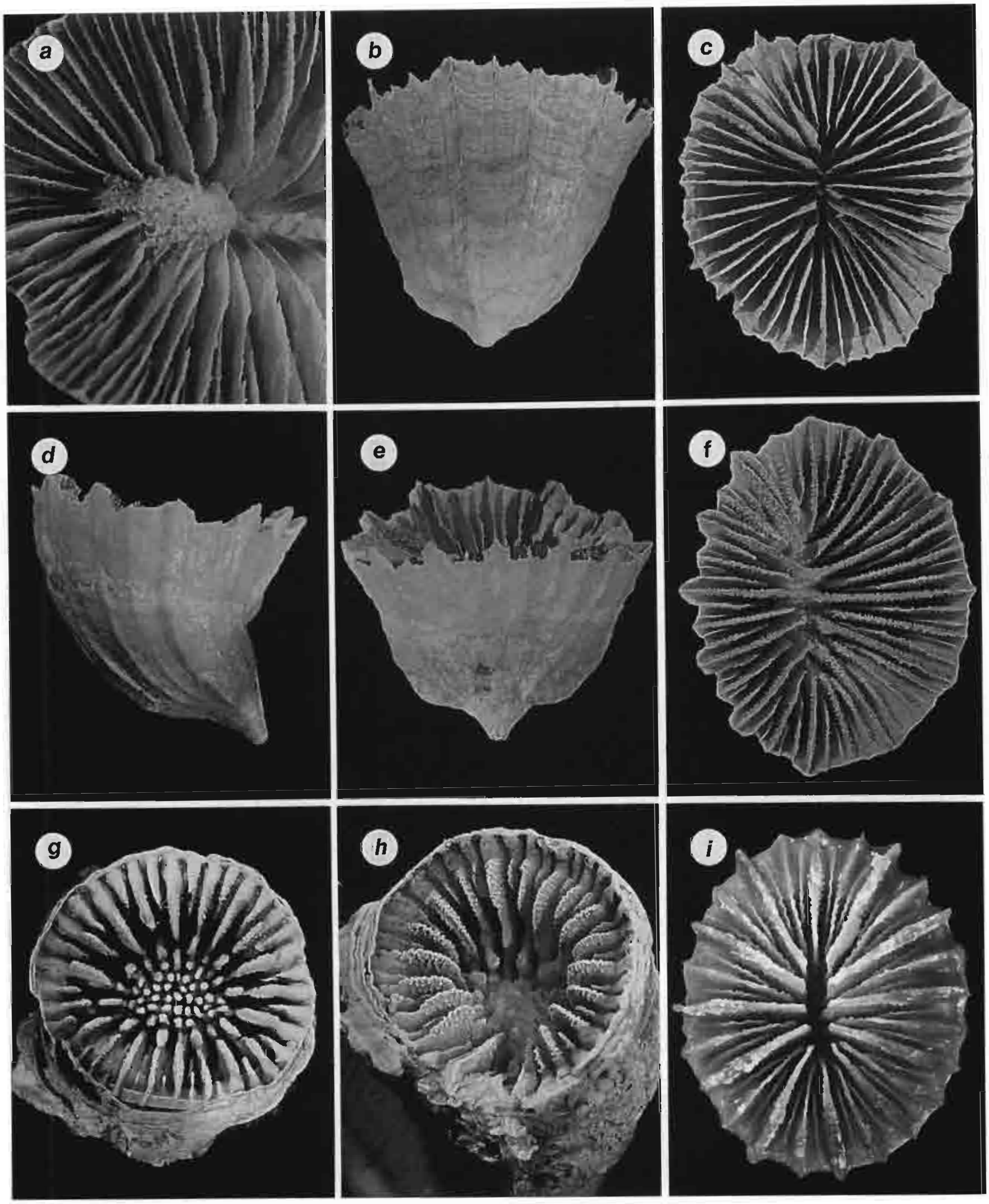

FIG. 21 a. — *Flabellum lamellulosum* Alcock, 1902, MUSORSTOM 1 stn 71 (MNHN), columellar gall of a petrarcid ascothoracidan crustacean, x 3.

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.

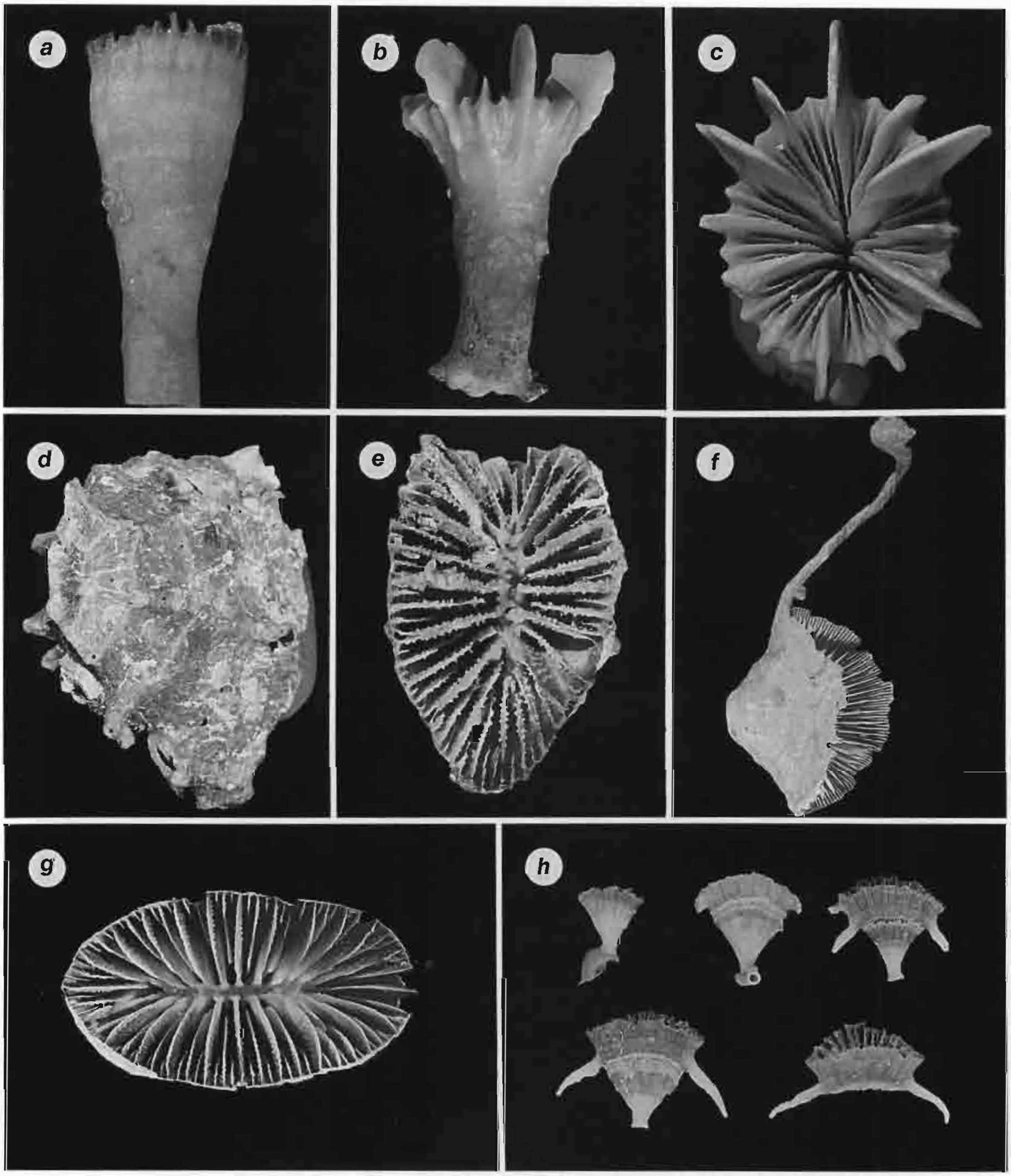

FIG. 22 a. — *Javania pachytheca* Cairns, 1995, *"Albatross"* stn 5634 (USNM 97486), side view, x 3.1.

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.

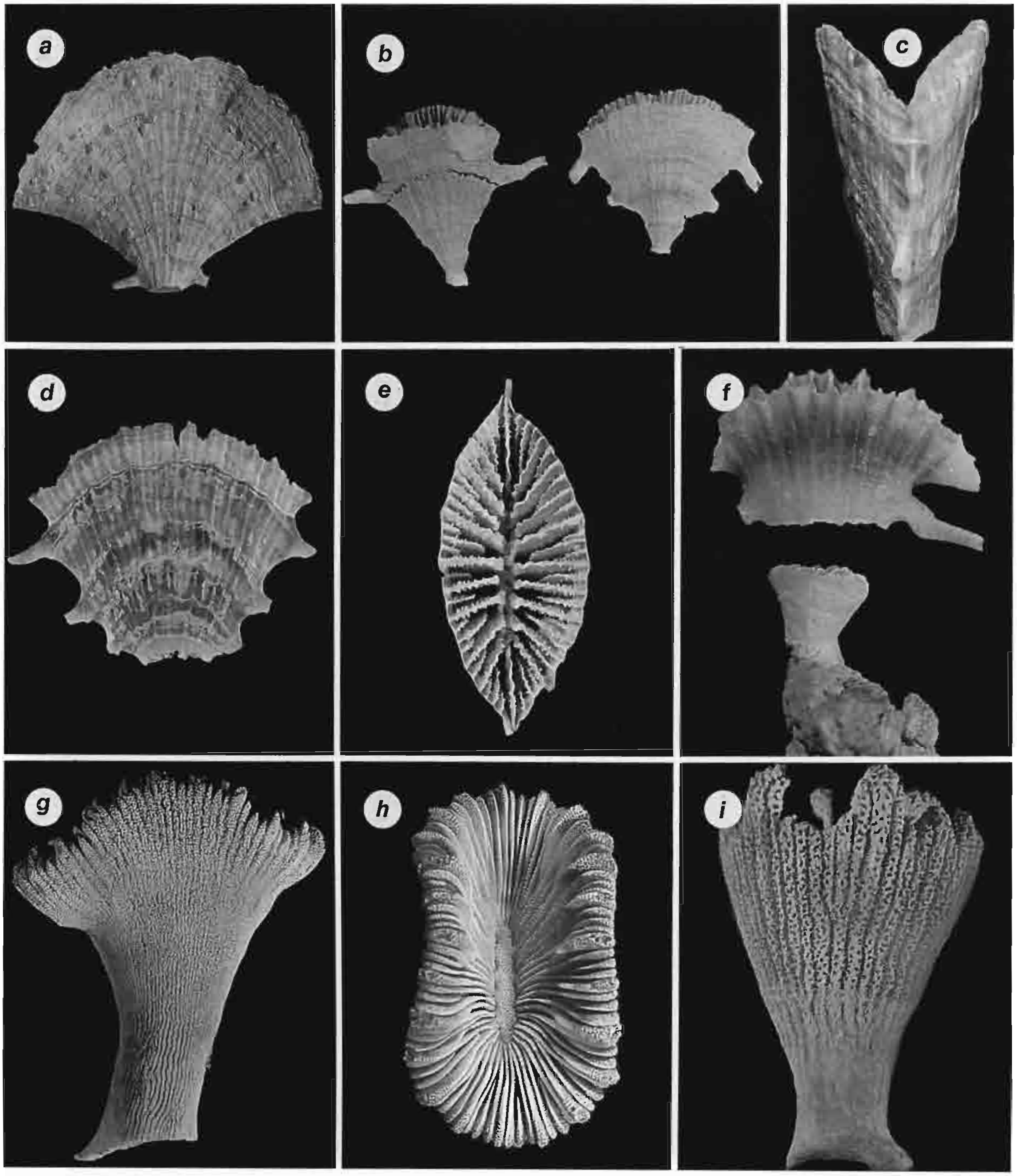

FIG. 23 a-b. — *Truncatoflabellum spheniscus* (Dana, 1846), *"Hakuho Maru"* stn KH72-1-30 (USNM 97501): **a**, side view, x 1.1; **b**, 2 anthocauli, one in process of dividing, x 1.8.

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.

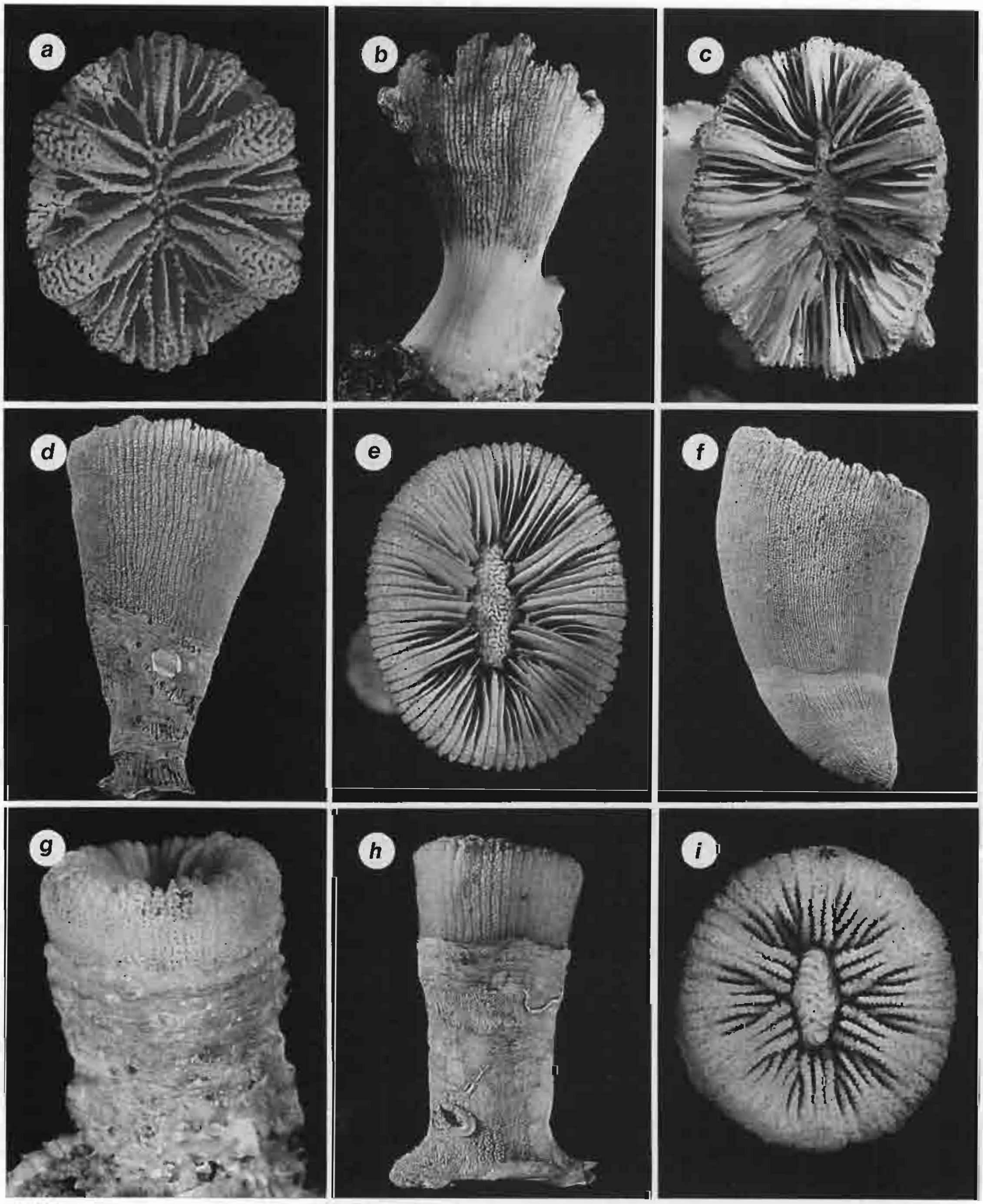

FIG. 24 a. — *Balanophyllia parvula* Moseley, 1881, KARUBAR stn 49 (MNHN), calice, x 4.7.

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.

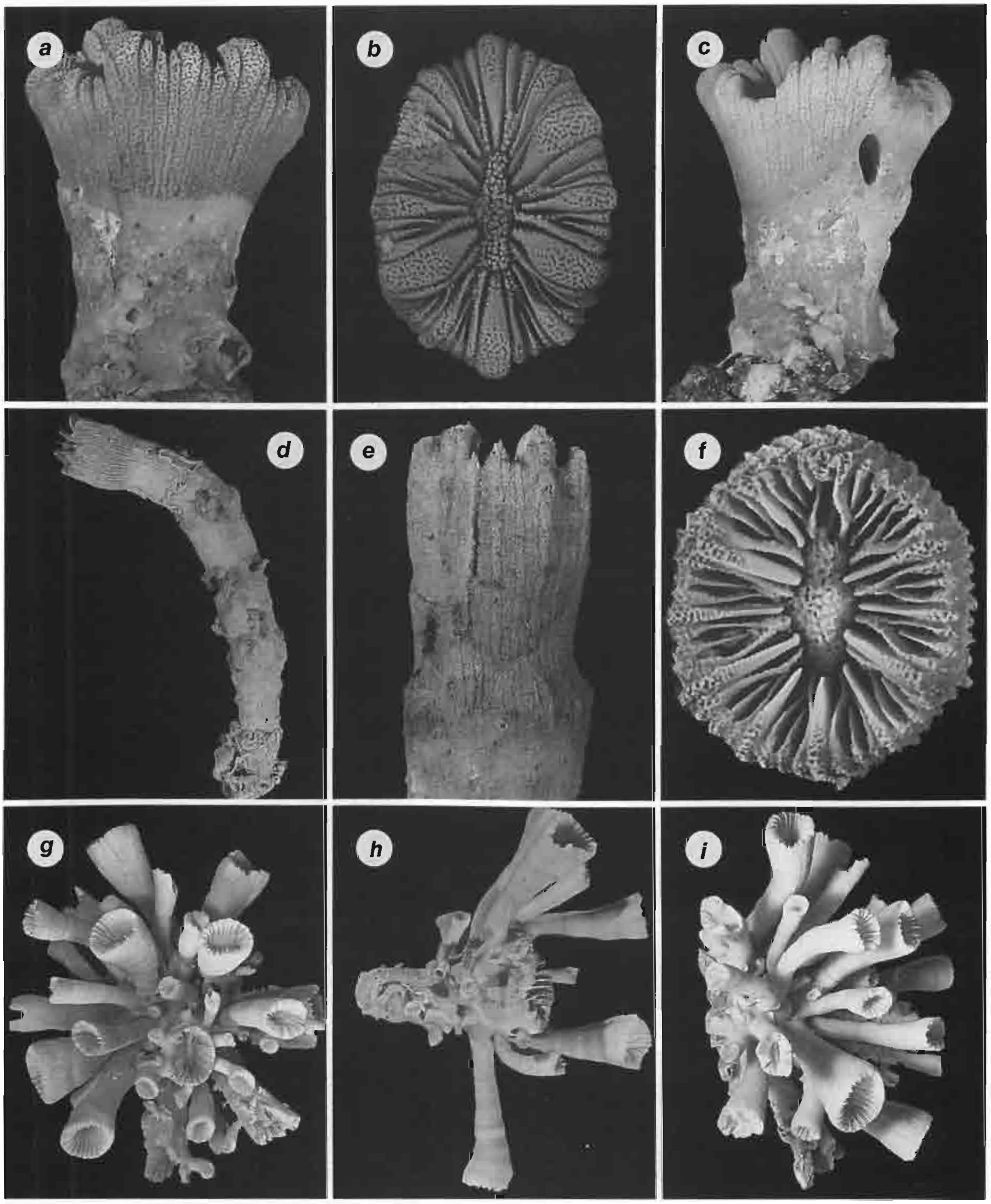

FIG. 25 a-c. — *Balanophyllia crassiseptum* sp. nov., holotype, KARUBAR stn 50 (MNHN): **a-b**, side and calicular views, x 3.2, x 3.8, respectively; **c**, other side showing boring of an acrothoracican cirripede, x 2.9.

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.

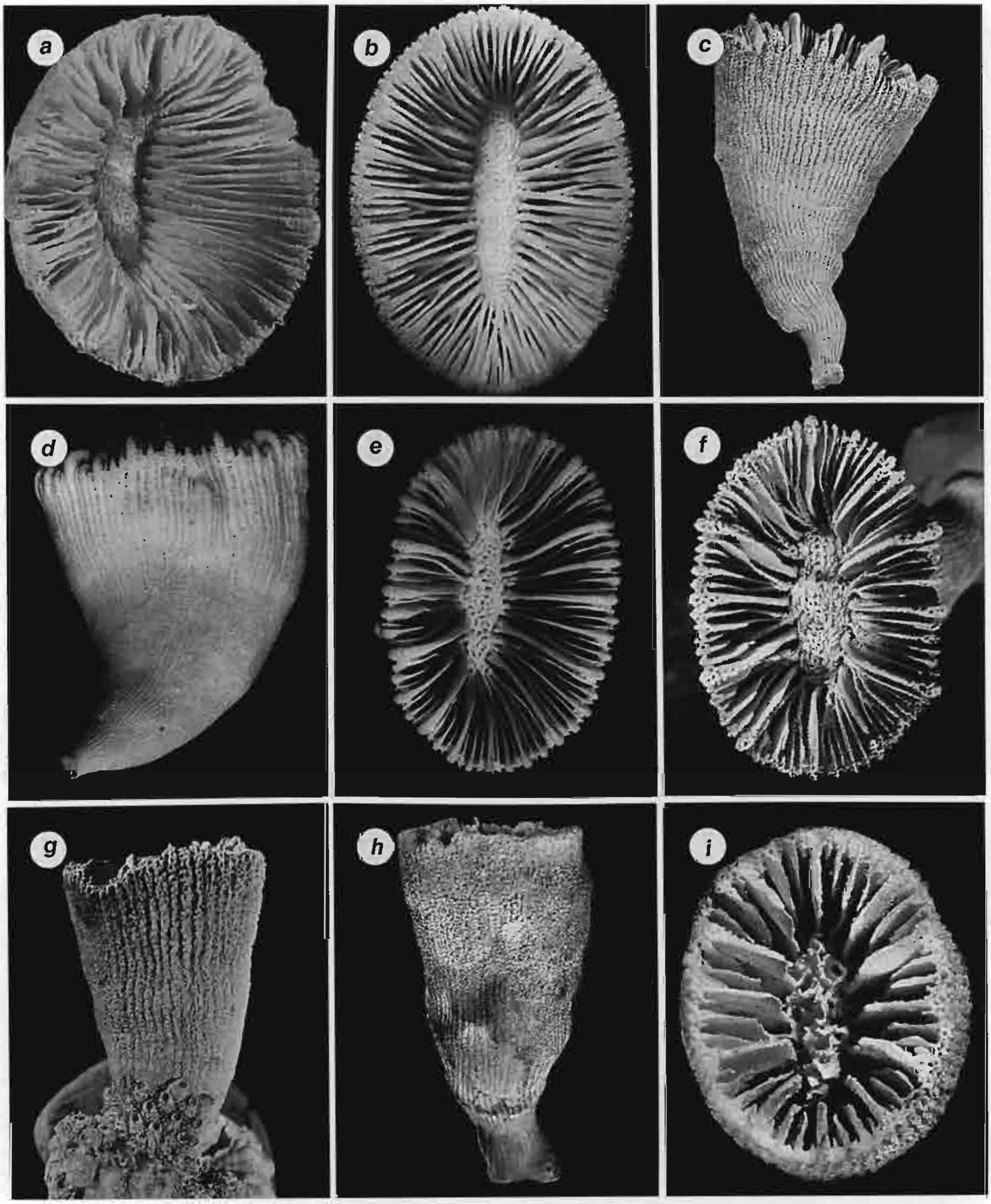

FIG. 26 a-b. — *Balanophyllia generatrix* sp. nov., paratype, *"Siboga"* stn 41 (ZMA Coel. 5538), 2 calicular views, both x 3.4.

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.

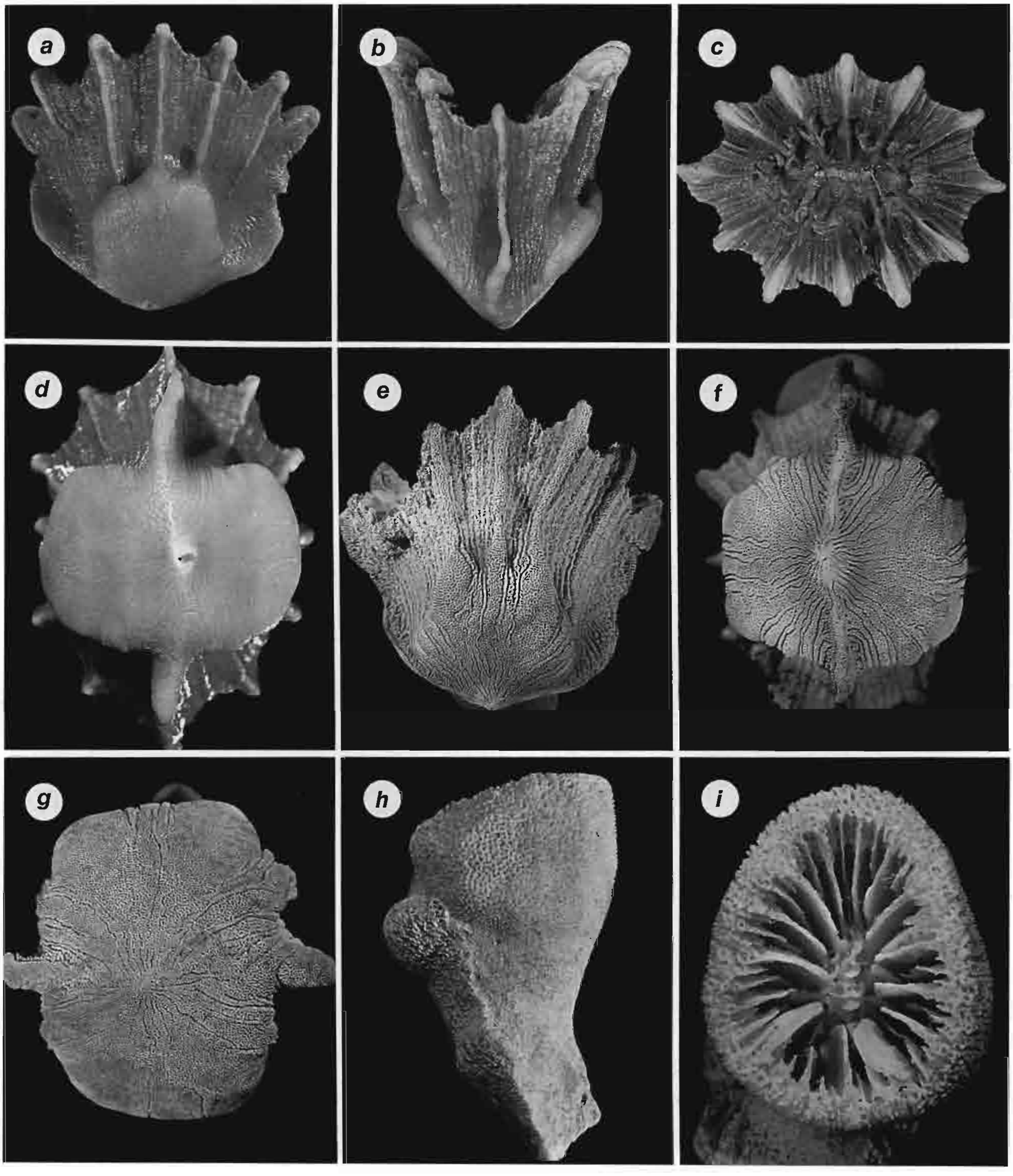

FIG. 27 a-g. — *Endopachys bulbosa* sp. nov.: **a-d**, holotype, KARUBAR stn 62 (MNHN), side, edge, calicular, and basal views, x 1.1, x 1.2, x 1.15, x 1.4, respectively; **e-g**, paratypes, KARUBAR stn 62 (MNHN): **e-g**, side and 2 basal views showing basal thickening and broad C_{1-2}, x 1.3, x 1.8, 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.

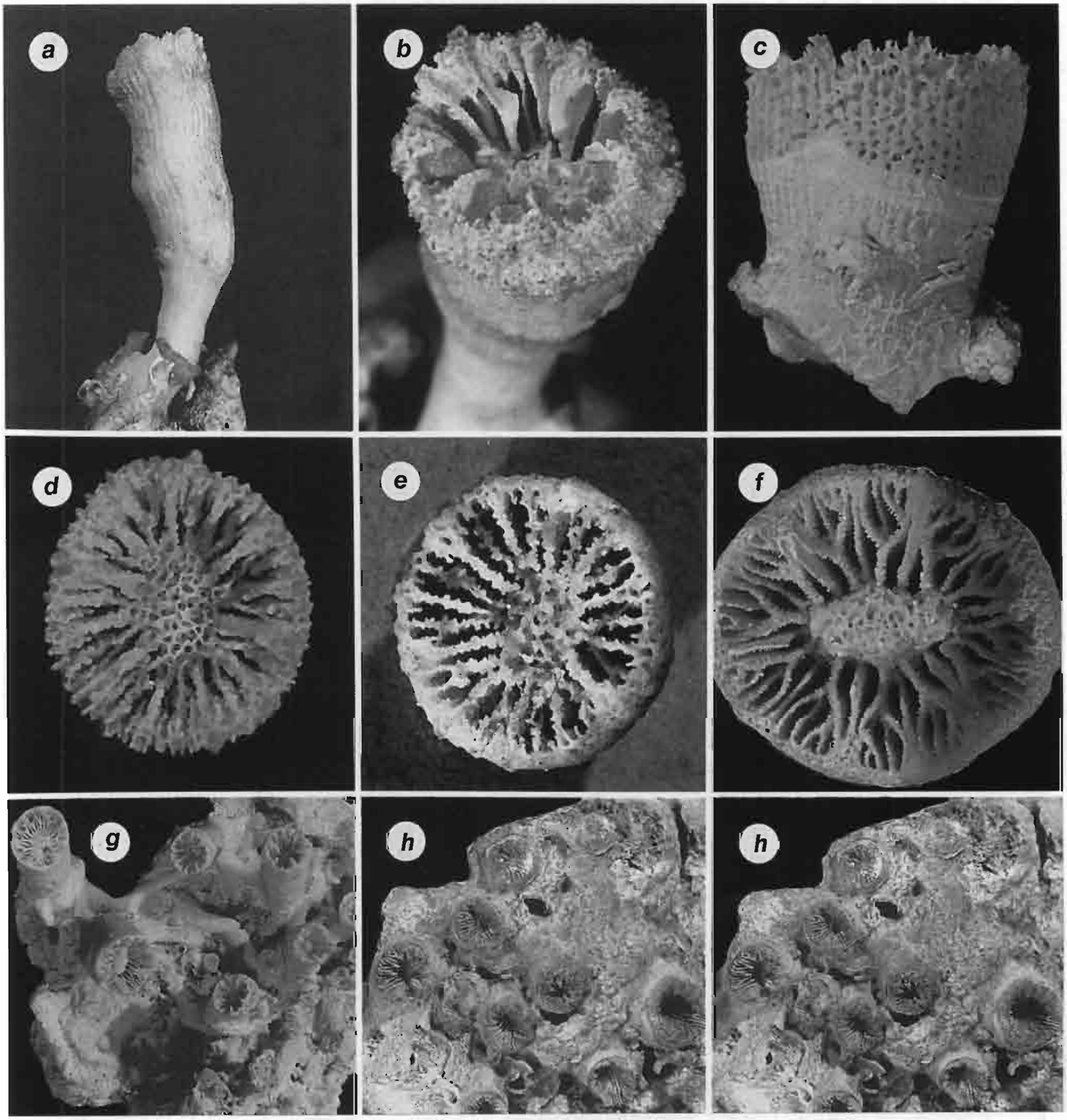

FIG. 28 a-b. — *Leptopsammia poculum* (Alcock, 1902), holotype, *"Siboga"* stn 260, side and calicular views, x 2.6, x 7, respectively.

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.

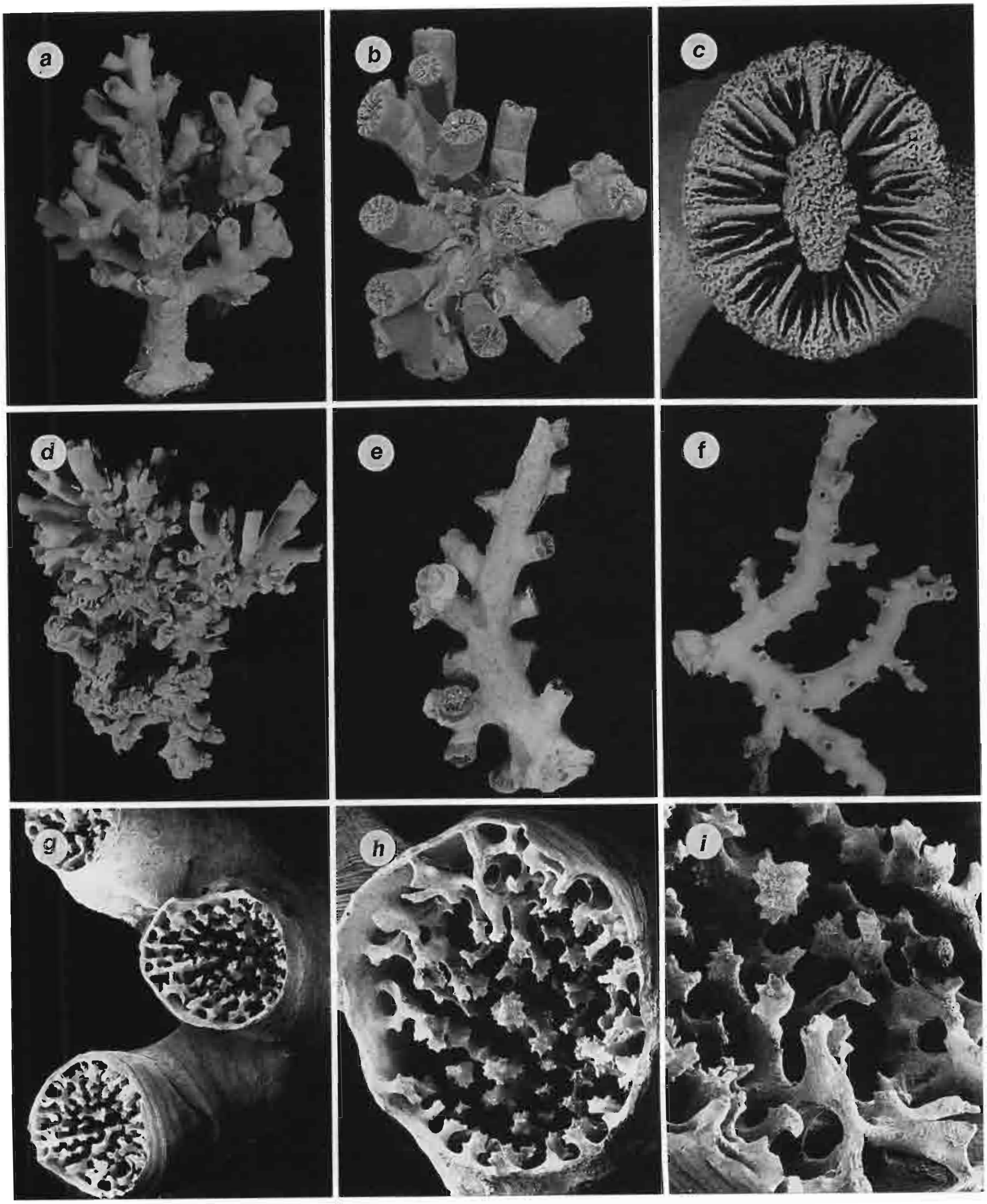

FIG. 29 a-c. — *Dendrophyllia arbuscula* van der Horst, 1922: **a**, syntype, *"Siboga"* stn 277 (ZMA Coel. 5477), x 0.75. — **b-c**, *"Albatross"* stn 5279 (USNM 97630), colony and calice, x 0.81, x 4.4, respectively.

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.

INDEX

Only the "SYSTEMATIC ACCOUNT" (p. 66-198) and the photographs (p. 209-237) are indexed.

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**.

Page numbers in **bold** refer to full taxonomic treatment; numbers in *italics* refer to illustrations.

3

Mollusca Bivalvia: Pectinoidea (Propeamussiidae and Pectinidae) from eastern Indonesia

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ABSTRACT

Thirty species of Pectinoidea are reported from off the Kai and Tanimbar Islands, Arafura Sea, at shelf to bathyal depths (111-1244 m). Of these, eight are new records for the Indonesian Archipelago and two are new species: *Parvamussium conspectum* sp. nov. (Propeamussiidae) and *Veprichlamys versipellis* sp. nov. (Pectinidae). On average, the bathymetric occurence of species is shallower in the study area than in the South-West Pacific. *Amussium margaritiferum* Dautzenberg & Bavay, 1912, is synonymized with *Propeamussium investigatoris* (E.A. Smith, 1906), and *Parvamussium crypticum* Hayami & Kase, 1993, is synonymized with *P. carbaseum* Dijkstra, 1991. Lectotypes are designated for five nominal taxa.

RÉSUMÉ

Mollusca Bivalvia : Pectinoidea (Propeamussiidae et Pectinidae) de l'Indonésie orientale.

Au cours de la campagne océanographique franco-indonésienne KARUBAR en mer d'Arafura, trente espèces de Pectinoidea ont été récoltées au voisinage des îles Kai et Tanimbar, sur le plateau et la pente continentals entre 111 m et 1244 m de profondeur. Sur ce total, huit sont signalées pour la première fois dans l'archipel indonésien et deux espèces nouvelles sont décrites : *Parvamussium conspectum* sp. nov. (Propeamussiidae) and *Veprichlamys versipellis* sp. nov. (Pectinidae). D'une manière générale, les espèces récoltées, déjà connues du Sud-Ouest Pacifique, ont été trouvées à des profondeurs moindres qu'ailleurs. *Amussium margaritiferum* Dautzenberg & Bavay, 1912, est mis en synonymie avec *Propeamussium investigatoris* (E.A. Smith, 1906), et *Parvamussium crypticum* Hayami & Kase, 1993, avec *P. carbaseum* Dijkstra, 1991. Des lectotypes sont désignés pour cinq espèces nominales.

DIJKSTRA, H. H. & KASTORO, W. W., 1997. — Mollusca Bivalvia: Pectinoidea (Propeamussiidae and Pectinidae) from eastern Indonesia. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 245-285. Paris ISBN: 2-85653-506-2.

INTRODUCTION

The fauna of the eastern seas of the Indonesian archipelago has remained little known to this date. The *Siboga* Expedition carried out nineteen stations (stns 250-268) near the Kai [= Kei] Islands in December 1899 (TYDEMAN, 1902: 14). At this occasion, seven species of Pectinoidea were collected in nearshore waters (DAUTZENBERG & BAVAY, 1912). Later, in 1922, during the Danish Expedition to the Kai Islands (MORTENSEN, 1923), Dr Th. MORTENSEN made 63 dredge and trawl hauls in sublittoral to bathyal depths. The Pectinoidea were never reported on, and this material (now in ZMUC) will be studied and treated elsewhere by the senior author. Finally, the Indonesian-Dutch SNELLIUS-II Expedition (1984-1985) did some sampling in the northwest of Banda Sea, but the investigations did not touch the Kai or Tanimbar Islands. The Pectinoidea of that expedition were described by DIJKSTRA (1991).

The present paper reports on the Propeamussiidae and Pectinidae collected during the Indonesian-French KARUBAR cruise. For a narrative of the cruise and complete station list, see CROSNIER, RICHER DE FORGES & BOUCHET (1997: this volume page 9). In addition, a few odd samples collected in 1980 during the CORINDON cruise in the strait of Makassar have also been considered. We follow the style and presentation of an earlier paper on deep-water Pectinoidea from the New Caledonia region (DIJKSTRA, 1995b), and extensive reference is made to that paper: lists of synonyms and references, diagnosis and descriptions are not repeated for species already discussed in the context of the New Caledonia fauna. The material is deposited in MNHN, Paris and POLIPI, Jakarta, with voucher specimens in the private collection of the senior author. Comparative material from Indonesia and type material was studied from various museum collections, namely AMS, BMNH, MNHN, RMNH, WAM, ZMA, ZMUC, ZSI.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS	Australian Museum, Sydney
BMNH	The Natural History Museum, London
HD	H.H. Dijkstra collection, Sneek
IGPS	Institute of Geology and Palaeontology, Sendai
IOAS	Institute of Oceanology, Academia Sinica, Qingdao
KBIN	Institut Royal des Sciences Naturelles de Belgique, Bruxelles
POLIPI	Puslitbang Oseanologi-LIPI [Research and Development Centre for Oceanology - Indonesian Institute of Sciences], Jakarta
MNHN	Muséum national d'Histoire naturelle, Paris
NMNZ	Museum of New Zealand *Te Papa Tongarewa*, Wellington
NMW	National Museum of Wales, Cardiff
NSMT	National Science Museum, Tokyo
RMNH	Nationaal Natuurhistorisch Museum, Leiden
UMUT	University Museum, University of Tokyo, Tokyo
USNM	National Museum of Natural History, Washington, DC
WAM	Western Australian Museum, Perth
ZMA	Zoölogisch Museum, Amsterdam
ZMUC	Zoologisk Museum, Copenhagen
ZSI	Zoological Survey of India, Calcutta.

Other abbreviations

OD	Original designation
SD	Subsequent designation

db	paired valves
lv	left valve(s)
rv	right valve(s)
v	valve(s)
spm(s)	live-taken specimen(s)
H	height of shell (dorsal-ventral)
L	length (width) of shell (anterior-posterior)
D	diameter of shell.

SYSTEMATIC ACCOUNT

Class BIVALVIA Linnaeus, 1758

Subclass PTERIOMORPHIA Beurlen, 1944 [emend., Boss, 1982]

Superorder EUPTERIOMORPHIA Boss, 1982

Order OSTREOIDA Waller, 1978

Suborder PECTININA Waller, 1978

Superfamily PECTINOIDEA Wilkes, 1810 [emend., Waller, 1978]

Family PROPEAMUSSIIDAE Abbott, 1954

Genus *PROPEAMUSSIUM* de Gregorio, 1884

Propeamussium alcocki (E.A. Smith, 1894)

Figs 1-4

Amussium alcocki E.A. Smith, 1894: 172, pl. 5, figs 15-16.
Propeamussium alcocki - DIJKSTRA, 1995b: 13, figs 1-4, 133-137 [references, description, discussion].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 13).
Indonesia. KARUBAR, *Tanimbar Islands*: stn CP 52, 08°03'S, 131°48'E, 1244-1266 m, 3 spms. — Stn CP 53, 08°18'S, 131°41'E, 1026-1053 m, 2 spms. — Stn CP 89, 08°39'S, 131°08'E, 1058-1084 m, 3 spms. — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 17 spms, 1 lv.

DISTRIBUTION. — Gulf of Aden, Laccadive Sea, Bay of Bengal, Coral Sea, New Caledonia, and Loyalty Islands (DIJKSTRA, 1995b: 13). Now the Arafura Sea. Present material alive in 891-1244 m.

Propeamussium caducum (E.A. Smith, 1885)

Figs 5-8

Amussium caducum E.A. Smith, 1885: 309, pl. 23, figs 1-1c.
Propeamussium caducum - DIJKSTRA, 1995b: 15, figs 9-10, 129-132 [synonymy, references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 17).
Indonesia. CORINDON, *Makassar Strait*: stn B 247, 00°55'S, 119°26'E, 520 m, 1 rv.
KARUBAR, *Kai Islands*: stn CP 35, 06°08'S, 132°45'E, 390-502 m, 1 lv. — Stn CP 39, 07°47'S, 132°26'E, 466-477 m, 17 spms.
Tanimbar Islands: stn CP 54, 08°21'S, 131°43'E, 836-869 m, 4 spms, 2 lv, 1 rv. — Stn CC 56, 08°16'S, 131°59'E, 549-552 m, 29 spms. — Stn CC 57, 08°19'S, 131°53'E, 603-620 m, 6 spms. — Stn CC 58, 08°19'S, 132°02'E, 457-

461 m, 3 spms, 3 lv, 4 rv. — Stn CP 71, 08°38'S, 131°44'E, 477-480 m, >50 spms, 7 lv, 3 rv. — Stn CP 72, 08°36'S, 131°33'E, 676-699 m, >50 spms, 7 lv, 4 rv. — Stn CP 73, 08°29'S, 131°33'E, 840-855 m, 2 spms. — Stn CP 75, 08°46'S, 131°36'E, 451-452 m, 17 spms, 3 lv, 1 rv.

DISTRIBUTION. — Japan, Philippines, Indonesia (DAUTZENBERG & BAVAY, 1912, THIELE & JAECKEL, 1931, DIJKSTRA, 1991), Bay of Bengal, Arabian Sea, Gulf of Aden, Tanzania, New Caledonia. Present material alive in 452-840 m.

REMARKS. — The present specimens are similar to the type material, but the growth lines are weaker, there are no radial striae on the left valve, internal ribs number 9 (instead of 10 in the type material), and the colour is cream instead of whitish transparent.

Propeamussium ina (Dautzenberg & Bavay, 1912)

Figs 9-10

Amussium ina Dautzenberg & Bavay, 1912: 32, pl. 28, figs 18-21.
Propeamussium (Parvamussium) ina - DIJKSTRA, 1990: 9, 10.
Parvamussium ina - ROMBOUTS, 1991: 68.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. CORINDON, *Makassar Strait*: stn B 268, 01°57'S, 119°16'E, 200 m, 2 lv.
KARUBAR, *Kai Islands*: stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 rv (see Remarks).

TYPE MATERIAL. — Lectotype (H 14, L 14, D 6.5 mm) ZMA Moll. 3.12.011, here designated, live taken. Two paralectotypes: ZMA Moll. 3.12.012. DIJKSTRA (1990: 10) noticed the existence of three complete specimens in ZMA, instead of 4 valves mentioned by DAUTZENBERG & BAVAY (1912: 32). BAVAY's manuscript in KBIN mentions these specimens.

TYPE LOCALITY. — *"Siboga"*, stn 312, 08°19'S, 117°41'E, Saleh Bay, North coast of Sumbawa, Indonesia, 274 m.

DISTRIBUTION. — Indonesia, shells in 200-288 m, live record in 274 m.

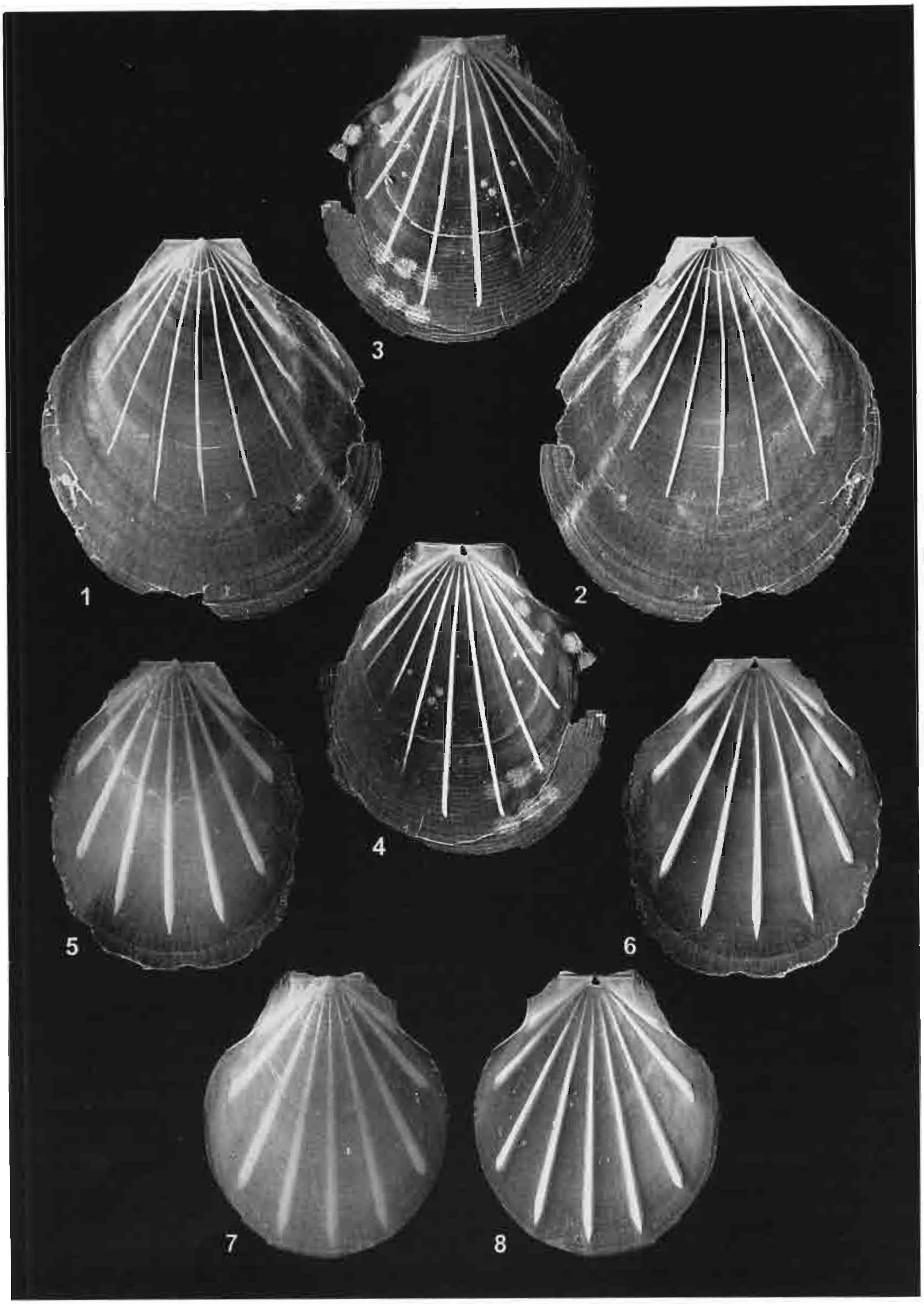
DESCRIPTION. — *Shell* small, up to *ca.* 14 mm high, fragile, transparent, slightly orbicular, equivalve, inequilateral, slightly convex, auricles unequal, umbonal angle *ca.* 105°. *Prodissoconch ca.* 200 µm in height. *Both valves* smooth, fine concentric striae on right valve. Auricles unequal with some more striae. Marginal apron very fragile and mostly broken off. Internal ribs 6 and 2 small auricular ribs. Hinge line straight. Resilifer triangular. No byssal fasciole, no byssal notch. Ctenolium absent. Colour pale brown with numerous small reddish maculations on left valve, right valve paler without maculations, visible internal ribs whitish.

REMARKS. — The present specimen from the Kai Island is somewhat similar to the type material of *P. ina*, although more elongate (umbonal angle *ca.* 90°) and whitish transparent. *P. steindachneri* (Sturany, 1901), from the northeastern Indian Ocean and the Red Sea, differs somewhat by having a more elongate shape and its colour with larger reddish maculations and small whitish streaks. *P. rubrotinctum* (Oyama, 1951) from southern Japan to New Caledonia differs from *P. ina* by having more numerous internal ribs (commonly 10) and the maculations are somewhat larger.

Propeamussium investigatoris (E.A. Smith, 1906)

Figs 11-15

Amussium investigatoris E.A. Smith, 1906: 255.
Amussium margaritiferum Dautzenberg & Bavay, 1912: 36, pl. 27, figs 15-18. Syn. nov.



FIGS 1-4. — *Propeamussium alcocki* (E.A. Smith, 1894), KARUBAR, stn CP 91, 30.8 x 27.8 mm (db): **1**, left valve, exterior; **2**, left valve, interior; **3**, right valve, exterior; **4**, right valve, interior.

FIGS 5-8. — *P. caducum* (E.A. Smith, 1885), KARUBAR, stn CC 56, 17.0 x 13.9 mm (db): **5**, left valve, exterior; **6**, left valve, interior; **7**, right valve, exterior; **8**, right valve, interior.

MATERIAL EXAMINED. — The type material (see below).

Indonesia. KARUBAR, *Kai Islands*: stn CP 09, 05°23'S, 132°29'E, 368-389 m, 10 spms, 4 lv. — Stn CC 10, 05°21'S, 132°30'E, 329-389 m, 1 spm. — Stn CP 12, 05°23'S, 132°37'E, 413-436 m, 6 spms, 1 lv. — Stn DW 13, 05°26'S, 132°38'E, 417-425 m, 4 spms, 3 lv, 5 rv. — Stn CP 17, 05°15'S, 133°01'E, 439-459 m, 7 spms. — Stn CP 39, 07°47'S, 132°26'E, 466-477 m, 13 spms.

Tanimbar Islands: stn CP 65, 09°14'S, 132°27'E, 174-176 m, >50 spms. — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 46 spms, 3 lv, 2 rv. — Stn CP 77, 08°57'S, 131°27'E, 346-352 m, 23 spms, 1 lv. — Stn CP 78, 09°06'S, 131°24'E, 284-295 m, 4 spms, 1 lv.

TYPE MATERIAL. — *Amussium investigatoris*: lectotype (H 25.0, L 23.0, D 4.5 mm) ZSI M835/1, here designated, live taken. Three paralectotypes: ZSI M836-838/1 and two paralectotypes: BMNH 1906.10.12.99-100. Although the largest syntype (H 26.0, L 25.1, D 5.4 mm) is preserved at the BMNH, and closest to SMITH' s measurements, a syntype from the ZSI is selected as lectotype in accordance with SMITH (1894: 158). The type specimens are extremely fragile and the marginal apron often broken off. — *A. margaritiferum*: holotype ZMA Moll. 3.12.021.

TYPE LOCALITY. — *A. investigatoris*: *"Investigator"*, stn 248, 08°37'N, 75°37'E, W of Travancore, 410-519 m. — *A. margaritiferum*: *"Siboga"*, stn 137, 0°23.8'N, 127°29'E, channel between Makjan and Halmaheira, Moluccas, 472 m.

DISTRIBUTION. — Northern Indian Ocean and eastern Indonesia. Present material alive in 176-466 m.

DESCRIPTION. — *Shell* relative small, fragile and semi-transparent, up to *ca.* 25 mm high, suborbicular, equilateral, inequivalve, slightly convex, left valve somewhat more so than right, auricles equal, umbonal angle *ca.* 100-110°. *Prodissoconch ca.* 220 µm. *Left valve* sculptured with many irregularly spaced radial riblets, which are squamous near ventral margin. Latticed microsculpture only in early growth stage (*ca.* 10 mm in height). Anterior and posterior auricle with *ca.* 7-10 fine squamous radial riblets, weaker on right valve. *Right valve* sculptured with fine regularly spaced concentric lamellae. Internal riblets 10 with 2 auricular riblets, and a few (2-4) intercostal rudimentary riblets near the periphery. Hinge line straight. Resilifer triangular. No byssal fasciole, or byssal notch, no ctenolium. Colour of left valve orange-tinted, of right whitish.

REMARKS. — The present specimens correspond very well with the type material of *P. investigatoris*, although the latticed sculpture is somewhat less developed. *P. jeffreysii* (E.A. Smith, 1885), from the Philippines, differs by having a finer and more irregularly spaced radial sculpture, developed into concentric lamellae near the periphery of the left valve. *P. maorium* (Dell, 1956), from the SW Pacific, differs by having a smooth surface, lacking the latticed microsculpture, in early growth stage, and a finer radial sculpture on the left valve.

Propeamussium rubrotinctum (Oyama, 1951)

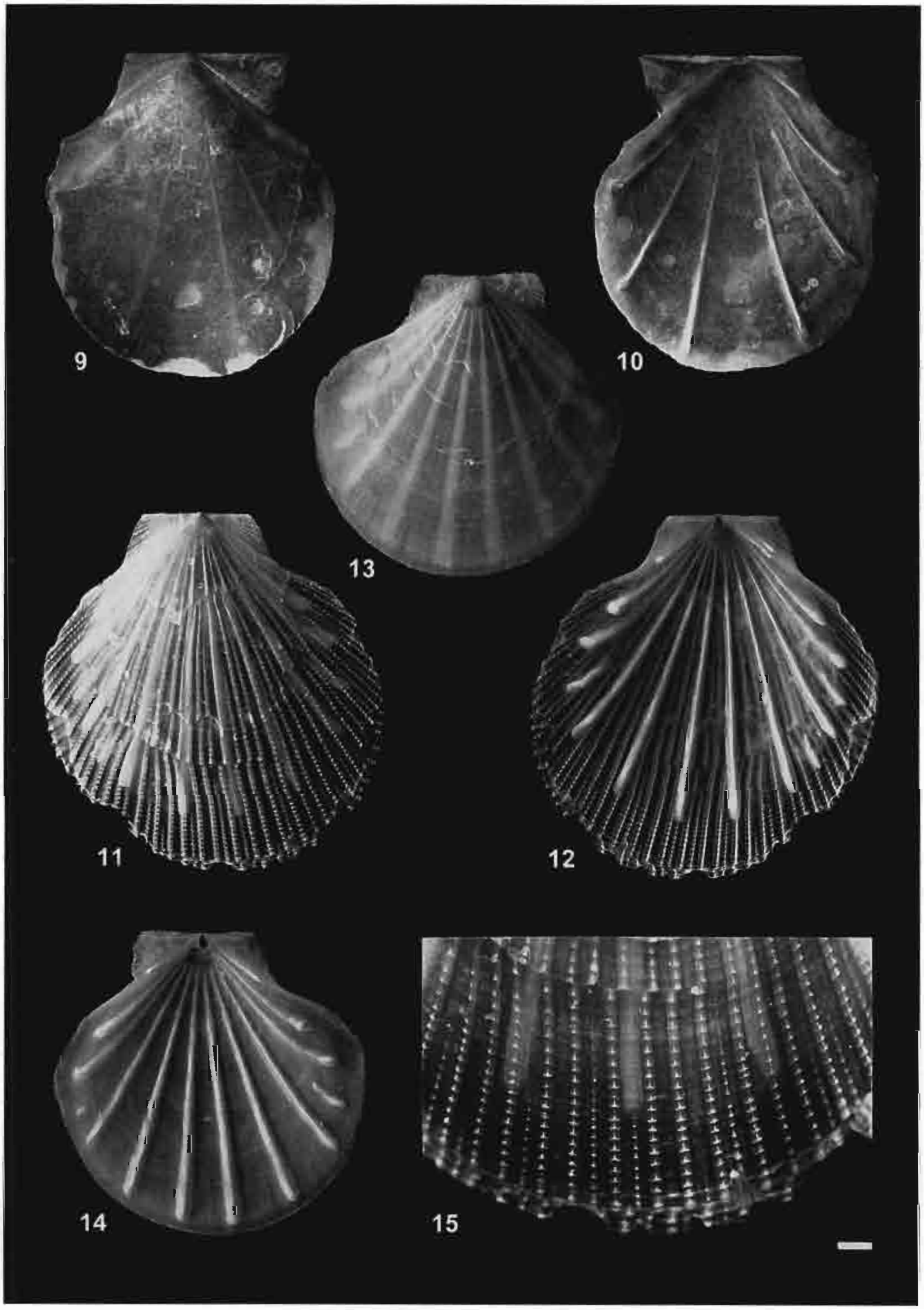
Figs 16-19

Parvamussium (Parvamussium) rubrotinctum Oyama, 1951: 81, pl. 13, figs 8-10.
Propeamussium rubrotinctum - DIJKSTRA, 1995b: 21, figs 23-26 [synonymy, reference, description].

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 32, 05°47'S, 132°38'E, 307-311 m, 1 lv. — Stn CP 36, 06°05'S, 132°44'E, 210-268 m, 11 spms, 1 lv.

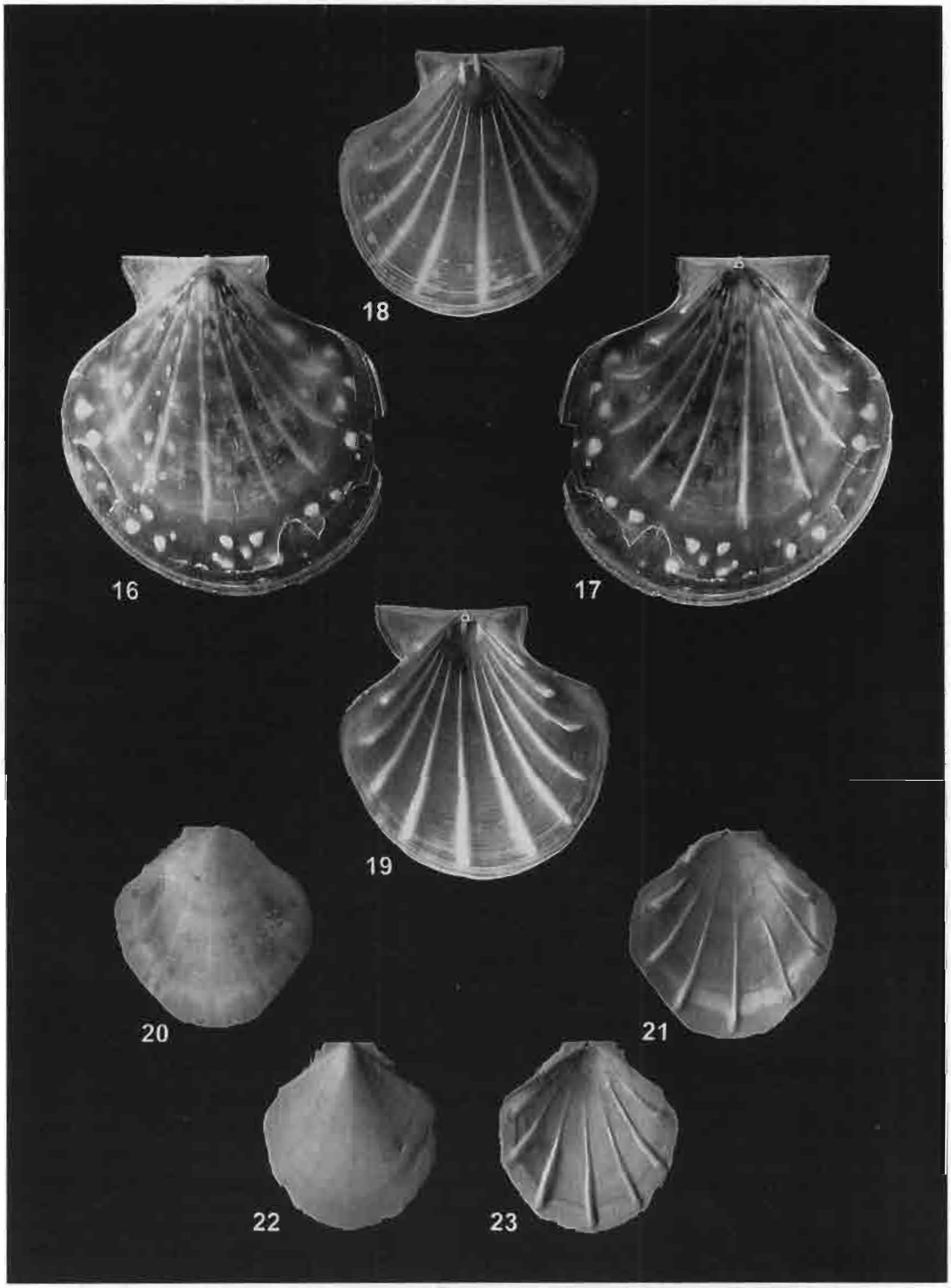
DISTRIBUTION. — Japan, South China Sea, New Caledonia, and the Loyalty Islands (DIJKSTRA, 1995b: 21); new record for Indonesia. Present material alive in 210-268 m.

REMARKS. — The present specimens are similar to OYAMA's description, but the figured specimen is somewhat more orbicular and has intercalated rudimentary riblets. OYAMA reported other specimens lacking intercalated riblets, just as in the present material.



FIGS 9-10. — *Propeamussium* sp. cf. *ina* (Dautzenberg & Bavay, 1912), KARUBAR, stn DW 31, 10.0 x 9.2 mm (rv) : **9**, right valve, exterior; **10**, right valve, interior.

FIGS 11-15. — *P. investigatoris* (E.A. Smith, 1906), KARUBAR, stn CP 09, 24.8 x 23.4 mm (db): **11**, left valve, exterior; **12**, left valve, interior; **13**, right valve, exterior; **14**, right valve, interior; **15**, left valve, exterior, ventral marginal detail, scale bar 1 mm.



FIGS 16-19. — *Propeamussium rubrotinctum* (Oyama, 1951), KARUBAR, stn CP 36, 17.9 x 17.0 mm (db): **16**, left valve, exterior; **17**, left valve, interior; **18**, right valve, exterior; **19**, right valve, interior.

FIGS 20-23. — *P. siratama* (Oyama, 1951), KARUBAR, stn DW 13, 12.1 x 12.0 mm (lv), 11.3 x 10.9 (rv): **20**, left valve, exterior; **21**, left valve, interior; **22**, right valve, exterior; **23**, right valve, interior.

Propeamussium sibogai (Dautzenberg & Bavay, 1904)

Figs 24-29

Amussium sibogai Dautzenberg & Bavay, 1904: 207, figs 1-4.
Propeamussium sibogai - DIJKSTRA, 1995b: 23, figs 19-22 [synonymy, references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 23).
Indonesia. KARUBAR, *Kai Islands*: stn DW 07, 05°46'S, 132°21'E, 283-285 m, 1 rv (fragment). — Stn CP 36, 06°05'S, 132°44'E, 210-268 m, 5 spms.

DISTRIBUTION. — South Africa, Japan, Philippines, Indonesia, NW Australia, New Caledonia, Loyalty Islands (DIJKSTRA, 1995b: 23). Present material alive in 210-268 m.

REMARKS. — The present material is very similar to the holotype from the Bali Sea. *P. watsoni* (E.A. Smith, 1894) differs by having a fine radiating sculpture in early growth stage and fine, closely spaced concentric lamellae on the left valve, more numerous (10-14) and not so broad internal ribs. *P. alcocki* (E.A. Smith, 1894) differs by having a more oval shape, a more fragile shell, and 11-12 narrower internal ribs. *P. andamanicum* (E.A. Smith, 1894) differs in its more oval shape, and its 9-10 shorter and narrower internal ribs. *P. sewelli* (Knudsen, 1967), from eastern Africa, differs by having a fine radiating and concentric sculpture on the left valve, and 11 narrower internal ribs. All these species are whitish transparent.

Propeamussium siratama (Oyama, 1951)

Figs 20-23

Ctenamusium (Micramussium) siratama Oyama, 1951: 80, pl. 13, figs 5-7.
Propeamussium (Propeamussium) siratama - DIJKSTRA, 1990: 2, pl. 1, figs 3-4.
Parvamussium siratama - ROMBOUTS, 1991: 70.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 09, 05°46'S, 132°21'E, 283-285 m, 2 spms. — Stn DW 13, 05°26'S, 132°38'E, 417-425 m, 2 lv, 5 rv. — Stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 lv.

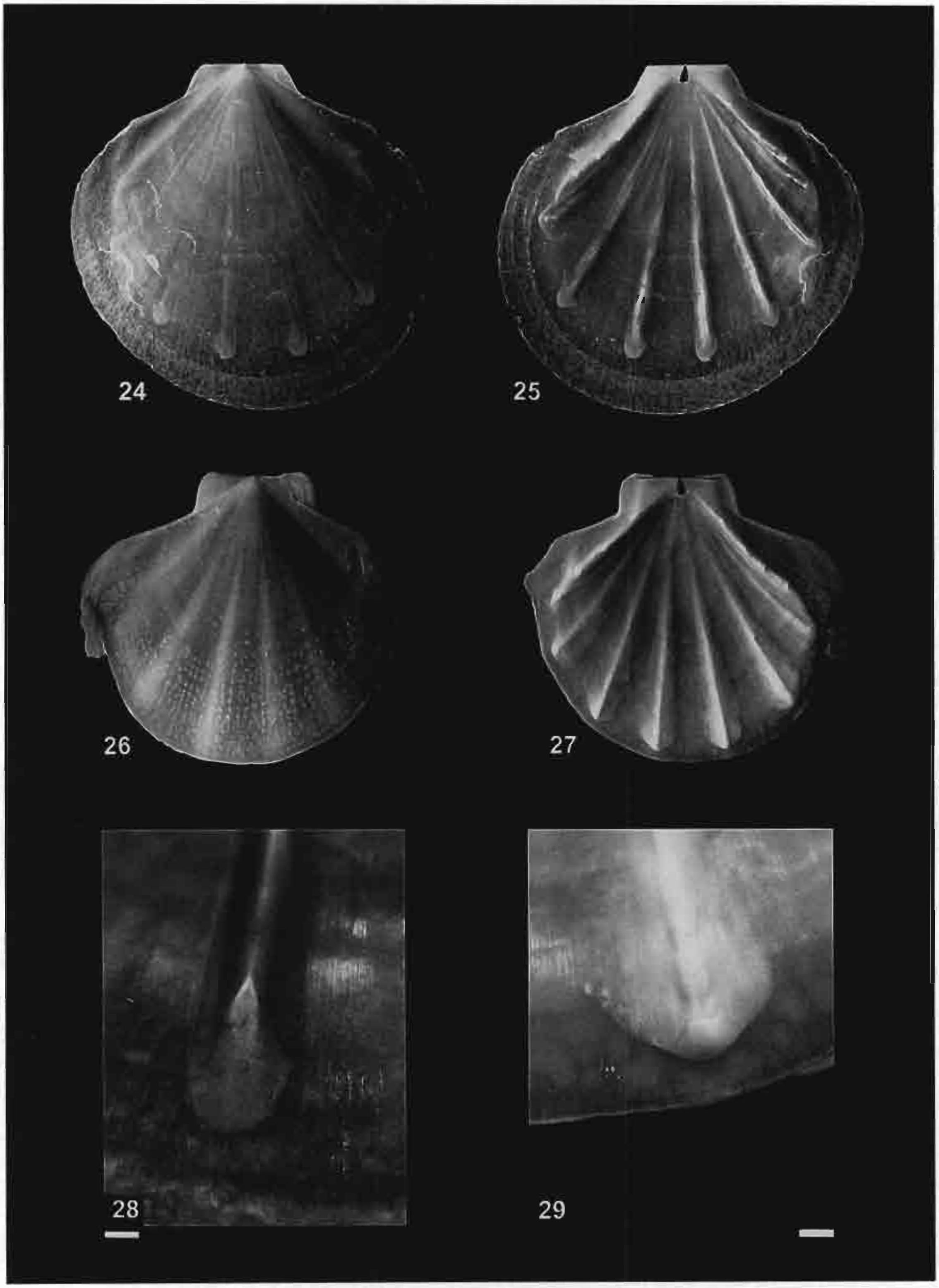
TYPE MATERIAL. — Holotype (H 7.4, L 7.5, D 2.8 mm) possible in the OYAMA collection at Toba Aquarium, Japan [not seen].

TYPE LOCALITY. — Off Manazuruzaki, Sagami Sea, Japan, 234-291 m.

DISTRIBUTION. — Western Pacific from Japan to Indonesia, 234-467 m; present specimens alive in 283-285 m.

DESCRIPTION. — *Shell* small, up to *ca.* 12 mm high, fragile, orbicular, nearly equivalve, equilateral, slightly convex, auricles equal, umbonal angle 110-115°. *Prodissoconch ca.* 200 µm in height. *Left valve* sculptured with fine, irregularly spaced radial lirae from early growth stage until beyond central part of disc, with microscopic regularly spaced concentric lamellae, smooth central part and periphery. Auricles frequently smooth, sometimes with fine concentric lirae. *Right valve* sculptured with fine, regularly spaced concentric lirae, more prominent near ventral margin. Inner surface with 9-10 ribs, sometimes with one rudimentary intercostal one. Hinge line straight. No byssal fasciole, or byssal notch. Ctenolium absent. Colour whitish or pale-brown transparent.

REMARKS. — The present specimens fit the original description, but they reach a larger size, have fewer (9) internal ribs and lack the very fine concentric lamellae on the left valve. A somewhat similar species is *P. malpelonium* (Dall, 1908), from tropical eastern Pacific off Colombia, which differs by a coarser and more developed microsculpture on the left valve, and more numerous (11) internal ribs. *P. malpelonium* is only recorded from abyssal depths, 2690-4505 m (GRAU, 1959: 14).



FIGS 24-29. — *Propeamussium sibogai* (Dautzenberg & Bavay, 1904), KARUBAR, stn CP 36, 49.1 x 52.1 mm (db) : **24**, left valve, exterior; **25**, left valve, interior; **26**, right valve, exterior; **27**, right valve, interior; **28**, left valve, detail internal costa, scale bar 1 mm; **29**, right valve, detail internal costa, scale bar 1 mm.

Genus *PARVAMUSSIUM* Sacco, 1897

Parvamussium araneum Dijkstra, 1991

Figs 30-38

Parvamussium araneum Dijkstra, 1991: 8, figs 3-10.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 5 lv, 2 rv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 rv. — Stn CP 34, 06°09'S, 132°41'E, 435-445 m, 2 lv.
Tanimbar Islands: stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 lv, 1 rv.

TYPE MATERIAL. — Holotype RMNH 56531, live taken.

TYPE LOCALITY. — SNELLIUS-II, stn 4.060, 9°51.8'S, 120°46.4'E, NE coast of Sumba, E of Melolo, 240 m.

DISTRIBUTION. — Indonesia, shells in 155-435 m, alive in 240-300 m.

REMARKS. — The present specimens are alike the type material, but on the left valve the commarginal lamellae are more irregularly spaced.

Parvamussium carbaseum Dijkstra, 1991

Figs 39-43

Parvamussium carbaseum Dijkstra, 1991: 9, figs 11-21.
Parvamussium sp. Kase & Hayami, 1992: 448. — HAYAMI & KASE, 1993: 3, fig. 5.
Parvamussium crypticum Hayami & Kase, 1993: 54, figs 173-181. Syn. nov.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 29, 05°36'S, 132°56'E, 181-184 m, 2 rv.

TYPE MATERIAL. — *Parvamussium carbaseum*: holotype RMNH 56534. — *P. crypticum*: holotype UMUT RM 19451a.

TYPE LOCALITY. — *Parvamussium carbaseum*: SNELLIUS-II, stn 4.031, 5°54'S, 123°58.4'E, Tukang Besi Islands, Banda Sea, Indonesia, 390 m. — *P. crypticum*: "Shodokutsu" (= small cave) of Ie Islet, 26°42.9'N, 127°50.1'E, Okinawa, Ryukyu Islands, Japan, alive, 7-20 m.

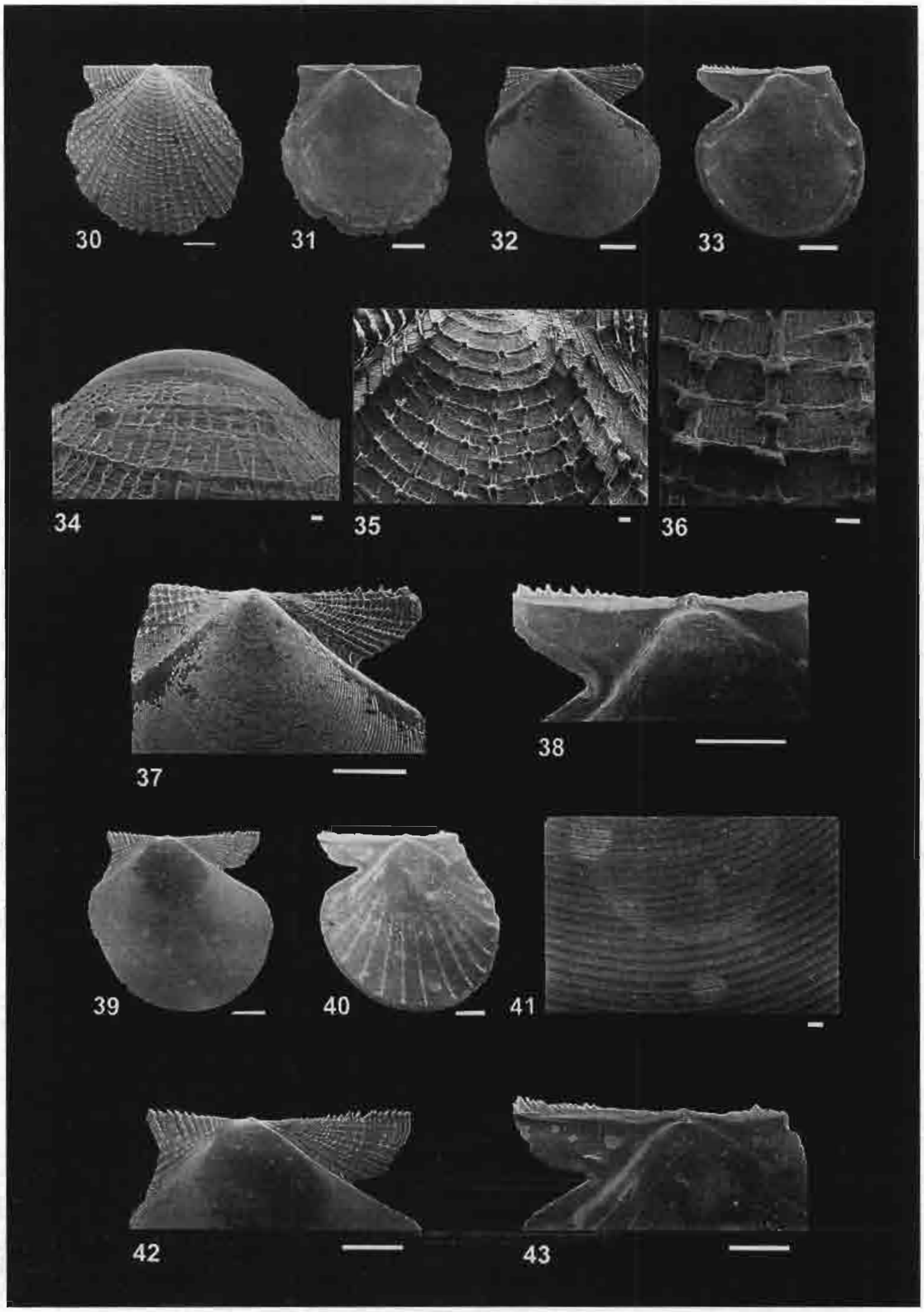
DISTRIBUTION. — Okinawa, alive in 7-20 m; eastern Indonesia, shells in 155-495 m.

REMARKS. — The present specimens are similar to the type material of *P. carbaseum*, and differ by their larger size, up to *ca.* 5 mm high, and by having a few more rudimentary intercostal riblets. HAYAMI & KASE (1993: 56) stated that *P. crypticum* differs from by "the byssal notch decidedly deeper, and the ratio of length/height a little larger...". However, similar features are observed in the present material and *P. crypticum* is here synonymized. *P. araneum* Dijkstra, 1991, differs from *P. carbaseum* by having a larger size, a latticed sculpture, and by having fewer (only a few rudimentary) internal ribs. *P. texturatum* (Dautzenberg & Bavay, 1912) differs in external sculpture, which is more prominent with lamellose radial costae and more widely spaced fine commarginal lamellae.

Parvamussium cassium Dijkstra, 1991

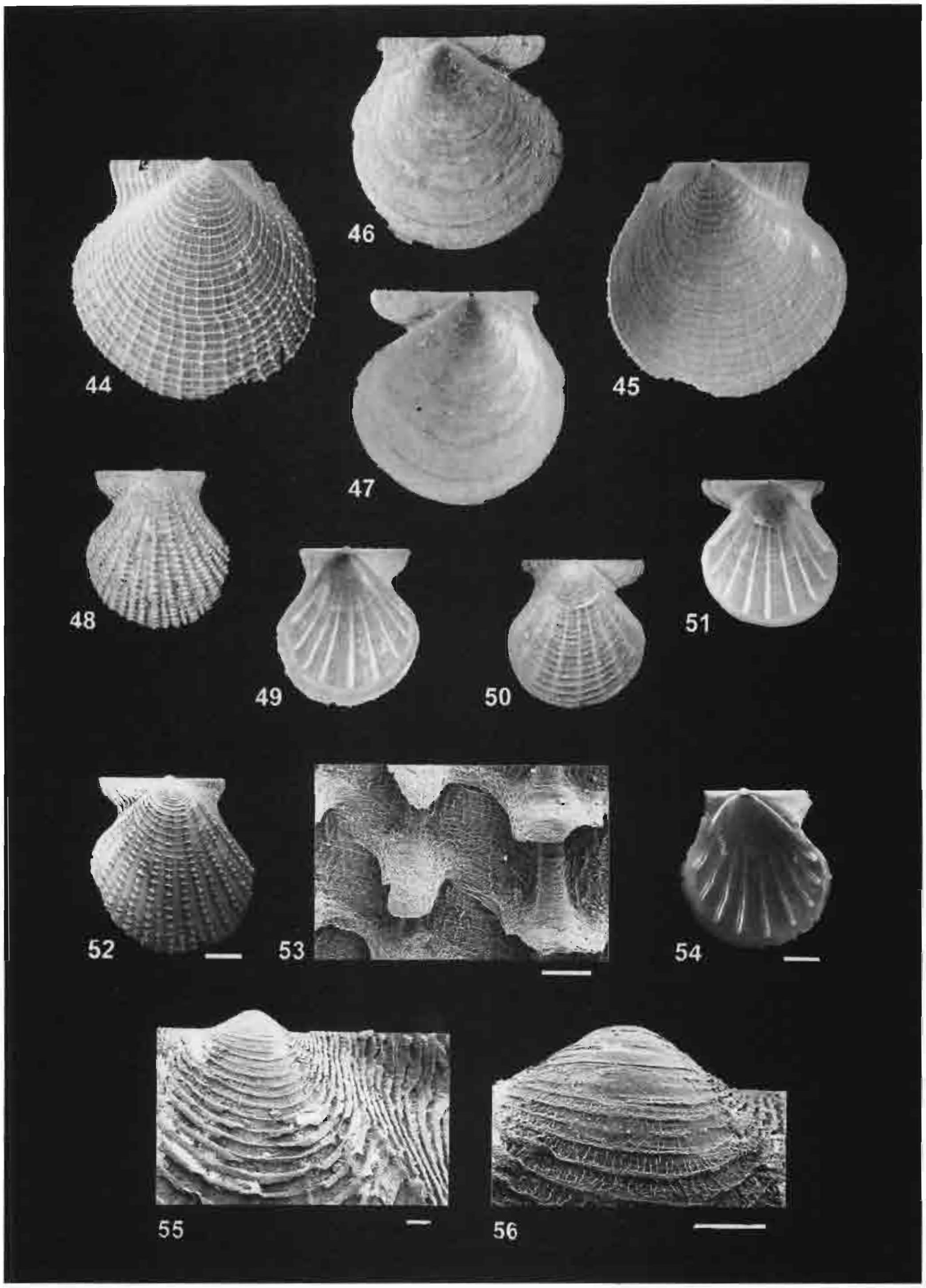
Figs 44-47

Parvamussium cassium Dijkstra, 1991: 11, figs 22-27.



FIGS 30-38. — *Parvamussium araneum* Dijkstra, 1991, KARUBAR, stn DW 18: **30**, left valve, exterior, scale bar 1 mm; **31**, left valve, interior, scale bar 1 mm; **32**, right valve, exterior, scale bar 1 mm; **33**, right valve, interior, scale bar 1 mm; **34**, left valve, prodissoconch, dissoconch, preradial stage, scale bar 10 μm; **35**, left valve, exterior, central detail, scale bar 100 μm; **36**, left valve, exterior, central detail, scale bar 100 μm; **37**, right valve, exterior, anterior and posterior auricles, scale bar 1 mm; **38**, right valve, interior, dorsal marginal detail, scale bar 1 mm.

FIGS 39-43. — *P. carbaseum* Dijkstra, 1991, KARUBAR, stn DW 29: **39**, right valve, exterior, scale bar 1 mm; **40**, right valve, interior, scale bar 1 mm; **41**, right valve, central detail, scale bar 100 μm; **42**, right valve, anterior and posterior auricles, scale bar 1 mm; **43**, right valve, interior, dorsal marginal detail, scale bar 1 mm.



FIGS 44-47. — *Parvamussium cassium* Dijkstra, 1991, KARUBAR, stn CP 05, 8.0 x 7.8 mm (db): **44**, left valve, exterior; **45**, left valve, interior; **46**, right valve, exterior; **47**, right valve, interior.

FIGS 48-56. — *P. conspectum* sp. nov., KARUBAR, stn DW 15: **48-51**, holotype, 5.1 x 4.7 mm (db): **48**, left valve, exterior; **49**, left valve, interior; **50**, right valve, exterior; **51**, right valve, interior. — **52-56**, paratype: **52**, left valve, exterior, scale bar 1 mm; **53**, left valve, antero-marginal detail, scale bar 100 µm; **54**, left valve, interior, scale bar 1 mm; **55**, left valve, exterior, preradial stage, scale bar 100 µm; **56**, left valve, exterior, dissoconch, preradial stage, scale bar 100 µm.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 1 spm.

TYPE MATERIAL. — Holotype RMNH 56549, live taken.

TYPE LOCALITY. — SNELLIUS-II, stn 4.142, 6°29.7'S, 121°10.8'E, NE Taka Bone Rate (Tiger Island), E of Tarupa Kecil, 450-600 m.

DISTRIBUTION. — Flores Sea and Banda Sea, Indonesia; alive in 299-450 m.

REMARKS. — The present specimen is similar to the type material, although more orbicular in shape, with fewer secondary radial riblets on the left valve and the small scales on the intersections are slightly more prominent. Other conchological features are identical.

Parvamussium conspectum sp. nov.

Figs 48-61

Parvamussium sp. cf. *texturatum* - DIJKSTRA, 1991: 17, figs 44-52.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 1 lv (paratype POLIPI), 2 rv (paratypes HD, POLIPI). — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 1 spm. (holotype), 2 lv, 2 rv (paratypes MNHN) — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 1 lv (paratype HD). — Stn DW 24, 05°32'S, 132°51'E, 230-243 m, 2 lv (paratypes MNHN).

TYPE MATERIAL. — Holotype, live taken, MNHN. Paratypes: 2 HD, 2 POLIPI, 5 MNHN.

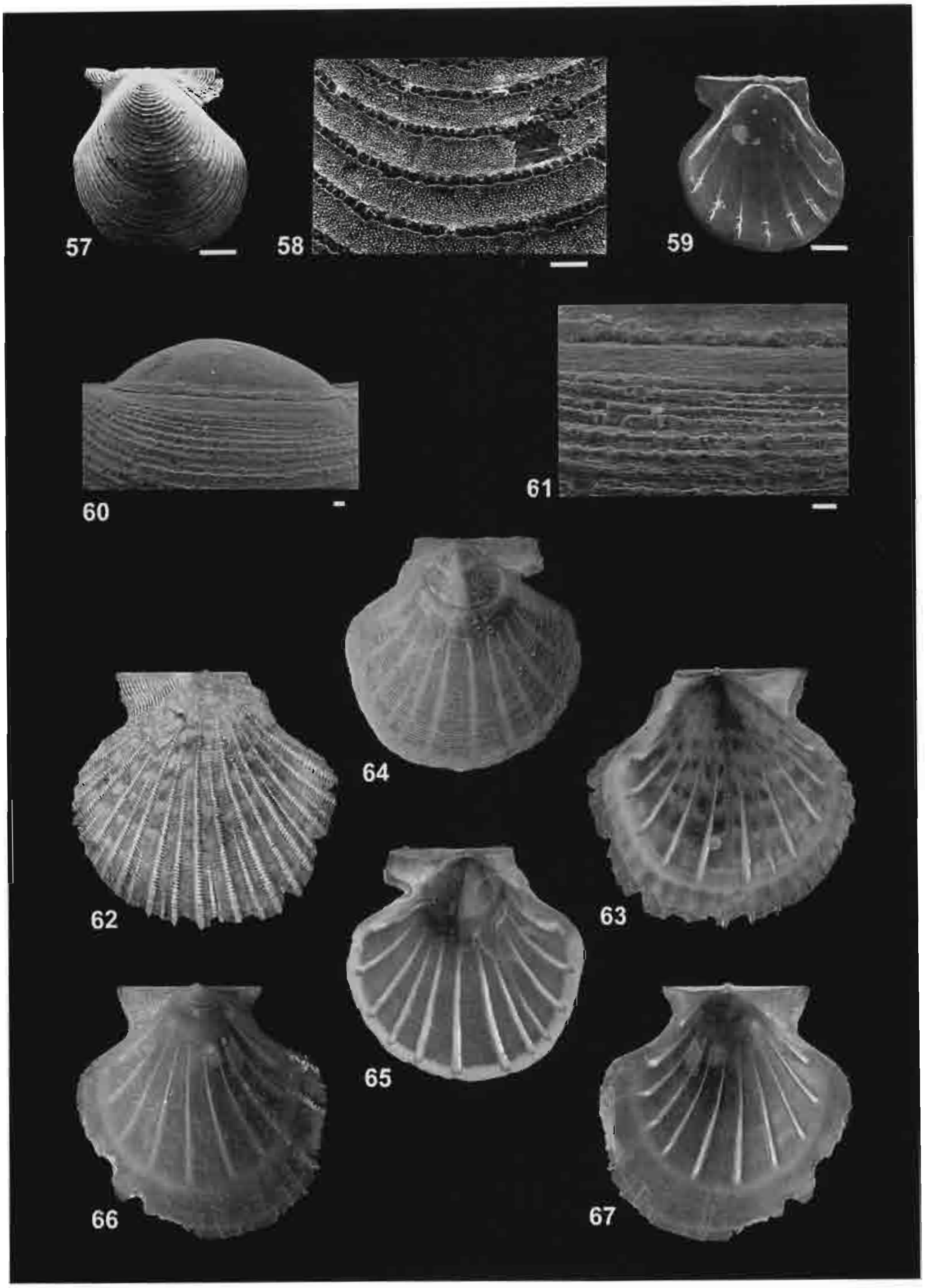
TYPE LOCALITY. — Kai Islands, E Indonesia, KARUBAR, stn DW 15, 050°17'S, 132°41'E, 212-221 m.

DISTRIBUTION. — Eastern Indonesia; shells in 100-290 m, alive in 212-250 m.

DESCRIPTION. — *Shell* small, up to *ca.* 5 mm high, fragile, semi-transparent, valves equally convex, elongate, inequivalve, slightly inequilateral, auricles unequal in size, umbonal angle *ca.* 90°. *Prodissoconch ca.* 190 µm in height. *Left valve* sculptured with *ca.* 20 primary and secondary irregularly spaced radial riblets, *ca.* 10 closely set commarginal lamellae in early growth stage (before pre-radial stage), widely spaced on central part of disc and more closely so towards ventral margin. Intersections of radial riblets and commarginal lamellae strongly squamous. Anterior auricle larger than posterior and provided with closely spaced, strongly irregularly developed concentric lamellae, more prominent anteriorly. A row of small lamellae produced near disc flank. *Right valve* sculptured with *ca.* 20 widely spaced concentric lamellose lirae. Sculpture of auricles similar to that of left valve. A radial lira on anterior auricle near byssal fasciole. Internal ribs 9, commencing 1 mm below resilifer and developed towards 0.5 mm above periphery, with a small auricular riblet on each side. Hinge line straight. Resilifer triangular. Byssal fasciole and notch small. Ctenolium absent. Left valve creamy-orange, right valve transparent white. Inner side of both valves glossy. Dimensions (holotype): H 5.1, L 4.7, D 1.1 mm.

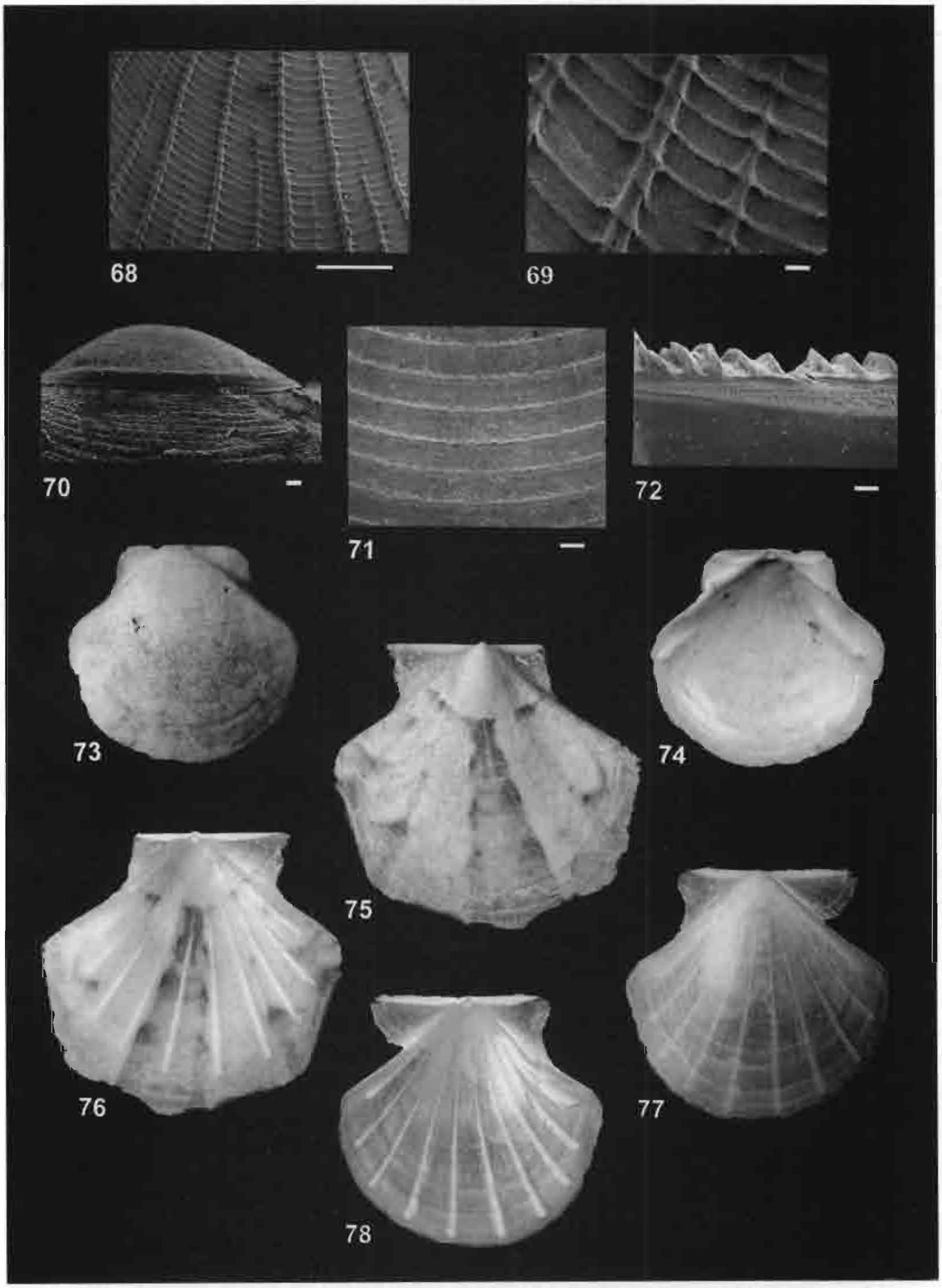
REMARKS.— *Parvamussium* sp. cf. *texturatum* of DIJKSTRA (1991: 17, figs 44-52) differs from the present material only in the internal ribs being shorter and slightly more numerous (10 instead of 9). *P. texturatum* (Dautzenberg & Bavay, 1912) differs by having a more orbicular shape, a weaker sculpture of commarginal lamellae on the left valve, and in having more numerous internal ribs (15). *P. vesiculatum* Dijkstra, 1995, differs by having a more nodose sculpture at intersections on the left valve, more numerous closely spaced concentric lamellae on the right valve, and less developed internal riblets (only a few rudimentary near the anterior and posterior margins). *P. undisonum* Dijkstra, 1995 differs in size (larger, up to *ca.* 14 mm), is more oblique, and more weakly sculptured with more close-set commarginal lamellae on the left valve.

ETYMOLOGY. —Lat. *conspectus*, adj. = conspicuous.



FIGS 57-61. — *Parvamussium conspectum* sp. nov., KARUBAR, stn DW 15, paratype (MNHN): **57**, right valve, exterior, scale bar 1 mm; **58**, right valve, exterior, central detail, scale bar 100 μm; **59**, right valve, interior, scale bar 1 mm; **60**, right valve, exterior, prodissoconch, dissoconch, preradial stage, scale bar 10 μm; **61**, right valve, exterior, dissoconch, preradial stage, scale bar 10 μm.

FIGS 62-67. — *P. cristatellum* Dautzenberg & Bavay, 1912, KARUBAR, stn DW 13, 8.4 x 8.9 mm (lv, typical), 8.3 x 8.1 mm (lv, atypical), 7.8 x 7.8 mm (rv): **62**, left valve, exterior; **63**, left valve, interior; **64**, right valve, exterior; **65**, right valve, interior; **66**, left valve (atypical), exterior; **67**, left valve (atypical), interior.



FIGS 68-72. — *Parvamussium cristatellum* Dautzenberg & Bavay, 1912, KARUBAR, stn DW 13: **68**, left valve, exterior, central detail, scale bar 1 mm; **69**, left valve, exterior, antero-ventral detail, scale bar 100 µm; **70**, left valve, exterior, prodissoconch, dissoconch, preradial stage, scale bar 10 µm; **71**, right valve, exterior, central detail, scale bar 100 µm; **72**, right valve, interior, antero-dorsal detail, scale bar 100 µm.

FIGS 73-74. — *P. pauciliratum* (E.A. Smith, 1903), KARUBAR, stn DW 28, 7.0 x 7.5 mm (rv): **73**, right valve, exterior; **74**, right valve, interior.

FIGS 75-78. — *P. scitulum* (E.A. Smith, 1885), KARUBAR: stn DW 22, 9.1 x 9.8 mm (lv), 7.8 x 8.0 mm (rv): **75**, left valve, exterior; **76**, left valve, interior; **77**, right valve, exterior; **78**, right valve, interior.

Parvamussium cristatellum (Dautzenberg & Bavay, 1912)

Figs 62-72

Pecten (Amussium) cristatum (sic) Bavay, 1905b: 187, pl. 17, figs 2a-c (*non Pecten cristatus* Bronn, 1828).
Amussium cristatellum Dautzenberg & Bavay, 1912: 36, pl. 28, figs 5-8 [*nom. nov.* for *Pecten (Amussium) cristatus* Bavay].
Parvamussium cristatellum - DIJKSTRA, 1991: 13, figs 28-32 [synonymy, references, description, discussion].

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 20 lv, 20 rv. — Stn DW 14, 05°18'S, 132°38'E, 245-246 m, 1 lv. — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 3 lv, 7 rv. — Stn DW 28, 05°33'S, 132°51'E, 304-314 m, 4 lv, 5 rv. — Stn DW 29, 05°36'S, 132°56'E, 181-184 m, 4 lv. — Stn DW 32, 05°47'S, 132°51'E, 170-206 m, 3 lv, 1 rv. — Stn CP 34, 06°09'S, 132°41'E, 435-445 m, 4 lv.
Tanimbar Islands: stn CP 65, 09°14'S, 132°27'E, 174-176 m, 4 lv, 5 rv. — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 8 lv, 8 rv.

TYPE MATERIAL. — Lectotype (lv illustrated by BAVAY, 1905b, pl. 17, fig. 2a; H 7.1, L 7.2 mm) ZSI M3360/1, here designated. Two paralectotypes (BAVAY, 1905b, pl. 17, figs 2b-c) ZSI M3360/2-3.

TYPE LOCALITY. — *"Masandam insulam"* [= Andaman Islands, India], depth unknown.

DISTRIBUTION. — Northeastern Indian Ocean and Indonesia.

REMARKS. — The present specimens are similar to the type material. The internal ribbing and sculpture are variable, from weak to more prominent, sometimes lacking sculpture or commarginal lamellae on the left valve. *P. thetidis* somewhat differs by having a weaker sculpture and more close-set commarginal lamellae on the left valve. *P. siebenrocki* (Sturany, 1901) from the northwestern Indian Ocean is nearly identical to *P. cristatellum*, and differs only in the radial costae on the left valve being somewhat weaker; however, intermediates seem to exist and the two may be synonyms. *P. formosum* (Melvill, 1907) from the western Indian Ocean is quite smooth and the auricles are very finely sculptured and more similar to those in *P. torresi* (E.A. Smith, 1885).

Parvamussium pauciliratum (E.A. Smith, 1903)

Figs 73-74

Amussium paucilirata (sic) E.A. Smith, 1903: 622, pl. 36, figs 23-24.
Parvamussium pauciliratum - DIJKSTRA, 1995b: 26, figs 107-110, 151-152 [references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 28).
Indonesia. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 rv.

DISTRIBUTION. — Northern Indian Ocean, Indonesia to New Caledonia; 27-448 m, alive in 27-45 m.

REMARKS. — The present specimen is very similar to the type material, although the internal ribs are somewhat more prominent. However, development of internal ribs is variable (very weak and small to strongly developed). Juveniles often lack the internal ribs.

Parvamussium scitulum (E.A. Smith, 1885)

Figs 75-78

Amussium scitulum E.A. Smith, 1885: 312, pl. 23, figs 4-4b.
Parvamussium scitulum - DIJKSTRA, 1995b: 31, figs 43-46, 153-154 [synonymy, references, description, discussion].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 31).
Indonesia. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 1 lv. — Stn DW 22, 05°22'S, 133°01'E, 124-850 m, 7 lv, 16 rv. — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 3 lv, 9 rv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 lv.

DISTRIBUTION. — Western and southwestern Pacific from Japan to New Caledonia; 50-300 m, with shells occasionally carried deeper, present material (shells only) in 118-296 m.

REMARKS. — The present specimens are similar to the type material, and reach a larger size, up to 10 mm. In *P. dautzenbergi* Dijkstra, 1990, also from Indonesia, the left valve is more prominently reticulated.

Parvamussium squalidulum Dijkstra, 1995

Figs 79-82

Parvamussium squalidulum Dijkstra, 1995b: 32, figs 47-50.

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 32).
Indonesia. KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 3 lv, 6 rv. — Stn DW 22, 05°22'S, 133°01'E, 124-850 m, 1 lv.

DISTRIBUTION. — Coral Sea to New Hebrides Arc, alive in 260-400 m; new record for Indonesia.

REMARKS. — The material from stn DW 02 differs slightly in sculpture. Concentric lamellae are somewhat more widely spaced on both valves and scales on riblets are weaker.

Parvamussium thetidis (Hedley, 1902)

Figs 83-89

Amusium thetidis Hedley, 1902: 304, fig. 49.
Parvamussium thetidis - DIJKSTRA, 1995b: 35, figs 99-102 [synonymy, references, description, discussion].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 35).
Indonesia. KARUBAR, *Kai Islands*: stn DW 24, 05°32'S, 132°51'E, 230-243 m, 3 lv, 2 rv. — Stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 lv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 lv, 8 rv.
Tanimbar Islands: stn CP 77, 08°57'S, 131°27'E, 346-352 m, 1 spm.

DISTRIBUTION. — Eastern Australia, Coral Sea to New Hebrides Arc; new record for Indonesia. Present material alive in 346-352 m, shells in 243-448 m.

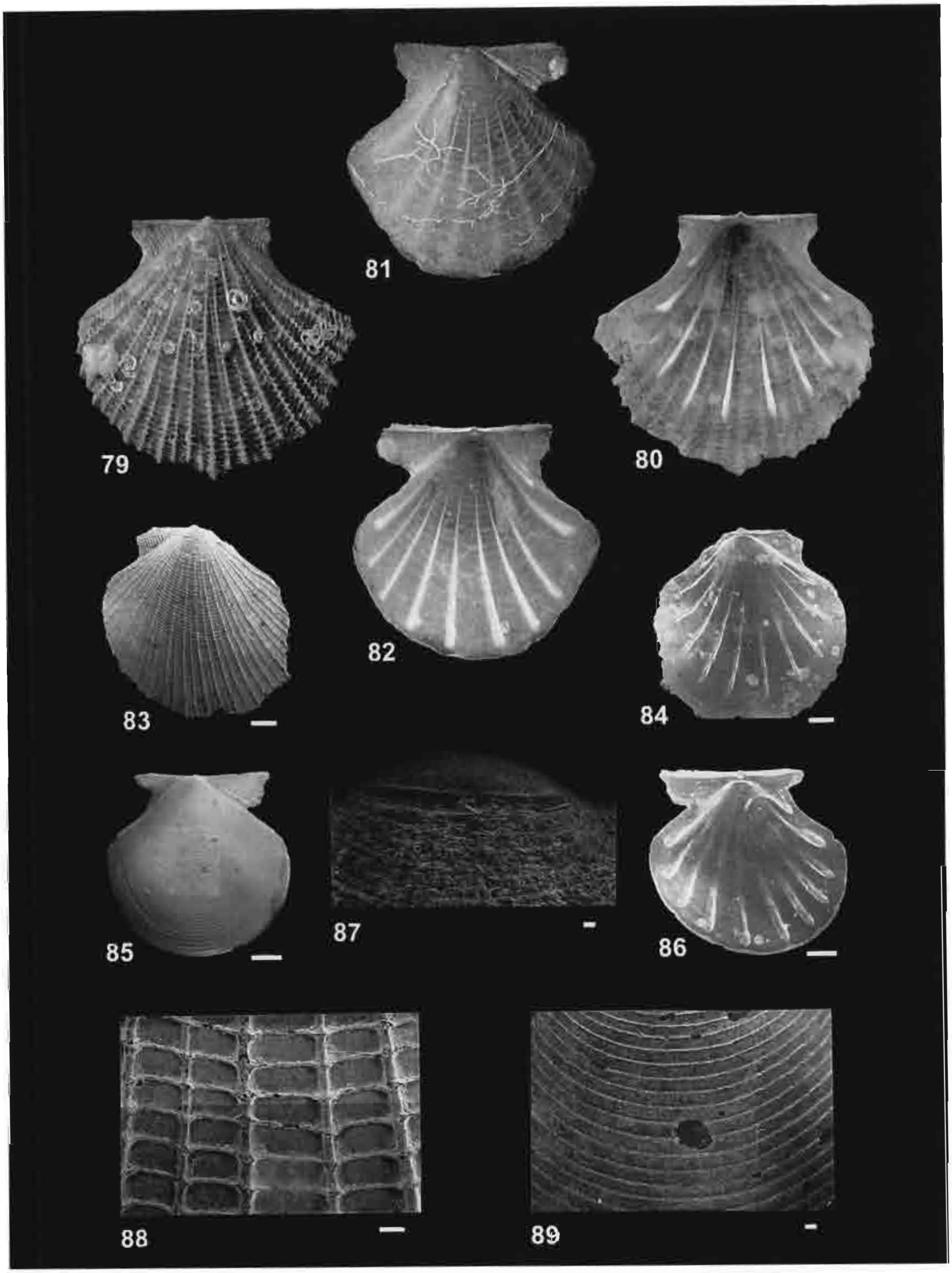
REMARKS. — The left valve of the specimen from stn CP 77 is slightly more prominently sculptured, with more numerous radial riblets and stronger commarginal lamellae.

Parvamussium torresi (E.A. Smith, 1885)

Figs 90-94

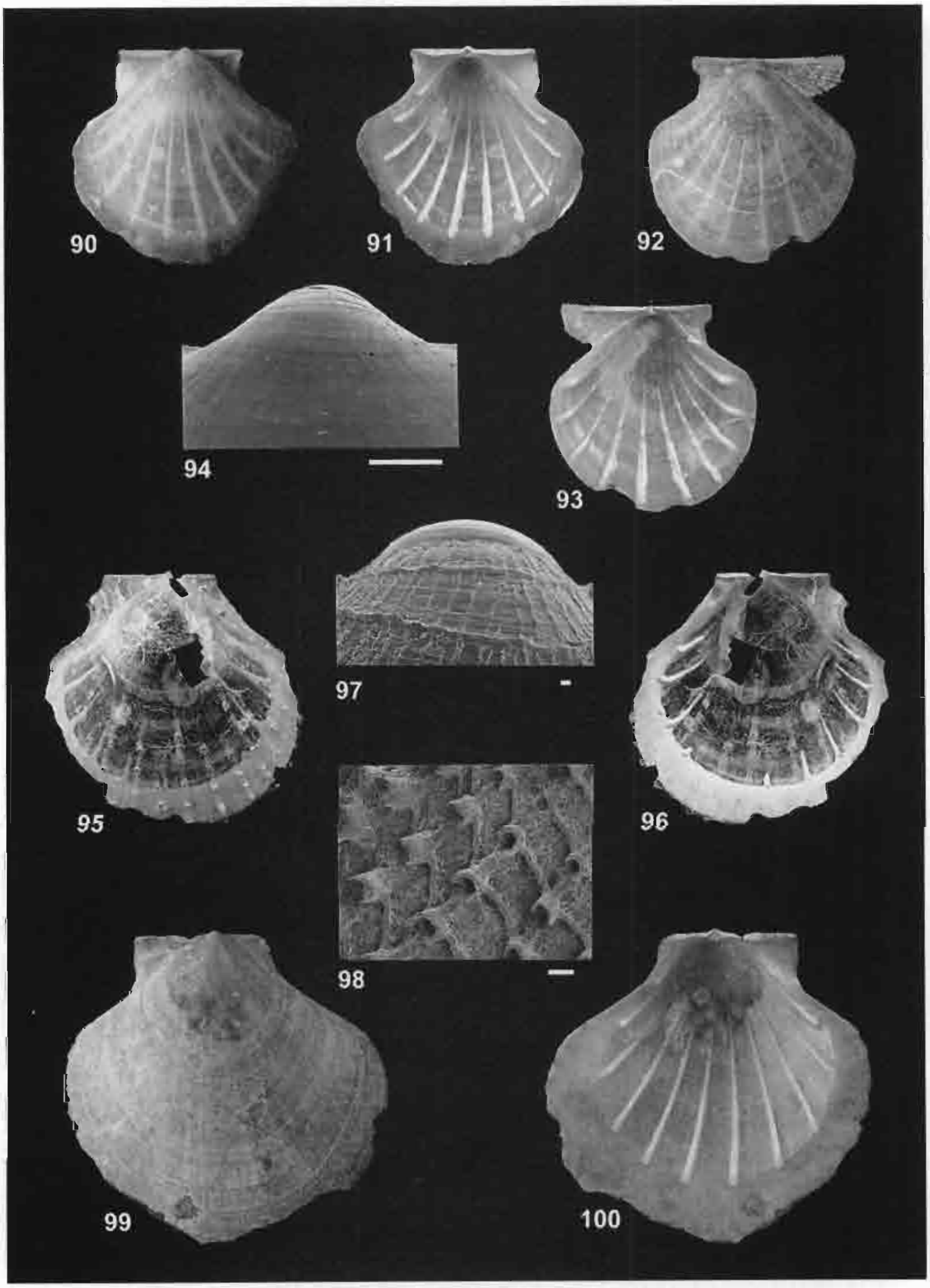
Amussium torresi E.A. Smith, 1885: 311, pl. 23, figs 3-3b.
Parvamussium torresi - DIJKSTRA, 1995b: 36, figs 51-54, 125-128 [references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 36).
Indonesia. KARUBAR, *Kai Islands*: stn DW 01, 05°46'S, 132°10'E, 156-305 m, 2 lv, 1 rv. — Stn DW 02, 05°47'S, 132°13'E, 209-240 m, 13 lv, 15 rv. — Stn DW 03, 05°48'S, 132°13'E, 278-301 m, 6 lv, 8 rv. — Stn DW 07, 05°46'S, 132°21'E, 283-285 m, 2 lv, 7 rv. — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 5 lv, 1 rv. — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 6 spms, 2 lv, 16 rv. — Stn DW 29, 05°36'S, 132°56'E, 181-184 m, 4 lv, 12 rv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 10 lv, 10 rv. — Stn DW 32, 05°47'S, 132°51'E, 170-206 m, 2 spms.



FIGS 79-82. — *Parvamussium squalidulum* Dijkstra, 1995, KARUBAR, stn DW 02, 8.2 x 8.9 mm (lv), 7.2 x 7.8 mm (rv): **79**, left valve, exterior; **80**, left valve, interior; **81**, right valve, exterior; **82**, right valve, interior.

FIGS 83-89. — *P. thetidis* (Hedley, 1902), KARUBAR, stn DW 31: **83**, left valve, exterior, scale bar 1 mm; **84**, left valve, interior, scale bar 1 mm; **85**, right valve, exterior, scale bar 1 mm; **86**, right valve, interior, scale bar 1 mm; **87**, left valve, exterior, prodissoconch, dissoconch, preradial stage, scale bar 10 µm; **88**, left valve, exterior, central detail, scale bar 100 µm; **89**, right valve, exterior, central detail, scale bar 100 µm.



FIGS 90-94. — *Parvamussium torresi* (E.A. Smith, 1885), KARUBAR, stn DW 02, 6.9 x 7.1 mm (lv), 6.3 x 6.3 mm (rv): **90**, left valve, exterior; **91**, left valve, interior; **92**, right valve, exterior; **93**, right valve, interior; **94**, left valve, exterior, prodissoconch, scale bar 100 µm.

FIGS 95-98. — *P. vesiculatum* Dijkstra, 1995: **95-96**, KARUBAR, stn DW 32, 7.9 x 8.1 mm (lv): **95**, left valve, exterior; **96**, left valve, interior. — **97-98**, KARUBAR, stn DW 18: **97**, left valve, exterior, dissoconch, preradial stage, scale bar 10 µm; **98**, left valve, exterior, antero-ventral detail, scale bar 100 µm.

FIGS 99-100. — *P. virgatum* Dijkstra, 1991, KARUBAR, stn DW 32, 10.0 x 10.2 mm (lv): **99**, left valve, exterior; **100**, left valve, interior.

DISTRIBUTION. — Southern Philippines, Indonesia, Coral Sea to the Loyalty Islands; 205-600 m, alive in 205-355 m.

REMARKS. — The present specimens are similar to the type material; a few specimens (stn DW 01 and DW 32) have colour maculations. *P. formosum* from the Arabian Sea is closely related but differs in having a more prominent sculpture of radial striae on auricles and near the anterior and posterior margins of the left valve. *P. scitulum* (E.A. Smith, 1885) differs from *P. torresi* by having a more compressed shell, more prominent sculpture of radial striae, and by being more brightly coloured. The right valve of *P. torresi* is covered with regularly spaced concentric lirae, which are generally lacking on *P. scitulum*.

Parvamussium vesiculatum Dijkstra, 1995

Figs 95-98

Parvamussium vesiculatum Dijkstra, 1995b: 37, figs 59-62, 93-96.

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 37).
Indonesia. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 3 spms. — Stn DW 29, 05°36'S, 132°56'E, 181-184 m, 1 lv, 1 rv. — Stn DW 32, 05°47'S, 132°51'E, 170-206 m, 1 lv.

DISTRIBUTION. —New Caledonia and Loyalty Islands; new record for Indonesia. Present material alive in 205-212 m.

Parvamussium virgatum Dijkstra, 1991

Figs 99-100

Parvamussium virgatum Dijkstra, 1991: 20, figs 62-65.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 32, 05°47'S, 132°51'E, 170-206 m, 1 lv.

TYPE MATERIAL. — Holotype RMNH 56556.

TYPE LOCALITY. — Banda Sea, Tukang Besi Islands, NW of Binongko, SNELLIUS-II, stn 4.033, 05°52.5'S, 123°58.5'E, 250-290 m.

DISTRIBUTION. — Eastern Indonesia; shells in 206-305 m.

REMARKS. — The present specimen is similar to the type material. *P. scitulum* (E.A. Smith, 1885) differs by having a more compressed shell, and a stronger sculpture with radial and concentric lirae on the left valve; the auricles are also more prominent sculptured.

Family PECTINIDAE Wilkes, 1810

Subfamily CAMPTONECTINAE Habe, 1977

Genus ***DELECTOPECTEN*** Stewart, 1930

Delectopecten alcocki (E.A. Smith, 1904)

Figs 101-108

Pecten alcocki E.A. Smith, 1904: 13.
Delectopecten alcocki - DIJKSTRA, 1995b: 50, figs 111-114, 147-150 [references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 50).

Indonesia. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 1 spm. — Stn DW 08, 05°20'S, 132°31'E, 358-360 m, 10 lv, 5 rv. — Stn CP 09, 05°23'S, 132°29'E, 68-389 m, 18 spms, 2 lv, 10 rv. — Stn CC 10, 05°21'S, 132°30'E, 329-389 m, 25 spms, 9 lv, 6 rv. — Stn DW 13, 05°26'S, 132°38'E, 417-425 m, 1 spm, 25 lv, 23 rv. — Stn CP 16, 05°17'S, 132°50'E, 315-349 m, 3 spms. — Stn CP 17, 05°15'S, 133°01'E, 439-459 m, 1 spm. — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 2 rv. — Stn CP 20, 05°15'S, 132°59'E, 769-809 m, 1 rv. — Stn CC 21, 05°14'S, 133°00'E, 688-694 m, 4 spms, 1 lv, 1 rv. — Stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 lv, 1 rv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 spm. — Stn CP 35, 06°08'S, 132°45'E, 390-502 m, 2 spms, 1 rv. — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 4 spms.

Tanimbar Islands: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 1 lv, 3 rv. — Stn CC 56, 08°16'S, 131°59'E, 549-552 m, 1 spm. — Stn CC 58, 08°19'S, 132°02'E, 457-461 m, 2 spms, 1 lv. — Stn CP 59, 08°20'S, 132°11'E, 399-405 m, 3 spms, 4 lv, 5 rv. — Stn DW 60, 08°21'S, 132°14'E, 387-389 m, 5 lv, 2 rv. — Stn CP 63, 08°00'S, 132°58'E, 214-215 m, 1 rv. — Stn CP 65, 09°14'S, 132°27'E, 174-176 m, 8 spms, 22 lv, 23 rv. — Stn CP 69, 08°42'S, 131°53'E, 399-405 m, many spms. — Stn CP 71, 08°38'S, 131°44'E, 477-480 m, 1 lv.

DISTRIBUTION. — East Africa, Gulf of Aden, Bay of Bengal, Philippines, Indonesia, Coral Sea (DIJKSTRA, 1995b: 50). Present material alive in 176-688 m.

REMARKS. — The present specimens are similar to the type material, although somewhat more variable in sculpture (diverging radial striae very weak to more prominent and radially aligned scales absent to strongly developed). In the type material the diverging radial striae are almost lacking and the scales are weak.

Delectopecten fluctuatus (Bavay, 1905)

Figs 109-113

Pecten (Chlamys) fluctuatus Bavay, 1905b: 188, pl. 17, figs 3a-b.
Delectopecten fluctuatus - DIJKSTRA, 1995b: 51, figs 83-86 [references, description].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 51).

Indonesia. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 1 lv. — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 3 spms.

Tanimbar Islands: stn CP 86, 09°26'S, 131°13'E, 223-225 m, 2 spms.

DISTRIBUTION. — Andaman Sea, Indonesia, Loyalty Islands (DIJKSTRA, 1995b: 51). Present specimens alive in 225-288 m.

REMARKS. — Present specimens differ from the holotype in being semi-transparent white instead of opaque cream, and by having more numerous radial riblets, up to *ca.* 40-70, near the ventral margin.

Subfamily CHLAMYDINAE Teppner, 1922
Tribe CHLAMYDINI Teppner, 1922

Genus ***LAEVICHLAMYS*** Waller, 1993

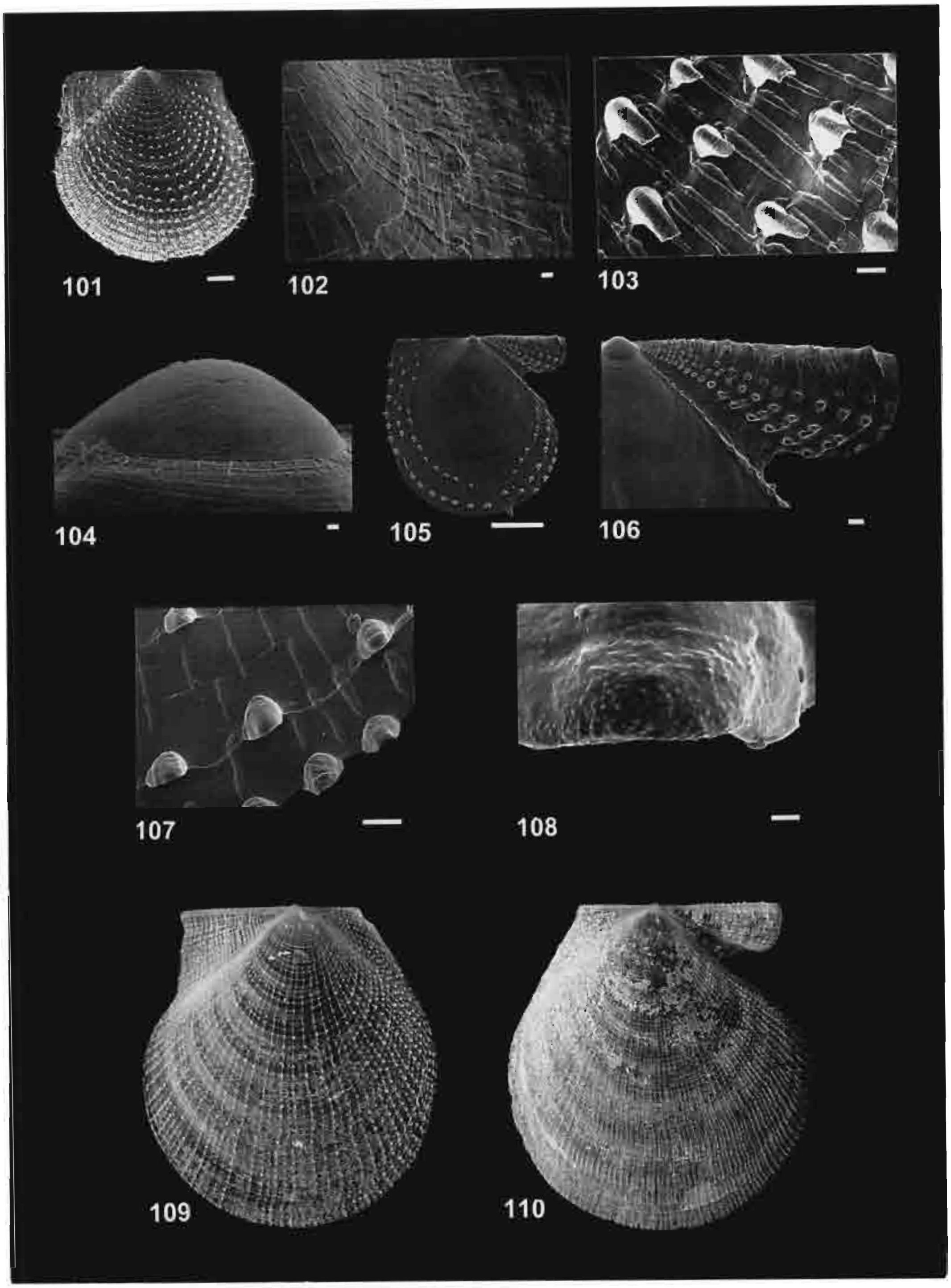
Laevichlamys aliae (Dijkstra, 1988) (comb. nov.)

Figs 132-133

Chlamys aliae Dijkstra, 1988: 17-18, unnumbered figs.
Chlamys aliae - DIJKSTRA, 1990: 7, 9. — ROMBOUTS, 1991: 90.

MATERIAL EXAMINED. — The type material (see below).

Indonesia. KARUBAR, *Kai Islands*: stn DW 29, 05°36'S, 132°56'E, 181-184 m, 1 lv. — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 7 lv, 3rv.



FIGS 101-108. — *Delectopecten alcocki* (E.A. Smith, 1904), KARUBAR, stn CP09: **101**, left valve, exterior, scale bar 1 mm; **102**, left valve, exterior, anterior auricular detail, scale bar 10 µm; **103**, left valve, exterior, antero-ventral detail, scale bar 100 µm; **104**, left valve, exterior, prodissoconch, scale bar 10 µm; **105**, right valve, exterior, scale bar 1 mm; **106**, right valve, exterior, anterior auricle, scale bar 100 µm; **107**, right valve, exterior, antero-ventral detail, scale bar 100 µm; **108**, right valve, exterior, vesicular detail, scale bar 10 µm.

FIGS 109-110. — *D. fluctuatus* (Bavay, 1905), KARUBAR, stn DW 31, 10.0 x 9.1 mm (db): **109**, left valve, exterior; **110**, left valve, interior.

TYPE MATERIAL. — Holotype ZMA Moll.3.88.046, live taken.

TYPE LOCALITY. — Off Punta Engano, Mactan, Cebu, Philippines, 110 m.

DISTRIBUTION. — Philippines and Indonesia; living in 30-200 m (DIJKSTRA, unpubl. data).

REMARKS. — The present specimens are similar to the type material. The shagreen microsculpture and strongly developed radial costae suggest a placement in *Laevichlamys* rather than *Chlamys* Röding, 1798.

Laevichlamys deliciosa (Iredale, 1939) (comb. nov.)

Fig. 134

Mimachlamys deliciosa Iredale, 1939: 350-351, pl. 5, figs 22-22a.
Chlamys deliciosa - DIJKSTRA, 1991: 30 [synonymy, references].

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 1 lv. — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 1 spm. — Stn DW 22, 05°22'S, 133°01'E, 124-850 m, 3 lv.
Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-212 m, 1 spm.

TYPE MATERIAL. — Holotype AMS C89669.

TYPE LOCALITY. — Low Isles, SE of Lizard Island, N Queensland, GREAT BARRIER REEF EXPED. stn 14, 14°41'S, 145°29'E, 35 m.

DISTRIBUTION. — Western and southwestern Pacific, alive in 80-205 m.

DESCRIPTION. — *Shell* small, commonly 15 mm high, occasionally to *ca.* 25 mm, equivalve, somewhat equilateral, valves convex, auricles very unequal, umbonal angle *ca.* 80-85°. *Prodissoconch* height *ca.* 240 µm. *Both valves* sculptured with numerous fine radial riblets commencing in early growth stage (*ca.* 1 mm) and increasing to *ca.* 45-50 by intercalating riblets towards ventral margin. Radial riblets bear small erect prickly scales. Interspaces microscopically granulated or reticulated, and smooth near ventral margin. Anterior auricles have 9-14 fine radial riblets; posterior auricles have fewer (6-10) and weaker riblets. Postero-dorsal margin of hinge line somewhat declined. Byssal gap small. Active ctenolium present with 4-6 teeth. Colour uniformly cream, pink, orange, red or purple, sometimes also stained.

REMARKS. — Present specimens are almost identical to the type material. Specimens from stations DW 18 and DW 50 reach 22 mm and 24 mm in height.

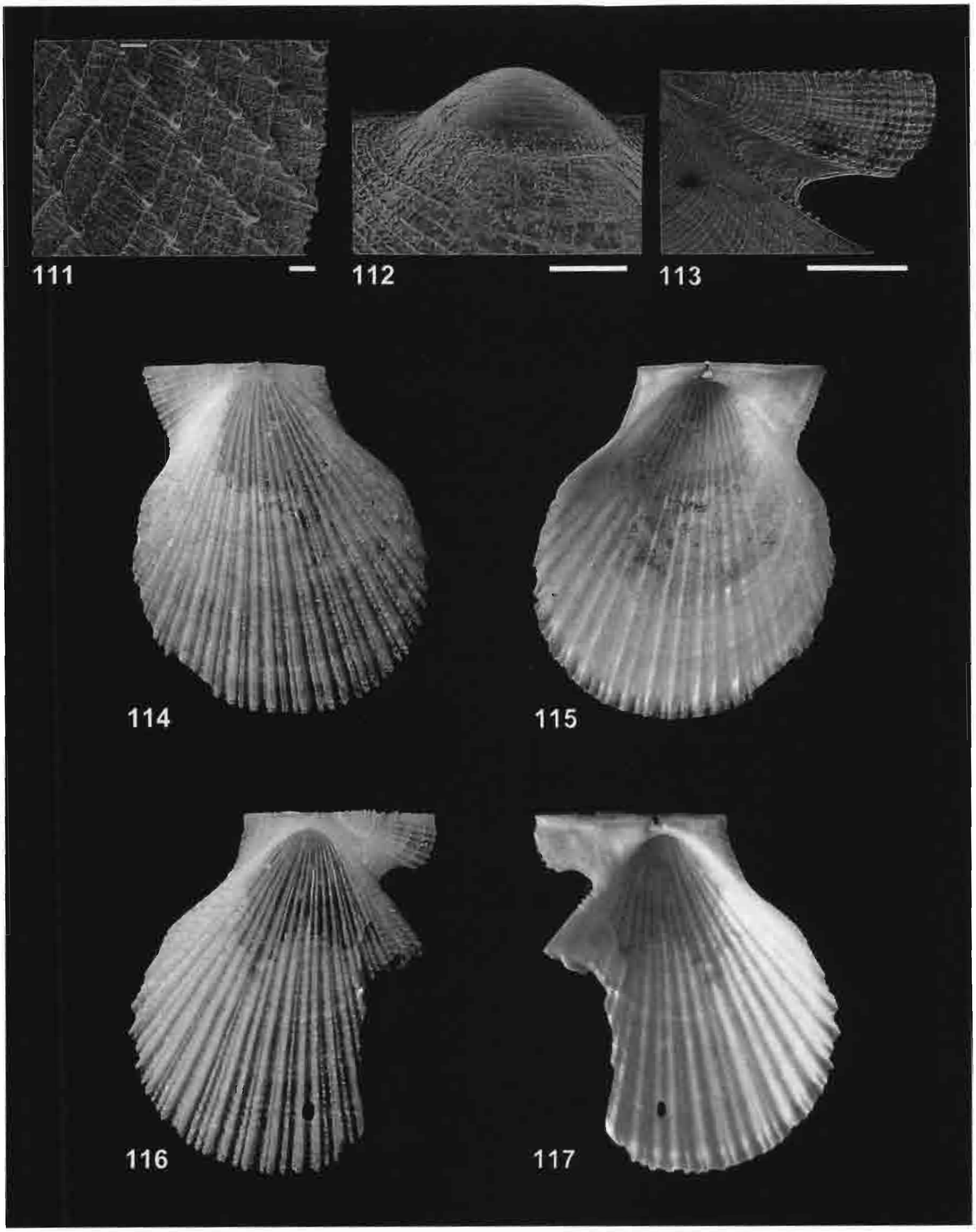
Genus ***SEMIPALLIUM*** Jousseaume, 1928

Semipallium Jousseaume in LAMY, 1928: 169. Type species (OD): *Pecten tigris* Lamarck, 1819. Recent, Indo-West Pacific.

DIAGNOSIS. — A byssate Chlamydini with shagreen (reticulated) microsculpture, sculptured with regularly spaced primary radial costae, fine secondary radial riblets commonly present at least in late growth stage; auricles very unequal; inner surface undulated; byssal notch moderately deep, ctenolium well developed.

DISTRIBUTION. — Miocene-Recent. Tropical Indo-West Pacific; littoral to sublittoral depths.

REMARKS. — HERTLEIN (1969: N365) considered *Semipallium* as a valid Indo-Pacific genus, placed in the *Decatopecten* group. WALLER (1993: 202) treated it as a genus of Chlamydini.



FIGS 111-113. — *Delectopecten fluctuatus* (Bavay, 1905), KARUBAR, stn DW 31: **111**, left valve, exterior, antero-ventral detail, scale bar 100 µm; **112**, left valve, exterior, prodissoconch, preradial stage, scale bar 100 µm; **113**, right valve, exterior, anterior auricle, ctenolium, scale bar 1 mm.

FIGS 114-117. — *Veprichlamys versipellis* sp. nov., holotype, 23.3 x 19.5 mm (db): **114**, left valve, exterior; **115**, left valve, interior; **116**, right valve, exterior; **117**, right valve, interior.

Semipallium dianae (Crandall, 1979)

Figs 135-137

Chlamys dianae Crandall, 1979: 114, figs 3-8.
Chlamys dianae - MATSUKUMA, OKUTANI & HABE, 1991: 137, 185, pl. 135, fig. 9. — LAN, 1993: 161, 219, fig.
Semipallium dianae - DIJKSTRA, 1991: 38. — ROMBOUTS, 1991: 59, pl. 5, figs 3-3a-b.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 124-850 m, 2 lv, 1 rv.

TYPE MATERIAL. — Holotype in the Taiwan Museum, Taipei, Taiwan 7911.

TYPE LOCALITY. — Ryukyu Islands, S Japan, alive, *ca.* 30 m.

DISTRIBUTION. — Western and southwestern Pacific, from southern Japan, the Philippines, Indonesia and the Solomon Islands; alive in 20-55 m (DIJKSTRA, unpubl. data).

DESCRIPTION. — *Shell* commonly *ca.* 35 mm high, occasionally up to *ca.* 50 mm, elongated, slightly convex, equivalve, subequilateral, auricles very unequal, umbonal angle *ca.* 80-90°. *Prodissoconch* height *ca.* 280 µm. *Both valves* covered with shagreen (reticulated) microsculpture and sculptured with 8-10 (commonly 9) regularly spaced, rounded radial costae. Fine radial riblets developed near ventral margin, most prominent on right valve. Anterior auricle with 5-6, posterior auricle with 2-4 radial ribs. Hinge line straight on anterior, somewhat declined on posterior auricle. Inner surface plicated, sometimes striated near ventral margin. Resilifer triangularly oblong, elongated. Byssal fasciole broad, byssal notch relative deep. Ctenolium well developed with 5-7 teeth. Colour very variable, occuring in brown, orange, red, purple and yellow, commonly creamy-yellowish with brown and milky white dots and streaks.

REMARKS. — The present valves from the Kai Islands are similar to the type material, although more monochrome yellow and orange.

Genus *VEPRICHLAMYS* Iredale, 1929

Veprichlamys versipellis sp. nov.

Figs 114-131

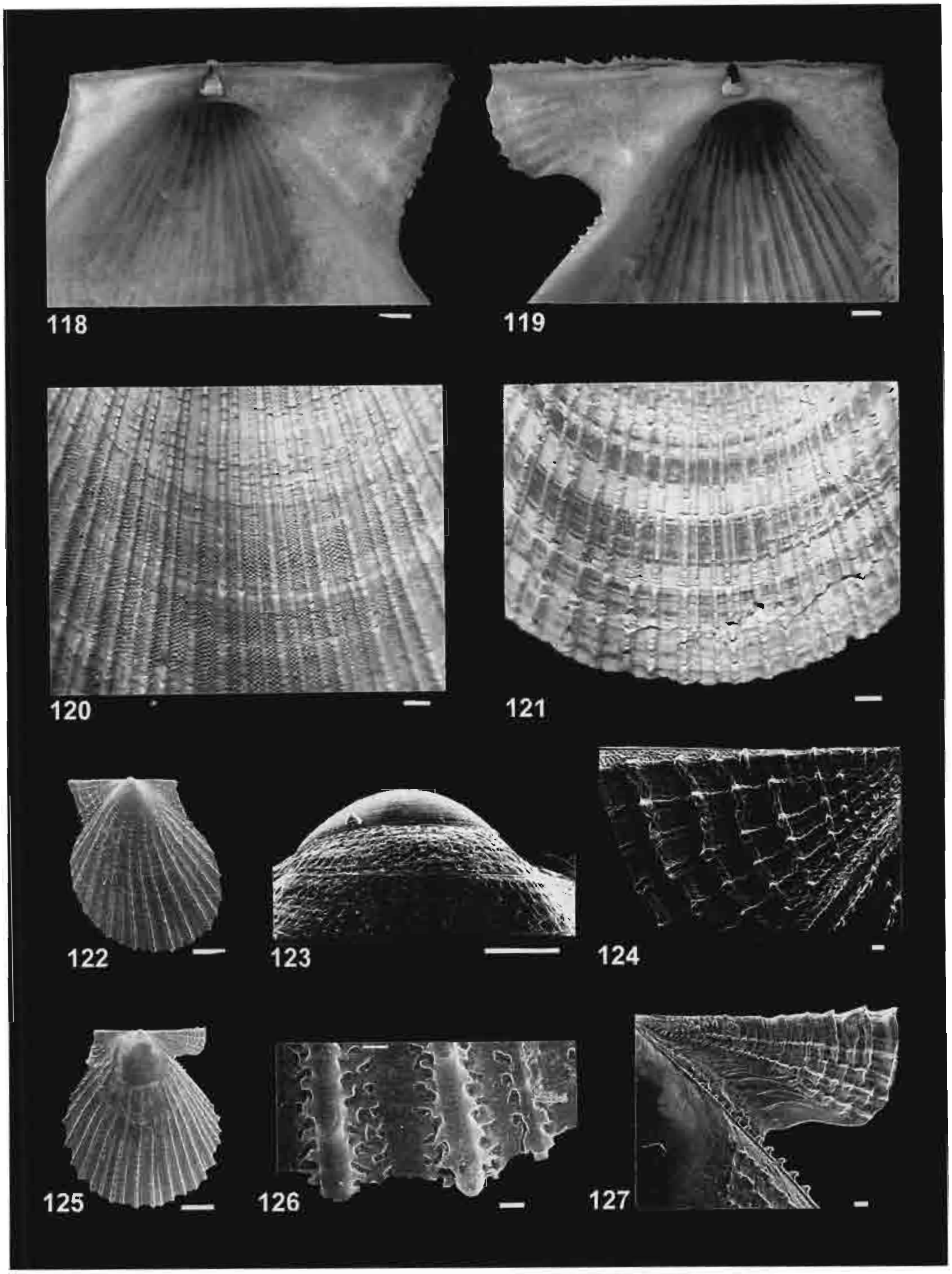
MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 5 v (MNHN). — Stn CP 33, 06°05'S, 132°38'E, 307-311 m, 1 v (MNHN).
Tanimbar Islands: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 5 v (3 MNHN, 2 LIPI). — Stn CP 46, 08°01'S, 132°51'E, 271-273 m, 1 fresh db (holotype). — Stn DW 61, 09°05'S, 132°44'S, 235-236 m, 14 v (10 MNHN, 4 LIPI). — Stn CP 79, 09°16'S, 131°22'E, 239-250 m, 3 v (1 MNHN, 2 HD). — Stn CP 86, 09°26'S, 131°13'E, 223-225 m, 2 v (MNHN).

TYPE MATERIAL. — Holotype MNHN. Paratypes: 22 MNHN, 6 LIPI, 2 HD.

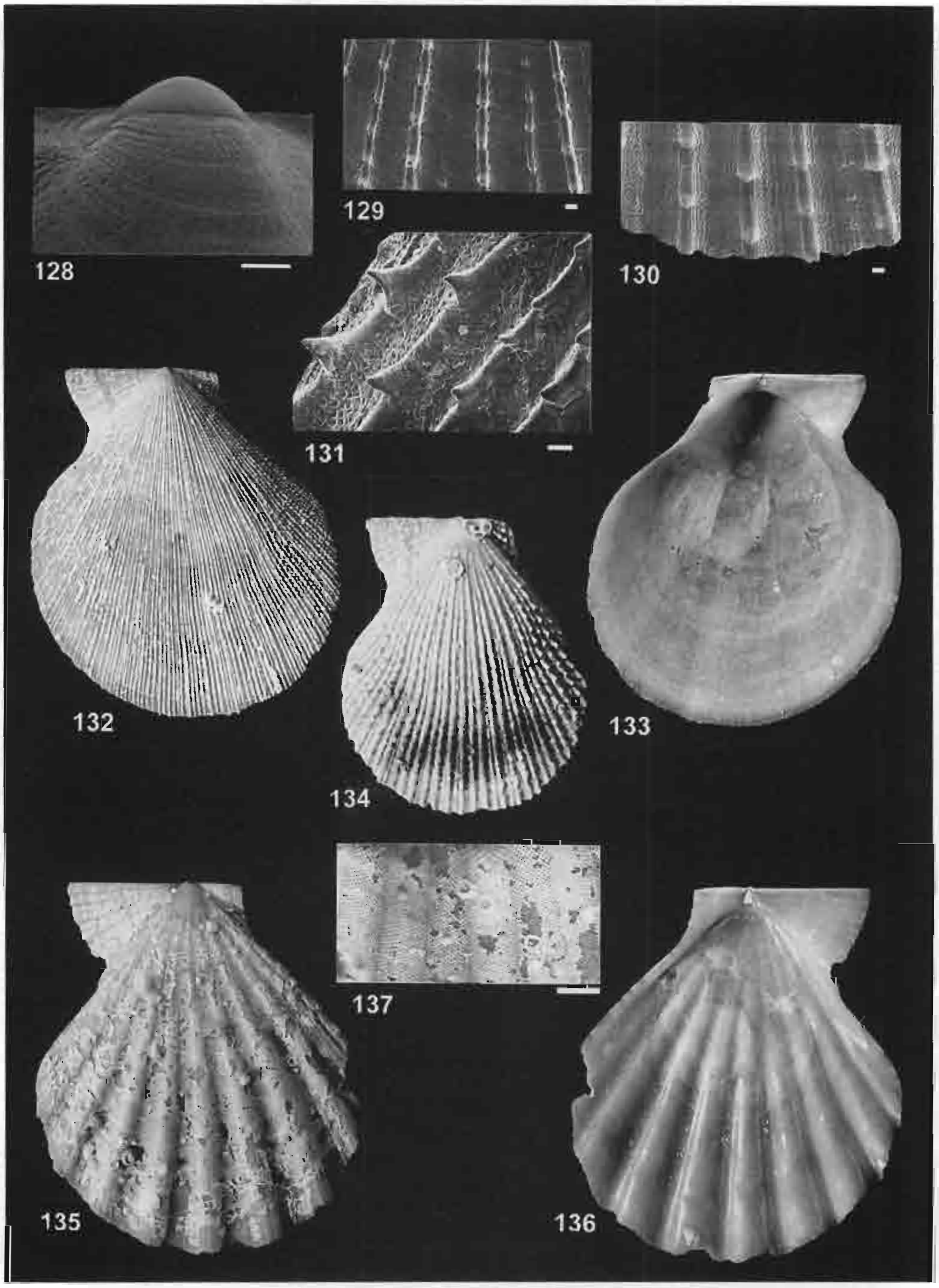
TYPE LOCALITY. — Arafura Sea, E of Tanimbar Islands, KARUBAR, stn CP 46, 08°01'S, 132°51'E, 271-273 m.

DISTRIBUTION. — Banda and Arafura Sea, shells only in 225-417 m.

DESCRIPTION. — *Shell* fragile, up to 35 mm high, somewhat obliquely ovate, compressed, equilateral, equivalve, auricles inequivalve, umbonal angle *ca.* 90°. *Prodissoconch* height *ca.* 280 µm. *Both valves* sculptured with numerous (*ca.* 40) irregularly spaced, primary radial costae, commencing at 1 mm shell height, and *ca.* 12,



FIGS 118-127. — *Veprichlamys versipellis* sp. nov.: **118-119**, holotype: **118**, left valve, interior, dorsal detail, scale bar 1 mm; **119**, right valve, interior, dorsal detail, scale bar 1 mm. — **120-121**, KARUBAR, stn DW 44, paratypes (lv, rv): **120**, left valve, exterior, central detail, scale bar 1 mm; **121**, right valve, exterior, ventral marginal detail, scale bar 1 mm. — **122-127**, KARUBAR, stn CP 86, paratype (db): **122**, left valve, exterior, scale bar 1 mm; **123**, left valve, exterior, prodissoconch, radial stage, scale bar 100 µm; **124**, left valve, exterior, anterior auricle, scale bar 100 µm; **125**, right valve, exterior, scale bar 1 mm; **126**, left valve, exterior, ventral marginal detail, scale bar 100 µm; **127**, right valve, exterior, anterior auricle, ctenolium, scale bar 100 µm.



FIGS 128-131. — *Veprichlamys versipellis* sp. nov., KARUBAR, stn CP 86, paratype (db): **128**, right valve, exterior, prodissoconch, preradial stage, scale bar 100 µm; **129**, left valve, exterior, central detail, scale bar 100 µm; **130**, left valve, exterior, ventral marginal detail, scale bar 100 µm; **131**, right valve, exterior, postero-marginal detail, scale bar 100 µm.

FIGS 132-133. — *Laevichlamys aliae* (Dijkstra, 1988), KARUBAR, stn DW 30, 23.8 x 20.6 mm (lv): **132**, left valve, exterior. — **133**, left valve, interior.

FIG 134. — *L. deliciosa* (Iredale, 1939), KARUBAR, stn DW 22, 9.0 x 7.6 mm, left valve, exterior.

FIGS 135-137. — *Semipallium dianae* (Crandall, 1979), KARUBAR, stn DW 22, 25.1 x 21.9 mm (lv): **135**, left valve, exterior; **136**, left valve, interior; **137**, left valve, exterior, central detail, scale bar 1 mm.

secondary radial riblets commencing at central part of disc, and increasing towards ventral margin. Costae squamose. Microsculpture of interspaces variable: early growth stage with diverging striae near anterior and posterior margin, shagreen microsculture above central part of disc and near ventral margin, in between radial striae and diverging to the anterior and posterior margins. Anterior auricle of left valve larger than posterior, sculptured with 10 weakly developed squamous radial lirae; posterior auricle with 6 fine squamous radial lirae, interspaces of early growth stage striae microscopically reticulated. Auricles of right valve sculptured with more prominent radial costae, fewer in number (anterior 6, posterior 5). Anterior hinge line straight, posterior somewhat suppressed. Byssal fasciole broad, byssal notch rather deep. Inactive and active ctenolium beside ledge of suture, with 4 teeth. Postero-lateral margins of disc scarcely gaping. Resilifer elongate triangular. Inner surface of both valves plicate near periphery. Colour creamy with pink-reddish dots and scales. Dimensions (holotype): H 23.4, L 20.0, D 6.1 mm.

REMARKS. — Juvenile specimens resemble *V. jousseaumei* (Bavay, 1904), from the western Pacific, which differs by the absence of intercalating ribs and of the shagreen microsculpture. Adult specimens of *V. versipellis* differ by having shagreen microsculpture on the anterior auricles, on the central part of the disc and near the ventral margin, whereas *V. jousseaumei* has radial striae. *V. versipellis* has many (*ca.* 50), irregularly spaced, radial riblets, *V. jousseaumei* fewer (*ca.* 20), regularly spaced, radial ribs. *V. perillustris* (Iredale, 1925) from southern and southeastern Australia differs having by a more oblique shape, fewer (*ca.* 20) radial ribs, more prominent scales on the ribs, and lack of a shagreen (reticulated) microsculpture. *V. kiwaensis* (Powell, 1933) resembles *V. perillustris* and differs from *V. versipellis* by having fewer (*ca.* 20) regularly spaced radial ribs and more prominent microscopic striae; shagreen microsculpture is absent. *V. incantata* (Hertlein, 1972) from the Galapagos Islands differs by attaining a larger size (*ca.* 45 mm high), having a more elongate shape, a larger convexity of the valves and lacking the shagreen microsculpture.

ETYMOLOGY. — From the Latin *versipellis*, adj. = metamorphosis, with regard to the inconstancy of shell microsculpture.

Tribe AEQUIPECTININI Nordsieck, 1969

Genus *CRYPTOPECTEN* Dall, Bartsch & Rehder, 1938

Cryptopecten Dall, Bartsch & Rehder, 1938: 93. Type species (OD): *Cryptopecten alli* Dall, Bartsch & Rehder, 1938. Recent, Hawaii Islands, 95-435 m.

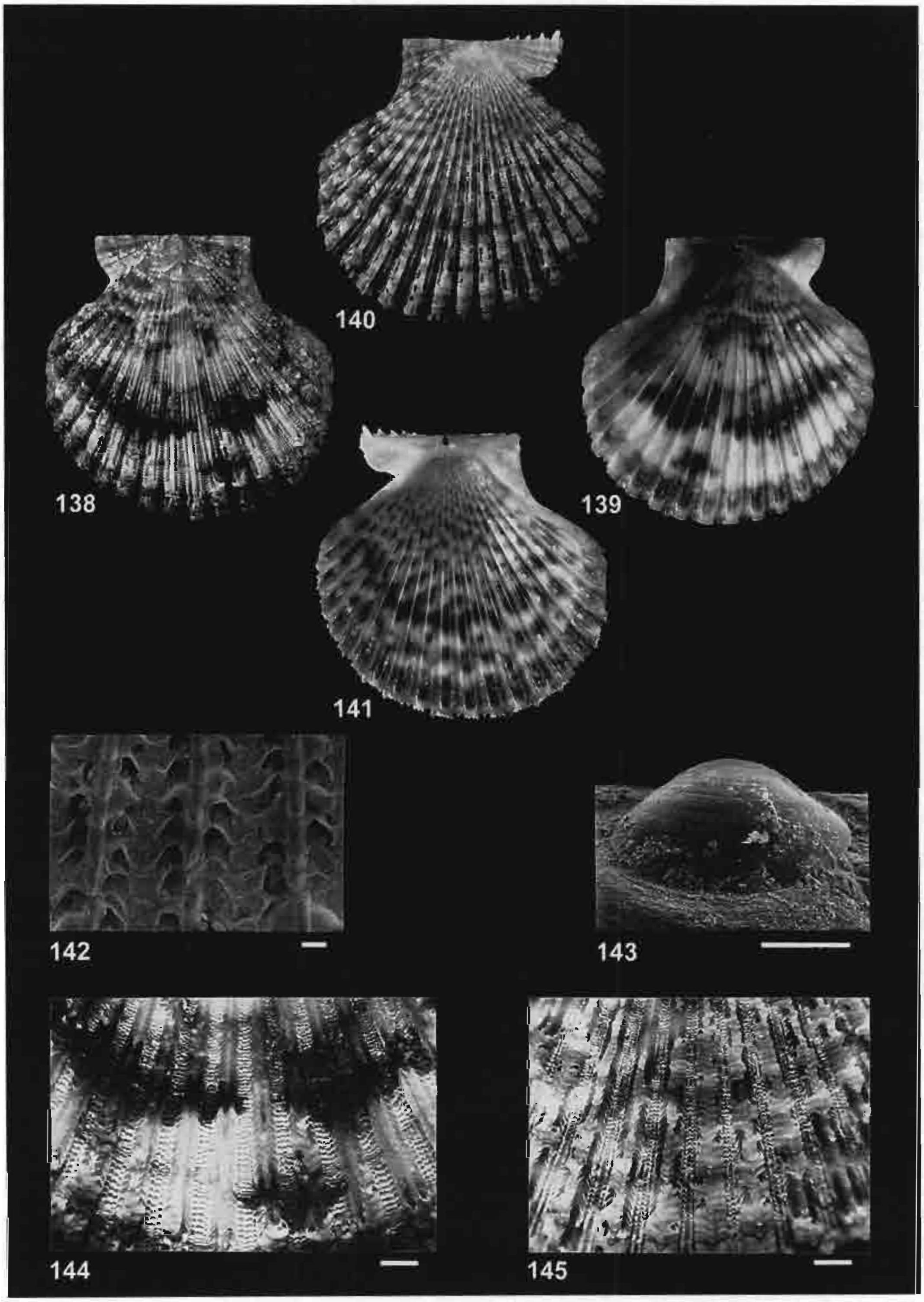
Synonymy and Diagnosis: see DIJKSTRA (1995b: 60).

Cryptopecten bullatus (Dautzenberg & Bavay, 1912)

Figs 138-145

Pecten (Chlamys) bullatus Dautzenberg & Bavay, 1912: 17, pl. 27, figs 1-2.
Cryptopecten bullatus - DIJKSTRA, 1995b: 60, figs 115-118 [synonymy, references, description, discussion].

MATERIAL EXAMINED. — The type material (see DIJKSTRA, 1995b: 60).
Indonesia. CORINDON, *Makassar Strait*: stn B 248, 00°54'S, 119°29'E, 170 m, 3 v.
KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 2 lv. — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 5 lv, 6 rv. — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 2 spms, 2 lv, 2 rv. — Stn DW 24, 05°32'S, 132°51'E, 230-243 m, 1 lv, 3 rv. — Stn DW 29, 05°36'S, 132°56'E, 181-184 m, 1 rv. — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 4 lv, 1 rv. — Stn DW 32, 05°47'S, 132°51'E, 170-206 m, 1 lv.
Tanimbar Islands: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 4 lv. — Stn CP 47, 08°01'S, 132°55'E, 235-246 m, 1 rv. — Stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 lv, 2 rv. — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 1 lv. — Stn DW 61, 09°05'S, 132°44'E, 235-236 m, 2 lv, 1 rv. — Stn CP 79, 09°16'S, 131°22'E, 239-250 m, 1 rv. — Stn DW 80, 09°37'S, 131°02'E, 199-201 m, 1 lv. — Stn CP 86, 09°26'S, 131°13'E, 223-225 m, 2 spms, 1 lv, 1 rv.



FIGS 138-145. — *Cryptopecten bullatus* (Dautzenberg & Bavay, 1912): **138-141**, KARUBAR, stn DW 18, 19.4 x 19.9 mm (db): **138**, left valve, exterior; **139**, left valve, interior; **140**, right valve, exterior; **141**, right valve, interior. — **142-145**, KARUBAR, stn DW 24: **142**, right valve, exterior, central detail, scale bar 100 µm; **143**, right valve, exterior, prodissoconch, scale bar 100 µm; **144**, left valve, exterior, ventral marginal detail, scale bar 1 mm; **145**, right valve, exterior, ventral marginal detail, scale bar 1 mm.

DISTRIBUTION. — Throughout the western, southwestern and Central Pacific; also known from the western Indian Ocean; present specimens from 111-295 m, alive in 212-223 m.

Cryptopecten nux (Reeve, 1853)

Figs 146-149

Pecten coruscans Reeve, 1853: sp. 143, pl. 32, fig. 143 (*non* Hinds, 1845).
Pecten nux Reeve, 1853: *errata*.
Cryptopecten nux nux - HAYAMI, 1984: 100, pl. 2, fig. 4, pl. 3, figs 1-2, pl. 9, figs 2-5, pl. 12, figs 1-2 [synonymy, references, description, discussion].

MATERIAL EXAMINED. — The type material (see below).
Indonesia. CORINDON, *Makassar Strait*: stn B 248, 00°54'S, 119°29'E, 170 m, 3 v.
KARUBAR, *Kai Islands:* stn DW 01, 05°46'S, 132°10'E, 156-305 m, 5 lv, 2 rv. — Stn DW 02, 05°47'S, 132°13'E, 209-240 m, 3 lv, 2 rv. — Stn DW 22, 05°22'S, 133°01'E, 124-850 m, 7 lv, 18 rv.

TYPE MATERIAL. — Lectotype BMNH 1950.11.14.52, designated by WAGNER (1989).

TYPE LOCALITY. — Panglao, Bohol, Philippines (restricted by WAGNER, 1989).

DISTRIBUTION. — Western and northwestern Indian Ocean, western and southwestern Pacifc, alive in 30-200 m (DIJKSTRA, unpubl. data).

Genus *HAUMEA* Dall, Bartsch & Rehder, 1938

Haumea Dall, Bartsch & Rehder, 1938: 86. Type species (OD): *Haumea juddi* Dall, Bartsch & Rehder, 1938 (= *Pecten loxoides* G.B. Sowerby II, 1882). Recent, Hawaiian Islands, 7-15 m.

DIAGNOSIS. — Free swimming Aequipectinini, slightly obliquely suborbicular, right valve more convex than left, auricles subequal, valves sculptured with 18-20 radial costae, interspaces with fine concentric lamellae, auricles weakly sculptured with 4-6 radial riblets and fine close-set concentric lamellae, byssal notch moderately deep, ctenolium present.

DISTRIBUTION. — Pliocene-Recent. Western Indian Ocean, western and southwestern Pacific; littoral to sublittoral depths.

REMARKS. — HERTLEIN (1969: N357) treated *Haumea* as a synonym of *Argopecten* Monterosato, 1899, a subgenus of *Chlamys*. WALLER (1991: 32) placed *Argopecten* in the *Aequipecten* group, or Aequipectinini (1993 : 198). *Haumea* differs from *Argopecten* by having a more compressed, and somewhat obliquely orbicular left valve (in *Argopecten* more convex and elongate, especially in young specimens) and smaller, subequal auricles (in *Argopecten* larger, inequal with a prominent anterior auricle in the right valve). Microsculpture of *Haumea* is finer with more closely spaced concentric lamellae. The genus includes *H. inaequivalvis* (G.B. Sowerby II, 1842), *H. loxoides* and *H. rehderi* (Grau, 1960). *Argopecten* is not known in the Indo-Pacific region.

Haumea inaequivalvis (G.B. Sowerby II, 1842)

Fig. 150

Pecten inaequivalvis Sowerby, 1842: 50, pl. 19, figs 193, 194, 195.
Pecten inaequivalvis - REEVE, 1852: sp. 1, pl. 1, figs 1, 6. — DESHAYES, 1863: 31. — MARTENS, 1880: 138. — MELVILL & STANDEN, 1898: 46.
Vola inaequivalvis - H. & A. ADAMS, 1858: 554. — DUNKER, 1882: 244.

Pecten (Vola) inaequivalvis - KÜSTER & KOBELT, 1888: 236, pl. 62, figs 5-8.
Chlamys (Aequipecten) inaequivalvis - DAUTZENBERG & BOUGE, 1933: 426.
Chlamys inaequivalvis - KIRA, 1962: 137, pl. 49, fig. 13.
Haumea inaequivalvis - DIJKSTRA, 1984b: 28, 4 figs. — ROMBOUTS, 1991: 43, pl. 25, fig. 1.
Cryptopecten inaequivalvis - BERNARD, CAI & MORTON, 1993: 50.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 111-118 m, 1 rv.

TYPE MATERIAL. — Lectotype, here designated, the shell figured by REEVE (1852: pl. 1, fig. 6; H 30.8, L 33.5, D 13.5 mm) BMNH 1994126/1. Two paralectotypes: BMNH 1994126/2-3.

TYPE LOCALITY. — Philippine Islands.

DISTRIBUTION. — Western and northeastern Indian Ocean, western, southwestern and central South Pacific; alive in 3-46 m (DIJKSTRA, unpubl. data).

DESCRIPTION. — *Shell* rather small, usually 20 mm high, occasionally up to *ca.* 30 mm, suborbicular, inequivalve, right valve more convex than left, auricles unequal, umbonal angle *ca.* 100-110°. *Prodissoconch* height *ca.* 220 µm. *Both valves* sculptured with 18-20 regularly spaced, prominent radial costae. Radial ribs near anterior and posterior margin weakly concentrically striated. Interspaces between radial costae with concentric lamellae. Auricles sculptured with 2-4 weak radial riblets. Inner surface strongly plicated near ventral margin. Hinge line straight. Byssal notch moderately deep. Resilifer obliquely triangular. Active ctenolium weak, with 4-5 teeth. Colour blackish grey or brownish marked with a few white spots and black streaks, right valve whitish or light brown.

REMARKS. — The present young specimen is similar to the type material. Young specimens could be easily confused with the closely related species *Haumea rehderi* (Grau, 1960) from the same region, which differs by having more prominent and widely spaced concentric lamellae between the radial costae, more prominent radial riblets on the auricles, and a deeper byssal notch. *Haumea loxoides* differs by having a more fragile shell, a more oblique shape, and a creamy mottled with red colour.

Genus *VOLACHLAMYS* Iredale, 1939

Volachlamys Iredale, 1939: 356. Type species (OD): *Pecten cumingii* Reeve, 1853. Recent, Queensland, Australia.

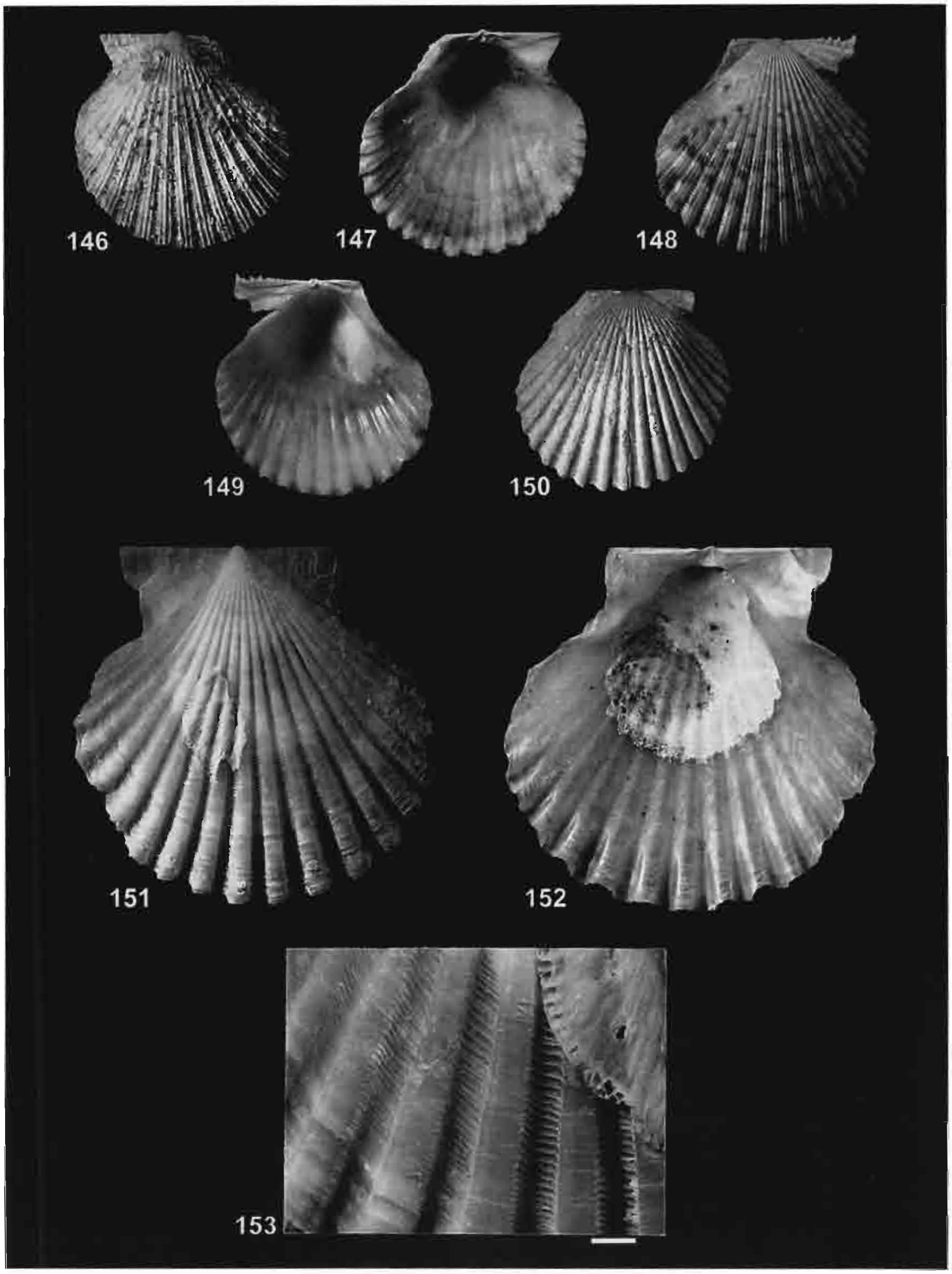
DIAGNOSIS. — Non-cemented, free swimming Aequipectinini, orbicular, equilateral, subequivalve, auricles subequal, valves sculptured with 14-24 radial costae, interspaces with concentric lamellae, byssal notch well-developed and moderately deep, ctenolium present.

DISTRIBUTION. — ?Miocene-Recent (HAYAMI, 1989: 16). Indo-West Pacific; intertidal to sublittoral depths.

Volachlamys singaporina (G.B. Sowerby II, 1842)

Figs 151-155

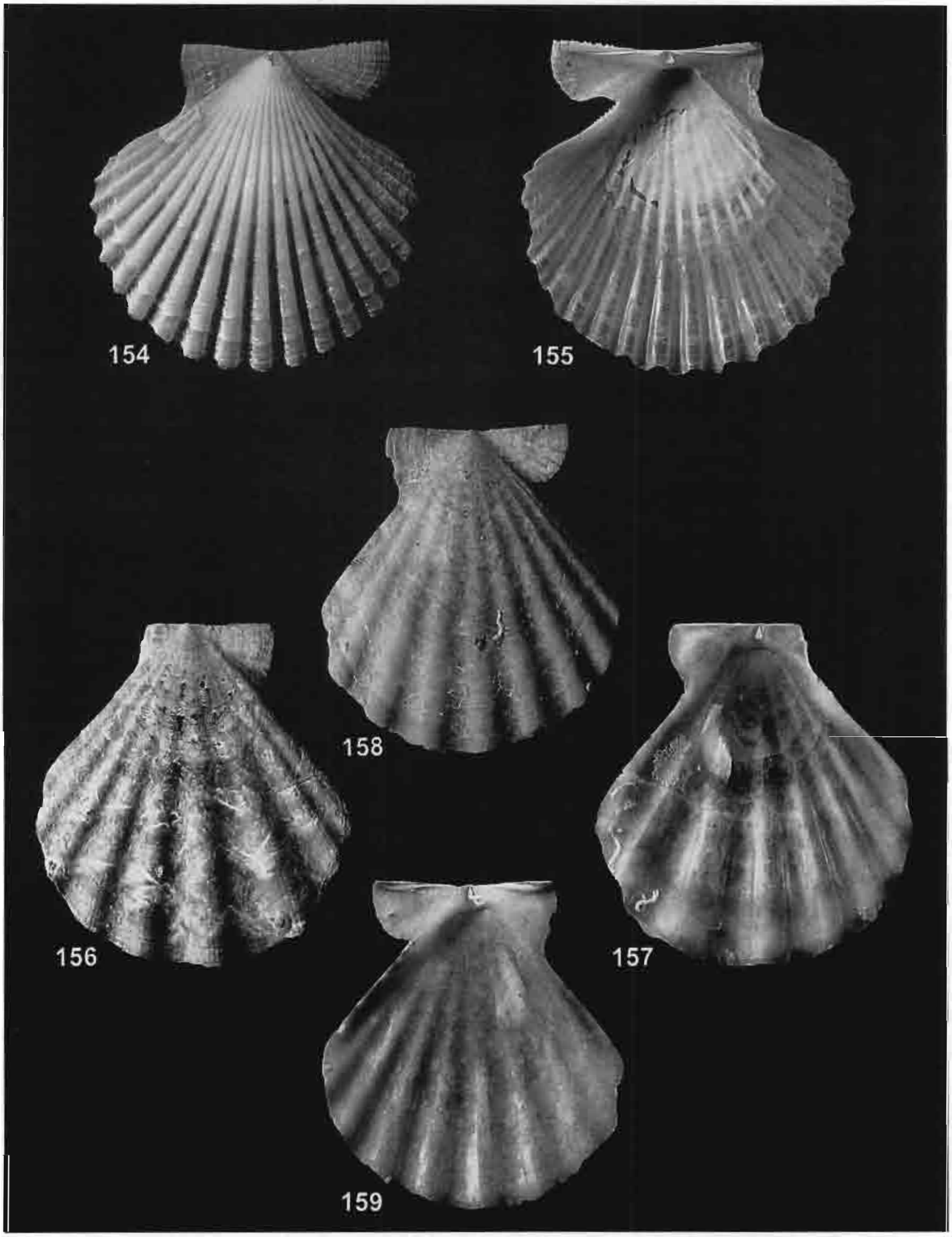
Pecten singaporinus G.B. Sowerby II, 1842: 74, pl. 13, fig. 55, pl. 14, fig. 71.
Pecten pica Reeve, 1853: sp. 115, pl. 27, figs 115 a-b.
Pecten singaporinus - REEVE, 1853: sp. 74, pl. 20, fig. 74. — KÜSTER & KOBELT, 1888: 94, pl. 25, figs 2-4.
Pecten pica - KÜSTER & KOBELT, 1888: 255-256, pl. 67, figs 1-2.
Chlamys (Argopecten) singaporina - DIJKSTRA, 1990: 8.
Volachlamys singaporina - ROMBOUTS, 1991: 62, pl. 22, fig. 6. — DHARMA, 1992: 84, pl. 20, figs 7-7a-d.
Chlamys singaporina - BERNARD, CAI & MORTON, 1993: 49.



FIGS 146-149. — *Cryptopecten nux* (Reeve, 1853), KARUBAR, stn DW 22, 6.9 x 6.9 mm (lv), 6.1 x 6.2 mm (rv): **146**, left valve, exterior; **147**, left valve, interior; **148**, right valve, exterior; **149**, right valve, interior.

FIG. 150. — *Haumea inaequivalvis* (G.B. Sowerby II, 1842), KARUBAR, stn DW 30, 6.0 x 6.8 mm, right valve, exterior.

FIGS 151-153. — *Volachlamys singaporina* (G.B. Sowerby II, 1842), KARUBAR, stn CP 65, 36.5 x 37.1 mm (lv): **151**, left valve, exterior; **152**, left valve, interior; **153**, left valve, exterior, antero-central detail, scale bar 1 mm.



FIGS 154-155. — *Volachlamys singaporina* (G.B. Sowerby II, 1842), KARUBAR, stn CP 65, 32.8 x 33.9 mm (rv): **154**, right valve, exterior; **155**, right valve, interior.

FIGS 156-159. — *Anguipecten* cf. *picturatus* Dijkstra, 1995, KARUBAR, stn DW 30, 26.6 x 24.5 mm (lv), 21.4 x 20.0 mm (rv): **156**, left valve, exterior; **157**, left valve, interior; **158**, right valve, exterior; **159**, right valve, interior.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Tanimbar Islands*: stn DW 64, 09°13'S, 132°31'E, 179-180 m, 3 lv. — Stn CP 65, 09°14'S, 132°27'E, 174-176 m, 10 lv, 7 rv.

TYPE MATERIAL. — *P. singaporinus*: lectotype (H 54.2, L 54.7, D 15.9 mm) BMNH 1994127/1, here designated. Two paralectotypes: BMNH 1994127/2-3. — *P. pica*: three syntypes BMNH 1994139.

TYPE LOCALITY. — *P. singaporinus*: Singapore. — *P. pica*: "New Zealand" [incorrect locality].

DISTRIBUTION. — Throughout the southwestern Pacific to northern Australia; alive from intertidal to subtidal depths. Present specimens probably washed into deep water.

DESCRIPTION. — *Shell* up to *ca.* 45 mm high, suborbicular, equilateral, equivalve, very compressed, auricles unequal, umbonal angle *ca.* 90°. *Prodissoconch* height *ca.* 260 µm. *Both valves* sculptured with 18 to 24 (commonly 20 to 22) regularly spaced, smooth rounded radial costae. Interspaces between radial costae with fine concentric lamellae. Anterior auricle of left valve sculptured with 6-8 weak radial riblets and very fine close-set concentric lamellae; riblets nearly absent on posterior auricle. Hinge line straight. Byssal notch moderately deep. Ctenolium well-developed with 4-6 teeth. Resilifer triangular oblong. Inner side with prominent plicae near ventral margin. Colour greyish or creamy with brown and/or whitish maculations and streaks.

REMARKS. — Present specimens are similar to the original and subsequent descriptions and illustrations by REEVE (1853), although with fewer radial costae (18-20). SOWERBY (1842) mentioned 24, REEVE (1853) *ca.* 22 and KÜSTER & KOBELT (1888) 20-22 radial costae. Material examined from throughout the southwestern Pacific, South China Sea, Malaysia and Indonesia (BMNH, HD, MNHN, RMNH, ZMA) shows variation in number of radial costae, decreasing to eastern Indonesia and northeastern Australia. It is possible that *V. cumingii* (Reeve, 1853) from Queensland is only a geographical variant (under study).

Subfamily PECTININAE Wilkes, 1810
Tribe DECATOPECTININI Waller, 1986

Genus *ANGUIPECTEN* Dall, Bartsch & Rehder, 1938

Anguipecten Dall, Bartsch & Rehder, 1938: 92. Type species (OD): *Anguipecten gregoryi* Dall, Bartsch & Rehder, 1938 (= *Pecten lamberti* Souverbie *in* SOUVERBIE & MONTROUZIER, 1874). Recent, Hawaiian Islands, 470-571 m .

DIAGNOSIS. — Free swimming Decatopectinini, suborbicular, laterally compressed, with 9-40 rounded radial costae, sculptured with very closely spaced commarginal lamellae, auricles subequal to equal, byssal notch nearly absent, no byssal fasciole, ctenolium weakly developed.

DISTRIBUTION. — Miocene-Recent. Indo-West Pacific; littoral to sublittoral depths.

Anguipecten cf. *picturatus* Dijkstra, 1995

Figs 156-159

Pecten aurantiacus A. Adams & Reeve *in* A. ADAMS, 1850: 74, pl. 21, fig. 12 (*non* Röding, 1798, *nec* J. Sowerby, 1820, *nec* Defrance, 1825).
Anguipecten picturatus Dijkstra, 1995a: 17 (*nom. nov.* for *P. aurantiacus* Adams & Reeve).
Pecten aurantiacus - REEVE, 1853: sp. 105, pl. 26, fig. 105. — KÜSTER & KOBELT, 1888: 171, pl. 47, fig. 7.
Gloripallium aurantiacum - MASUDA, 1962: 197.
Anguipecten lamberti - ABBOTT & DANCE, 1982: 312, fig. (*non* Souverbie *in* Souverbie & Montrouzier, 1874).
Anguipecten aurantiacus - DIJKSTRA, 1984a: 9, figs; 1991: 41.

Bractaechlamys (sic) aurantiaca - MATSUKUMA, OKUTANI & HABE, 1991: 185, pl. 134, fig. 4.
Decadopecten (Anguipecten) aurantiacus - ROMBOUTS, 1991: 38, pl. 13, fig. 12.
Bractechlamys aurantiaca - BERNARD, CAI & MORTON, 1993: 50. — LAN, 1993: 161, fig.

MATERIAL EXAMINED. — The type material (see below).
Indonesia. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 111-118 m, 2 lv, 2 rv.

TYPE MATERIAL. — Holotype BMNH 1950.11.14.8.

TYPE LOCALITY. — "China Sea" [= South China Sea].

DISTRIBUTION. — Western Indian Ocean, western and southwestern Pacific; alive in subtidal to sublittoral waters (2-90 m) (DIJKSTRA, unpubl. data).

DESCRIPTION. — Present specimens of the Kai Islands are up to 25 mm high, somewhat triangularly elongated, nearly equilateral and equivalve, right valve slightly more convex than left valve, auricles subequal, umbonal angle 85°. *Prodissoconch* heigh *ca.* 250 µm. *Both valves* undulated and sculptured with 7 rounded radial costae. Microsculpture consisting of very fine and closely set, commarginal lamellae. Faint secondary radial riblets developed on radial costae near ventral margin. Auricles weakly sculptured with 4-5 radial riblets. Hinge line straight, somewhat raised on right valve. Inner surface plicated, more prominently so near periphery. Resilifer triangular, erected. Byssal notch very small, byssal fasciole absent. Ctenolium weakly developed with 3 teeth. Colour creamy, maculated with dots and streaks, right valve more uniform and paler.

REMARKS. — The present valves differ strongly from the type material of *P. aurantiacus* by having a more orbicular shape (typical specimens are more elongated), fewer 7 vs 9-15) radial costae and are nearly lacking secondary radial riblets on costae (strongly developed and scabrous in typical specimens). The shape is somewhat similar to *Mirapecten rastellum* (Lamarck, 1819), but the latter is sculptured with strongly erected scales on the radial costae and dorsal margin of right valve. The byssal notch is also wider than in *M. rastellum* and the auricles are larger.

DISCUSSION

A total of 19 species of Propeamussiidae and 11 species of Pectinidae are present in the material from the KARUBAR cruise in the Arafura Sea. Twenty-eight species (18 propeamussiids and 10 pectinids) were collected near the Kai Islands, and twelve species (6 each of propeamussiids and pectinids) near the Tanimbar Islands. Two species (*Parvamussium conspectum* and *Veprichlamys versipellis*) are new to science, and 8 are new records for Indonesia: *Propeamussium alcocki, P. investigatoris, P. rubrotinctum, Parvamussium squalidulum, P. thetidis, P. vesiculatum, Delectopecten fluctuatus,* and *Haumea inaequivalvis.*

There are 33 stations without pectinoids and 26 stations have only one species. Five stations (02, 13, 29, 31, 32) have six species and station 18 has seven species (3 of them live-taken). Half of the species are represented by at least one live-taken sample, others only by empty shells. *Haumea inaequivalvis* and *Volachlamys singaporina* are intertidal to subtidal species and the KARUBAR records represent empty shells carried downslope to water depths where the species is apparently not normally living. Other than these two species, the depth range indicated by empty shells appears compatible with what is known for the relevant species elsewhere in the Indo-Pacific.

The Kai Islands were selected as the site of the Danish 1922 and KARUBAR 1991 Expeditions because MORTENSEN had hypothesized that deep-sea species occured there at considerably shallower depths than elsewhere in the world. Ten species of Pectinoidea were collected alive during both the KARUBAR and New Caledonia dredging programs (DIJKSTRA, 1995b) and in this respect it may be of interest to compare their bathymetric range in the two regions (Table 1). *Propeamussium alcocki* appears to range deeper in the Arafura Sea than in New Caledonia, but the first occurence of 8 species is shallower or considerably shallower in the Arafura Sea than in New Caledonia. The limited evidence available thus appears to support MORTENSEN's hypothesis.

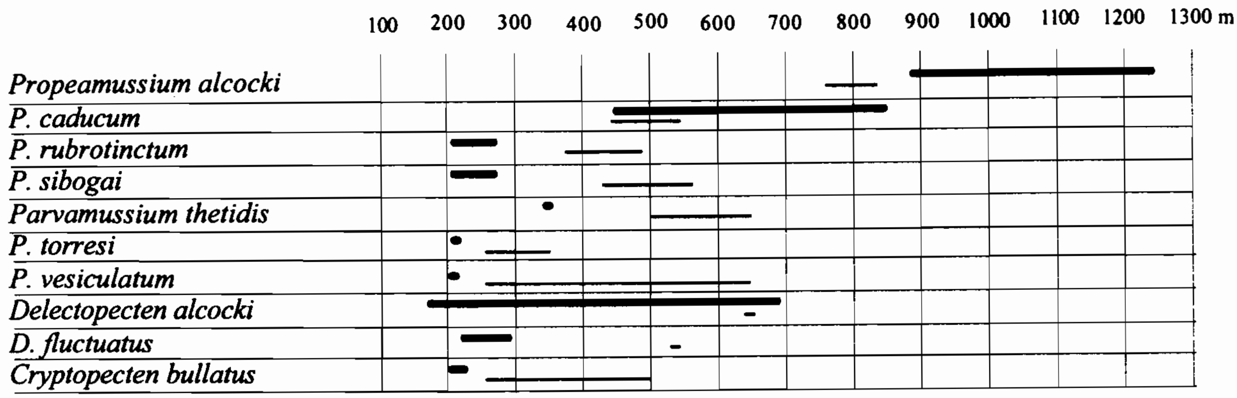


TABLE 1. — Bathymetric range of Pectinoidea in the Arafura Sea (thick bar) and New Caledonia (thin line).

The Indonesian archipelago has been touched by several major expeditions (*Challenger, Valdivia, Galathea*), and was the main focus of several specific ones (*Siboga*, SNELLIUS-II, KARUBAR). A total of 43 deep-water pectinoids are now recorded from the archipelago (Table 2, next page), with most of present knowledge based on the last three mentioned expeditions. Despite this collecting effort, the deep-sea fauna of Indonesia is still probably very incompletely known:

(a) Seventeen species (40%) were first discovered or recorded during the recent SNELLIUS-II (1984-85) and KARUBAR (1991) expeditions.

(b) Nine species (21%) taken during the historical *Challenger, Valdivia* and *Siboga* expeditions have never been taken again since then in Indonesian waters.

(c) In the KARUBAR material, on average, each species is present at 4.4 stations, but there is considerable variation in occurence patterns, with *Delectopecten alcocki* present at 23 stations and 9 species present at single stations. The new species and species representing new records for Indonesia are present on average at 3.9 stations: it thus seems that they are not significantly rarer than the species already known from Indonesia, which are present on average at 4.7 stations.

This indicates that rather many more species of Pectinoidea will probably be discovered when new regions of the Indonesian archipelago will be properly sampled.

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	CH	VA	SI	GA	SN	KA
Propeamussium alcocki						+
P. caducum		+	+		+	+
P. ina			+			+
P. investigatoris			+			+
P. manaricum		+				
P. rubrotinctum						+
P. sibogai			+	+		+
P. siratama			+			+
P. watsoni	+			+		
Parvamussium araneum					+	+
P. carbaseum					+	+
P. cassium					+	+
P. conspectum					+	+
P. cristatellum			+		+	+
P. dautzenbergi			+			
P. lacteum			+			
P. pauciliratum					+	+
P. scitulum			+		+	+
P. squalidulum						+
P. texturatum			+		+	
P. thetidis						+
P. torresi			+			+
P. undosum					+	
P. vesiculatum						+
P. virgatum					+	+
P. zoniferum			+			
Cyclopecten aequatorialis		+				
C. bavayi			+			
C. cancellus					+	
Similipecten eous					+	
Catillopecten translucens			+			
Pectinella aequoris					+	
Delectopecten alcocki		+			+	+
D. fluctuatus						+
D. musorstomi			+		+	
Pseudohinnites levii			+			
Hyalopecten tydemani			+		+	
Laevichlamys aliae			+			+
L. deliciosa			+		+	+
L. gladysiae			+		+	
Veprichlamys versipellis						+
Cryptopecten bullatus			+		+	+
C. nux			+		+	+

TABLE 2. — Pectinoidea from Indonesia normally occuring in depths deeper than 100 m, as collected by the *Challenger* (CH), *Valdivia* (VA), *Siboga* (SI), *Galathea* (GA), SNELLIUS-II (SN) and KARUBAR (KA) Expeditions.

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4

Mollusca, Gastropoda: The Muricidae collected during the KARUBAR Cruise in eastern Indonesia

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ABSTRACT

Sixteen species of Muricidae were collected during the French-Indonesian KARUBAR cruise. Most of them are new records for the region. *Leptotrophon kastoroae* sp. nov. is described and compared to three similar species from New Caledonia.

RÉSUMÉ

Mollusca Gastropoda : Les Muricidae récoltés lors de la campagne KARUBAR en Indonésie orientale.

Seize espèces de Muricidae ont été récoltées lors de la campagne franco-indonésienne KARUBAR. La plupart de celles-ci n'étaient pas connues dans la région. *Leptotrophon kastoroae* sp. nov. est décrite et comparée à trois espèces similaires de Nouvelle-Calédonie.

INTRODUCTION

Rather few species of Muricidae were collected during the French-Indonesian KARUBAR cruise on board of the Indonesian R.V. *"Baruna Jaya 1"*. Indonesia and Papua New Guinea have a very diverse muricid fauna (DHARMA, 1988; HINTON, 1972, 1979), and it was thus unexpected that as few as 16 species are represented in the expedition material. Furthermore one third (6 species) occurred only as empty shells. Eleven species (69%) are represented by a single sample and none has been collected at more than three stations. Most probably the bottom types surveyed during KARUBAR were not favourable to muricids. Most hauls sampled fauna on bottoms of mud or sandy mud, whereas a majority of muricids favour hard substrates. Only 15 stations (16% of all stations) yielded muricids, and in 10 of these the family Muricidae is represented by a single species. Three stations (stn 15, 22, 50) yielded two species, and two (stn 18, 30) gave three species each. Despite the small size of the collection, as many

HOUART, R., 1997. — Mollusca Gastropoda: The Muricidae collected during the KARUBAR Cruise in eastern Indonesia. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des campagnes MUSORSTOM. Volume 16. *Mém. Mus. natn. Hist. nat.*, **172** : 287-294. Paris ISBN 2-85653-506-2.

as 11 species (69%) are new records for the Indonesian archipelago. All this points out to a diverse, but still poorly recorded, fauna, at least in the 100-250 m depth range, where most of the findings have been made.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS	Australian Museum, Sydney, Australia
MNHN	Muséum national d'Histoire naturelle, Paris, France
NSMT	National Science Museum, Tokyo, Japan
POLIPI	Puslitbang Oseanologi-LIPI [Research and Development Centre for Oceanology - Indonesian Institute of Sciences], Jakarta
RH	Author's collection

Other abbreviations

dd	empty shell
lv	collected alive

SYSTEMATIC ACCOUNT

Family MURICIDAE Rafinesque, 1815

Subfamily MURICINAE Rafinesque, 1815

Genus *HAUSTELLUM* Schumacher, 1817

Haustellum multiplicatum (Sowerby, 1895)

Figs 1-2

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 65, 09°14'S, 132°27'E, 174-176 m, 1 dd.

REMARKS. — The species is already known from neighbouring localities, on the Australian side of the Arafura Sea (PONDER & VOKES, 1988). Only one dead and damaged specimen was collected during the expedition.

Genus *CHICOREUS* Montfort, 1810

Chicoreus (Triplex) axicornis (Lamarck, 1822)

MATERIAL EXAMINED. —**Indonesia**. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 111-118 m, 1 lv.

Chicoreus (Siratus) cf. *pliciferoides* Kuroda, 1942

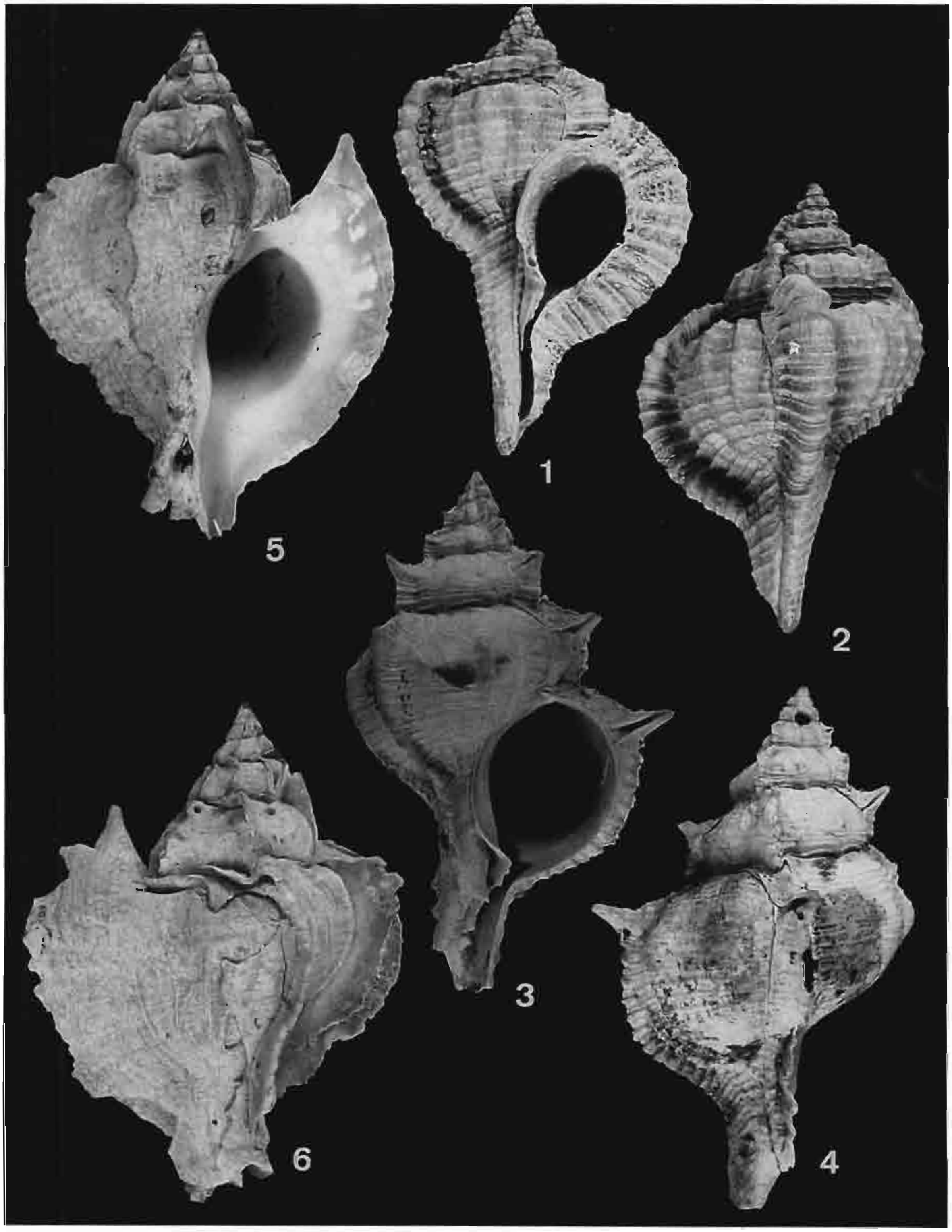
Figs 3-4

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 25, 05°30'S, 132°52'E, 336-346 m, 1 dd.

REMARKS. — The identity of the single collected specimen is uncertain. It is probably not *C. pliciferoides*, but this is the most similar species. The present material is lighter, and relatively smaller, with narrower varices. Nevertheless, the shell of *C. pliciferoides* being very variable morphologically, an examination of more numerous specimens from the same region is necessary before a decision can be reached.

Chicoreus (Chicopinnatus) orchidiflorus (Shikama, 1973)

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands:* stn DW 30, 05°39'S, 132°56'E, 111-118 m, 1 dd.



FIGS 1-2. — *Haustellum multiplicatum* (Sowerby, 1895). Indonesia, Tanimbar Islands, 32.8 mm.
FIGS 3-4. — *Chicoreus (Siratus)* cf. *pliciferoides* Kuroda, 1942. Indonesia, Kai Islands, 50.1 mm.
FIGS 5-6. — *Poirieria (Flexopteron) poppei* Houart, 1993. Indonesia, Kai Islands, 33.3 mm.

Genus *POIRIERIA* Jousseaume, 1880

Poirieria (Flexopteron) poppei Houart, 1993

Figs 5-6

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 10, 05°21'S, 132°30'E, 229-289 m, 1 lv.

REMARKS. — New record for Indonesia.

Genus *DERMOMUREX* Monterosato, 1890

Dermomurex (Takia) infrons Vokes, 1974

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands:* stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 lv. — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 1 lv, 1 dd.

REMARKS. — New record for Indonesia. *Dermomurex infrons* was originally described from Japan (as *Murex inermis* Sowerby, 1841, *non M. inermis* Philippi, 1836). The type locality is confirmed by specimens that were recently collected off Tosa Bay and Sagami Bay (NSMT). Specimens are also known from Transkei, South Africa (material in Natal Museum, Pietermaritzburg).

Subfamily MURICOPSINAE Radwin & D'Attilio, 1971

Only three species (3 specimens) were collected during the KARUBAR expedition. All have been originally described from the Philippine Islands and are new records for Indonesia.

Genus *FAVARTIA* JOUSSEAUME, 1880

Favartia jeanae Bertsch & D'Attilio, 1980

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 1 lv.

Genus *MUREXIELLA* Clench & Perez Farfante, 1945

Murexiella judithae (D'Attilio & Bertsch, 1980)

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 111-118 m, 1 dd.

Murexiella peregrina Olivera, 1980

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 85-124 m, 1 lv.

Subfamily ERGALATAXINAE Kuroda & Habe, 1971

Genus *ERGALATAX* Iredale, 1931

Ergalatax tokugawai Kuroda & Habe, 1971

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 50, 07°59'S, 133°02'E, 184-196 m, 2 lv, 1 dd.

REMARKS. — New record for Indonesia. The species is known from Japan and the Philippine Islands.

Genus *CYTHAROMORULA* Kuroda, 1953

Cytharomorula springsteeni Houart, 1995

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 1 dd. — Stn DW 32, 05°47'S, 132°51'E, 170-206 m, 3 dd.

REMARKS. — New record for Indonesia. The species was only recently described from the Philippine Islands (HOUART, 1995a: 255).

Genus *ORANIA* Pallary, 1900

Orania archaea Houart, 1995

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands:* stn DW 22, 05°22'S, 133°01'E, 85-124 m, 1 lv.

REMARKS. — Although only recently described (HOUART, 1995a: 267), it is present in many collections from many localities in the Indo-West Pacific, but was misidentified.

Subfamily TYPHINAE Cossmann, 1903

Genus *SIPHONOCHELUS* Jousseaume, 1880

Siphonochelus japonicus (A. Adams, 1863)

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 2 lv, 1 dd. — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 1 lv, 5 dd.
Tanimbar Islands: stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1dd.

REMARKS. — New record for Indonesia. Originally described from Japan, its presence there is confirmed by material from Sagami Bay (NSMT 44066). The species is also known from off Queensland, Australia (AMS C169094).

Subfamily TROPHONINAE Cossmann, 1903

Genus *TROPHONOPSIS* Bucquoy & Dautzenberg, 1882

Trophonopsis carduelis (Watson, 1883)

Figs 7-8

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 2 lv, 1 dd. — Stn CC 21, 05°14'S, 133°00'E, 688-694 m, 2 dd.

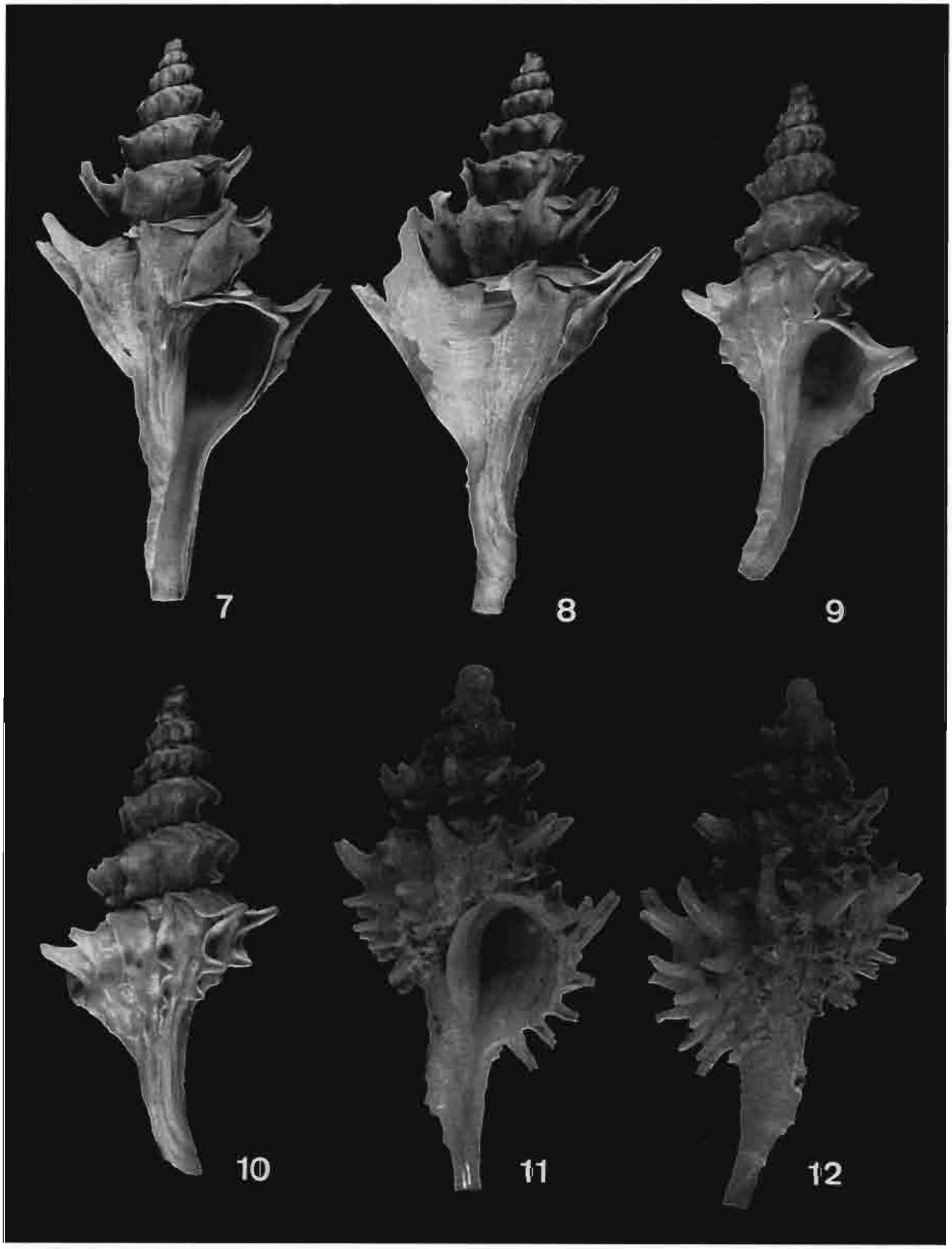
REMARKS. — New record for Indonesia. *Trophonopsis carduelis* was described from off Sydney (Australia). The holotype, although having one teleoconch whorl more, is very similar to the specimen illustrated here.

Trophonopsis plicilaminatus (Verco, 1909)

Figs 9-10

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands:* stn CP 69, 08°42'S, 131°53'E, 356-368 m, 1 lv, 6 dd.

REMARKS. — New record for Indonesia. The species is known from the type locality, off Beachport, South Australia, and from New Caledonia (HOUART, 1995b).



FIGS 7-8. — *Trophonopsis carduelis* (Watson, 1883). Indonesia, Kai Islands, 22.8 mm.
FIGS 9-10. — *Trophonopsis plicilaminatus* (Verco, 1909). Indonesia, Kai Islands, 13 mm.
FIGS 11-12. — *Leptotrophon kastoroae* sp. nov. Indonesia, Kai Islands, holotype, 11.2 mm.

Genus *LEPTOTROPHON* Houart, 1995

Leptotrophon kastoroae sp. nov.

Figs 11-12

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 14, 05°18'S, 132°38'E, 245-246 m, 2 lv, 1 dd. — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 1 lv (holotype), 12 dd (paratypes: 2 MNHN, 2 POLIPI, 1 RH). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 1 lv, 4 dd.

TYPE MATERIAL. — Holotype MNHN. Paratypes: 2 MNHN, 2 POLIPI, 1 RH.

TYPE LOCALITY. — Indonesia. Kai Islands, KARUBAR, stn DW 15, 05°17'S, 132°41'E, 212-221 m.

DISTRIBUTION. — Indonesia, Kai Islands, alive in 212-245 m.

DESCRIPTION. — *Shell* up to 11.2 mm (holotype), slender, spinose, lightly built. Spire high, with 1.5 protoconch whorls, and up to 5 weakly convex, spinose teleoconch whorls. Suture impressed. *Protoconch* broad, globose, smooth, glossy. Terminal varix unknown (eroded). Axial sculpture of teleoconch whorls consisting of numerous, weak growth striae and high, rounded varices, each with long, narrow, sharp primary and secondary spines. Shoulder spine longest, weakly adapically bent. First and second whorls with 9 varices, third with 9 or 10, fourth with 10 or 11, last whorl with 10 varices. Spiral sculpture of strong, smooth, primary and secondary cords: first to third whorl with 2 primary cords, fourth with 2 primary and 1 secondary cords, shoulder with 1 secondary cord, last whorl with 5 or 6 primary and secondary cords, shoulder with 1 secondary cord. Occasionally with numerous, narrow spiral striae. Aperture small, rounded. Columellar lip flaring, smooth. Lip erect, adherent adapically. Anal notch indistinct. Outer lip smooth, with 4-6 more or less visible denticles within, very variable in strength. Siphonal canal long, narrow, straight, open, smooth. White.

REMARKS. — The genus *Leptotrophon* Houart, 1995 was described to include numerous small species of Trophoninae with a spinose, delicate, and small shell, all from the New Caledonia region (HOUART, 1995b). The occurrence of another, new species in Indonesia is a very interesting range extension for the genus. *Leptotrophon kastoroae* is similar to three other spinose species of *Leptotrophon*: *L. spinacutus* Houart, 1986; *L. bernadettae* Houart, 1995, and *L. rigidus* Houart, 1995. From *L. spinacutus*, *L. kastoroae* differs in having relatively longer spines, a narrower siphonal canal, and a broader aperture with a narrower apertural varix. From *L. bernadettae*, it differs in its relatively broader and rounded protoconch, narrower columellar lip, and more slender shell. *L. kastoroae* is relatively smaller than *L. rigidus*, with more numerous, longer spines, a twice larger protoconch, and a narrower siphonal canal.

ETYMOLOGY. — Named for Mrs W. KASTORO (Indonesian Institute of Sciences Research and Development Centre for Oceanology, Jakarta), one of the member of the KARUBAR cruise.

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5

Mollusca Gastropoda: Arafura Sea Cancellariidae collected during the KARUBAR Cruise

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ABSTRACT

The deep-water Cancellariidae collected during the KARUBAR cruise near the Kai and Tanimbar Islands are represented by 20 species (9 new), only two of which were recorded earlier from the Arafura Sea. As many as 14 species (70% of the total) are represented by single specimens, and 17 (85%) have been collected at one station only: this points to a still more diverse cancellariid fauna. New species of *Axelella*, *Perplicaria*, and *Solatia* represent the first occurence of these genera in the Indo-West Pacific. *Admete aethiopica* Thiele, 1925, recently suspected to be a species of Turridae, is confirmed as a cancellariid.

RÉSUMÉ

Mollusca Gastropoda : Cancellariidae de la mer d'Arafura récoltés durant la campagne KARUBAR.

Les Cancellariidae de mer profonde, récoltés pendant la campagne KARUBAR près des îles Kai et Tanimbar (mer d'Arafura) sont représentés par 20 espèces, dont 9 nouvelles. Deux de ces espèces, seulement, étaient déjà connues de la mer d'Arafura. Pas moins de 14 espèces (70% du total) sont représentées par des spécimens uniques, et 17 (85%) ont été récoltées uniquement à une station : ceci indique que la faune locale de cancellaires est encore plus diversifiée que ne le laissent apparaître les résultats de cette expédition. Des espèces nouvelles d'*Axelella, Perplicaria* et *Solatia* permettent de mentionner, pour la première fois, ces genres dans l'Indo-Ouest Pacifique. Il est par ailleurs confirmé qu'*Admete aethiopica* Thiele, 1925, supposée récemment être un Turridae, est bien un Cancellariidae.

INTRODUCTION

The malacofauna of the Indonesian seas has not yet been adequately inventoried. A review of the Cancellariidae from that area has been published (VERHECKEN, 1986), based on the rather poorly documented material collected mainly early this century, furthermore mostly from shallow water. By contrast, the material studied here is

VERHECKEN, A., 1997. — Mollusca Gastropoda: Arafura Sea Cancellariidae collected during the KARUBAR Cruise. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 295-323. Paris ISBN 2-85653-506-2.

excellently documented and originates from depths from the continental shelf down to about 800 m. Despite that only a limited geographical area of the northern Arafura Sea was covered, it is unexpectedly rich in specimens (72) and species (20, nine of which are here described as new to science) of Cancellariidae.

Supraspecific taxonomy of Cancellariidae has not yet been worked out satisfactorily and generic allocation of several species discussed here proved to be difficult. Genera of small deep-water cancellariids have been named based on fossil and Recent Australian and New Zealand species. A great confusion prevails, which will be difficult to unravel without reevaluation of the relevant type material and examination of representative collections. Hence, generic names used here may be open to discussion and their usage does not necessarily imply their recognition as the most appropriate name. Therefore, in this paper all genus-level names are treated as genera (no subgenera), and no new generic names are introduced.

ABBREVIATIONS AND TEXT CONVENTIONS

Repositories

AMS	Australian Museum, Sydney
AMNH	American Museum of Natural History, New York
AV	Author's collection, Mortsel
BMNH	The Natural History Museum, London
DMNH	Delaware Museum of Natural History, Greenville
NZGS	Institute of Geological and Nuclear Sciences, Lower Hutt
KBIN	Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels
MNHN	Muséum national d'Histoire naturelle, Paris
NMW	National Museum of Wales, Cardiff
NSMT	National Science Museum, Tokyo
POLIPI	Puslitbang Oseanologi-LIPI [Research and Development Centre for Oceanology - Indonesian Institute of Sciences], Jakarta
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC
WAM	Western Australian Museum, Perth
ZMA	Zoologisch Museum, Amsterdam
ZMHU	Museum für Naturkunde, Berlin

Other abbreviations

dd	empty shell
lv	collected alive
spm	specimen (condition at the time of collecting unknown)
OD	original designation
SD	subsequent designation

Counting of protoconch whorls follows VERDUIN (1984). Full references to taxa mentioned in comparisons are listed in PETIT & HARASEWYCH (1990) and are not repeated here.

Paratypes and other reference material are in POLIPI as noted under each species. All other material is in MNHN.

SYSTEMATIC ACCOUNT

Family CANCELLARIIDAE Forbes & Hanley, 1851

Subfamily CANCELLARIINAE

Genus *AXELELLA* Petit, 1988

Axelella Petit, 1988: 130 (*nom. nov.* for *Olssonella* Petit, 1970, *non* Glibert & Van de Poel, 1967). Type species (OD): *Cancellaria smithii* Dall, 1888. Recent, Western Atlantic.

Species of *Axelella* are found almost exclusively in central American seas, both Caribbean and Panamic-Pacific. The two species treated here are certainly not typical representatives and are placed in the genus only by lack of a more appropriate genus.

Axelella kastoroae sp. nov.

Figs 1-4

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 31, 05°40'S, 132°51'E, 288-289 m, 1 dd.

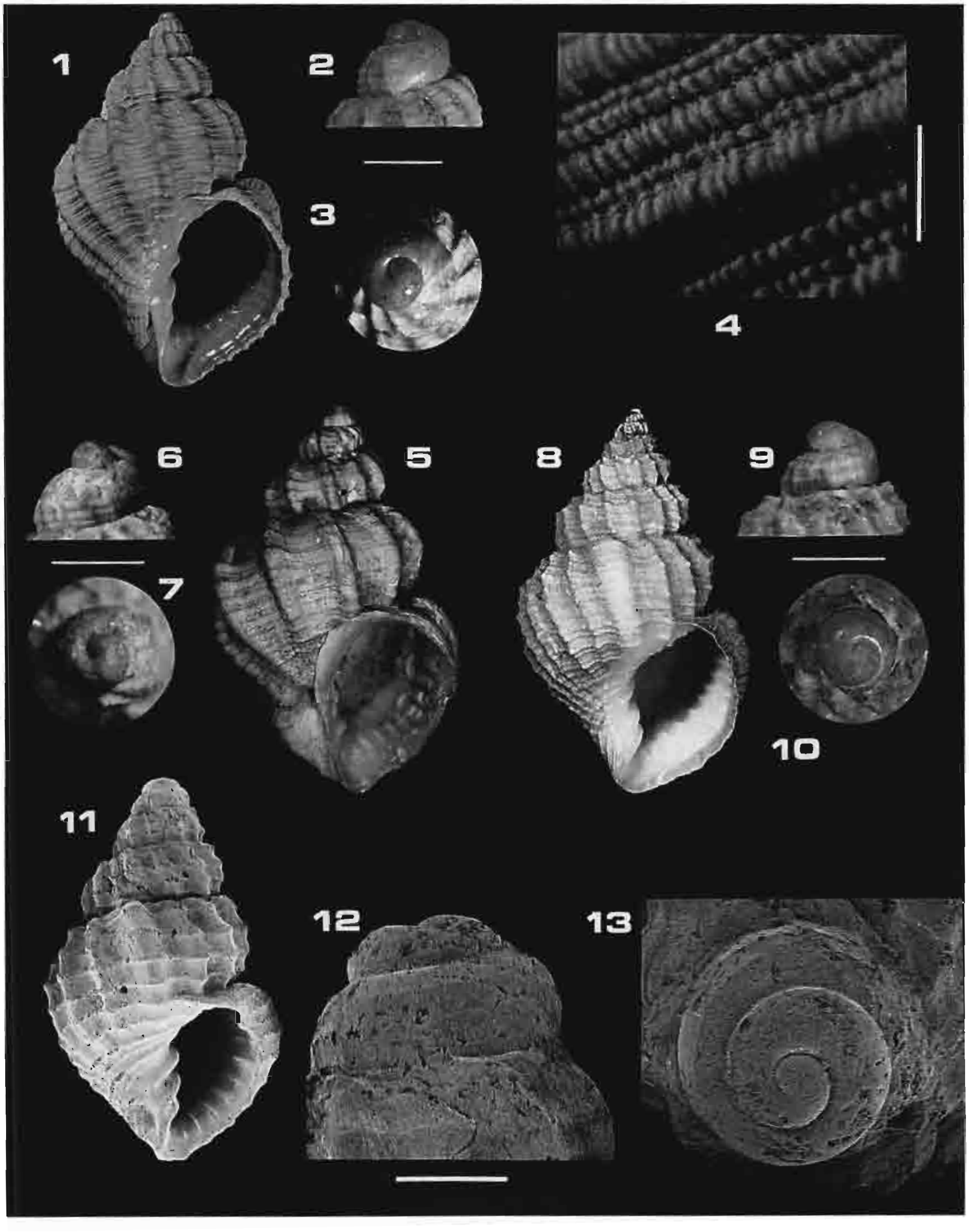
TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — Indonesia. Off Kai Islands, KARUBAR, stn DW 31, 05°40'S, 132°51'E, 288-289 m.

DESCRIPTION. — *Shell* biconical, with convex whorls and a large aperture. *Protoconch* (Figs 2-3) smooth, paucispiral with 1.0 whorl, maximum diameter 1.0 mm, exposed height 0.7 mm. Transition to teleoconch marked only by start of teleoconch sculpture. *Teleoconch* with 4 1/4 convex whorls. Axial sculpture of narrow rounded ribs: 12, 12, 13 and 12 on first to fourth whorl respectively, 10 on last whorl. Spiral sculpture of broad flat bands, 6 on first teleoconch whorl. From the second whorl on, between the broader bands up to 4 narrower ones occur, all bands fitting closely together. On third and fourth whorl 8 primary bands, plus secondary and tertiary ones. On last whorl up to 60 spirals bands, divided axially by sharp, raised incremental riblets (Fig. 4). Suture impressed, very slightly canaliculate. *Aperture* semicircular, tapering anteriorly into a short siphonal canal oriented slightly abaxially. Columella straight, parallel to shell axis, with three strongly oblique folds, adapical one strongest, weak abapical fold near rim of siphonal canal. Outer lip with crenulated edge, 14 lirae inside. Umbilical slit narrow, almost completely closed by columellar callus. Siphonal fasciole present but not strong.

Dimensions: 15.5 x 10.4 mm.

REMARKS. — *Axelella kastoroae* is rather similar to *Cancellaria quasilla* Petit, 1987 (= *Cancellaria cretacea* E. A. Smith, 1899, *non* Nyst, 1881) from off Southern India, Burma, and off Northern Somalia. The apical whorls of the holotype of *C. quasilla* (material examined in the Zoological Survey of India, Calcutta) are strongly eroded, but specimens from off Somalia (AV) have a multispiral protoconch. In spite of a large distance in time and space, *A. kastoroae* also resembles *Cancellaria paraguanensis* H. K. Hodson *in* HODSON & HODSON, 1931, from the Miocene of Venezuela, as figured by JUNG (1965, pl. 75, figs 15-16). The latter species grows up to 36 mm, has a stronger siphonal fasciole and fewer axials on the last whorl as compared to *A. kastoroae*. HODSON (1931: 44) and JUNG (1965: 555) did not place *C. paraguanensis* in a subgenus and PETIT (1987: 154) compared *C. quasilla* with species of *Merica*, stating that a determination of subgeneric placement was not yet possible. These species, which in my opinion are congeneric, differ from typical *Cancellaria* (*s. s.*) species in lacking the bifid posterior columellar fold. Further, *Axelella kastoroae* differs from species of *Merica* in its much more convex whorls and its broad axial sculpture. The microsculpture of *A. kastoroae* (Fig. 4) resembles that of *Nipponaphera habei* Petit, 1972 (Japan and the Philippines) but is finer; the latter species has a multispiral protoconch and the teleoconch whorls are strongly angulate. In general form, the new species also bears some resemblance to



FIGS 1-4. — *Axelella kastoroae* sp. nov.: **1**, holotype, 15.5 mm; **2-3**, protoconch. Scale bar: 1 mm; **4**, detail of teleoconch sculpture. Scale bar: 0.4 mm.

FIGS 5-7. — *Axelella* cf. *nodosivaricosa* (Petuch): **5**, 14.9 mm, stn CP 67, 146-233 m; **6-7**, protoconch. Scale bar: 1 mm.

FIGS 8-10. — *Bonellitia atopodonta* (Petit & Harasewych): **8**, 22.6 mm, stn CP 83, 285-297 m; **9-10**, protoconch of Fig. 8. Scale bar: 1 mm.

FIGS 11-13. — *Bonellitia garrardi* (Petit): **11**, 7.4 mm, stn DW 49, 206-210 m; **12-13**, protoconch of same. Scale bar: 0.5 mm.

Axelella funiculata (Hinds, 1843) from western Central America, but that species is more elongated, it has a much more impressed suture and stronger columellar folds, it lacks the sculpture of sharp, raised incremental riblets and it has a multispiral protoconch.

ETYMOLOGY. — Named in honour of Mrs Widana KASTORO (POLIPI).

***Axelella* cf. *nodosivaricosa* (Petuch, 1979)**

Figs 5-7

Agatrix (Olssonella) nodosivaricosa Petuch, 1979: 11, 15, figs 26-27.
Scalptia nodosivaricosa - SPRINGSTEEN & LEOBRERA, 1986: 334, pl. 95, fig. 10.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 67, 08°58'S, 132°06'E, 146-233 m, 1 dd.

TYPE MATERIAL. — Holotype (11 x 9 mm), DMNH 126397.

TYPE LOCALITY. — Philippines. Off Balicasag, Bohol Island, 300 m.

DISTRIBUTION. — *A. nodosivaricosa* is known from the Philippines and Japan (AV, KBIN), now possibly extended to the Arafura Sea.

REMARKS. — The rather eroded shell (14.9 x 9.8 mm) is very close to specimens of *A. nodosivaricosa* from the Philippines and Japan (AV, KBIN) but differs from them in having the whorls more inflated, fewer axial ribs on spire whorls (8, 9, 9 vs 14, 13, 9 on second to fourth whorl respectively), and spiral sculpture only weakly indicated. The last adult whorl has 7 axial ribs in both the KARUBAR specimen and typical *A. nodosivaricosa*. The present specimen has a paucispiral protoconch with 1 whorl, maximum diameter 0.9 mm, exposed height 0.7 mm, nucleus diameter 0.4 mm. Typical *A. nodosivaricosa* (KBIN, AV, Figs 60-62) have a protoconch with 1 1/4 to 1 3/4 whorl, maximum diameter 0.95 mm, exposed height 0.8 mm, nucleus diameter 0.3 mm, and this results in rather different general appearance (Figs 6-7 vs Figs 61-62). The main difference resides in the regularly squared cancellation of the earlier whorls in *A. nodosivaricosa*, versus the strong axial sculpture in the present specimen. Since only one rather eroded shell is at hand, it is hard to judge the value of cited differences; therefore this shell is here provisionally identified as conforming *A. nodosivaricosa*.

Genus ***BONELLITIA*** Jousseaume, 1887

Bonellitia Jousseaume, 1887: 223. Type species (OD): *Cancellaria bonellii* Bellardi, 1841. Miocene-Pliocene Italy.
Admetula Cossmann, 1889 has been used for species in this genus; for a discussion on these names, see VERHECKEN, 1986 : 33.

Bonellitia atopodonta **(Petit & Harasewych, 1986)**

Figs 8-10

Cancellaria atopodonta Petit & Harasewych, 1986: 440, figs 5-6.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59' E, 769-809 m, 1 dd. — Stn CC 21, 05°14'S, 133°00'E, 688-694 m, 1 lv. — Stn DW 24, 05°32'S, 132°51'E, 230-243 m, 1 dd.

Tanimbar Islands: stn CP 38, 07°40'S, 132°27'E, 620-666 m, 1 lv (POLIPI). — Stn CP 59, 08°20'S, 132°11'E, 399-405m, 1 dd (POLIPI). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 7 dd, 1 lv. — Stn CP 70, 08°41'S, 131°47E, 410-413 m, 2 dd (POLIPI). — Stn CP 72, 08°36'S, 131°33'E, 676-699 m, 1 lv. — Stn CP 77, 08°57'S, 131°27'E, 346-352 m, 1 lv (POLIPI). — Stn CP 78, 09°06'S, 131°24'E, 284-295 m, 1 dd (POLIPI). — Stn CP 83, 09°23'S, 131°00'E, 285-297 m, 1 dd.

Total: 19 specimens; dimensions up to 24.8 x 15.4 mm.

TYPE MATERIAL. — Holotype (21.5 x 13.6 mm) and 2 paratypes MNHN.

TYPE LOCALITY. — Philippines. SSW of Batangas, Luzon, MUSORSTOM 2, stn CP 78, 13°49'N, 120°28'E, 441-510 m.

DISTRIBUTION. — Philippines, now extended to the Arafura Sea, alive in 352-688 m, shells in 243-809 m.

REMARKS. — The protoconch of most specimens is heavily corroded. Fresh shells have a pale fawn periostracum with strong solid hairs, 0.5 mm long, flattened and broadened at base. This species is nearest to *Bonellitia garrardi*, from which it differs by its larger size, sharper sculpture, and paucispiral protoconch (Figs 9-10). *B. garrardi* has more rounded whorls, and lacks the deep suture and distinct shoulder of *B. atopodonta*.

Bonellitia garrardi (Petit, 1974)

Figs 11-13

Cancellaria (Merica) nassoides Schepman, 1911: 263, pl. 18, fig. 9 (*non* von Koenen, 1889).
Admetula garrardi Petit, 1974: 104 (*nom. nov.* for *C. nassoides* Schepman). — GARRARD 1975: 33, fig. 2(10).
Neadmete nassoides - HABE, 1961: 435, pl. 23, fig. 5.
Bonellitia garrardi - VERHECKEN, 1986: 34, figs 1-2.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 dd.

TYPE MATERIAL. — Holotype (16.2 x 10.1 mm) ZMA.

TYPE LOCALITY. — Indonesia. Near Kai Islands, *"Siboga"*, stn 256, 05°26.6'S, 132°32.5'E, 397 m.

DISTRIBUTION. — Japan, Indonesia, and Queensland, Australia (VERHECKEN, 1986: 34); Philippines (USNM, several lots, unpublished).

REMARKS. — The present specimen is small (7.4 x 4.6 mm), slightly worn, and has part of the outer lip broken. Its large, blunt-tipped multispiral protoconch (1 7/8 whorls; maximum diameter 1.0 mm; exposed height 0.6 mm; Figs 12-13) differentiates it from the sympatric *B. atopodonta* and from *B. superstes* Finlay, 1930, from New Zealand, both having a relatively high paucispiral protoconch.

Genus ***BROCCHINIA*** Jousseaume, 1887

Brocchinia Jousseaume, 1887: 221. Type species (SD by SACCO, 1894: 68): *Voluta mitraeformis* Brocchi, 1814 *non* Lamarck, 1811 [= *Brocchinia tauroparva* Sacco, 1894]. Pliocene, Italy.

Inglisella Finlay, 1924 [type species (OD): *Ptychatractus pukeuriensis* Suter, 1917, Miocene, New Zealand] may be a synonym. FINLAY (1924: 501) first placed *P. pukeuriensis* provisionally in *Brocchina* [*sic*], but later proposed the new genus *Inglisella*, differing "in the thin shell, different form of growth, discrepant sculpture, much straighter columella, and rather pronounced posterior notch in the outer lip just at the keel" (FINLAY, 1924: 513).

The KARUBAR species have a solid shell and a columella with rather strong folds; consequently they are here placed in *Brocchinia*.

Brocchinia fischeri (A. Adams, 1860)

Figs 14-18, 22-24

Cancellaria (Merica) fischeri A. Adams, 1860: 411.
?*Solutosveltia abyssicola* Habe, 1961: 438, pl. 23, fig. 4.

Merica fischeri - A. ADAMS, 1868: 368.
"Cancellaria" fischeri - HABE, 1961: 437.
Inglisella fischeri - GARRARD, 1975: 39, figs 4 (8)-(11).
Cancellaria (Merica) fischeri - HABE, 1985: 10, pl. 2, fig. 4.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 1 dd. — Stn DW 14, 05°18'S, 132°38'E, 245-246 m, 1 lv (POLIPI). — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 1 lv, 2 dd. — Stn DW 28, 05°31'S, 132°54'E, 448-467 m, 8 dd.

Tanimbar Islands: stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 lv, 2 dd. — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 1 lv (POLIPI).

Total 16 specimens, dimensions up to 12.8 x 5.4 mm, with up to 6 teleoconch whorls.

TYPE MATERIAL. — *C. fischeri*: Not located. Three shells from the CUMING collection, BMNH 1968419, were considered possible syntypes and figured as such by GARRARD (1975) and HABE (1985). However, the locality "was written in pencil on the reverse of the board, together with the citation for the original description; the front of the board also bears the locality Korea. The only original writing on the board is the label on the front with the name '*Fischeri*, A. Ad' and the initials M.C. on the reverse denoting the origin of the specimens with Hugh Cuming" (K. WAY, *in litt.* viii-1995). This lot is now in the general collection, BMNH, with the label "These specimens had been separated as the types; this is unlikely".

S. abyssicola: whereabouts of holotype (7.9 x 4.8 mm) and paratype (6.8 x 4.2 mm) not mentioned by HABE (1961).

TYPE LOCALITY. — *C. fischeri*: "Strait of Corea", 114 m. — *S. abyssicola*: Japan, off Kochi Prefecture, Shikoku, about 150 m.

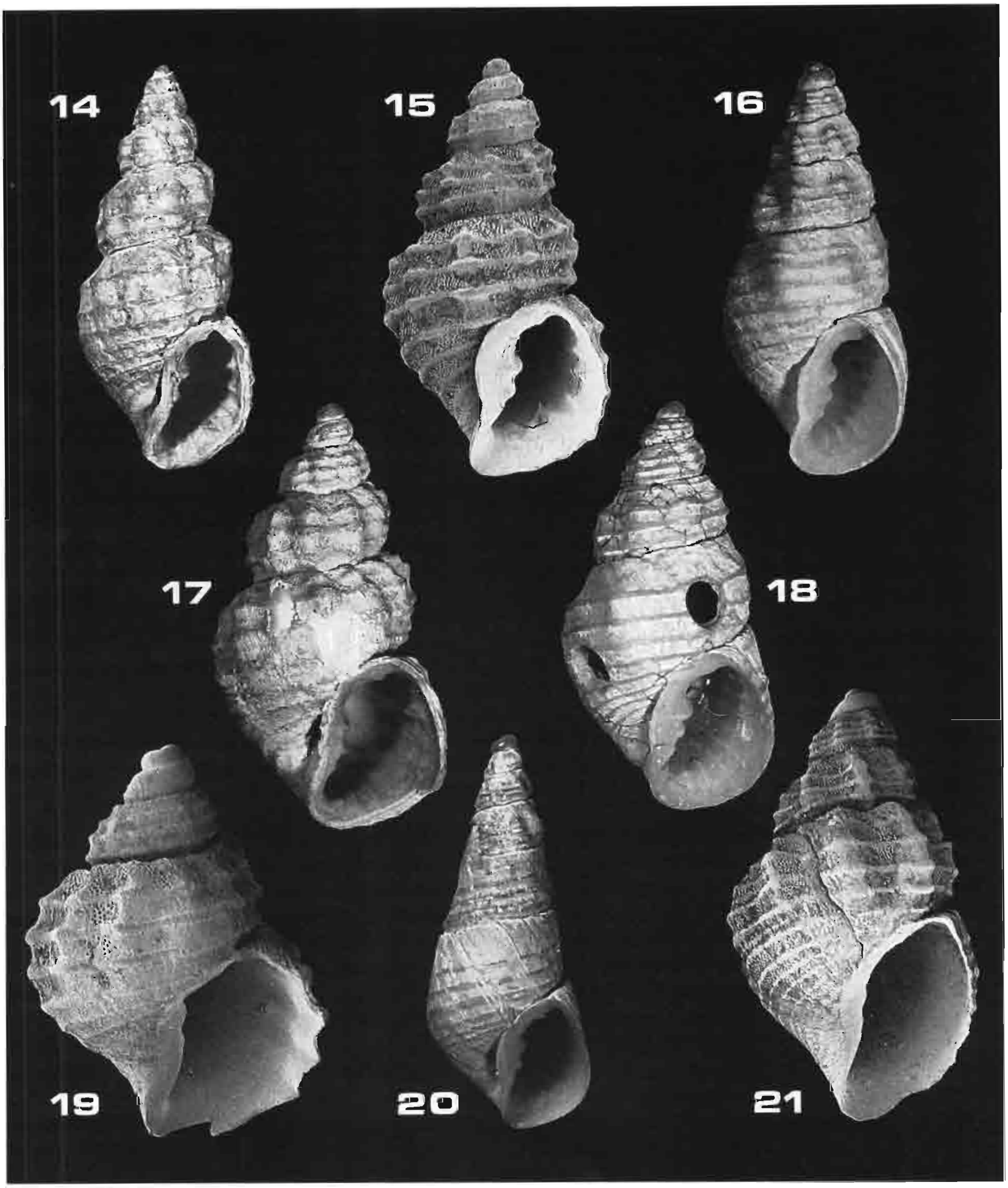
DISTRIBUTION. — Korea; formerly recorded from Japan [A. ADAMS, 1868: 368; and a single specimen each in KBIN, ZMHU, NMW (1955.158.1906), and BMNH], but such records have not been confirmed recently (HABE, 1985: 10); China Sea, off Pratas Island, 234 m (USNM 284939); Philippines (USNM 288372, 289413; said to be from 40 and 1017 m !); Borneo, 622 m (USNM 289966); off South and Western Australia, 79-147 m (GARRARD, 1975: 39).

REMARKS. — *Brocchinia fischeri* has remained little known in the literature. It was omitted by LOEBBECKE (1881-1886), and TRYON (1885: 84) simply mentioned it under the "unfigured and unidentified species of *Cancellaria*". It has only been illustrated by GARRARD (1975) and HABE (1985). *B. fischeri* proves to be rather variable (Figs 14-18), spire angle 36°-41°. Most KARUBAR specimens as well as 8 specimens in AMS show a pitted surface at magnification x 30-60, and SEM pictures show a complex surface with irregularly shaped cavities (Fig. 24). This may represent an intritacalx, an outer shell layer known in Muricidae and several other families, including Cancellariidae (D'ATTILIO & RADWIN, 1971). This microsculpture is practically absent on exposed parts of the shell, such as the spiral cords, and this observation agrees with the softness of intritacalx layers. The fact that a similar pitted layer is also present in related species (*B. kaiensis*, *B.* spec. A, *B.* spec. B) might indicate that this is indeed an intritacalx with possibly taxonomic value, rather than an accidental corrosion present on the teleoconch but not on the protoconch. This type of intritacalx structure has not yet been described in Cancellariidae.

Measurements of intact protoconchs (mean and standard deviation, n = 14): number of whorls, 1.17, 0.24; maximum diameter, 0.74, 0.08 mm; exposed height, 0.59, 0.10 mm.

The name *Solutosveltia abyssicola* is based on shells with an aberrant aperture and may well be a synonym of *B. fischeri*. A shell from KARUBAR: stn DW 28 (Fig. 17) seems to be intermediate between *B. fischeri* and *S. abyssicola* (Fig. 64). The genus *Solutosveltia* is based only on the presence of a semidetached aperture, a character of doubtful taxonomic value.

The elongated form of *Brocchinia fischeri* is similar to that of *B. clenchi* Petit, 1986, from the Atlantic, which has a much weaker sculpture and no pitted shell surface. *B. exigua* (Smith, 1891) from off southeastern Australia has a less constricted suture, lacks the pitted shell surface, has 2 spiral cords per whorl, and only one weak columellar fold.



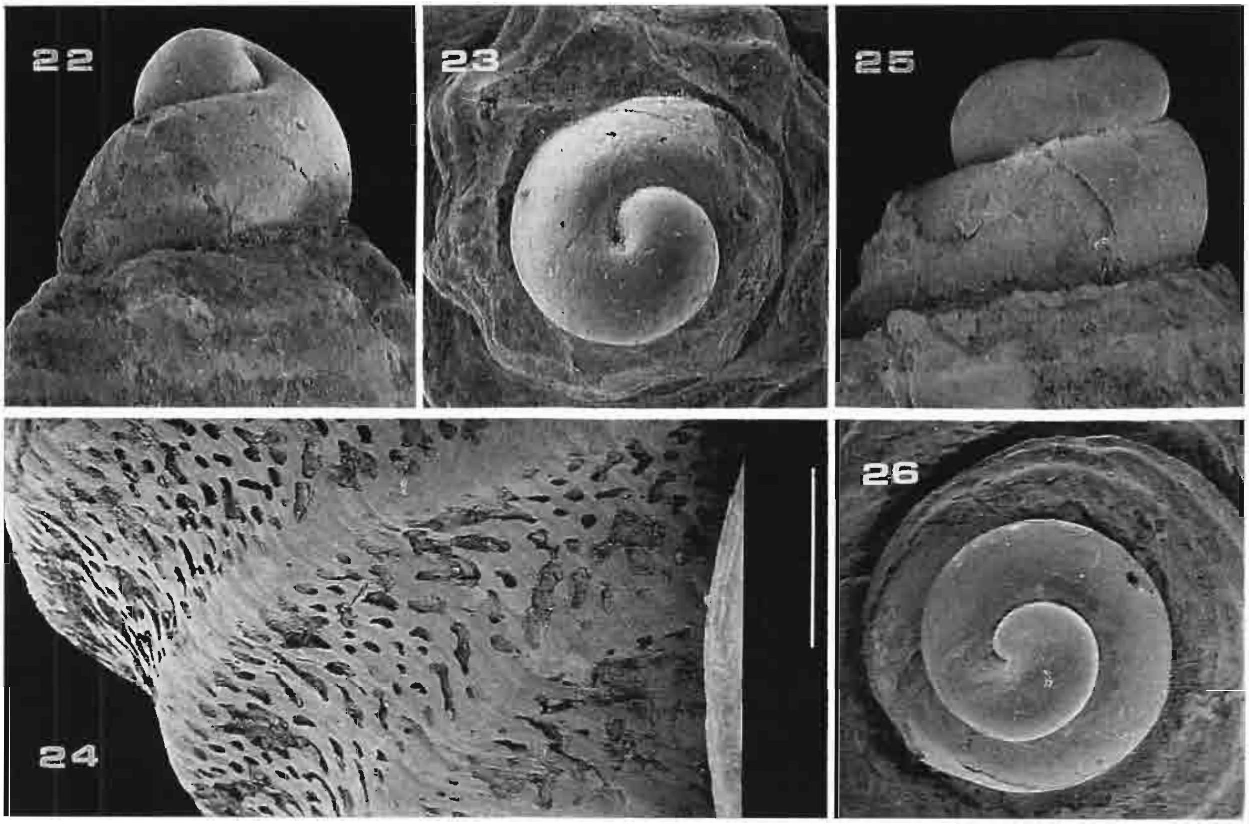
FIGS 14-18. — *Brocchinia fischeri* (A. Adams), illustration of variability: **14**, 12.8 mm, stn DW 28, 448-467 m; **15**, 6.9 mm, stn DW 28; **16**, 8.2 mm, stn DW 15, 212-221 m; **17**, 10.3 mm, stn DW 28; **18**, 9.8 mm, stn DW 02, 209-240 m.

FIG. 19. — *Brocchinia kaiensis* sp. nov., holotype, 4.4 mm.

FIG. 20. — *Brocchinia* spec. A, 9.0 mm, stn DW 15, 212-221 m.

FIG. 21. — *Brocchinia* spec. B, 5.7 mm, stn DW 49, 206-210 m.

Brocchinia fischeri belongs to a group of closely related species, occurring both as fossil and Recent in the Pacific from Japan to New Zealand, and also in the Atlantic including Europe, and which have been classified under various generic names. *Brocchinia* was introduced for a European tertiary fossil; *Inglisella* Finlay, 1924, *Anapepta* Finlay, 1930, *Gergovia* Cossmann, 1899, *Microsveltia* Iredale, 1925, *Solutosveltia* Habe, 1961, etc. have been proposed for Indo-Pacific, Australian and New Zealand species.



FIGS 22-24. — *Brocchinia fischeri* (A. Adams), stn DW 49, 206-210 m: **22-23**, protoconch; **24**, detail of (intritacalx ?) sculpture on last teleoconch whorl. Scale bar: 1 mm.

FIGS 25-26. — *Brocchinia kaiensis* sp. nov., holotype, protoconch. Scale bar: 0.5 mm for both protoconchs.

Brocchinia kaiensis sp. nov.

Figs 19, 25-26

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 446-467 m: 1 lv.

TYPE MATERIAL. — Holotype lv, MNHN.

TYPE LOCALITY. — Indonesia. Off Kai Islands. KARUBAR, stn DW 28, 05°31'S, 132°54'E, 446-467 m.

DESCRIPTION. — *Shell* small, globose, spire angle 65°. *Protoconch* paucispiral, somewhat eroded, with about 1.5 whorls with impressed suture, maximum diameter 0.8 mm, exposed height 0.7 mm (Figs 25-26). Transition to teleoconch eroded. *Teleoconch* of about 2 3/4, rapidly expanding whorls. Axial sculpture practically absent on first whorl; 9 indistinct broad rounded ribs on second and last whorls. Spiral sculpture consisting of 3 spiral bands on first two whorls, width about 0.1 mm, remaining equal in strength when crossing over the axial ribs, almost no nodules formed at intersections. Whorls convex, suture lined by a very narrow and shallow canal.

Aperture semicircular; outer lip crenulated, no inner lirae, only broad grooves corresponding to spiral bands on outer surface of last whorl. Columella straight, short, with a moderately strong fold and a fainter one forming the rim of the wide siphonal canal. Narrow zone of thin columellar callus; no umbilicus, no siphonal fasciole.

Dimensions: 4.4 x 4.3 mm.

REMARKS. — *B. kaiensis* also has a pitted shell surface between the spiral bands. The general outline is intermediate between *B. tanimbarensis* and *B. fischeri*. From *B. tanimbarensis*, *B. kaiensis* differs by having distinct spiral bands, also in interspaces between axials, no sutural ramp and practically no nodules at intersection of axial and spiral sculpture. *B. fischeri* is much more slender than *B. kaiensis*, its protoconch is more depressed, its columellar folds and callus are much stronger, and it has a parietal tooth.

ETYMOLOGY. — Named after the Indonesian archipelago of the Kai Islands.

Brocchinia spec. A

Figs 20, 27-28

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 15, 05°17'S, 132°41'E, 212-221 m, 1 dd.

DESCRIPTION. — *Shell* high, conical, spire angle 27°, with straight sides and small aperture. *Protoconch* paucispiral with 1 1/4 whorl, nucleus relatively large, whorls smooth and rounded (Figs 27-28), maximum diameter 0.8 mm, exposed height 0.6 mm. Protoconch wider than adapical part of first teleoconch whorl. Transition to teleoconch clearly marked. *Teleoconch* with 5 whorls, the first two with 7 weak, broad axial ribs, subsequent whorls without axial sculpture apart from strongly prosocline growth lines. Spiral sculpture of 3 narrow bands on spire whorls, grouped in abapical two thirds of whorl. Younger whorls flush, suture very slightly grooved. Base with 4 spiral bands getting weaker abapically. Last whorl with 13 spiral bands. Teleoconch surface pitted. *Aperture* rounded, triangular. Outer lip expanded abapically, with 8 strong lirae inside at some distance from edge. Columella short, inclined adaxially, with 2 strong folds and a weaker one at rim of short siphonal canal. One parietal tooth. Columellar callus expanded into a solid but thin-edged columellar collar, half covering a deeply placed umbilical slit.

Dimensions: 9.0 x 3.9 mm.

REMARKS. — This single shell is characterised by its elongated, almost perfectly conical shape, differentiating it from *B. fischeri* with its rather strongly constricted suture. Already the first teleoconch whorl has the characteristic flush shape, versus the more rounded whorls of *B. fischeri*. However, the possibility cannot be excluded that this shell is only an aberrant form of *B. fischeri*: it has columellar folds, callus, and parietal tooth much like it, and the early whorls similarly do have axial sculpture. The loss of axial sculpture might have been caused by some trauma to the mantle. Protoconch dimensions do not allow a distinction to be made. More material will be needed to assess whether or not it is a separate species.

Brocchinia spec. B

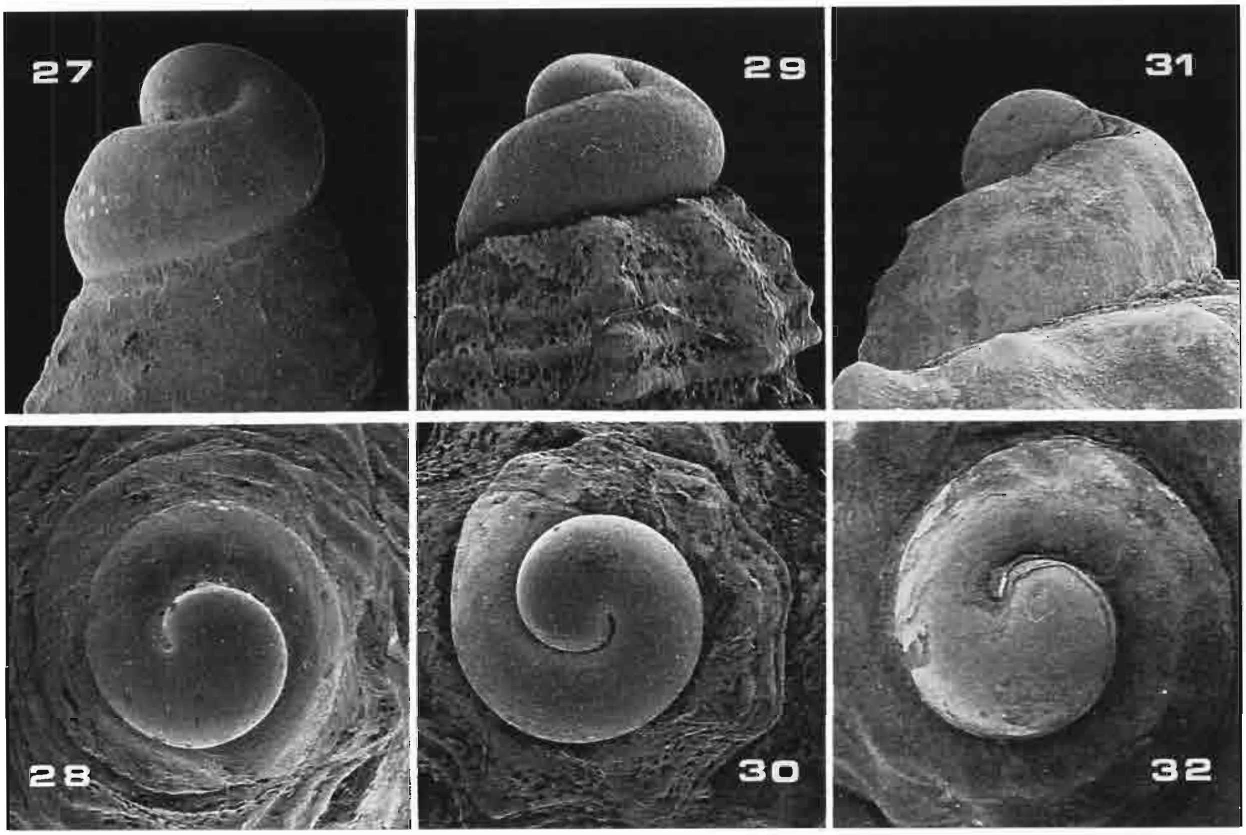
Figs 21, 31-32

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 206-210 m, 1 lv.

DESCRIPTION. — *Shell* small, elongated, spire angle 53°. *Protoconch* paucispiral, 1 1/4 smooth whorl, maximum diameter 0.8 mm, exposed height 0.6 mm (Figs 29-30). *Teleoconch* with 3.5 whorls, suture impressed with rather narrow groove. Axial sculpture of broadly rounded ribs, 8, 7, 9 on 1st to 3rd whorl. Spiral sculpture consisting on first two whorls of 3 cords, packed together in abapical 2/3 of whorl; on 3rd whorl 4 well-defined spiral cords and a smoothly indicated one in adapical part of whorl; on last half whorl, secondary spirals are formed between the main cords. Fifteen spirals on last whorl behind outer lip. Teleoconch surface pitted.

Aperture elongated oval, outer lip thin, possibly not fully developed. No umbilicus, no siphonal fasciole. Only a narrow zone with thin columellar callus. Columella straight, one faint fold and a very faint one forming the rim of a wide siphonal canal.

Dimensions: 6.1 x 3.5 mm.



FIGS 27-28. — *Brocchinia* spec. A, protoconch.
FIGS 29-30. — *Brocchinia* spec. B, protoconch.
FIGS 31-32. — *Brocchinia tanimbarensis* sp. nov., protoconch of juvenile shell from stn CP 71, 477-480 m.
Scale bar: 0.5 mm for all figures.

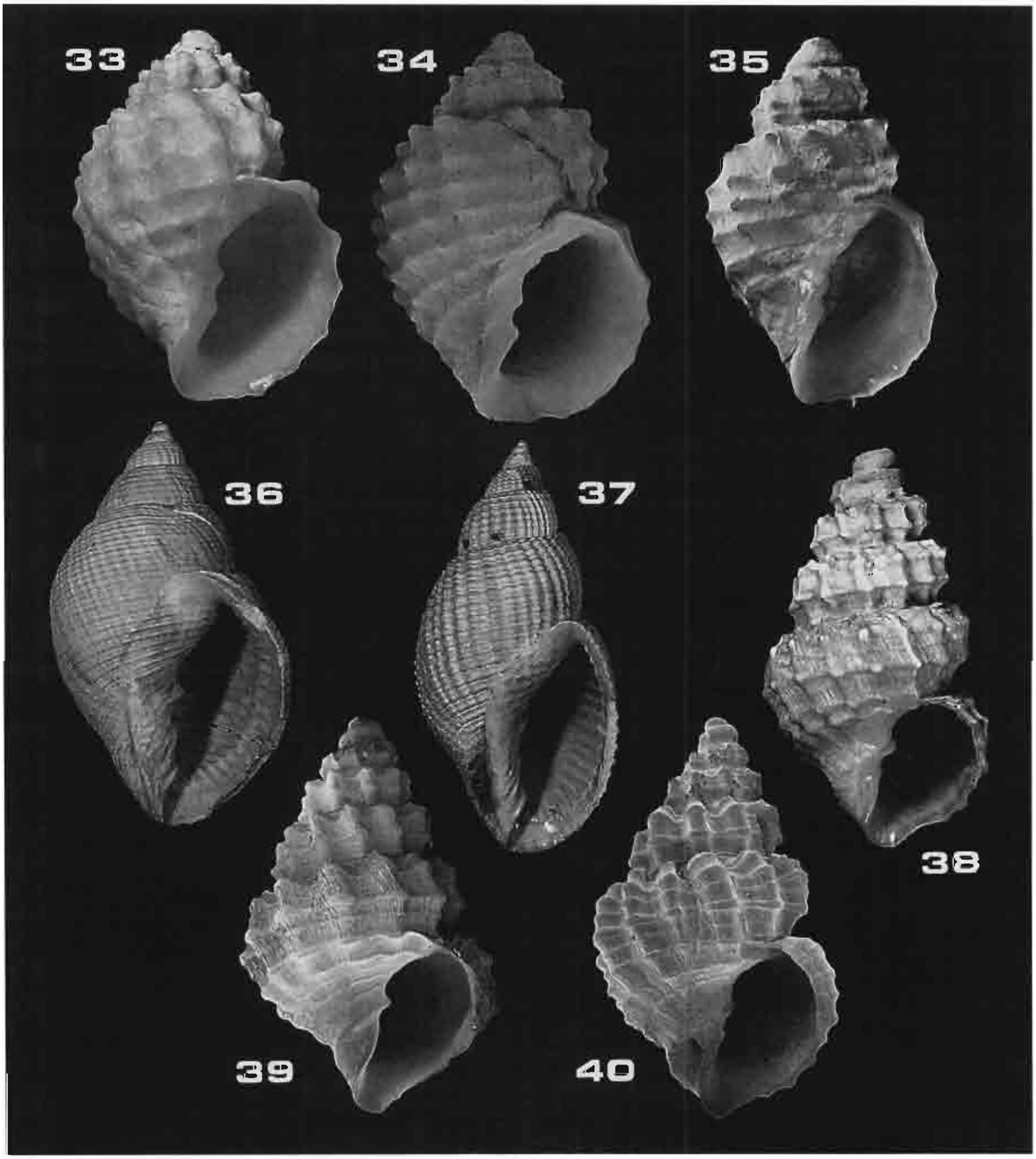
REMARKS. — This single shell differs from *B. fischeri* in its broader spire angle, relatively higher aperture, and somewhat less convex whorls. The columellar folds of *B. fischeri* are much stronger and are placed more transversely. This shell can be considered to be subadult, with incompletely formed aperture, but even then the difference in strength of columellar folds still holds. In a specimen of *B. fischeri* (Fig. 18) the columellar folds can be observed through a boring hole in the last whorl and, although not as bold as in a normally formed aperture, they are much sharper than in *Brocchinia* sp. B, where they are very much like those of *B. kaiensis*. The protoconch and the sculpture of the teleoconch, however, are very near that of *B. fischeri*. Therefore, recognition of this single shell as a different species is not straightforward, and more specimens will be needed to confirm it as a separate, undescribed species.

Brocchinia tanimbarensis sp. nov.

Figs 31-35

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 60, 08°21'S, 132°14'E, 387-389 m, 1 dd (paratype POLIPI). — Stn CP 69, 08°42' S, 131°53' E, 356-368 m, 1 lv (paratype MNHN). — Stn CP 70, 08°41'S, 131°47'E, 410-413 m, 2 lv (paratypes POLIPI). — Stn CP 71, 08°38'S, 131°44'E, 477-480 m, 10 lv, 1 dd (paratypes: 3 POLIPI, 8 MNHN). — Stn CP 77, 08°57'S, 131°27'E, 346-352 m, 1 lv (holotype).

TYPE MATERIAL. — Holotype MNHN. Paratypes: 6 POLIPI, 9 MNHN.



FIGS 33-35. — *Brocchinia tanimbarensis* sp. nov.: **33**, holotype, 6.5 mm; **34**, 7.4 mm, stn CP 69, 356-368 m; **35**, 7.0 mm, stn CP 71, 477-480 m.

FIG. 36. — *Merica elegans* (Sowerby), 30.4 mm, stn CP 65, 174-176 m.

FIG. 37. — *Merica oblonga* (Sowerby), 38.6 mm, stn CP 65, 174-176 m.

FIGS 38-39. — *Microsveltia karubar* sp. nov.: **38**, holotype, 9.9 mm; **39**, paratype, 7.6 mm, stn CP 71, 477-480 m.

FIG. 40. — *Microsveltia metivieri* sp. nov., holotype, 6.3 mm.

TYPE LOCALITY. — Indonesia. Off Tanimbar Islands, KARUBAR, stn CP 77, 08°57'S, 131°27'E, 346-352 m.

DISTRIBUTION. — Known only from off the Tanimbar Islands.

DESCRIPTION. — *Shell* small, solid, white, with short spire, spire angle 60-80°. *Protoconch* (strongly eroded on most shells, preserved only on the smallest one but already with corroded surface, Figs 31-32) paucispiral with 3/4 whorl, surface sculpture etched, maximum diameter 0.9 mm, exposed height 0.6 mm, transition to teleoconch indistinct. Possibly, a quarter whorl with only smooth sculpture of 2 spiral lines may also be part of the protoconch. *Teleoconch* with up to about 3 1/8 whorls. Sculpture starts on the first teleoconch whorl with 3 smoothly indicated spiral lines, undulating to form 8 gradually stronger nodules. Three spirals on spire whorls, 6 on last whorl. Axial sculpture of broad rounded ribs, 10 and 11 on second and third whorl, 13 on last whorl. Shell sculpture prominent at intersection of axials and spirals, forming strong raised rounded nodules. Whorls with a flat narrow sutural shelf. *Aperture* semicircular, columella parallel to shell axis, with two rather strong folds, the weaker abapical fold on the rim of broad short siphonal canal. Outer lip thin, wavy because of nodulose sculpture, no inner lirae. Thin white columellar callus; no umbilicus nor siphonal fasciole.

Dimensions: holotype 6.5 x 5.5 mm; paratypes up to 7.4 mm.

REMARKS. — None of these specimens has a pitted shell surface like *B. fischeri*, but most of them have sporadic remains of a soft white layer, possibly an intritacalx. The Recent *Oamaruia deleta* Finlay, 1930, of which only the juvenile holotype has been figured, reaches 11 mm and has 3 distinct columellar folds, the lowest being stronger (POWELL, 1979: 224). It may be the closest living relative of *B. tanimbarensis*. *Oamaruia major* Marwick, 1965, from the Opoitian (Pliocene, Piacenzan) of New Zealand is also rather close to *B. tanimbarensis* but differs by its size up to 11.3 mm, its sculpture with only 2 spirals on spire, its more elongate aperture and 3 columellar folds. The New Zealand Miocene *Admete suteri* Marshall & Murdoch, 1920, type species (OD) of *Oamaruia* Finlay, 1924, has a protoconch of two whorls, "the apex obliquely disposed", 17-21 axials on the last whorl, and also has 3 columellar folds. *Waipaoa marwicki* Dell, 1956, from off New Zealand, depth about 600 m, in general form resembles small specimens of *B. tanimbarensis*, but lacks the columellar folds and the nodulose sculpture. *B. tanimbarensis* is rather different from *B. fischeri* and the closely related *B. exigua* from New South Wales, that share with it the general form of the aperture and columella, but lack the strong nodulose sculpture and are much more elongate. *B. tanimbarensis* resembles closely the Atlantic species *B. nodosa* (Verrill & Smith *in* VERRILL, 1885) and *B. azorica* (Bouchet & Warén, 1985). *B. nodosa* is much larger (up to 16 mm: MNHN specimen from Bay of Biscay), and also *B. azorica* may grow somewhat larger. *B. nodosa* and *B. azorica* differ from *B. tanimbarensis* in having no distinct sutural ramp, the nodules more pointed, and the columellar and parietal callus thicker so that the underlying sculpture is barely visible. *B. pustulosa* Verhecken, 1991a, from off Brazil, 637 m, has a sutural area comparable to that of the new species, grows up to 11.6 mm high, and has a much higher spire.

ETYMOLOGY. — Named after the Indonesian archipelago of the Tanimbar Islands.

Genus ***MERICA*** H. & A. Adams, 1854

Merica H. & A. Adams, 1854: 277. Type species (SD by COSSMANN, 1899: 13): *Cancellaria melanostoma* Sowerby, 1849. North-western Indian Ocean.

The two species of *Merica* from the KARUBAR expedition were taken dead at the same station; they may have been carried down from more shallow depths.

Merica elegans (Sowerby, 1822)

Fig. 36

Cancellaria elegans Sowerby, 1822: fig. 3.

Cancellaria reeveana Crosse, 1861: 237 (unnecessary name change: VERHECKEN, 1986: 39). — LOEBBECKE, 1881: 12, pl. 2, figs 1-2, 4-6.
Merica elegans - VERHECKEN, 1986: 40, fig. 9.
Not *Cancellaria (Merica) elegans* - GARRARD, 1975: 3, fig. 1(1).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Island*: stn CP 65, 09°14'S, 132°27'E, 174-176 m, 1 dd.

TYPE MATERIAL. — A confusion about the "type lot" of this species asks for some explanation. The shell figured by SOWERBY was "in Mrs. Mawe's collection", but no shell in BMNH has a label indicating that origin. GARRARD (1975: 4) mentioned "Holotype unknown. ... Location of type: BMNH. Not located at present" and I (VERHECKEN, 1986: 40) myself stated "there is no indication that this specimen is, or should be, in BMNH". However, PETIT & HARASEWYCH (1986: 442) mention a type lot BMNH 1968387 of 3 specimens, "labeled *C. elegans*, Baclayon, Bohol Id., Philippines on the back of an old board", stating that "it is possible that two specimens with locality data were added later, as only one specimen has an old label with the number '4', the same sort as used by SOWERBY, glued inside the aperture". About 15 years ago one of these 3 shells was labelled "Awaiting neotype selection by Petit", a designation which has never been published. Furthermore, SOWERBY's figure has the number "3", not "4". This material has now been checked again (vi-1995) and discussed with K. WAY (BMNH). Of the 3 shells, the one (33.6 x 22.7 mm) once intended for neotype selection resembles best but is broader than SOWERBY's figure (33.5 x 20.8 mm), and shows no traces of a label having been glued inside the aperture, although there is an old label with the species name in SOWERBY's handwriting (*fide* K. WAY). That shell now has a label "Although there is no evidence that this specimen reached Cuming via Mrs. Mawe; its very close similarity to the type figure and Sowerby's own hand on the label must make it eligible to be considered as a possible type. K. WAY, 1986". Since there is no solid proof that this is the figured shell, its designation as lectotype would pose a problem; and because it has no reliable locality data, it does not qualify for selection as a neotype. I suggest the best solution would be to select as neotype a well documented shell resembling as closely as possible this BMNH shell, when such specimen can be found.

TYPE LOCALITY. — Unknown to SOWERBY (I). Ticao, Philippines, according to G. B. SOWERBY (II) (1849: 447), possibly based on 4 shells *ex* Mrs DE BURGH coll. (BMNH).

DISTRIBUTION. — Philippines; Indonesia.

REMARKS. — Within the genus *Merica*, *M. elegans* is characterised by its numerous weak prosocline ribs, only very slightly canaliculate suture, and slightly inflated fusiform outline. The present specimen (30.4 x 18.8 mm) is more slender than *Merica melanostoma* Sowerby, 1849, and *M. subsinensis* Loebbecke, 1881. Its suture is less canaliculate, and its sculpture is dominantly spiral, much more like that of *Merica sinensis* Reeve, 1856, which however has a strongly oblique protoconch. The species described and illustrated by GARRARD [1975: 3, fig. 1(1)] as *Cancellaria (Merica) elegans* and occurring subtidally down to 49 m off NE Australia (including Gulf of Carpenteria, near the Arafura Sea) to Queensland, differs markedly from the present material.

Merica oblonga (Sowerby, 1825)

Fig. 37

Cancellaria oblonga Sowerby, 1825: Appendix p. xv. — SOWERBY 1832: fig. 19.
Cancellaria bifasciata Deshayes, 1830: 181. — LOEBBECKE, 1885: 30, pl. 9, figs 1-2.
Merica bifasciata - HABE, 1961: 434, pl. 24, fig. 27.
Merica oblonga - CHENU, 1859: 277, fig. 1847. — PETIT, 1974: 112, fig. 5. — VERHECKEN, 1986: 41, figs 7-8.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 65, 09°14'S, 132°27'E, 174-176 m, 2 dd (38.6 x 19.2 mm; 35.1 x 17.2 mm).

TYPE MATERIAL. — *C. oblonga*: SOWERBY's shell from the Tankerville auction has not been located (not in BMNH). — *C. bifasciata*: holotype (21.4 x 11.8 mm) in MNHN.

TYPE LOCALITY. — *C. oblonga*: Unknown. KIENER (1841: 6) indicated "l'océan équinoxial, les côtes de Panama", which is erroneous (KEEN, 1971: 649). SOWERBY (II) (1849: 447) first mentioned a correct locality: "Straits of Macassar". — *C. bifasciata*: Unknown.

DISTRIBUTION. — Japan to Indonesia; Northern Indian Ocean to Aden; Eastern South Africa (?) (VERHECKEN, 1986: 41; VERHECKEN & WRANIK, 1991: 60).

REMARKS. — Specimens in collections are usually smaller in size [heights of 43 mm (Loebbecke Museum und Aquarium, Düsseldorf) and 37 mm (VERHECKEN, 1986: 42) are exceptional] and have a much smoother sculpture. The coarse sculpture of present specimens resembles that of *Merica laddi* Petit, 1987 [= *Cancellaria (Merica) petiti* Ladd, 1982, *non* Olsson, 1967], from the Pliocene of Fiji, which is smaller and has a more acuminate spire.

Genus *MICROSVELTIA* Iredale, 1925

Microsveltia Iredale, 1925: 265. Type species (OD): *Microsveltia recessa* Iredale, 1925. Recent, New South Wales, Australia.

GARRARD (1975: 35) considers *Microsveltia* a synonym of *Gergovia* Cossmann, 1899, because *Cancellaria platypleura* Tate, 1898, type species (OD) of *Gergovia* "was almost certainly ancestral [to *M. recessa*], and the introduction of a new genus was unwarranted". However, COSSMANN originally included *Gergovia* in *Merica* as a new section; and *M. recessa* has very little resemblance to any species of *Merica*. Hence, this synonymy is not accepted here, and *Microsveltia* is considered valid. FINLAY (1930: 241) considered *Microsveltia* to be "an absolute synonym" of *Inglisella*; but the *Brocchinia*-like species included in *Inglisella* do not seem closely related to *M. recessa*. Inclusion of the following four species in *Microsveltia* is only provisional, awaiting a thorough revision of the cancellariid genera.

Microsveltia karubar sp. nov.

Figs 38-39

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 71, 08°38'S, 131°44'E, 477-480 m, 3 lv.

TYPE MATERIAL. — Holotype lv, MNHN. Paratypes: 1 lv MNHN, 1 lv POLIPI.

TYPE LOCALITY. — Indonesia. Off Tanimbar Islands, KARUBAR, stn CP 71, 08°38'S, 131°44'E, 477-480 m.

DESCRIPTION. — *Shell* small, with relatively high, conical spire and small aperture, whorls bicarinate, suture well impressed. *Protoconch* (severely corroded in all shells) apparently paucispiral and rather high, not flattened. Teleoconch with up to about 5 whorls. Axial sculpture of rather narrow rounded ribs, constricted near suture, numbering 7-10, 9-11, 11-13, 11-15 on 2nd to 5th whorl respectively; base without axial sculpture. Spiral sculpture of narrow cords numbering 2, 3-4, 3-4 on second to fourth whorl, 10-12 on last whorl, including secondary spirals. Whorls rounded, angular at main spirals, constricted near deeply impressed suture. *Aperture* small, oval, ending abapically in short but distinct siphonal canal. Columella short, with one strong fold and a very weak one at the start of the siphonal canal, which is slightly inclined adaxially. Outer lip crenulate; no lirae inside. Siphonal fasciole slightly developed. No umbilicus, only a slight, completely closed, depression. Almost no columellar callus. Thin pale fawn periostracum.

Dimensions: holotype 9.9 x 5.8 mm. Paratypes 7.6 x 4.6 mm (MNHN); 5.6 x 3.6 mm (POLIPI).

REMARKS. — The constricted profile of the whorls resembles that of *M. metivieri*, but the latter species has much broader ribs. The sculpture somewhat resembles that of *Cancellaria patricia* Thiele, 1925, from East Africa (type locality) and south-eastern Australia (VERHECKEN, 1991b), but that species has much weaker columellar folds and a shorter spire. *M. recessa* has a reticulated sculpture much stronger than in *M. karubar*, moreover it has two columellar folds of about the same strength, a small and narrow umbilicus, partly covered by callus, and a fine bristly greenish-brown periostracum (GARRARD, 1975: 37).

ETYMOLOGY. — This species is named after the French-Indonesian scientific expedition that discovered it.

Microsveltia metivieri sp. nov.

Figs 40-42

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 dd.

TYPE MATERIAL. — Holotype dd, MNHN.

TYPE LOCALITY. — Indonesia. Off Kai Islands, KARUBAR, stn DW 28, 05°31'S, 132°54'E, 448-467 m.

DESCRIPTION. — *Shell* small, white, with acuminated spire, spire angle 55°, and strongly constricted suture. *Protoconch* (Figs 41-42) white, paucispiral with one whorl, slightly deviating from teleoconch axis, nucleus relatively large, diameter 0.3 mm, suture slightly impressed. Maximum diameter 0.6 mm, exposed height 0.5 mm. Transition to teleoconch rather indistinct. *Teleoconch* with 4 3/4 whorls. Axial sculpture consisting of strong, broad rounded ribs, far less prominent near suture, numbering 8, 8, 9, 11 on 1st to 4th whorl respectively, 12 on last whorl. Growth lines microscopic, hardly visible. Spiral sculpture of well-marked cords, width up to 0.1 mm, numbering 2, 2, 3, 5 on 1st to 4th teleoconch whorl respectively, 11 on last whorl. The spirals keep their profile when crossing over the axials, without nodular intersection. Spiral cords more closely set in adapical two-third of whorls, thus giving the impression of a slightly excavated suture, but in younger whorls a much narrower spiral cord appears just above abapical suture. Last whorl regularly convex; axial sculpture disappearing towards umbilicus. *Aperture* rounded, columella straight, inclined adaxially, with two weak folds, anterior one weaker. Siphonal fasciole well developed, enclosing a narrow umbilicus which is almost closed by a thin columellar callus. No lirae inside outer lip. Short, broad siphonal canal.

Dimensions: 6.3 x 3.8 mm.

REMARKS. — The sculpture of strong ribs of *M. metivieri* superficially resembles the much stronger sculpture of *Scalptia mercadoi* Old, 1968, from the Philippines, but that species has a multispiral protoconch and grows up to 34 mm (AV) for 6 teleoconch whorls, or 18 mm for 4.5 whorls. *M. metivieri* is rather close to, but different from *M. recessa* Iredale, 1925, from New South Wales, Australia, which has bicarinate whorls with nodules on intersections of coarse spiral and axial sculpture, "microscopic hair-like growth lines", and 8 lirations inside outer lip (GARRARD, 1975: 37).

ETYMOLOGY. — This species is named in honour of Bernard MÉTIVIER (MNHN).

Microsveltia procerula sp. nov.

Figs 43-46

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 71, 08°38'S, 131°44'E, 477-480 m, 2 lv.

TYPE MATERIAL. — Holotype lv and 1 paratype lv, MNHN.

TYPE LOCALITY. — Indonesia. Off Tanimbar Islands, KARUBAR , stn CP 71, 08°38'S, 131°44'E, 477-480 m.

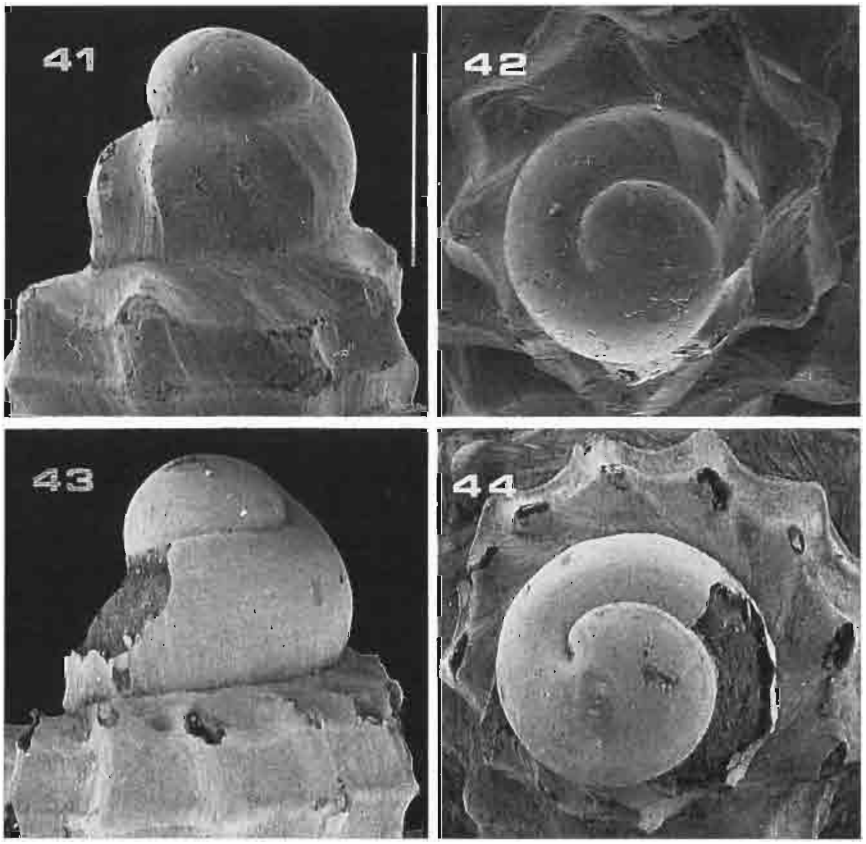
DESCRIPTION. — *Shell* small, high-spired, thin-walled, younger whorls translucent. Protoconch (Figs 43-44) paucispiral, bulbous, with about one smooth slightly oblique whorl, suture impressed, maximum diameter

0.7 mm, exposed height 0.6 mm. Transition to teleoconch not discernible because of shell damage in that area. *Teleoconch* with about 4 whorls. Axial sculpture consists of rather narrow, slightly opisthocline rounded ribs, 12, 11, 10 and 11 on 1st to 4th whorl respectively. Spiral sculpture of narrow threads, 2, 3, 3 + 1 secondary, on 1st to 3rd whorl, 10 on last whorl, crossing over axials without nodules. *Aperture* rounded, trapeziform, with short, wide siphonal canal; outer lip thin, without inner lirae. Columella short, parallel to shell axis. One very weak columellar fold in holotype (Fig. 45); paratype (Fig. 46) with a relatively strong fold, and a weak one at rim of siphonal canal which deviates adaxially from the columellar direction. No umbilicus, no columellar callus. Siphonal fasciole not developed. Shell covered by thin pale-beige periostracum, forming microscopic axial folds which apparently do not reflect the presence of a similar sculpture on shell surface.

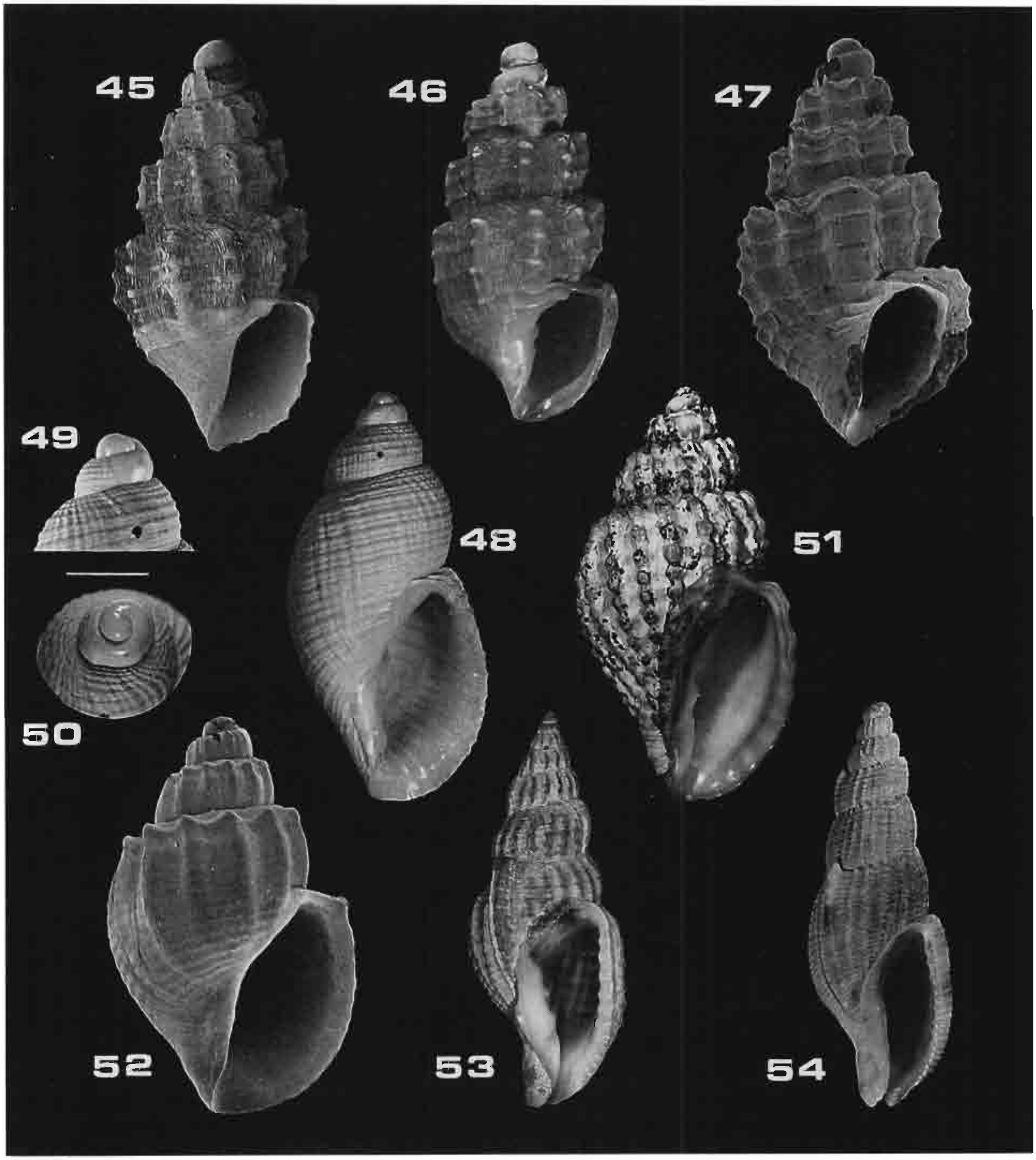
Dimensions: holotype 5.0 x 2.6 mm; paratype 6.0 x 3.0 mm.

REMARKS. — *Microsveltia procerula* is close to *M.* cf. *sagamiensis*, but differs by its thin shell, its less constricted suture, its sutural area sloping down towards shoulder of whorl, and its stronger columellar folds. It differs from *M. metivieri* in its less conical spire, and the strength and form of its axial ribs. *M. procerula* closely resembles *Cancellaria turriculata* Tate, 1889, from the upper Eocene of South Australia, judging from the original description and illustration (TATE, 1889: 156, pl. X, fig. 14), but conspecificity can be excluded because of the very large gap in time.

ETYMOLOGY. — The specific name is from the Latin adjective *procerulus*, diminutive of *procerus*, meaning "rather long, elongate", and refers to the slender form of this small shell.



FIGS 41-42. — *Microsveltia metivieri* sp. nov., holotype, protoconch.
FIGS 43-44. — *Microsveltia procerula*, holotype, protoconch.
Scale bar: 0.5 mm for all figures.



FIGS 45-46. — *Microsveltia procerula* sp. nov.: **45**, holotype, 5.0 mm; **46**, paratype, 6.0 mm, stn CP 71, 477-480 m.
FIG. 47. — *Microsveltia* cf. *sagamiensis* (Kuroda & Habe), 4.3 mm, stn DW 44, 291-295 m.
FIGS 48-50. — *Perplicaria boucheti* sp. nov.: **48**, holotype, 9.0 mm; **49-50**, protoconch. Scale bar: 1 mm.
FIG. 51. — *Solatia arafurensis* sp. nov., holotype, 36.0 mm.
FIG. 52. — ?*Admete aethiopica* Thiele, 5.2 mm, stn CP 71, 477-480 m.
FIG. 53. — *Plesiotriton vivus* Habe & Okutani, 40.3 mm, stn DW 44, 291-295 m.
FIG. 54. — *Tritonoharpa beui* sp. nov., holotype, 16.5 mm.

Microsveltia cf. *sagamiensis* (Kuroda & Habe, 1971)
Figs 47, 55-57

Neadmete sagamiensis Kuroda & Habe *in* KURODA, HABE & OYAMA, 1971: 204, pl. 109, fig. 24.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 1 dd.

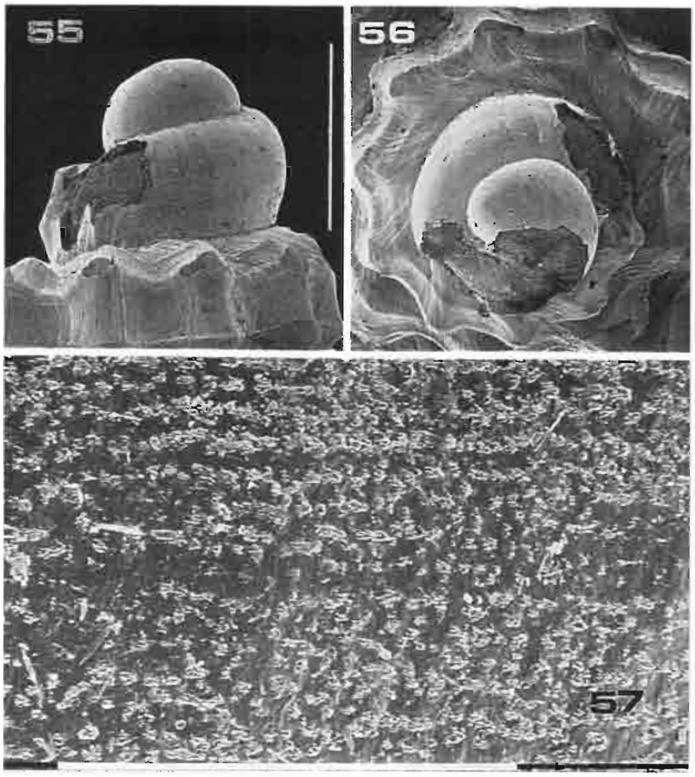
TYPE MATERIAL. — The illustrated syntype of *Neadmete sagamiensis* (6.3 x 3.3 mm) is here designated lectotype; it is in the collection of the Emperor of Japan, together with at least 3 paralectotypes (not seen).

TYPE LOCALITY. — West of Jogashima, Sagami Bay, Japan, 110-150 m.

DISTRIBUTION. — Japan: from Sagami Bay, Honshu and Tosa Bay, Shikoku, sandy bottom, 50-200 m.

DESCRIPTION. — *Shell* minute, solid, elongated, spire angle 50°, constricted near suture, aperture small. *Protoconch* bulbous, paucispiral with about 1 whorl, suture impressed (Figs 55-56). Maximum diameter about 0.6 mm, exposed height 0.5 mm. Remains of a finely granular microsculpture still present (Fig. 57). Transition to teleoconch not discernible because of shell damage in that area. *Teleoconch* with about 3.5 shouldered whorls. Axial sculpture of rounded ribs, narrow on first, broadly rounded on later whorls, 10, 9 and 10 on 1st to 3rd teleoconch whorl, 7 on last whorl. Spiral sculpture of narrow (up to 0.1 mm wide) cords running over the axial ribs without forming nodules, 2 cords on 1st whorl, 2 + 1 secondary spiral and 1 on shoulder plane on 2nd whorl, 3 + 2 on shoulder plane on 3rd whorl. The zone between suture and the first adapical spiral cord is wider than the spiral interspaces. Last whorl with 11 narrow, well-marked spiral cords. Suture strongly constricted, sutural area almost horizontal and slightly wavy because of vanishing axial ribs; shoulder of axial ribs produced in a rounded angle. *Aperture* small, rounded triangular. Outer lip with thin edge (partly broken) and 5 widely spaced rather indistinct inner lirae continuing deep inside aperture. Columella straight, with 2 very weak folds deep inside aperture. Short, broad siphonal canal. Columellar callus narrow and thin, but covering most of the umbilical slit. Almost no siphonal fasciole. No periostracum.
Dimensions (KARUBAR specimen): 4.25 x 2.5 mm.

REMARKS. — PETIT (1974: 111) considered *Neadmete sagamiensis* to be a synonym of *Admete cancellata* Kobelt, 1887, described from Japan, and said to have 'narrow high radial ribs', narrower than their interspaces, and crossed by spirals of about the same strength, forming a neatly quadratic cancellation (KOBELT, 1887a: 12; 1887b : 105). KOBELT's illustration (1887b: pl. 24, fig. 14) is so small that it can hardly be used for identification, but the sculpture described is very obvious on the type [holotype by monotypy, ICZN art. 73a(ii), see KOBELT, 1887b; 10.2 x 6.2 mm, ZMHU 101677, Fig. 63]. The dimensions of the holotype and of its paucispiral protoconch (1 1/8 whorl, max. diameter 0.95 mm, exposed height 0.8 mm) are significantly larger than in the present material; and the sculpture is quite different, so that identification of the KARUBAR shell as *A. cancellata* is rejected. Both the KARUBAR shell and the lectotype of *Neadmete sagamiensis* (according to the original illustration) have axial ribs broader than their interspaces and much stronger than the spirals, and the whorls are more shouldered than the regularly rounded whorls of *A. cancellata*. Therefore, PETIT's identification of *N. sagamiensis* as *Admete cancellata* does not seem completely warranted, but variability within these taxa is as yet unknown. Since the present specimen is certainly different from the holotype of *A. cancellata* and closest to *M. sagamiensis*, the latter name is used here. The KARUBAR specimen differs from the lectotype of *N. sagamiensis* in having the whorls more shouldered and the aperture more triangular. The protoconch of the lectotype, according to KURODA & HABE's description and illustration, is larger and has more whorls. Because of these differences, identification of the present material is only tentative. *M.* cf. *sagamiensis* is quite similar to *M. metivieri* but differs in having the whorls more shouldered, a wider and flatter sutural area, the axial ribs less pronounced, the whorls less convex, and the columellar folds much weaker.



FIGS 55-57. — *Microsveltia* cf. *sagamiensis* (Kuroda & Habe): **55-56**, protoconch, stn DW 44, 291-295 m. Scale bar: 0.5 mm; **57**, detail of protoconch sculpture. Scale bar: 0.1 mm.

Published illustrations of *M. recessa* from New South Wales, Australia are somewhat contradictory, drawings of the holotype (IREDALE, 1925: pl. 43, fig. 16; LASERON, 1955: 268, fig. 11) resembling the present shell except for the 2 strong columellar folds, but photographs of the holotype [GARRARD, 1975: fig. 3(8)] and other specimens [GARRARD, 1975: fig. 3(7); KAICHER, 1978: card 1919] showing a very coarse quadratic sculpture. *M. recessa* has two bold and narrow spiral cords, forming prominent lateral nodules at junction with ribs, and strong lirations inside the outer lip (GARRARD, 1975: 37). In general form and in the sculpture of broad axial ribs overridden by narrow spiral bands, *M. sagamiensis* seems also to be close to *Cancellaria japonica* Smith, 1879, but extensive damage to the latter's holotype (11.9 x 5.8 mm, BMNH 1878.11.7.90, figured by PETIT, 1974: 110, text-fig. 3) prevents clear conclusions. Subsequent to the original description, no additional specimens of *C. japonica* have been reported; it could not be recognised as any known Japanese species by HABE and by OKUTANI (PETIT, 1974: 110). Hence, its real relation to *M. sagamiensis* remains unclear.

KURODA & HABE (1971) placed *sagamiensis* in the genus *Neadmete* Habe, 1961. Its type species (ICZN Opinion 1370), *N. okutanii* Petit, 1974, has a dominantly spiral sculpture (see HABE, 1961: pl. 23, fig. 11, incorrectly identified as *Neadmete japonica*, later renamed *N. okutanii*). The genus has been used for several rather large, cold-water species from the northeastern Pacific (KANAKOFF & MCLEAN, 1966; ABBOTT, 1974: 248) with a dominantly spiral sculpture. Hence, I prefer not to use this genus for the present species in which the axials dominate.

Genus *PERPLICARIA* Dall, 1890

Perplicaria Dall, 1890: 90. Type species (by monotypy): *Perplicaria perplexa* Dall, 1890. Pliocene, Florida, USA.
Synonym: *Daguinia* Magne, 1966: 127, fig. 1. Type species (by monotypy): *Daguinia vigneauxi* Magne, 1966. Miocene, France.

Perplicaria has been known only from five fossil species in the Caribbean and France, and one Recent species (*Perplicaria clarki* M. Smith, 1947) from West Central America. The genus ranges from the early Miocene (*Perplicaria prior* Maury, 1910) to Recent.

Perplicaria boucheti sp. nov.

Figs 48-50

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 79, 09°16'S, 131°22'E, 239-250 m, 1 dd.

TYPE MATERIAL. — Holotype dd, MNHN.

TYPE LOCALITY. — Indonesia. Tanimbar Islands, KARUBAR, stn CP 79, 09°16'S, 131°22'E, 239-250 m.

DESCRIPTION. — *Shell* outline typical for a *Perplicaria*. *Protoconch* whitish, paucispiral with one rapidly expanding whorl (Figs 49-50), maximum diameter 0.9 mm, exposed height 0.8 mm. Surface smooth and shiny, last 1/16 whorl showing a smoothly indicated start of spiral sculpture. Transition to teleoconch clearly marked by an expansion of shell width and the beginning of strong teleoconch sculpture. *Teleoconch* with 2 3/4 whorls, rapidly expanding in height. On first half whorl only spiral sculpture of 7 low flat bands. On second whorl 36 gently indicated axial ribs, and 11 primary spiral cords, with one narrower second order spiral in between. Last whorl with 19 broad spiral cords, second and third order spirals in between. On last whorl, axial ribs have practically disappeared. Axial ribs and growth lines opisthocyrt. Whorls rounded, suture impressed. Inclination of whorls steeper than inclination of spiral bands. *Aperture* oblong, 54 % of total shell height, slightly expanded abapically. Outer lip solid, with narrow and slightly crenulated edge, 15 lirae inside. Columella straight, with 3 folds, adapical one strongest, abapical fold forming rim of short siphonal canal. No umbilicus, only a very narrow slit is present. Columellar callus thin, almost completely covering the umbilical slit. Colour pale fawn, inside of aperture white, with an indistinct colabral pale orange band near base of lirae.

Dimensions: 9.0 x 4.5 mm.

REMARKS. — *P. boucheti* represents the first *Perplicaria* known from the Eastern hemisphere, and the second known living species of the genus. *Perplicaria clarki* differs in having a multispiral protoconch (as ascertained based on a shell from Gobernadora Island, Panama, AMNH 253840), and adult size reaching 33 mm (KEEN, 1971: 656). Based on analogy with the other species of this genus, the holotype of *P. boucheti* may not be fully grown.

ETYMOLOGY. — This species is named in honour of Philippe BOUCHET (MNHN).

Genus *SOLATIA* Jousseaume, 1887

Solatia Jousseaume, 1887: 222. Type species (OD): *Solatia solat* Jousseaume, 1887 (junior subjective synonym of *Solatia piscatoria* Gmelin, 1789. See VERHECKEN, 1988: 665), North-west Africa.

This genus groups mainly European fossil and two Recent species in the eastern Atlantic (VERHECKEN, 1988). Only *Solatia buccinoides* (Sowerby, 1832) from tropical West America has also been placed in *Solatia* (KEEN, 1971: 654), but this placement is questionable.

Solatia arafurensis sp. nov.

Fig. 51

Cancellaria sp. - WILSON, 1994: 175, pl. 37, fig. 19.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 72, 08°36'S, 131°33'E, 676-699 m, 1 lv.

TYPE MATERIAL. — Holotype lv, MNHN.

TYPE LOCALITY. — Indonesia. Off Tanimbar Islands, KARUBAR, stn CP 72, 08°36'S, 131°33'E, 676-699 m.

DISTRIBUTION. — Type locality, and off Port Hedland, north Western Australia (WILSON, 1994; material not examined).

DESCRIPTION. — *Shell* large, solid, oblong, strongly sculptured; last whorl elongated. *Protoconch* missing, early teleoconch whorls strongly corroded. *Teleoconch* axial sculpture of strong, broad rounded ribs, interspaces about as wide as ribs, 13, 15, 16 on spire whorls, 16 on last whorl. Spiral sculpture of broad rounded cords, smoothly indicated, 4 per whorl, plus one on shoulder of whorl, fused onto nearest cord. Intersection with axials strongly nodular. Suture impressed, forming a narrow concave sutural area, bordered by strong nodules on shoulder of ribs and obliquely crossed by strong growth lines. *Aperture* white, oblong, ending abapically in a well-defined siphonal canal. Columella straight, parallel to shell axis, two rather strong columellar folds placed near half height. Columellar callus thin, transparent, covering almost completely narrow umbilical slit. Outer lip slightly crenulated, no lirae inside.

Dimensions: 36.0 x 20.1 mm.

REMARKS. — Except for two recently formed sections of the last whorl, the shell surface is heavily corroded and chalky. In spite of this, aperture interior is intact and smooth, and the specimen was live-taken. Large parts of the shell surface were covered by a black layer (about 0.5 mm thick, still partly visible on Fig. 51) with the aspect of bitumen, which however does not dissolve in acetone or dichloromethane, usual solvents for bituminous substances. It might be periostracum, or remains of an epibiont. The last section of the last whorl, where shell dissolution must have been minimal, had very little of this layer: this seems to point out an epibiont rather than periostracum.

This species is close only to *Solatia buccinoides* (Sowerby, 1832) from tropical West America, which grows up to 40 mm, has a brown shell, much stronger spiral sculpture, and sutural area sloping down towards shoulder. *S. buccinoides* also has a wider aperture, the outer lip expanded near half height with 11 lirae inside, and a posterior canal. The two columellar folds are stronger than in *S. arafurensis*. Placement of this new species in *Solatia* is by reference to *S. buccinoides*, since there seems to be no better fitting genus.

This is clearly the species mentioned and illustrated by WILSON (1994), who gives the following information: "4 cm. North West Shelf. This unidentified species has been trawled recently on the scampi grounds on the outer edge of the continental shelf off Port Hedland".

ETYMOLOGY. — Named after the Arafura Sea, where the holotype was collected.

Subfamily ADMETINAE Troschel, 1856

Genus ***ADMETE*** Krøyer *in* Möller, 1842

Admete Kroyer *in* Möller, 1842: 88. Type species (by monotypy): *Admete crispa* Möller, 1842 (= ?*Tritonium viridulum* Fabricius, 1780). North Atlantic.

Species of *Admete* typically occur at high latitudes or in deep water.

?***Admete aethiopica*** Thiele, 1925

Figs 52, 58-59

Admete aethiopica Thiele, 1925: 201, pl. 22, fig. 23.

MATERIAL EXAMINED. — **Somalia**. The type material (see hereafter).
Indonesia. KARUBAR, *Tanimbar Islands*: stn CP 71, 08°38'S, 131°44'E, 477-480 m, 1 lv.

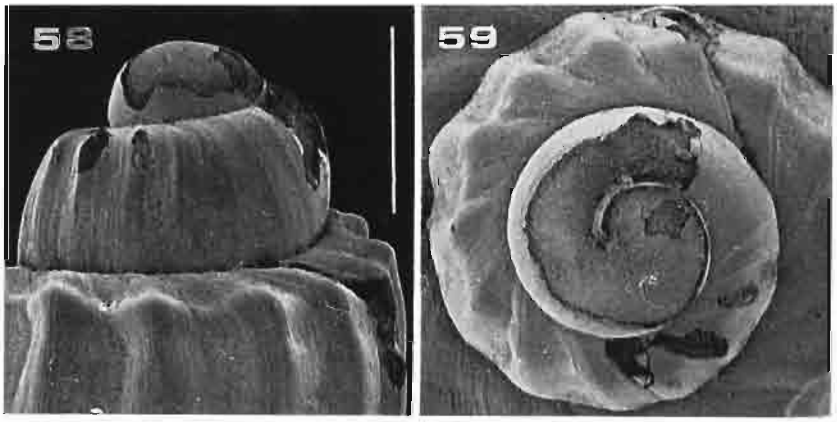
TYPE MATERIAL. — Lectotype, here designated, the shell figured by THIELE, 3.7 x 2.4 mm. Paralectotypes: 10 specimens, *"Valdivia"*, stn 251, 01°40.6'S, 41°47.1'E, 693 m, and 2 specimens, *"Valdivia"*, stn 256, 01°49'N, 45°29.5'S, 1134 m. All types are in ZMHU; no registration number. Paralectotype 10 (3.5 x 2.0 mm, lv) is quite different and resembles the turrid *Propebela exarata* (Möller, 1842) from Greenland, as illustrated by SNELI & STOKLAND (1986: 122, fig. 2).

TYPE LOCALITY. — Eastern Africa. Off Somalia, *"Valdivia"*, stn 251, 01°40.6'S, 41°47.1'E, 693 m.

DISTRIBUTION. — Off Somalia, 693-1134 m; now the Arafura Sea, 480 m.

DESCRIPTION. — [KARUBAR specimen] *Shell* small, thin-walled, semi-translucent, whitish; spire short. *Protoconch* smooth, paucispiral, with about 1 1/8 whorl, maximum diameter 0.7 mm, exposed height 0.5 mm (Figs 58-59). Nucleus relatively large, diameter 0.26 mm. Transition to teleoconch only marked by start of axial teleoconch sculpture. *Teleoconch* with 3 slightly inflated whorls, suture impressed, last whorl large, height 4.0 mm (77 % of total shell height). Axial sculpture on 1st to 3rd whorl consisting of respectively 13, 12, 12 smoothly indicated, slightly sigmoid rounded ribs, disappearing near shell base. One rather strong spiral cord on shoulder, forming nodular intersection with axials, adjacent to somewhat concave spiral depression. Smooth spiral bands, width 0.1 mm, numbering 6 on 2nd, 14 on last whorl, separated by narrow groove, crowded towards shell periphery and base. Shoulder area flat, slightly sloping down towards shoulder cord, axials obliquely crossing over it. Aperture oval, slightly square-cut adapically. Columella straight, almost parallel to shell axis, with 2 very weak folds near half height; siphonal canal wide and short. Outer lip thin, translucent, no inner lirae. No umbilicus.

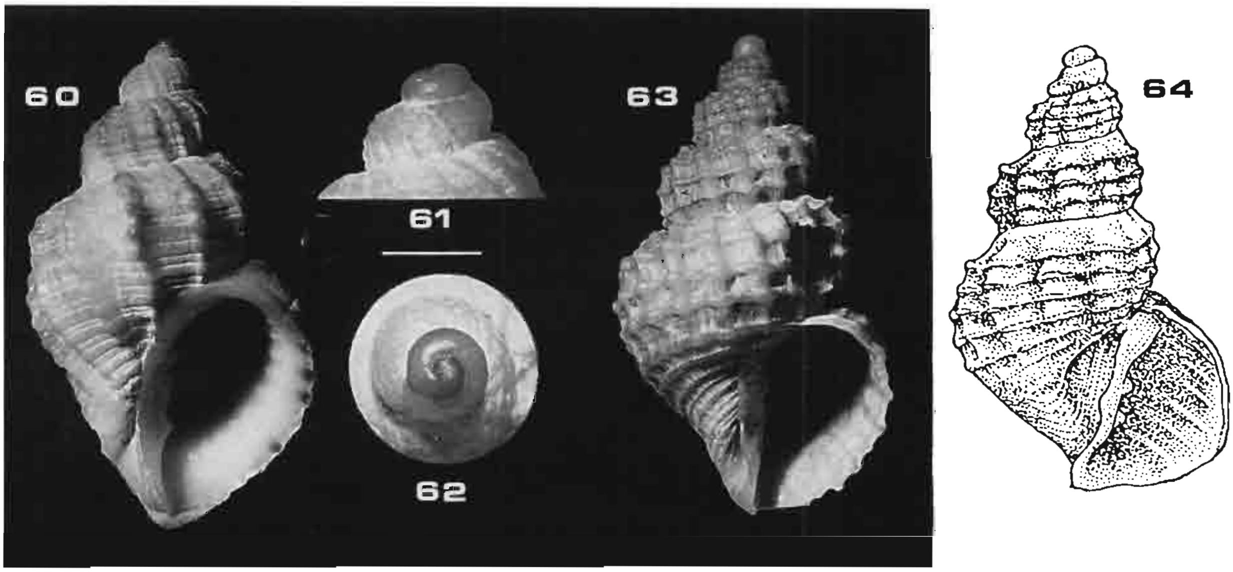
Dimensions: 5.2 x 3.4 mm.



FIGS 58-59. — ?*Admete aethiopica* Thiele, stn CP 71, 477-480 m, protoconch. Scale bar: 0.5 m.

REMARKS. — The lectotype of *Admete aethiopica* has a dome-shaped paucispiral protoconch of 1 whorl, maximum diameter 0.7 mm, exposed height 0.6 mm, nucleus large, diameter 0.33 mm. The teleoconch has 2.5 whorls, axial ribs 15 and 16 on 1st and 2nd whorl, 13 on last whorl; 13 spirals on apertural side of last whorl. Height of aperture 1.9 mm, height of last whorl 3.0 mm. Paralectotypes measure up to 4.4 x 2.7 mm (THIELE gave 4.25 x 2.5 mm), average 3.8 x 2.3 mm. The double row of nodules near shoulder, as figured by THIELE, is only clearly present in the five largest shells, and can be even stronger than in the lectotype. It may be a characteristic of fully grown specimens. The Indonesian specimen, although larger than any of the types, has the second row only vaguely indicated and has fewer axial ribs than the lectotype. The number of axial ribs in the type material (excluding paralectotype 10) is 14-16 and 15-16 on the 1st and 2nd teleoconch whorls respectively. The obtusely angled truncated columella figured by THIELE occurs in most, but not all of the paralectotypes. Also the strength of the spiral striae is quite variable. Considering all this, and despite the geographic distance, there seems to be no reason to separate the East African material and the present Indonesian material.

Subsequent to its original description, *Admete aethiopica* has been mentioned only by PETIT & HARASEWYCH (1990: 9), stating that *Admete aethiopica* is "not a cancellariid". This statement was based on a verbal communication by P. BOUCHET in 1984 (PETIT, *in litt.*, June 1995), who considered THIELE's species to be a juvenile *Gymnobela* at that time. BOUCHET (*in litt.*, July 1995) now admits that his 1984 opinion was erroneous and that *Admete aethiopica* is a cancellariid. Placement of the species in *Admete* is not certain, but seems the most appropriate for the time being. THIELE found no radula, and I equally found neither radula nor tubular jaw. Two perfectly spherical glassy statocysts, diameter 0.1 mm, could be seen by transparency after rehydrating the animal prior to dissection.



FIGS 60-64. — Japanese cancellariids. **60-62,** *Axelella nodosivaricosa* (Petuch): **60**, 15.9 mm, Yaku Island, 130 m; **61-62**, protoconch, scale bar: 1 mm. — **63,** *Admete cancellata* Kobelt, holotype (ZMHU 101677), 10.2 mm. — **64,** *Solutosveltia abyssicola* Habe, enlarged reproduction of HABE, 1961: pl. 23, fig. 4.

Subfamily PLESIOTRITONINAE Beu & Maxwell, 1987

Genus ***PLESIOTRITON*** Fischer, 1884

Plesiotriton Fischer, 1884: 654. Type species (OD): *Cancellaria volutella* Lamarck, 1803. Eocene, France.

Range of the genus: Upper Cretaceous to Recent. Only two Recent species are known: the Indo-Pacific *P. vivus* Habe & Okutani, 1981, and the Pacific *P. mirabilis* Beu & Maxwell, 1987.

Plesiotriton vivus Habe & Okutani, 1981

Fig. 53

Plesiotriton vivus Habe & Okutani, 1981: 144, figs 2-3. — BEU & MAXWELL, 1987: 28, fig. 2D, pl. 4 f, i, m.
Pisanella viva - SPRINGSTEEN & LEOBRERA, 1986: 98, pl. 18, fig. 25.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 1 dd.

TYPE MATERIAL. — Holotype (39.0 x 15.2 mm), NSMT-Mo 58602. Two paratypes NSMT-Mo 58603-4.

TYPE LOCALITY. — Philippines. Off Panglao, Bohol Island, deep water.

DISTRIBUTION. — Philippines, Indonesia, Zanzibar (BEU & MAXWELL, 1987: 28).

REMARKS. — The placement of this species in *Plesiotriton* was maintained with doubt by BEU & MAXWELL, who figured the protoconch (1987: 10, fig. 2D).

Genus ***TRITONOHARPA*** Dall, 1908

Tritonoharpa Dall, 1908: 319. Type species (OD): *Tritonoharpa vexillata* Dall, 1908. Recent, Panamic Western America. Synonyms: *Nivitriton* Iredale, 1929, *Esbelta* Sarasua, 1975 (*fide* BEU & MAXWELL, 1987: 33).

Tritonoharpa differs from *Plesiotriton* in lacking the prominent columellar folds and (as far as presently known) a radula. BEU & MAXWELL (1987: 33) include 19 Recent species, most of them from the tropical Indo-West Pacific. Six species of *Tritonoharpa* are currently known from Indonesia (BEU & MAXWELL 1987), three of them still unnamed.

Tritonoharpa beui sp. nov.

Fig. 54

Tritonoharpa n. sp.?C, aff. *T. angasi* (Brazier) - BEU & MAXWELL 1987: 35, pls 12i-j, l-p.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 111-118 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype dd, MNHN. Paratype 22.4 x 7.4 mm, WAM 3043.83: MARIEL KING MEMORIAL EXPEDITION, *Tanimbar Islands*: stn TSIII:1-7, 6 miles west of Labuan Olendir, Selaru, 08°07'S, 130°51'E, 25-vi-1970, 46-64 m; (BEU & MAXWELL, 1987: 35; not seen).

TYPE LOCALITY. — Indonesia. Off Kai Islands, KARUBAR, stn DW 30, 05°39'S, 132°56'E, 111-118 m.

DISTRIBUTION. — Kai and Tanimbar Islands, southern Moluccas, Indonesia.

DESCRIPTION. — *Shell* elongate, axial sculpture slightly more prominent than spiral sculpture; aperture long (45% of total shell length) and rather narrow. *Protoconch* relatively large, slightly deviating from teleoconch axis, paucispiral with 1.5 swollen smooth whorls, not planorboid; maximum diameter 1.2 mm, exposed height 1.0 mm. Transition to teleoconch shell clearly marked by sudden start of teleoconch spiral sculpture. *Teleoconch* with 5.5 weakly convex whorls. Axial sculpture of narrow, low, opisthocline non-collabral ribs, 16, 17, 18, 25 on 1st to 4th teleoconch whorl, 25 on last whorl. Varices formed at irregular intervals (150°-360°) on spire whorls, spaced about 240° on adult whorls, not parallel to axial ribs, raised rather high above suture, which is coronated by axial ribs of the subsequent whorl. Varices reflected and concave on abapertural face. On base, fine growth lines present between axials. Spiral sculpture of flattened narrow cords, 0.1 mm wide, 8, 8, 8, 10, 10 on 1st to 5th whorl, 34 on last whorl. Three to 6 microscopic spiral lines in spiral interspaces. Spirals form tiny nodules when crossing axial ribs. *Aperture* forming a rounded elongated parallellogram, ending adapically in a small sinus. Outer lip smooth inside, edge crenulated with 16 small nodules, bordered at a distance of 0.5 mm by a strong varix. The same arrangement can also be seen on older varices, where further shell growth occurred not at the curled-up edge of outer lip, but somewhat inside it. Inner lip erect, extended into a well developed columellar collar. Columella almost parallel to shell axis, slightly swollen near centre but without a distinct fold. Siphonal canal well developed, open and strongly twisted dorsally. Umbilical chink partly hidden by anterior end of columellar collar. Background colour pale beige; a large brown blotch at mid-distance between two varices, and a narrow brown band extending over the width of 3 spiral cords on varices, brown elements paler and indistinct on apical whorls.

Dimensions (holotype): 16.5 x 6.0 mm.

REMARKS. — A photograph of the KARUBAR specimen was submitted to A. BEU (NZGS), who advised that its presumed identity with *Tritonoharpa* n. sp. ?C, aff. *T. angasi* appears to be correct. BEU & MAXWELL (1987: 35) state that it "lacks the interstitial cords of *T. angasi*". This refers to the secondary spiral cords (BEU, *in litt.*) and these are indeed lacking on the holotype. The only difference between holotype and paratype is the slightly greater inflation of the whorls of the latter. The protoconch of the paratype was figured by BEU & MAXWELL (1987: pl. 12, fig. o).

Distinction of species within *Tritonoharpa* is not easy. *T. beui* differs from some of its congeners by its nearly straight-sided whorls and general shell outline, from others by its microscopic spiral sculpture or by the protoconch retained in adult specimens (several species are normally decollate at this size). For further differentiation from other species of *Tritonoharpa*, see BEU & MAXWELL (1987: 35).

ETYMOLOGY. — This species is named in honour of A. G. BEU (NZGS), senior author of the important study on Plesiotritoninae where this species was figured for the first time and was recognised as a probably new species.

DISCUSSION

The present collection is remarkable in the number of new records and new taxa collected in the somewhat restricted geographical area covered by the expedition. From the Arafura Sea, only 7 cancellariids had been recorded in the literature and/or are represented in museum collections: the holotype of *Cancellaria nassoides* Schepman, 1911 [= *Bonellitia garrardi*] from the Kai Islands (ZMA); a specimen of *Trigonostoma bicolor* (Hinds, 1843) from *"Samarang"* stn 258, Tual, Kai Islands, 22 m (ZMA); a damaged specimen of *T. antiquatum* (Hinds, 1843) from approximately 100 miles North of Croker Island, Arafura Sea, 09°30' S, 132°34' E, 124 m (AMS); a specimen of *Neadmete okutanii* (identification by T. GARRARD) from off W. Aru Island, 54-65 m (USNM 747371); and three species of *Tritonoharpa*: *T. pseudangasi* Beu & Maxwell, *T. brunnea* Beu & Maxwell and *T.* aff. *angasi*, together represented by 5 specimens. The present material adds 18 additional species, only 3 of which are here well represented in number of specimens. The total number of cancellariid species known to occur in Indonesian seas is now 41 (VERHECKEN, 1986; BEU & MAXWELL, 1987; the present study). This compares favourably to other, much more thoroughly studied, (Indo-) Pacific areas: Australia 48, Philippines16, Japan 36 species. Among the new species, some appear to have their closest relative in west central America and the Atlantic Ocean. Faunal affinities between Plio-Pleistocene molluscs from the latter areas and from western Pacific islands had already been reported (LADD, 1982: 19-20).

Another result of the present study is the presence of a shell layer, possibly an intritacalx, which has been noted in some, but not all species here placed in *Brocchinia*. Surface layers of this type had not yet been described in Cancellariidae. Further work will be necessary to evaluate the significance of this character at genus level.

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6

Mollusca Gastropoda: New deep-water turrid gastropods (Conoidea) from eastern Indonesia

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ABSTRACT

Nineteen new species are described from the bathyal zone of the Arafura Sea at depths between 146 and 1084 m. The genus *Lusitanops* is recorded for the first time from the Indo-Pacific and *Clinura vitrea* sp. nov. is the first Recent representative of this hitherto Cenozoic fossil genus. Based on shell and radula morphology, the classification of *Heteroturris* in the Clathurellinae is confirmed. Including new species described here, there are now 92 turrid species recorded from Indonesia at depths greater than 200 m.

RÉSUMÉ

Mollusca Gastropoda : Nouveaux Turridae bathyaux (Conoidea) de l'est de l'Indonésie.

Dix-neuf espèces nouvelles de Turridae *sensu lato* (= Turridae *s. s.* + Conidae) sont décrites de la mer d'Arafura, à des profondeurs comprises entre 146 et 1084 m. Le genre *Lusitanops* est signalé pour la première fois de l'Indo-Pacifique, et *Clinura vitrea* sp. nov. représente la première occurrence dans les faunes modernes de ce genre, jusqu'ici connu comme fossile du Cénozoïque. L'attribution du genre *Heteroturris* à la sous-famille Clathurellinae est confirmée par la morphologie de sa radula. Certaines espèces nouvelles atteignent de grandes dimensions (par exemple *Comitas rex* sp. nov., 87 mm et *Nihonia maxima* sp. nov., 128 mm), ce qui suggère que la faune bathyale de Turridae d'Indonésie (92 espèces actuellement recensées à des profondeurs supérieures à 200 m) est encore loin d'être inventoriée de façon satisfaisante.

INTRODUCTION

Conoidea, or Turridae *sensu lato* as they used to be known, represent a significant component of deep-water gastropod assemblages worldwide. Because of the sheer size of the family, and also because many species are extremely scarce, Indo-Pacific turrids are poorly known. Despite the rich harvest of turrids obtained there by the landmark "*Siboga*" expedition one hundred years ago, the fauna of Indonesian waters is no exception.

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SCHEPMAN (1913) recorded 52 species, most of them new, from water depths exceeding 200 m in the Indonesian archipelago. The KARUBAR expedition, which worked in eastern Indonesia during October and November 1991, obtained a very rich material of Conoidea, comprising over 100 species. Work on this collection is in progress and the results will greatly extend our knowledge of the deep-water Indonesian fauna. The purpose of the present paper, which is a preliminary report on this turrid fauna, is to record and describe some of the more spectacular new species collected during the expedition. Twenty new species are described from 19 deeper-water stations, at depths between 146 and 1084 m. They belong to 15 genera.

Type material is housed in Muséum national d'Histoire naturelle, Paris (MNHN) and Pusat Penelitian dan Pengembangan Oseanologi LIPI, Jakarta (POLIPI).

SYSTEMATIC ACCOUNT

Superfamily CONOIDEA Fleming, 1822

Family TURRIDAE H. & A. Adams, 1853

Subfamily TURRINAE H. & A. Adams, 1853

Genus *GEMMULA* Weinkauff, 1875

TYPE SPECIES: *Pleurotoma gemmata* Reeve, 1843 (= *Gemmula hindsiana* Berry, 1958) [Non *Pleurotoma gemmata* Conrad, 1835].

Gemmula closterion sp. nov.

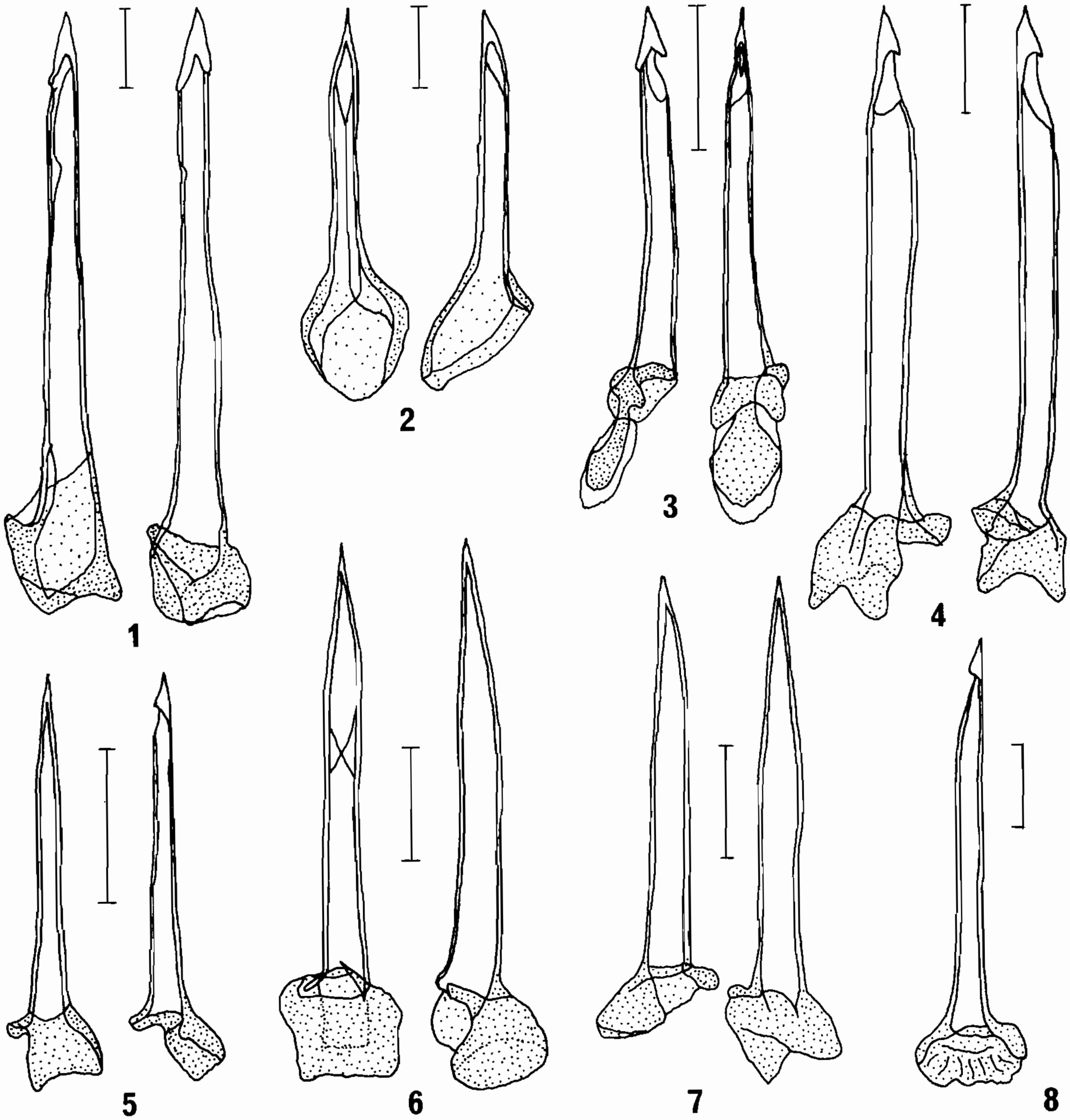
Figs 11-12, 16

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 61, 09°05'S, 132°44'E, 235-236 m, 1 dd (paratype MNHN). — Stn CP 67, 08°58'S, 132°06'E, 146-233 m, 1 lv (holotype), 2 dd (paratypes MNHN and POLIPI). — Stn CP 79, 09°16'S, 131°22'E, 239-250 m, 2 lv (paratypes MNHN and POLIPI).

TYPE MATERIAL. — Holotype and 3 paratypes MNHN, 2 paratypes POLIPI.

DIAGNOSIS. — Shell small, up to 22 mm high, very narrow, spire height about 40% of shell height, periostracum rather thick, light-brown. Protoconch non-planktotrophic, of 1.5 whorls, smooth except for a few arcuate axial ribs near transition to teleoconch. Teleoconch whorls with strong bicarinate subsutural fold, narrow and concave subsutural ramp, and prominent peripheral keel with rounded gemmae. Suture deeply channeled. Base with three very strong spiral cords separated by wide and usually smooth interspaces. Canal long and straight. Anal sinus deep, wide, U-shaped.

DESCRIPTION (holotype). — Shell, slender, very narrow (diameter/height 0.27), spire height comprising 40% of shell height. Color white under rather thick light-brown periostracum. Protoconch consisting of 1.5 smooth whorls, diameter is 0.85 mm, with 5 narrow arcuate axial ribs near transition to teleoconch. Teleoconch consisting of 8.75 whorls with a narrow, concave subsutural ramp, a strong, gemmate peripheral keel and another strong cord between keel and abapical suture. Keel bearing 16 rounded and slightly longitudinally elongate gemmae on last two whorls, bordered by 2 narrow cords on either side. Subsutural fold strong, bicarinate, with 1 wavy cord running along its edge and 1 more prominent, weakly granulate cord below it. Suture deeply channeled and covered by edge of subsutural fold. Base with 3 very strong cords separated by wide smooth interspaces, 3 weaker and rather widely spaced cords near base of canal, which is covered by 15 weak cords. Aperture small, ovate, inner lip with straight columellar side covered by white callus. Outer lip chipped, but growth lines define rather deep and broad, U-shaped, peripheral anal sinus.



FIGS 1-8. — Radulae. **1**, *Borsonia jaya*, paratype. — **2**, *Heteroturris gemmuloides*, paratype. — **3**, *Gymnobela ioessa*, paratype. — **4**, *Gymnobela muricata*, paratype. — **5**, *Gymnobela mitrodeta*, holotype. — **6**, *Gymnobela baruna*, holotype. — **7**, *Clinura vitrea*, holotype. — **8**, *Xanthodaphne cladara*, paratype. Scale bar 50 µm.

Dimensions: height 18.0 mm, last whorl height 10.8 mm, aperture height 8.2 mm, shell diameter 4.8 mm. Largest paratype 22.2 x 5.7 mm. Diameter/height ratio of intact shells 0.26-0.30, mean 0.28.

Paratypes very similar to holotype, differing only in details of spiral sculpture. Subsutural fold on last whorl occasionally with 1 additional thin thread in its lower part, cords below keel may number up to 4, and two paratypes have a thin cord in 1 interspace between main cords on shell base. Also, in some paratypes, the subsutural ramp may have numerous, rather strong, oblique growth lines.

REMARKS. — *Gemmula closterion* is one of the smallest species in the genus. I cannot ascertain that the specimens examined are adult, but this is likely since shells from 3 different stations are of about the same size.

Even if the type specimens are subadult, the species is nevertheless easily recognizable by its paucispiral protoconch, a character so far unique in *Gemmula s. str.*, which indicates that the species has non-planktotrophic development (probably lecithotrophic). The most similar species is *G. graeffei* (Weinkauff, 1875) (= *G. hombroni* Hedley, 1922), which differs in having a uniformly brown shell, a non-channeled suture, spiral ribs on the entire subsutural ramp area, and a typical multispiral protoconch. A similar, paucispiral protoconch occurs in the subgenus *Kuroshioturris* Shuto, 1961, which differs from the nominotypical subgenus by numerous conchological characters.

ETYMOLOGY. — From the Greek *kloster*, spindle; *klosterion* is a diminutive. It is treated as a noun in apposition.

Subfamily COCHLESPIRINAE Powell, 1942

Genus *COMITAS* Finlay, 1926

TYPE SPECIES: *Surcula oamarutica* Suter, 1917 (= *Drillia fusiformis* Hutton, 1877).

Comitas rex sp. nov.

Figs 19-20

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 84, 09°23'S, 131°09'E, 246-275 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell large, 87 mm high, fusiform, spire height comprising 40% of shell height, with long and broad canal. Color of periostracum light brown, with abapically to whorl periphery a band of dark reddish-brown rectangular blotches on axial ribs. Whorls strongly angulate, with wide concave subsutural ramp covered by very fine spiral threads. Suture shallow. Axial ribs very strong, widely spaced, oblique, gradually weakening towards base of last whorl. Spiral sculpture of strong, rounded and widely spaced cords, occasionally with additional secondary cord in interspaces. Interspaces covered by 2-4 fine spiral threads. Cords equally strong on axial ribs and between them. Anal sinus deep, wide and rounded, deepest point just below middle of subsutural ramp. Outer lip projecting forward below sinus.

DESCRIPTION (holotype). — Shell solid, elongate fusiform, with a high turreted spire consisting of 13.5 whorls strongly angulated somewhat above periphery, with a wide, concave subsutural ramp. Protoconch and first 2-3 teleoconch whorls eroded, but protoconch probably paucispiral. Suture well defined, shallow, straight. Axial ribs very strong, rather sharp, widely spaced, opisthocline, produced adapically without forming a knob, entirely traversing spire whorls, gradually weakening abapically, abruptly stopping on shell base; 10 on penultimate whorl and 8 on last whorl. Subsutural ramp covered by very fine and closely set spiral threads. Spiral cords below ramp coarse, rounded, equally strong on axial ribs and between them; interspaces broader than cord, with 2-4 coarse threads and occasionally an additional secondary cord. Base almost flat, smoothly continuous with canal. Canal long, proportionally very broad, and slightly curved adaxially. Inner lip of aperture weakly and rather evenly concave, with thin, longitudinally rugose callus. Outer lip projecting moderately forward below sinus. Anal sinus deep, wide and rounded, deepest point just below middle of subsutural ramp. Shell covered by thin, firmly attached light brown periostracum, with abapically to whorl periphery a reddish-brown band forming distinctly darker rectangular blotches on axial ribs, most clearly visible on wet shell.

Dimensions: height 87.1 mm, last whorl height 52.3 mm, aperture height 42.7 mm, diameter 27.5 mm.

REMARKS. — The sculpture and general colour pattern resemble those of *C. ilariae* Bozzetti, 1991, but *Comitas rex* clearly differs by having angulate whorls with stronger axial ribs and concave subsutural ramp, and much broader canal. Another similar species is *C. kaderlyi* (Lischke, 1872), which, however, is characterized by more numerous and weaker axial ribs and finer spiral sculpture.

ETYMOLOGY. — From the Latin *rex*, king, with reference to the large size of the species. It is treated as a noun in apposition.

Genus *NIHONIA* MacNeil, 1961

TYPE SPECIES: *Nihonia shimajiriensis* MacNeil, 1961.

Nihonia maxima sp. nov.

Figs 13-15

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 84, 09°23'S, 131°09'E, 246-275 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell large for genus, over 120 mm high, slender, fusiform, spire rather high, comprising 35% of shell height. Suture shallow. Spiral sculpture of narrow, granular cords in the slightly concave substural ramp, and rather weak and widely spaced primary cords below the shoulder. Interspaces with thinner secondary cords and thin, wavy, and closely set tertiary ones. Aperture narrow, canal long and straight. Anal sinus deep, asymmetrical, outer lip strongly projecting forward below sinus. Colour yellowish-white, with reddish-brown primary spiral cords.

DESCRIPTION (holotype). — Shell solid, slender, fusiform, with relatively high spire comprising 35% of shell height. Protoconch and tip of teleoconch missing. Teleoconch consisting of 10.5 whorls, adapical 3 whorls styloid, with very slow increase in diameter. Suture tightly adpressed, sometimes hardly distinguishable, clearly lined on spire whorls by a narrow, strongly granular subsutural cord, which becomes rather obsolete on last 2 whorls. Subsutural ramp concave, especially on juvenile whorls, less so on adult whorls. Spiral sculpture of spire whorls consisting of thin cords on the subsutural ramp, a broader cord bordering abapically the subsutural ramp, and 3 (later 2) strong cords below whorl periphery. On subsequent whorls sculpture becoming more complex. Cords in subsutural ramp fading out until only three indistinct ones remain in the middle of subsutural ramp of last adult whorl. Secondary and wavy, closely set tertiary spiral cords appearing gradually in interspaces between main cords. On periphery and base of last adult whorl, sculpture consisting of 4 single and 2 twinned flattened, rather weak primary cords. No axial sculpture except numerous strong incremental lines intersecting spiral cords, spiral cords sometimes interrupted at intersections, especially on canal. Aperture rather narrow, ovate, smoothly continuous with long, straight canal. Inner lip covered by thin callus. Outer lip thin, strongly projecting forward below anal sinus. Sinus deep, asymmetrical, deepest part in abapical half of subsutural ramp. Colour yellowish-white, with reddish-brown primary spiral cords.

Dimensions: height 128.2 mm, last whorl height 83.8 mm, aperture height 71.2 mm, diameter 32.1 mm.

REMARKS. — In whorl profile and type of sculpture, *Nihonia maxima* is most similar to the type species of the genus, *N. shimajiriensis*, from the Pliocene of Okinawa. However, *N. shimajiriensis* is much smaller (the incomplete holotype is 26 mm high at about 9 whorls, including 1.5 whorls of the protoconch, but the last whorl is partly broken), lacks the styloid apical whorls with slowly increasing diameter present in *N. maxima*, and has strongly angulate whorls bearing more pronounced cords. *N. maxima* can be easily distinguished from the two common Recent species of the genus, *N. australis* (Roissy, 1805) and *N. mirabilis* (Sowerby, 1914), by its complex and much weaker spiral sculpture.

ETYMOLOGY. — From the Latin *maximus*, largest, with reference to the very large adult size.

Genus *CLAVOSURCULA* Schepman, 1913

TYPE SPECIES: *Clavosurcula sibogae* Schepman, 1913.

Clavosurcula schepmani sp. nov.

Figs 17-18

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 21, 05°14'S, 133°00'E, 688-694 m, 1 lv (holotype).

Tanimbar Islands: stn CP 69, 08°42'S, 131°53'E, 356-368 m, 1 dd (paratype).

TYPE MATERIAL. — Holotype and paratype MNHN.

DIAGNOSIS. — Shell biconical with cyrtoconoid spire. Protoconch of 1.5 smooth light-brown whorls, indicating non-planktotrophic development. First teleoconch whorls angulate, with subsutural row of tubercles, and strong, oblique, axial knobs at periphery. Last whorls with abapical portion of suture at level of undulating peripheral keel, leaving only subsutural ramp exposed. Base of last whorl with broad flattened spiral cords separated by narrow grooves.

DESCRIPTION (holotype). — Shell thin, biconical, spire cyrtoconoid. Protoconch light brown, teleoconch white. Protoconch of 1.5 evenly convex whorls, diameter 850 µm. Teleoconch of 7.3 rapidly expanding whorls. First 3 teleoconch whorls with broad, smooth, concave ramp with a subsutural row of pointed tubercles, and strong peripheral keel overhanging abapical part of whorl, sculptured by broad, opisthocline axial ribs, forming pointed knobs on periphery, and extending to abapical suture, crossed by rather indistinct, narrow, spiral cords. After third whorl, exposed whorl height abapically of peripheral keel becomes covered by successive whorl, gradually leaving only concave ramp exposed. On subadult and adult whorls, subsutural row of tubercles coalesced to a wavy subsutural fold, and adapical margin of peripheral keel forming spirally striated suprasutural undulating fold, suture impressed, undulating. Subsutural ramp broad, rather flat, with weak indistinct spiral cords, on penultimate whorl sculptured in median area by two more distinct cords. Base of last whorl sculptured by 35 rather strong, wide, flattened cords separated by narrow interspaces, interspaces broader on canal. Base slightly convex, smoothly connecting to a long and straight canal. Aperture narrow, subrectangular. Inner lip covered by very thin callus. Anal sinus deep, with rounded outline, deepest point above middle of subsutural ramp. Outer lip chipped but, judging from growth lines, greatly projecting forward below sinus.

Dimensions: height 25.5 mm, diameter 12.2 mm, last whorl height 20.0 mm, aperture height 17.9 mm.

REMARKS. — The paratype measures 36.0 x 16.0 mm for 8.5 whorls. The early whorls are decorticated, but probably only part of the protoconch is missing. Spire whorls have the same sculpture as on the holotype. In the last two whorls there is a distinct spiral striation between abapical edge of sinus zone and peripheral keel, which is straight, not undulating.

Clavosurcula schepmani is very similar to the type and only species of the genus, *C. sibogae*, from the Flores Sea in 794 m. The latter species is, however, larger (38 mm at 8 whorls; SHUTO's [1970] measurements of the holotype are erroneous), broader, and without peripheral knobs and subsutural tubercles, even on first teleoconch whorls.

ETYMOLOGY. — The species is named in honor of M. M. SCHEPMAN for his pioneering work on the deep-sea turrids of the "*Siboga*" expedition.

Family CONIDAE Fleming, 1822

Subfamily CLATHURELLINAE H. & A. Adams, 1858

Genus *BORSONIA* Bellardi, 1839

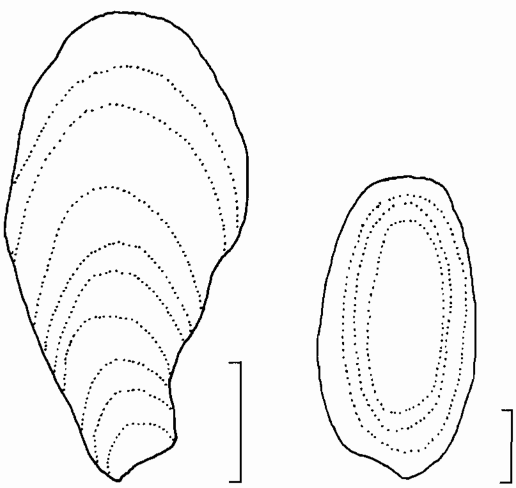
TYPE SPECIES: *Borsonia prima* Bellardi, 1839.

Borsonia jaya sp. nov.

Figs 1, 9, 39-44

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 72, 08°36'S, 131°33'E, 676-699 m, 1 lv, 1 dd (paratypes MNHN). — Stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 2 lv (paratypes MNHN), 3 dd (2 paratypes MNHN and 1 paratype POLIPI). — Stn CP 89, 08°39'S, 131°08'E, 1058-1084 m, 4 lv (holotype and 1 paratype MNHN, 2 paratypes POLIPI), 2 dd (paratypes MNHN). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 1 lv (paratype POLIPI), 1 dd (paratype MNHN).

TYPE MATERIAL. — Holotype and 10 paratypes MNHN, 4 paratypes POLIPI.



9 10

FIGS 9-10. — Opercula.
9, *Borsonia jaya*, paratype. Scale bar 0.5 mm. — **10**, *Heteroturris gemmuloides*, paratype. Scale bar 0.25 mm.

DIAGNOSIS. — Shell fusiform, solid, up to 70 mm high, with high spire, periphery angulate, subsutural ramp concave in abapical part and devoid of axial sculpture. Axial ribs oblique, narrow, short, weakening abapically, restricted to periphery on last adult whorl. Spiral cords rather strong and closely set, narrower on ramp, covering the whole shell surface. Aperture pyriform with moderately long canal, inner lip with low pleat in adapical part of columellar edge. Anal sinus broad, moderately deep. Shell chalky, covered with dark-brownish grey periostracum, aperture of adult, live collected specimens light orange inside. Operculum small, pyriform, with terminal nucleus. Radular teeth large, straight, with short rounded basal part.

DESCRIPTION (holotype). — Shell slender, fusiform, solid, with high spire forming 41.5% of shell height. Protoconch and early teleoconch whorls corroded. Remaining part of teleoconch consisting of 8 convex whorls, angulate at periphery, suture shallow, slightly channeled. Subsutural ramp weakly convex adapically, concave abapically. Axial ribs short, opisthocline, narrow, separated by interspaces wider than ribs, abapically extending from angulation to suture, evanescent on outer base; 16 ribs on penultimate whorl, 18 on last whorl, where their vertical extension is restricted to periphery. Spiral cords rather strong, flattened, sometimes with a narrower cord between primary ones, narrower on subsutural ramp. Interspaces between cords narrow, not exceeding half of cord width, except on canal and adjacent portion of base, where interspaces exceed cord width. Last whorl moderately convex, base smoothly continuous with rather long and straight canal. Aperture broad, pyriform, evenly curved inner lip with broad callus and low pleat in adapical part of columellar edge. Outer lip evenly curved, projecting forward below anal sinus. Sinus moderately deep, as broad as subsutural ramp, deepest point in the middle of ramp. Shell chalky, covered with dark-brownish grey periostracum, aperture light orange inside.

Dimensions: height 60.9 mm, last whorl height 35.6 mm, aperture height 28.7 mm, diameter 19.8 mm.

Radula of a paratype (stn CP 87, height 35.5 mm) with large, straight, narrow teeth with rounded basal part, length 490 µm. Operculum small, pyriform, with slightly curved axis and terminal nucleus.

REMARKS. — The paratypes are 35.5 to 70.5 mm high, with some variation in proportions of the last whorl (*e.g.* Figs 41-42). Younger specimens (Fig. 43) have a relatively broader body whorl with axial ribs proportionally higher, extending to shell base. In such small specimens the aperture is greyish-white inside. The importance of columellar pleat may vary slightly, it is present in all but one specimen. Axial ribs on last whorl number 17-19.

Borsonia jaya is very similar to *B. epigona* Martens, 1901 from west of Sumatra, 646-676 m, but the latter is much smaller (up to 28 mm high), with distinctly angulate shell base, straight axial ribs, very prominent columellar pleat, and, judging from the original illustration, without spiral sculpture in the subsutural ramp. *B. jaya* also shows some similarity to the type-species of *Buridrillia* Olsson, 1942, *Clathrodrillia (Buridrillia) panarica* Olsson, 1942 from the Pliocene of Central America. However, it has been recently shown (EMERSON & MCLEAN, 1992) that *Buridrillia* has radular teeth of modified wishbone type and therefore belongs to the subfamily Crassispirinae.

ETYMOLOGY. — From the Indonesian *jaya*, meaning large, beautiful.

Genus ***HETEROTURRIS*** Powell, 1967

TYPE SPECIES: *Heteroturris sola* Powell, 1967.

REMARKS. — *Heteroturris* was originally described in the subfamily Turrinae because POWELL (1967) considered it closely allied to *Lophiotoma* Casey, 1904. POWELL also noticed that the sculpture of the subsutural ramp resembles that of *Microdrillia* Casey, 1903, which he classified in subfamily Clavinae. TAYLOR *et al.* (1993) have included *Microdrillia* in the "tomopleurid" group of genera of the subfamily Clathurellinae (Conidae). The style and position of anal sinus in *Heteroturris* is rather different from the character states of Turrinae, and the radular morphology of *H. gemmuloides* confirms the classification of *Heteroturris* in Clathurellinae.

Heteroturris gemmuloides sp. nov.

Figs 2, 10, 21-23

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 59, 08°20'S, 132°11'E, 399-405 m, 1 lv (paratype MNHN). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 1 lv (holotype), 1 dd (paratype POLIPI).
Philippines. MUSORSTOM 2: stn CP 75, 13°51'N, 120°30'E, 300-330 m, 1 lv (paratype MNHN).

TYPE MATERIAL. — Holotype and 2 paratypes MNHN, 1 paratype POLIPI.

DIAGNOSIS. — Shell large for the genus, height up to 40 mm, solid, narrowly fusiform, with high spire and long canal. Whorls with rather prominent bicarinate subsutural fold, concave subsutural ramp, and prominent, tuberculate, peripheral keel. Subsutural ramp bearing numerous, regular, curved folds formed by thickened scars of anal sinus. Abapically of keel, spiral cords strong and widely spaced, sometimes with a thinner cord in interspaces, two on exposed part of spire whorls, over 20 on base and canal of last whorl. Anal sinus deep, U-shaped, with parallel sides. Shell chalky white under rather thick light-brown periostracum. Operculum small, vestigial, with large central nucleus. Radula long, with more than 50 transverse rows. Radular teeth small, inflated at the base, with proximal opening.

DESCRIPTION (holotype). — Shell solid, narrowly fusiform, with tall spire comprising 40% of total shell height. Protoconch and apical teleoconch whorls eroded. Remaining part of teleoconch consisting of 10.5 angulate whorls. Subsutural ramp wide, concave with rather massive, broad, flat-topped, bicarinate subsutural fold and 2 weak spiral threads in the middle, ramp bearing numerous, regular, curved folds formed by thickened scars of anal sinus. On last whorl, cords of subsutural fold becoming strongly and irregularly granulate, and appearing like a spirally twisted rope, due to intersection with growth lines. Peripheral keel moderately prominent, bearing numerous rounded tubercles truncated adapically at edge of ramp, 24 tubercles on penultimate whorl, 27 on last whorl. Spiral sculpture consisting of one abapical cord bordering suture, and one additional strong cord (missing on apical whorls) below peripheral keel. On last whorl, periphery with 4 widely interspaced strong cords, additional thinner cords appearing in between. Base and canal covered by ca. 26 cords, sometimes with thinner cord in interspaces; adapical basal cords of almost same strength as those at periphery, but prominence of cords gradually decreases towards tip of canal, where cords are obsolete. Axial sculpture consisting of strong incremental lines, intersection with spiral cords granular. Aperture rather narrow, ovate, gradually continued by long and straight canal. Inner lip covered by thick callus, parietal wall weakly and evenly curved. Anal sinus deep, U-shaped, with parallel sides, occupying entire width between subsutural fold and peripheral keel. Colour chalky white under thick light-brown periostracum.

Dimensions: height 40.5 mm, last whorl height 24.4 mm, aperture height 21.1 mm, diameter 11.8 mm.

Operculum (of paratype) small, 1.05 x 0.6 mm, vestigial, very thin, with large central nucleus. Radula long, narrow, with over 50 transverse rows. Radular teeth rather small, mean length 270 µm (in specimen 38.5 mm high), short, base strongly inflated, with proximal opening.

REMARKS. — Paratypes are smaller than holotype: 38.5 x 11.3 mm and 33.0 x 9.7 mm. Specimens from Indonesia are very similar to the holotype, except for minor variation in the strength and number of peripheral tubercles, and width of subsutural fold, which may be slightly concave between two marginal cords. The specimen from the Philippines (Fig. 23) has a stronger subsutural fold, and a slightly narrower subsutural ramp, especially on last whorl, with only one thin thread in its middle. *Heteroturris gemmuloides* is very similar to *H. sola*, but differs in attaining twice the size, with a broad, bicarinate subsutural fold, and a nodulose peripheral keel. The shape of radular teeth is very similar to that of *Typhlomangelia polythele* Barnard, 1963 and *T. adenica* Sysoev, 1996 (BARNARD, 1963, fig. 3f; SYSOEV, 1996, fig. 4).

ETYMOLOGY. — Named *gemmuloides* because of its superficial resemblance to species of *Gemmula*.

DISTRIBUTION. — Tanimbar Islands, Indonesia, and southwest of Luzon Island, Philippines, taken alive at 330-399 m.

Heteroturris serta sp. nov.

Fig. 28

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell solid, small, less than 10 mm high, narrowly fusiform, with high spire and long canal. Protoconch with 3.25 whorls, initial 1.5 whorls smooth, subsequent whorls sculptured by strong, closely spaced axial ribs. Suture channeled. Whorls with very strong, smooth, rounded peripheral keel and thick subsutural fold, crenulated adapically. Subsutural ramp narrow, concave, with one spiral cord in the middle, and regular arcuate folds formed by thickened scars of anal sinus. Spiral cords very strong and widely spaced. Last whorl with three cords on shell base below keel. Anal sinus broad and shallow. Colour light yellowish.

DESCRIPTION. — Shell solid, thick-walled, small, narrowly fusiform with tall spire comprising 37% of shell height. Protoconch multispiral, consisting of 3.25 whorls; first 1.5 whorls smooth, subsequent whorls covered with numerous arcuate axial ribs, which gradually become stronger towards abrupt protoconch/teleoconch discontinuity. Teleoconch consisting of 6.25 whorls. Spiral sculpture on spire whorls consisting of a thick, overhanging subsutural fold with flattened and steeply descending surface, a strong, smooth peripheral keel, and another cord bordering abapical suture (on last 2 spire whorls only). Axial sculpture consisting of strong incremental folds that do not extend over main spiral cords. Subsutural fold consisting of a strong, smooth spiral cord abapically and a much weaker crenulated adapical cord, separated by area covered by oblique incremental wrinkles. Subsutural ramp rather narrow, concave, covered by distinct, crisp, arcuate incremental folds formed by scars of anal sinus, and on last 3 whorls bearing a narrow cord running in the middle of ramp and forming tubercles at intersection with axial folds. Periphery and base of last whorl with 4 strong cords with wide interspaces, followed by 13 gradually weakening cords on canal. Canal long and straight. Aperture rather narrow, pyriform, with a strong lira inside. Inner lip covered by thick callus, parietal side evenly curved. Outer lip chipped, but growth lines indicating broad and shallow anal sinus. Colour yellowish-white, with a very thin periostracum.

Dimensions: height 9.5 mm, last whorl height 6.0 mm, aperture height 4.8 mm, diameter 3.4 mm.

REMARKS. — *Heteroturris serta* differs from *H. sola* in having a solid and broad subsutural fold, stronger spiral sculpture, and a protoconch with fewer whorls. It also differs from *H. gemmuloides* in its stronger spiral sculpture and smooth peripheral keel. The holotype of *H. serta* may not be fully adult, but it is well preserved and the species should be easily recognizable, either as a juvenile with protoconch or as a mature specimen with adult sculpture.

ETYMOLOGY. — From the Latin *sertus*, plaited, with reference to the very regular incremental sculpture.

Subfamily RAPHITOMINAE Bellardi, 1875

Genus ***CRYPTODAPHNE*** Powell, 1942

TYPE SPECIES: *Cryptodaphne pseudodrillia* Powell, 1942.

Cryptodaphne rugosa sp. nov.

Figs 24-27

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 1 dd (holotype). — Stn DW 24, 05°32'S, 132°51'E, 230-243 m, 1 dd (paratype POLIPI).
Tanimbar Islands: stn DW 44, 07°52'S, 132°48'E, 291-295 m, 2 lv (paratypes MNHN).

TYPE MATERIAL. — Holotype and 2 paratypes MNHN, 1 paratype POLIPI.

DIAGNOSIS. — Shell rather small, up to 13 mm high, thin, teleoconch shell surface finely granulate. Protoconch multispiral, consisting of ca. 3 diagonally cancellated whorls. Teleoconch whorls with deep, slightly channeled suture, and very broad, slightly concave subsutural ramp, occupying most of height on spire whorls. Strong spiral keel adjacent to abapical suture in early whorls and well below periphery in penultimate whorl. Last whorl with 10 fine spiral cords and numerous closely set sigmoid incremental lines in subsutural ramp, and several strong and narrow cords below keel, thin secondary and tertiary cords in interspaces. Siphonal canal short and curved. Anal sinus moderately deep, asymmetrical, with deepest point in lower half of ramp. Colour of protoconch light brown, teleoconch off-white.

DESCRIPTION (holotype). — Shell rather small, thin but solid, narrowly biconical, with tall spire comprising 40% of shell height. Protoconch multispiral, protoconch I and initial part of protoconch II missing, remaining part consisting of about 2 whorls with diagonally cancellated sculpture, diameter 650 µm. Protoconch/teleoconch boundary sharp, with deeply opisthocyrt protoconch outer lip. Teleoconch consisting of 6.75 whorls separated by deep, slightly channeled suture, shell surface minutely granular. Most of whorl height occupied by very broad, slightly concave subsutural ramp. Primary sculpture consisting of spiral cords, only the strongest adapical one exposed on early whorls, forming a suprasutural keel; penultimate whorl with one additional strong cord exposed below keel; last whorl with 8 strong, widely spaced primary cords exposed on base below peripheral keel, 1-3 thinner secondary cords in interspaces; 9 weaker cords on canal. Subsutural ramp smooth on early whorls, on later whorls bearing narrow spiral cords, 8 on penultimate, 10 on last whorls, the second from adapical margin and the most abapical ones strongest. Axial sculpture of numerous, narrow sigmoid folds formed by thickened incremental lines. Axial folds and spiral cords forming reticulate pattern in ramp, small nodules at points of intersection. Canal rather short and curved. Aperture oval, columella thick, forming a distinct angle with parietal part of inner lip. Anal sinus asymmetrical, moderately deep, steeply descending adapically, deepest point rounded in abapical half of ramp. Protoconch light brown, teleoconch off-white.

Dimensions: height 11.8 mm, diameter 4.8 mm, body whorl height 7.0 mm, aperture height 5.2 mm.

REMARKS. — In the paratypes (dimensions 12.8 x 5.1 mm, 9.3 x 3.7 mm, and 7.7 x 3.5 mm), the strength and relative position of the main spiral keel vary a little, as do also the concavity of the subsutural ramp and the number of cords on the ramp and in interspaces of primary spirals. One paratype has a protoconch of about 3 whorls with etched surface, but even in that specimen the earliest part is dissolved.

Cryptodaphne rugosa resembles *C. affinis* (Schepman, 1913), but can be easily distinguished by its proportionally larger body whorl, differently shaped anal sinus, and details of sculpture. In fact, it is much more similar to the fossil type-species than to any of the Recent species assigned to the genus (POWELL, 1966; SHUTO, 1971). The New Zealand type species *C. pseudodrillia* was originally recorded from the Lower Miocene (POWELL, 1942) and later (POWELL, 1966) the Upper Oligocene, but BEU & MAXWELL (1990) list it in the Early Miocene faunal assemblage. *C. rugosa* is almost twice the size of the holotype of *C. pseudodrillia* and differs mainly in the shape of the anal sinus, in *C. pseudodrillia* "descending almost vertically and then abruptly produced forward" (POWELL, 1942: 165), as well in the twisted canal, absence of "close-spaced spiral threads" covering the entire shell surface, and presence of minute granulation.

The diagonally cancellate protoconch sculpture clearly indicates a position in Raphitominae, however *C. rugosa* possesses features more frequently encountered in Clathurellinae, such as the closely spaced axial folds, formed by thickened growth lines, well developed over the entire subsutural ramp, and the presence of minute granulation on the shell surface.

ETYMOLOGY. — *Rugosus*, Latin adjective meaning rough, with reference to granular microsculpture.

Genus *GYMNOBELA* Verrill, 1884

TYPE SPECIES: *Gymnobela engonia* Verrill, 1884.

Gymnobela ioessa sp. nov.

Figs 3, 29-33

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 54, 08°21'S, 131°43'E, 836-869 m, 5 lv (holotype and 3 paratypes MNHN, 1 paratype POLIPI), 5 dd (3 paratypes MNHN and 2 paratypes POLIPI).

TYPE MATERIAL. — Holotype lv and 6 paratypes MNHN, 3 paratypes POLIPI.

DIAGNOSIS. — Shell exceeding 45 mm in height, fusiform, solid, with high spire and short canal. Whorls angulate below periphery, angulation obsolete on last adult whorl. Subsutural ramp broad, moderately to weakly concave, without axial sculpture and with fainter spiral cords, sometimes with thickened scars of anal sinus adapically. Axial ribs oblique, rather short, reaching abapical suture, only occupying periphery on adult whorls, obsolete on last whorl of large adults. Spiral cords flat, separated by narrow interspaces and, sometimes, additional narrower cords. Anal sinus broad, moderately deep, somewhat angulate. Colour reddish-violet, with lighter subsutural band, aperture brown inside. Radular teeth straight, narrow, barbed, with narrow trilobate basal part.

DESCRIPTION (holotype). — Shell fusiform, thin but solid, with tall spire comprising 41.5% of shell height. Protoconch and outer layers of apical teleoconch whorls dissolved, only traces of brown protoconch columella remaining. Teleoconch consisting of 10 whorls, suture shallow, slightly channeled. Apical whorls angulate at periphery, angulation weaker and situated a little below periphery in subadult whorls, last whorl rather evenly rounded. Whorl profile concave above angulation, slightly convex below it. Axial sculpture consisting of ribs that extend abapically from whorl angulation to outer base, oblique, weakening abapically, 14 on penultimate whorl, obsolete on last whorl. Spiral sculpture consisting of narrow grooves delimiting low, flat spiral bands, grooves weaker on subsutural ramp, deeper below periphery. Base evenly convex, smoothly continuous with rather short, straight, moderately broad canal. Aperture broad, oval, parietal side weakly concave, separated by obtuse angle from straight columella. Inner lip a thin, broad callus, outer lip evenly curved. Anal sinus moderately deep, broad, slightly angulate, deepest point just below middle of subsutural ramp. Colour dull reddish-violet, with a lighter band subsuturally in part of ramp, aperture and columella orange brown. Periostracum very thin, transparent.

Dimensions: height 46.3 mm, last whorl height 27.1 mm, aperture height 21.2 mm, diameter 16.0 mm.

Last 1-1.5 protoconch whorls preserved on 2 paratypes, brown, with sculpture of spiral cords interrupted by close set, curved axial riblets. Radular teeth of 34.2 mm high paratype straight, narrow, barbed, with narrow trilobate basal part, mean length 170 µm (Fig. 3). No operculum.

REMARKS. — The paratypes are smaller than the holotype (largest 45.5 x 16.3 mm). In smaller specimens, the axial ribs number 14 or 15 on the last whorl and do not extend onto shell base. The adapical part of the subsutural ramp may bear numerous, regular, thickened scars of the anal sinus.

Gymnobela ioessa resembles *G. muricata*, occurring sympatrically, but differs in having a more slender, reddish-violet shell, higher axial ribs reaching suture abapically, and smaller radular teeth with narrow, trilobate basal part. *G. ioessa* also attains a smaller size.

G. ioessa and *G. muricata* form a distinct group within the genus, which combines characters of two different subfamilies of Conidae. The general shell outline and colouration, and the character of anal sinus are similar to those of Clathurellinae (*e.g.*, *Borsonia* and *Typhlosyrinx* Thiele, 1925), whereas the protoconch sculpture and the structure of radular teeth indicate a position in the Raphitominae. These species, however, can be placed in *Gymnobela* taken in a broad sense, as is frequently adopted in the current literature.

ETYMOLOGY. — From the Greek *ioeis* (feminine *ioessa*), meaning violet or dark brown, based on the ground colour of the shell.

Gymnobela muricata sp. nov.

Figs 4, 34-38

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 54, 08°21'S, 131°43'E, 836-869 m, 3 lv (2 paratypes MNHN, 1 paratype POLIPI), 2 dd (holotype and paratype MNHN). — Stn CP 73, 08°29'S, 131°33'E, 840-855 m, 1 lv (paratype POLIPI). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 1 dd (paratypes MNHN).

TYPE MATERIAL. — Holotype (dd) and 4 paratypes MNHN, 2 paratypes POLIPI.

DIAGNOSIS. — Fully adult shell very large, up to 70 mm high, broad, solid, with high, regularly conical spire, short, broad siphonal canal. Whorls angulate just below middle of whorl, angulation obsolete in last adult whorls. Subsutural ramp wide, weakly concave, without axial sculpture. Axial ribs oblique, short, not reaching abapical suture, only occupying periphery in last whorls, obsolete on last whorl of large adults. Spiral grooves narrow, delimiting flat, unevenly broad cords, weaker on ramp than on periphery and base. Anal sinus broad, moderately deep, somewhat angulate. Colour white to light-brown. Radular teeth straight, long, weakly barbed, with bifurcate basal part.

DESCRIPTION (holotype). — Shell broadly fusiform, thin but solid, with tall spire comprising 39% of total shell height. Protoconch and apical whorls dissolved. Teleoconch consisting of 10 whorls, suture shallow. Earliest teleoconch whorls angulate just below middle of whorl, angulation weaker on subsequent whorls, last whorl almost evenly rounded. Whorl profile weakly concave above angulation, almost flat below. Axial ribs very short, oblique, extending abapically from whorl angulation on earliest teleoconch whorls, forming rounded knobs just below periphery on subadult whorls (18 ribs on penultimate whorl), obsolete on last adult whorl. Spiral sculpture consisting of narrow, shallow, unevenly spaced grooves separating low, flat cords. Cords weaker but more regular on subsutural ramp, stronger but uneven below whorl angulation. Last whorl rather inflated, with evenly convex base, clearly separated from short, very broad, slightly twisted siphonal canal. Aperture broad, oval. Inner lip covered by thin, broad, longitudinally wrinkled callus, concave parietal and columellar sides forming obtuse angle. Outer lip evenly convex. Anal sinus moderately deep, broad, slightly angulate, deepest point in abapical part of subsutural ramp. Colour chalky light yellowish brown.

Dimensions: height 69.1 mm, last whorl height 42.4 mm, aperture height 33.3 mm, diameter 25.7 mm.

Radular teeth of 33.3 mm high paratype weakly barbed with strong basal spur and bifurcate basal part, mean length 275 µm (Fig. 4). No operculum.

REMARKS. — The paratypes are smaller than the holotype (the largest is 52.1 x 20.6 mm). Small specimens are dull greyish-white, with a very thin transparent periostracum, and proportionally longer and narrower canal. The protoconch is dissolved in all specimens, but there are traces of a brown layer, suggesting that the protoconch was of the planktotrophic type.

For differences with *G. ioessa*, see that species.

ETYMOLOGY. — From the Latin *muricatus* (adj.), meaning pointed or spiny like a murex, with reference to the high spire and short, knob-like axial ribs.

Gymnobela mitrodeta sp. nov.

Figs 5, 45-46

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 12, 05°23'S, 132°37'E, 413-436 m, 1 lv (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell of medium size, 24 mm high, thin but solid, buccinoid. Protoconch multispiral, small, with 2+ diagonally cancellated whorls. Teleoconch whorls angulate at periphery, suture deep, slightly channeled. Subsutural ramp occupying about half of exposed whorl height between subsutural row of blunt tubercles and crowned periphery, ramp concave on both sides of convex median part. Spiral sculpture of fine cords in ramp, stronger but narrow cords at periphery and broad rounded cords abapically, secondary and tertiary cords in interspaces. Axial ribs oblique, numerous, very short on last whorls. Canal moderately long, slightly curved and obliquely truncated. Anal sinus asymmetrical, with apex in lower half of subsutural ramp. Protoconch brown, teleoconch white, with two light reddish-brown bands at periphery and on canal. Radular teeth small with well-developed basal part.

DESCRIPTION (holotype). — Shell thin but solid, buccinoid, with angulated shoulder at whorl periphery. Protoconch I and initial part of protoconch II missing, remaining part consisting of about 2 whorls with diagonally cancellated sculpture, diameter 550 µm. Protoconch/teleoconch boundary sharp. Teleoconch consisting of 7.8 convex, strongly angulated whorls, suture deep, narrowly channeled by subsutural ridge. Subsutural ramp occupying about half of spire whorls, concave on early whorls, but becomes progressively convex in the middle part on three last whorls; smooth on first 2 whorls, on subsequent whorls sculptured by spiral cords, very weak below subsutural ridge, increasing in strength on abapical half of subsutural ramp, and becoming very narrow near shoulder. Below shoulder, spiral sculpture of strong, rounded and widely spaced primary cords, 2 on spire whorls, 4 on periphery of last adult whorl, interspaces with densely packed thinner secondary and tertiary cords. Spiral cords weaker on base and siphonal canal. Axial sculpture consisting of strong ribs, which are interrupted by ramp, and form blunt, elongated tubercules on subsutural ridge and at periphery. On early whorls, ribs almost straight, extending over all exposed part of whorl below periphery, on two last whorls ribs more numerous (28 on penultimate, 34 on last whorl), oblique, very short, occupying only periphery. Base moderately constricted to a rather short, slightly twisted, and obliquely truncated canal. Aperture oval, siphonal canal poorly demarcated. Inner lip covered by thin and glossy callus, parietal area weakly convex, columellar area almost straight. Anal sinus strongly asymmetrical, deepest part in abapical half of subsutural ramp, abapical edge almost horizontal, outer lip strongly projecting forward below sinus. Protoconch brown, teleoconch ground color white, with two pale reddish-brown bands, one encircling peripheral angulation on last two whorls, the other obliquely encircling canal.

Dimensions: height 24.2 mm, diameter 11.2 mm, last whorl height 16.3 mm, aperture height 13.4 mm.

Radular teeth small, 130 µm long, with well-developed basal part, subquadrate in front view (Fig. 5).

REMARKS. — *Gymnobela mitrodeta* can be easily distinguished from other species of the genus by its complex spiral sculpture, short and numerous axial ribs, tuberculated subsutural fold, strongly asymmetrical anal sinus, and peculiar color pattern.

ETYMOLOGY. — From the Greek *mitrodetos* (adjective), crowned by a turban, with reference to the orange spiral band encircling the periphery of subadult and adult whorls.

Gymnobela micraulax sp. nov.

Figs 47-48

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 91, 08°44'S, 131°05'E, 884-891 m, 2 lv (holotype and paratype).

TYPE MATERIAL. — Holotype and paratype MNHN.

DIAGNOSIS. — Shell of medium size, up to 27 mm, thin, semi-transparent, narrow, with high spire. Teleoconch whorls angulate at periphery or above it, with steep, smooth subsutural ramp. Suture shallow. Spiral sculpture of narrow grooves. Axial ribs strong, oblique, vanishing rapidly below periphery before abapical suture. Canal moderately long, inner lip without callus. Outer lip strongly projecting below deep anal sinus. Colour light-brown.

DESCRIPTION (holotype). — Shell fusiform, thin, semi-transparent, narrow, with high spire forming about 40% of total height. Protoconch corroded apically, remaining 2 whorls sculpture etched, but traces of oblique reticulation present. Teleoconch consisting of 8.5 shouldered whorls, whorl angulation above periphery, suture shallow, slightly adpressed, steeply descending subsutural ramp almost flat adapically and concave near whorl angulation. Axial sculpture of strong, broad and opisthocline ribs, forming axially elongated nodule below shoulder, vanishing abapically before reaching suture. 14 axial ribs on penultimate whorl, 13 on last whorl. Incremental lines forming raised wrinkles in adapical part of subsutural ramp. Spiral sculpture consisting of narrow, rather evenly spaced grooves, 9 on exposed part of penultimate whorl, 35 on last whorl, more crowded on canal. Base weakly convex, smoothly connected to moderately long, obliquely truncated canal. Aperture narrow, poorly demarcated from canal, inner lip weakly and evenly concave, without a callus, outer lip thin, fragile, strongly projecting forward below anal sinus. Anal sinus deep, deepest point just below suture. Colour of protoconch with traces of brown, teleoconch glassy light-brown.

Dimensions: shell height 26.6 mm, diameter 8.1 mm, body whorl height 15.8 mm, aperture height 12.8 mm.

REMARKS. — The paratype measures 22.0 x 7.1 mm and has 7.5 teleoconch whorls (protoconch corroded, surface etched). Whorl angulation is approximately at periphery, which also results in a slightly broader subsutural ramp. It also differs slightly from the holotype in the ribs being slightly more axially elongated.

Gymnobela micraulax can be easily distinguished from other Indo-Pacific species of *Gymnobela* by its high spire and sculpture of narrow grooves.

ETYMOLOGY. — *Micraulax*, Greek (adj.) meaning with small furrows, with reference to the spiral sculpture.

Gymnobela baruna sp. nov.

Figs 6, 49-50

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 21, 05°14'S, 133°00'E, 688-694 m, 1 lv (holotype), 1 dd (paratype).

TYPE MATERIAL. — Holotype and paratype MNHN.

DIAGNOSIS. — Shell thin, up to 36 mm high, with high spire occupying 45% of shell height. Protoconch multispiral, with diagonally cancellated sculpture. First teleoconch whorls with angular periphery, weakly concave anal sinus occupying ca. 60% of subsural ramp, periphery with very short oblique axial ribs, last whorls almost evenly convex. Spiral sculpture of fine spiral cords and strongly sigmoid incremental lines, intersection irregularly reticulate. Colour white, adapical half of last whorls with very pale yellowish-white band.

DESCRIPTION (holotype). — Shell consisting of 1+ protoconch and 9.5 teleoconch whorls, slender, thin but rather solid, high, fusiform, tall spire occupying 45% of shell height, suture rather deep, slightly channeled. Tip of protoconch dissolved, remaining whorl surface etched but remnants of sculpture typical of multispiral larval shell with diagonally cancellated sculpture, indicating planktotrophic development. First 6 teleoconch whorls distinctly shouldered, weakly concave sinus zone occupying about 60% of broad subsutural ramp, whorl profile almost flat above and below strong peripheral angulation. Subsequent whorls almost evenly convex, subsutural ramp flat with poorly defined abapical border. Axial sculpture consisting of strongly sigmoid incremental lines, forming raised opisthocyrt riblets in sinus zone, and strongly prosocline threads below sinus; very short, broad, opisthocline ribs on periphery of spire whorls, ca. 15 per whorl, vanishing on 6th and subsequent whorls. Spiral sculpture consisting of cords, weakly defined and widely spaced in sinus zone, sharply defined, thin, rounded and closely spaced on rest of the whorl, a few stronger below periphery. Intersection of incremental lines and spiral cords rather regularly reticulate on spire whorls, more irregularly so on last whorl, due to unevenness of lines and cords. Aperture rather broad, oval, widely open siphonal canal not distinctly set off. Inner lip with thin, polished callus extending over convex parietal and concave columellar areas. Outer lip chipped, anal sinus (from shape of growth) rather deep, its deepest point in middle of subsutural ramp. Colour chalky white, adapical half of last whorls with very pale yellowish-white band.

Dimensions: height 36.2 mm, diameter 12.8 mm, last whorl height 21.3 mm, aperture height 16.7 mm.

Radular teeth (Fig. 6) straight, unbarbed, basal part subquadrate in frontal view, length 250 μm.

REMARKS. — The paratype (21.6 x 8.5 mm at 2+ protoconch and 7.5 teleoconch whorls) is a damaged and slightly eroded shell. Whorl profile and sculpture correspond to the characters of holotype at comparable size, but whorl angulation is more pronounced than on corresponding (7th) whorl of the holotype; also, spiral cords and growth lines are slightly coarser.

Gymnobela baruna is rather different from most other representatives of the genus. The general shell outline, the absence of prominent axial sculpture and fine spiral cords are more characteristic of *Xanthodaphne*. However, the high spire and clearly defined broad subsutural ramp, delimited by the whorl angulation in early whorls, are features that do not fit that genus. *G. baruna* is most similar to the species illustrated by MATSUMOTO (1979, pl. 17, fig. 3) as *Daphnella proxima* Kuroda. The latter, however, is a manuscript name and a *nomen nudum* [ICZN Art. 13a(i)].

ETYMOLOGY. — From the name of the Indonesian research vessel "*Baruna Jaya 1*" which collected the material. *Baruna* is used as a noun in apposition.

Genus *MIOAWATERIA* Vella, 1954

TYPE SPECIES: *Awateria personata* Powell, 1954.

Mioawateria asarotum sp. nov.

Fig. 55

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell small, about 7 mm high, short, wide, solid, with few rapidly expanding whorls. Protoconch multispiral with diagonally cancellated sculpture. Teleoconch whorls angulate. Last whorl almost as high as wide, completely covered by sculpture of low, wide cords, intersecting numerous, stronger but narrower axial ribs, intersection forming axially elongated nodules. Aperture broad. Canal very short and poorly differentiated from aperture. Anal sinus broad and shallow.

DESCRIPTION. — Shell small, solid, broadly biconical, with low spire and very large, inflated last whorl, occupying 74% of total shell height. Protoconch consisting of 2+ convex whorls, protoconch I and probably about 0.5 whorl of protoconch II missing, sculpture of opisthocyrt, opisthocline axial riblets, forming diagonal cancellation with oblique threads in abapical two-thirds. Axial riblets nearly orthocline near clearly defined protoconch/teleoconch discontinuity. Teleoconch consisting of 3.8 rapidly expanding whorls, with sharp angulation above periphery, subsutural ramp weakly concave. On first teleoconch whorl, two spiral cords and a third, poorly defined one on shoulder, intersecting thinner axial riblets, intersection forming axially elongate nodules. On 2nd and third whorls, an additional spiral cord exposed above suture, shoulder cord more distinct, intersecting axial riblets of similar strength, intersection forming rounded beads. On last whorl, 19 spiral cords and 35 ribs; subsutural cord indistinct on broad subsutural fold, peripheral cords broad, low, separated by narrow groove, cords on base and canal higher and separated by interspaces occupying equal width; axial ribs sharp, stronger than cords, forming raised, prosocline, sigmoid wrinkles in subsutural zone, rather orthocline and extending over whole whorl height below angulation, forming checkerboard pattern with spiral grooves. Aperture broad, parietal wall convex with rather thin callus, columella almost straight with thicker callus. Canal short and broad. Outer lip broken, but growth lines indicating very shallow sinus, with deepest point at whorl angulation. Protoconch brown, teleoconch beige-white.

Dimensions: height 6.9 mm, diameter 4.8 mm, last whorl height 5.1 mm, aperture height 3.9 mm.

REMARKS. — *Mioawateria asarotum* is similar to the type species, *M. personata*, but differs in having much lower spire and inflated body whorl. In shell outline, it is similar to *M. rhomboidea* (Thiele, 1925) from West Africa, but differs in its smaller shell with curved axial ribs and very wide spiral cords. *M. extensaeformis* (Schepman, 1913), which is rather common in the Indo-Pacific bathyal, has a narrower shell and much weaker spiral sculpture.

ETYMOLOGY. — Latin *asarotum* (noun in apposition), a floor laid in mosaic, with reference to the elongated squares formed by intersection of axial and spiral sculpture.

Genus *CLINURA* Bellardi, 1875

TYPE SPECIES: *Murex (Pleurotoma) calliope* Brocchi, 1814 (Neotype figured by ROSSI RONCHETTI, 1955, fig. 163).

Clinura vitrea sp. nov.

Figs 7, 54

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 91, 08°44'S, 131°05'E, 884-891 m, 1 lv (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell of medium size, 21 mm high, thin, porcellaneous, with high pagodiform spire. Teleoconch whorls very convex, with keeled periphery. Axial ribs numerous, very short, restricted to whorl periphery, forming narrow oblique knobs on keel. Spiral sculpture of strong cords below periphery, interspaces rather wide. Last whorl attenuated towards moderately long, straight canal. Subsutural ramp broad, almost devoid of sculpture, sinus rounded, deepest point in middle of ramp. Radular teeth short, straight, with bilobate basal part.

DESCRIPTION (holotype). — Shell thin, porcellaneous, broadly fusiform, consisting of 8.5+ very convex teleoconch whorls (protoconch and apical teleoconch whorls dissolved) with high pagodiform spire occupying 42% of total shell height. Suture impressed, periphery angulate, subsutural ramp broad, convex, whorl profile concave abapically of slightly overhanging peripheral keel, base regularly convex. Outer shell layer etched on spire whorls, details of sculpture preserved on last two whorls only. Axial sculpture consisting of numerous (28 on penultimate and last whorls), short, opisthocline riblets, forming oblique nodules on peripheral keel and extending to abapical concavity only; incremental lines very distinct in ramp, occasionally thickened as opisthocyrt wrinkles. Spiral sculpture in subsutural ramp consisting of 6-8 poorly defined cords, on and below peripheral keel consisting of strong, sharply defined cords, interspaces broader than cords, 2 stronger cords just above suture in exposed part of spire whorls. Base convex, canal distinctly set off, long, straight, narrow. Aperture ovate, inner lip a thin glaze over weakly convex parietal area and almost straight columella. Outer lip chipped, based from incremental lines anal sinus occupies whole ramp, rounded, deepest point on abapical side of middle part of ramp. Colour porcellaneous white, etched shell surface and interspaces between cords opaque, chalky white, ramp and cords vitreous.

Dimensions: height 21.3 mm, diameter 10.5 mm, last whorl height 13.4 mm, aperture height 11.1 mm.

Radular teeth 250 µm long, straight, short, with a bilobed and turned out basal part (Fig. 7).

REMARKS. — Until now the genus *Clinura* was known only from Oligocene to Pliocene deposits in Europe, Indonesia and New Zealand (POWELL, 1966), and *C. vitrea* is the first Recent record. Regrettably, however, the protoconch of the new species is unknown, and this makes the generic placement only provisional. It is similar to the type species from the Pliocene of Italy. Characters shared by fossil species of *Clinura* and *C. vitrea* are the fusiform-biconic shell profile with a pagodiform spire, narrow canal, crenulate peripheral keel, and strong spiral sculpture below whorl periphery. In *C. calliope* the anal sinus is rather shallow and has the apex in the upper part of subsutural ramp but the form and position of anal sinus vary rather greatly within the genus (see BEETS, 1942) and in some species are similar to those of *C. vitrea.*

ETYMOLOGY. — Latin *vitreus* (adjective), like glass, with reference to both the fragility of the shell and the semi-transparent appearance.

Genus ***VEPRECULA*** Melvill, 1917

TYPE SPECIES: *Clathurella sykesi* Melvill & Standen, 1903.

Veprecula bandensis sp. nov.

Fig. 53

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 21, 05°14'S, 133°00'E, 688-694 m, 1 lv (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell large for genus, 21 mm high, very thin and fragile, slender, with high spire. Protoconch multispiral with oblique axial ribs. Teleoconch whorls weakly angulate at shoulder, narrow, weakly concave subsutural ramp with regular fold-like scars of anal sinus. Sculpture finely reticulate, of numerous thin axial riblets and thin strong spiral cords, interspaces spirally elongate. Canal moderately long, slightly twisted and obliquely truncated. Anal sinus deep, deepest point in adapical part of ramp. Colour white.

DESCRIPTION. — Shell very thin and fragile, slender, fusiform, with high spire comprising 37% of total shell height. Protoconch I and tip of multispiral protoconch II dissolved, only last whorl remaining, convex, sculptured by strong, coarse, prosocline axial ribs; protoconch / teleoconch discontinuity sharp. Teleoconch consisting of 7.0 whorls, suture tightly impressed, whorls weakly angulate at shoulder, evenly convex below shoulder. Subsutural ramp narrow, weakly concave, without spiral sculpture, with numerous regular, raised, opisthocyrt wrinkles corresponding to scars of anal sinus. Sides finely reticulately sculptured by numerous (42 on last whorl), prosocyrt, sharply defined, narrow axial riblets overriden by almost equally strong but narrower spiral cords, interspaces spirally very elongate, intersection of cords and riblets spirally elongate; 3 spiral cords on first teleoconch whorl, additional cords added at shoulder and between cords, reaching 20 on penultimate whorl, 35 on periphery and base of last whorl, plus 13, slightly stronger, on canal. Base evenly connected to moderately long, twisted, and obliquely truncated canal. Aperture pyriform. Inner lip strongly concave on abapical part of parietal side, covered by thin, translucent, axially wrinkled callus. Outer lip damaged, anal sinus (based on incremental scars) deep, deepest point in adapical part of ramp. Colour of protoconch deep brown, of teleoconch semi-transparent white with thin, tightly adhering beige periostracum.

Dimensions: height 21.1 mm, diameter 7.7 mm, last whorl height 13.2 mm, aperture height 10.2 mm.

REMARKS. — *Veprecula bandensis* can be included in *Veprecula* on the basis of shell outline, reticulate sculpture, and characteristic sculpture of protoconch. It is most similar to the type species, *V. sykesi*, but differs in having a much larger shell with lower spire, fainter sculpture, twisted canal, and poorly prominent intersection of axial and spiral sculpture. Other known species of the genus have a much stronger sculpture, consisting of widely spaced ribs and cords.

The new species is also similar to *Daphnella thia* Melvill & Standen, 1903 (the original figure of that species is rather inadequate, but it was recently illustrated by BOSCH *et al.*, 1995: 167) in shell outline and sculpture, but differs in having more curved ribs, a well differentiated subsutural ramp, and different protoconch sculpture.

ETYMOLOGY. — *Bandensis*, an adjective based on the stem Banda (Sea), the type locality.

Genus *XANTHODAPHNE* Powell, 1942

TYPE SPECIES: *Pleurotoma (Thesbia) membranacea* Watson, 1886.

Xanthodaphne cladara sp. nov.

Figs 8, 51-52

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 21, 05°14'S, 133°00'E, 688-694 m, 2 lv (holotype and paratype).

TYPE MATERIAL. — Holotype and paratype MNHN.

DIAGNOSIS. — Shell large for genus, about 32 mm high, buccinoid, very thin, fragile, light-brown. Protoconch brown, of about 3 diagonally cancellated whorls. Teleoconch spiral sculpture of very fine cords, appearing on third whorl and becoming stronger towards last whorl. Subsutural zone of first whorls with regular, opisthocyrt folds formed by thickened growth lines, becoming obsolete on last whorls. Canal rather long, columella slightly twisted.

DESCRIPTION (holotype). — Shell buccinoid, very thin, fragile, consisting of 2.1+ protoconch and 6 teleoconch whorls. Tip of protoconch broken, probably consisting of protoconch I and less than 0.5 whorl of protoconch II. Remaining whorls forming a rather low spire, diameter 1.05 mm, sculptured over abapical two-thirds by oblique reticulation, and opisthocyrt riblets on adapical third. Protoconch/teleoconch boundary sharp. Teleoconch whorls very convex, with rather deep, impressed suture, slightly concave subsutural ramp defined only on first 4 whorls, last two whorls very regularly convex. Sculpture fine and delicate, consisting of sigmoid incremental lines, obsolete in last 2 whorls, strong in first 4 whorls, forming raised opisthocyrt wrinkles in subsutural zone, and low, indistinct, prosocyrt lines below shoulder; numerous, fine, flattened spiral cords, interspaces narrow, indistinct on first two whorls, stronger on subsequent whorls, also present in subsutural zone. Last adult whorl strongly convex, with weak incremental lines and thin, but strong spiral cords, 4 or 5 per mm on periphery, a little more crowded on base, more spaced on canal. Canal rather long, broad, straight. Aperture broad, columella slightly twisted, without inner lip callus. Based on growth lines, anal sinus broad, very shallow. Colour light-brown, protoconch brown.

Dimensions: height 31.7 mm, diameter 13.8 mm, last whorl height 22.3 mm, aperture height 17.1 mm.

REMARKS. — The paratype (30.4 x 12.4 mm at 6 teleoconch whorls) has a less inflated last whorl: diameter/height 0.41 vs. 0.435 in the holotype. Such a difference could possibly represent sexual dimorphism. Growth lines on the last whorl are more distinctly sigmoid than in the holotype, due to more prosocyrt profile on periphery. Radular teeth 280 µm, straight, with short but strongly expanded basal part (Fig. 8).

Xanthodaphne cladara is similar to *X. subrosea* (Barnard, 1963) from off Cape Point, South Africa, 2524-2780 m, but differs in having a more slender shell, with more slowly expanding whorls, a smaller protoconch (diameter 1.45 mm in *subrosea*), and fainter spiral sculpture.

ETYMOLOGY. — From the Greek *kladaros* (adj.; feminine *kladara*), easily broken, with reference to the fragility of the shell.

Genus ***LUSITANOPS*** Nordsieck, 1968

TYPE SPECIES: *Pleurotomella lusitanica* Sykes, 1906.

Lusitanops dictyota sp. nov.

Fig. 56

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 38, 07°40'S, 132°27'E, 620-666 m, 1 lv (holotype).

New Caledonia. BIOCAL: stn. CP 60, 24°01'S, 167°08'E, 1480-1530 m, 1 lv.

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell large for genus, about 17 mm high, thin, light-brown. Protoconch of 3+ diagonally cancellated brown whorls. Teleoconch sculpture of thin spiral cords covering the entire shell surface, and numerous, regularly and closely set incremental riblets, intersection finely reticulate. Aperture broad. No anal sinus. No radula, no operculum.

DESCRIPTION (holotype). — Shell buccinoid, thin, consisting of 3 + protoconch and 4.3 teleoconch whorls. Tip of protoconch (probably only protoconch I) damaged, remaining whorls convex, diameter 1.05 mm, sculptured on abapical two-thirds by opisthocyrt riblets intersected by equally strong oblique cords, on adapical third by much fainter spiral threads in axial interspaces. Protoconch/teleoconch boundary sharp. Teleoconch whorls evenly convex, suture impressed, rather deep. Spiral sculpture consisting of fine, flattened cords, occasionally in last 2 whorls with thinner additional cord in interspaces, interspaces equal to or narrower than cord width, 17 on penultimate whorl, about 75 on last whorl. Axial sculpture consisting of numerous, evenly spaced, orthocline, thickened incremental lines, interspaces narrow. On first half teleoconch whorl, spiral cords stronger than incremental ribs; on subsequent 2 whorls, cords and ribs of equal strength, cords a little rugose at intersection with ribs, producing a finely reticulate sculpture; on last 2 whorls, spiral cords stronger than incremental riblets. Base regularly convex, connected rather abruptly to rather short, straight canal. Aperture broad, columellar and parietal areas of inner lip forming an obtuse angle, callus very narrow, outer lip partly broken, but apparently regularly convex. No distinct anal sinus. Colour light-brown, protoconch brown. No operculum. No radula.

Dimensions: height 16.9 mm, diameter 9.4 mm, last whorl height 13.2 mm, aperture height 10.4 mm.

REMARKS. — *Lusitanops dictyota* is similar to *L. cingulata* Bouchet & Warén, 1980 from the upper abyssal of the North-Eastern Atlantic, but differs in having a much larger shell with fainter and closely set spiral cords. This is the first record of *Lusitanops* outside the North-Eastern Atlantic.

The specimen from New Caledonia is very similar to the holotype, except for being much smaller (8.6 x 5.2 mm at 3+ adult whorls), with slightly broader last whorl. Its protoconch consists of 2.5 remaining whorls, upper ca. 1.25 whorls missing.

ETYMOLOGY. — From the Greek *dictyotos* (adj.), reticulate, with reference to the sculpture of the teleoconch.

DISTRIBUTION. — Tanimbar Islands, Indonesia, and southward of New Caledonia, taken alive at 620-1530 m.

CONOIDEA incertae sedis

Genus ***THELECYTHARELLA*** Shuto, 1969

TYPE SPECIES: *Agladrillia oyamai* Shuto, 1965.

Among existing genera of Conoidea, the new species described below conforms rather well with *Metaclathurella* Shuto, 1983 [type species: *Austropusilla (Metaclathurella) crokerensis* Shuto, 1983], originally classified by Shuto as a subgenus of *Austropusilla* Laseron, 1954. KILBURN (1995) has synonymized *Metaclathurella* and *Lioglyphostomella* Shuto, 1970 with *Thelycytharella* [*sic*!], and stated that *Austropusilla* is not related. This synonymization seems reasonable, with *Metaclathurella* only characterized by a complete absence of axial sculpture. Within this complex, *T. vitrea* (Reeve, 1845) and *T. kecil* sp. nov., form a distinct group characterized by a very small (5.5 mm high) pupoid shell without axial sculpture, and further research may prove that they belong to a separate genus.

The taxonomic position of *Thelecytharella* is unclear. It was originally placed in the subfamily Mangeliinae, an opinion followed by KILBURN (1995), without an indication of reasons for such placement. However, conchological characters alone are insufficient to allocate it to a subfamily, and even to a family. Examination of anatomy is badly needed, but the present material is represented by a single empty shell.

Thelecytharella kecil sp. nov.

Fig. 58

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 1 dd (holotype).

TYPE MATERIAL. — Holotype MNHN.

DIAGNOSIS. — Shell small, 5.5 mm, but solid, subcylindrical, few-whorled, white. Protoconch multispiral, smooth. Teleoconch whorls very weakly but evenly convex, covered by strong spiral cords, 5 on first whorl, 22 on last whorl. Aperture narrow, canal very short. Anal sinus moderately deep, rounded, directed somewhat adapically.

DESCRIPTION (holotype). — Shell very solid, subcylindrical, consisting of 2+ protoconch and 3.1 teleoconch whorls. Tip of protoconch dissolved, plugged by secondary callus, remaining whorls smooth, polished, with strongly opisthocyrt incremental lines and strong basal keel partly covered by successive whorl; protoconch diameter 850 µm, *i.e.* half diameter of first teleoconch whorl. Protoconch/teleoconch boundary sharp. Teleoconch whorls rapidly growing but slowly expanding, weakly and evenly convex, suture shallow. Sculpture primarily spiral, consisting of strong rounded cords, 5, 7 and 22 on first to third whorls respectively, two adapical cords more widely spaced at level of sinus. Very fine spiral microsculpture in interspaces between cords. No axial sculpture other than fine, sigmoid incremental lines. Aperture ovate, narrow, siphonal canal very short, indistinctly set off. Inner lip evenly curved, covered by thick callus with free edge. Outer lip with thin edge but strengthened behind by low varix, deep stromboid notch at base of siphonal canal. Anal sinus moderately deep, semi-enclosed, directed slightly adapically. Colour white.

Dimensions: height 5.5 mm, diameter 1.6 mm, last whorl height 3.4 mm, aperture height 2.4 mm.

REMARKS. — In shell shape, the new species is very similar to *T. vitrea* from the Philippines (lectotype figured by KILBURN, 1995, fig. 12), but clearly differs in having strong spiral sculpture.

ETYMOLOGY. — From the Indonesian *kecil* (adj.), small, with reference to the small adult size. It is used here as an invariable noun in apposition.

Genus *ALICEIA* Dautzenberg & Fischer, 1897

TYPE SPECIES: *Aliceia aenigmatica* Dautzenberg & Fischer, 1897.

REMARKS. — The taxonomic position of *Aliceia* is rather enigmatic, and the species described below offers no help. The anal sinus of the type species is shallow, whereas in *A. simplicissima* (Thiele, 1925) it is deep, rather narrow, and distinctly peripheral. Such style of anal sinus suggests that the genus may belong to the family Turridae, subfamily Turrinae, or to the bathytomine group of Clathurellinae (Conidae). At the same time, the protoconch is more similar to some genera of the subfamily Raphitominae (Conidae), *e.g.*, *Pleurotomoides* Bronn, 1831 and *Famelica* Bouchet & Warén, 1980. In shell outline, sinus character, and the absence of sculpture, *A. simplicissima* resembles the turrine genus *Lucerapex* Iredale, 1936. However, *Lucerapex* has a paucispiral globular smooth protoconch and nodules or scales on the peripheral keel.

Aliceia presently includes three species: the North Atlantic *A. aenigmatica*, the Indo-West Pacific *A. simplicissima*, and the Hawaiian species figured by KAY (1979: 364, fig. 115 N) as "*Thatcheriasyrinx* sp." and suggested by BOUCHET & WARÉN (1980) to be also a member of *Aliceia*. This genus thus appears to have a world-wide distribution. Whereas *A. aenigmatica* and "*Thatcheriasyrinx* sp." are very similar to each other in shell outline, and possess a broad and shallow anal sinus, a false umbilicus, and semi-tubular processes on the periphery, *A. simplicissima* differs in having a slender shell lacking sculpture, with a rather deep and narrow anal sinus. Nevertheless, the thin small shell without spiral cords or axial ribs, the more or less peripheral position of the sinus, and the peculiar protoconch with axial pillars below peripheral keel are characters shared by all three species, and it seems reasonable to include the species of THIELE in *Aliceia*, at least until more material, with soft parts, comes to hand.

Aliceia simplicissima (Thiele, 1925)

Fig. 57

Pleurotoma (Gemmula?) simplicissima Thiele, 1925: 175 (209), pl. 23 (35), fig. 3-3a.

MATERIAL EXAMINED. — **Indonesia**. *"Valdivia"* : stn 199, 0°15,5'N, 98°04'E, 470 m: 1 dd 4.8 x 2.0 mm.
KARUBAR, *Tanimbar Islands*: stn CP 69, 08°42'S, 131°53'E, 356-369 m, 1 dd 5.75 x 2.2 mm
Zanzibar. *"Valdivia"*: stn 245, 05°27.9'S, 39°18.8'E, 463 m: 1 dd 3.8 x 1.75 mm.

TYPE MATERIAL. — The shell collected by the *"Valdivia"* at the station 245 is here designated as the lectotype. The other shell is a paralectotype. Both are deposited at the Zoologisches Museum, Berlin, no registration number.

DESCRIPTION (KARUBAR specimen). — Shell slender, thin, semi-transparent, consisting of 3+ protoconch and 4.7 teleoconch whorls, suture impressed, deep. Tip of protoconch (probably protoconch I and less than 0.5 whorl of protoconch II) broken, remaining whorls smooth above periphery, sculptured by short straight axial ribs below periphery, indistinct near protoconch/teleoconch boundary. Teleoconch whorls obtusely angulate at periphery, angulation stronger towards adult whorls, periphery occupied by anal sinus forming a band with sharply defined edges. Incremental lines thin, indistinct, strongly prosocyrt above and below periphery, strongly opisthocyrt in sinus zone. No spiral sculpture. Aperture broadly subtriangular, canal moderately long and straight. Shell colour translucent white, with one light-brown spiral band at base of exposed whorl height, encircling base of last whorl, and a second narrower band encircling base of canal.

REMARKS. — None of the shells of the Zoologisches Museum, Berlin, corresponds to measurements given by THIELE (5 x 1.8 mm), but the shell from Zanzibar (apparently figured by THIELE) is better preserved and is for this reason designated as lectotype. It has 3.5 teleoconch and 3+ protoconch whorls.

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APPENDIX

Check-list of deep-water turrid gastropods from Indonesia

To estimate the richness of the turrid fauna of Indonesian waters, and to provide a basis for further research, it seems useful to give here a check-list of deep-water turrid gastropods presently known from Indonesia. This list includes species recorded at depths greater than 200 m, in the area within the political borders of Indonesia. A total of 92 species are listed.

The taxonomic position of species has been re-evaluated, when possible, but brief descriptions and poor illustrations of some species allow to allocate them only tentatively to genera, awaiting the examination of respective type material.

Species	Locality and depth	References
TURRIDAE/TURRINAE		
Gemmula hombroni Hedley, 1922	Throughout Indonesia, 34-522 m	SCHEPMAN, 1913
Gemmula kieneri (Doumet, 1840)	Throughout Indonesia, 69-462 m	SCHEPMAN, 1913
Gemmula congener (Smith, 1894)	Bali Sea, SW Halmahera I., 330-397 m	SCHEPMAN, 1913
Gemmula praesignis (Smith, 1895)	Flores and Halmahera Seas, 411-794 m	SCHEPMAN, 1913
Gemmula sibogae (Schepman, 1913)	W Sumatra, Halmahera I., 362-660 m	SCHEPMAN, 1913
Gemmula gemmulina (Martens, 1902)	NE & W Sumatra, Sulawesi, Maluku Is, Kalimantan, 68-750 m	THIELE, 1925; POWELL, 1964

Species	Locality and depth	References
Gemmula sibukoensis Powell, 1964	Kalimantan, Sulawesi, Maluku Is, 476-885 m	POWELL, 1964
Gemmula closterion Sysoev, 1997	Arafura Sea, 146-250 m	Present paper
Gemmula (Ptychosyrinx) truncata (Schepman, 1913)	Banda Sea, 2798 m	SCHEPMAN, 1913
Gemmula (Ptychosyrinx) teschi Powell, 1964	Kalimantan, Sulawesi, Maluku Is, 635-1022 m	POWELL, 1964
Gemmula (Pinguigemmula) thielei (Finlay, 1930)	W Sumatra, 614 m	THIELE, 1925
Gemmula (Unedogemmula) unedo (Kiener, 1839-40)	Maluku Is, 503 m	POWELL, 1964
Lucerapex molengraaffi (Tesch, 1915)	Kalimantan, Sulawesi, 558-1022 m	POWELL, 1964
Lucerapex schepmani Shuto, 1970	Ceram Sea, 835 m	SHUTO, 1970b
COCHLESPIRINAE		
Comitas pagodaeformis (Schepman, 1913)	Halmahera Sea, E Banda Sea, 397-411 m	SCHEPMAN, 1913
Comitas melvilli (Schepman, 1913)	E Banda Sea, 560-918 m	SCHEPMAN, 1913
Comitas obtusigemmata (Schepman, 1913)	Makassar Strait, Halmahera and Arafura Seas, 472-2029 m	SCHEPMAN, 1913
Comitas undosa (Schepman, 1913)	Flores Sea, Molucca Passage, 794-796 m	SCHEPMAN, 1913; POWELL, 1969
Comitas erica (Thiele, 1925)	NE Sumatra, 750 m	THIELE, 1925
Comitas obliquicosta (Martens, 1901)	W Sumatra, 1143 m	THIELE, 1925
Comitas chuni (Martens, 1902)	W Sumatra, 1143 m	THIELE, 1925
Comitas suratensis (Thiele, 1925)	NW Sumatra, 1024 m	THIELE, 1925
Comitas paupera (Watson, 1881)	Arafura Sea, 1463 m	POWELL, 1969
Comitas galatheae Powell, 1969	Arafura Sea, 352 m	POWELL, 1969
Comitas eurina (Smith, 1899)	Kalimantan, 1626 m	POWELL, 1969
Comitas thisbe diomedea Powell, 1969	Sulawesi, 987-1022 m	POWELL, 1969
Comitas rex Sysoev, 1997	Arafura Sea, 246-275 m	Present paper
Nihonia maxima Sysoev, 1997	Arafura Sea, 246-275 m	Present paper
Cochlespira pulchella (Schepman, 1913)	Halmahera Sea, 411-472 m	SCHEPMAN, 1913
Leucosyrinx (Sibogasyrinx) pyramidalis (Schepman, 1913)	Timor Sea, 918 m	SCHEPMAN, 1913
Shutonia variabilis (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Clavosurcula sibogae Schepman, 1913	Flores Sea, 794 m	SCHEPMAN, 1913
Clavosurcula schepmani Sysoev, 1997	Banda and Arafura Seas, 356-694 m	Present paper
Apiotoma tibiaformis sibukoensis Powell, 1969	Kalimantan, 635 m	POWELL, 1969
Marshallena philippinarum (Watson, 1882)	NE Sumatra, Flores Sea, 750-794 m	SCHEPMAN, 1913, POWELL, 1969
Marshallena nierstraszi (Schepman, 1913)	Arafura Sea, 1788 m	SCHEPMAN, 1913
Marshallena diomedea Powell, 1969	Kalimantan, 558-567 m	POWELL, 1969
CLAVATULINAE		
Makiyamaia sibogae Shuto, 1970	Ceram Sea, 835 m	SHUTO, 1970b
CRASSISPIRINAE		
Inquisitor subangusta (Schepman, 1913)	Halmahera Sea, 411 m	SCHEPMAN, 1913; SHUTO, 1970a
Inquisitor? radula (Hinds, 1843)	Java, S Celebes Sea, W New Guinea, E Banda Sea, 14-275 m	SCHEPMAN, 1913

Species	Locality and depth	References
"Drillia" audax Melvill & Standen, 1903	Savu Sea, 247 m	SCHEPMAN, 1913
Paradrillia celebensis (Schepman, 1913)	Makassar Strait, 1301 m	SCHEPMAN, 1913; SHUTO, 1970a
"Crassispira" aequatorialis Thiele, 1925	NE Sumatra, 750 m	THIELE, 1925
CONIDAE/CLATHURELLINAE		
Bathytoma atractoides (Watson, 1881)	W Sumatra, Timor Sea, 918-1143 m	SCHEPMAN, 1913; THIELE, 1925
Borsonia smithi Schepman, 1913	Savu Sea, 959 m	SCHEPMAN, 1913
Borsonia symbiotes (Wood-Mason & Alcock, 1891)	W Sumatra, Flores Sea, 794-1143 m	SCHEPMAN, 1913; THIELE, 1925
Borsonia timorensis (Schepman, 1913)	Timor Sea, 918 m	SCHEPMAN, 1913
Borsonia epigona Martens, 1901	W Sumatra, 614-677 m	THIELE, 1925
Borsonia jaya Sysoev, 1997	Arafura Sea, 676-1084 m	Present paper
Maoritomella batjanensis (Schepman, 1913)	Halmahera I., 397 m	SCHEPMAN, 1913; SHUTO, 1970a
Typhlosyrinx supracostata (Schepman, 1913)	Flores Sea, Kalimantan, Molucca Passage, 759-921 m	SCHEPMAN, 1913; SHUTO, 1970b; POWELL, 1969
Glyphostoma cara (Thiele, 1925)	NE Sumatra, 750 m	THIELE, 1925
Heteroturris gemmuloides Sysoev, 1997	Arafura Sea, 356-405 m	Present paper
Heteroturris serta Sysoev, 1997	Banda Sea, 448-467 m	Present paper
MANGELIINAE		
Benthomangelia trophonoidea (Schepman, 1913)	NE Sumatra, Flores and Ceram Seas, 660-903 m	SCHEPMAN, 1913; THIELE, 1925
Benthomangelia gracilispira (Powell, 1969)	Kalimantan, 558 m	POWELL, 1969
Anticlinura biconica (Schepman, 1913)	Banda Sea, 462 m	SCHEPMAN, 1913; SHUTO, 1970a
"Mangelia terpnisma" abyssicola Schepman, 1913	Makassar Strait, 1301 m	SCHEPMAN, 1913
Guraleus? verhoeffeni (Martens, 1904)	W Sumatra, 470 m	THIELE, 1925
Guraleus halmahericus (Schepman, 1913)	Halmahera I., 472 m	SCHEPMAN, 1913; SHUTO, 1970b
Guraleus (Euguraleus) savuensis (Schepman, 1913)	Savu Sea, 247 m	SCHEPMAN, 1913; SHUTO, 1970b
Stellatoma rufostrigata (Schepman, 1913)	Halmahera Sea, 411 m	SCHEPMAN, 1913; SHUTO, 1970b
Heterocithara sibogae Shuto, 1970	Halmahera I., 472 m	SHUTO, 1970b
RAPHITOMINAE		
Neopleurotomoides rufoapicatus (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913; SHUTO, 1971
Isodaphne perfragilis (Schepman, 1913)	Makassar Strait, Ceram Sea, 835-2029 m	SCHEPMAN, 1913; SHUTO, 1971
Pagodidaphne gradata (Schepman, 1913)	Halmahera Sea, 411 m	SCHEPMAN, 1913
Pagodidaphne schepmani (Thiele, 1925)	NE Sumatra, 750 m	THIELE, 1925
Cryptodaphne affinis (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Cryptodaphne abbreviata (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Cryptodaphne (Acamptodaphne) biconica (Schepman, 1913)	E Halmahera Sea, 469 m	SCHEPMAN, 1913; SHUTO, 1971

Species	Locality and depth	References
Cryptodaphne rugosa Sysoev, 1997	Banda and Arafura Seas, 230-425 m	Present paper
Gymnobela pulchra (Schepman, 1913)	Banda Sea, 462 m	SCHEPMAN, 1913
Gymnobela ceramensis (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Gymnobela dubia (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Gymnobela ioessa Sysoev, 1997	Arafura Sea, 836-869 m	Present paper
Gymnobela muricata Sysoev, 1997	Arafura Sea, 836-891 m	Present paper
Gymnobela mitrodeta Sysoev, 1997	Banda Sea, 413-436 m	Present paper
Gymnobela micraulax Sysoev, 1997	Arafura Sea, 884-891 m	Present paper
Gymnobela baruna Sysoev, 1997	Banda Sea, 688-694 m	Present paper
Mioawateria extensaeformis (Schepman, 1913)	W Sumatra, Banda Sea, 462-750 m	SCHEPMAN, 1913; THIELE, 1925
Mioawateria asarotum Sysoev, 1997	Arafura Sea, 884-891 m	Present paper
Clinura vitrea Sysoev, 1997	Banda Sea, 417-425 m	Present paper
Veprecula bandensis Sysoev, 1997	Banda Sea, 688-694 m	Present paper
Pleurotomella clathurellaeformis (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Pleurotomella siberutensis (Thiele, 1925)	NE Sumatra, 750 m	THIELE, 1925
Eubela equatorialis Thiele, 1925	NE Sumatra, 750 m	THIELE, 1925
Xanthodaphne pyriformis (Schepman, 1913)	Ceram Sea, 835 m	SCHEPMAN, 1913
Xanthodaphne cladara Sysoev, 1997	Banda Sea, 688-694 m	Present paper
Lusitanops dictyota Sysoev, 1997	Arafura Sea, 620-666 m	Present paper
Spergo sibogae Schepman, 1913	E Banda Sea, 560 m	SCHEPMAN, 1913
INCERTAE SEDIS		
Aliceia simplicissima Thiele, 1925	W Sumatra, Arafura Sea, 356-470 m	THIELE, 1925; Present paper
Thelecytharella kecil Sysoev, 1997	Banda Sea, 448-467 m	Present paper

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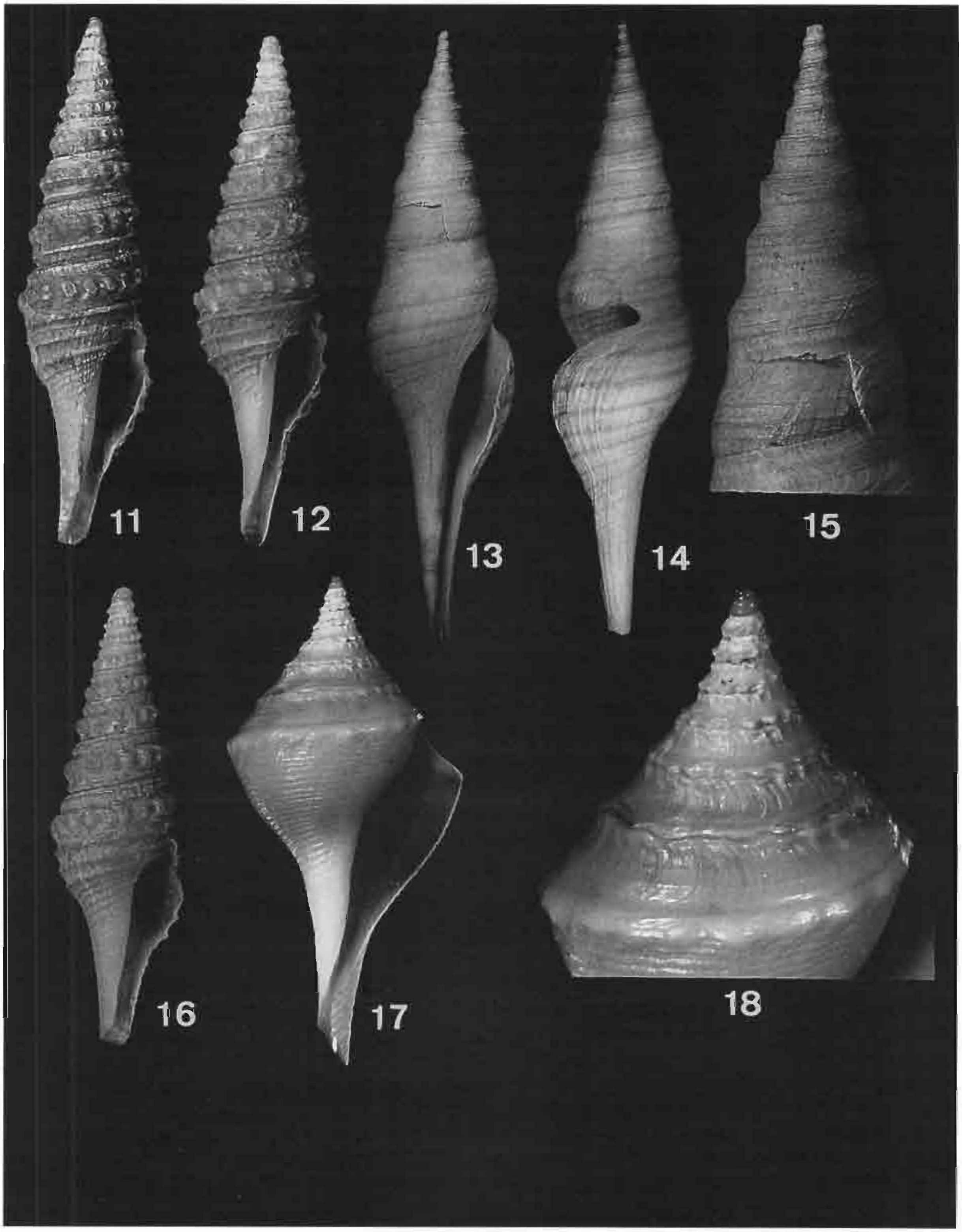
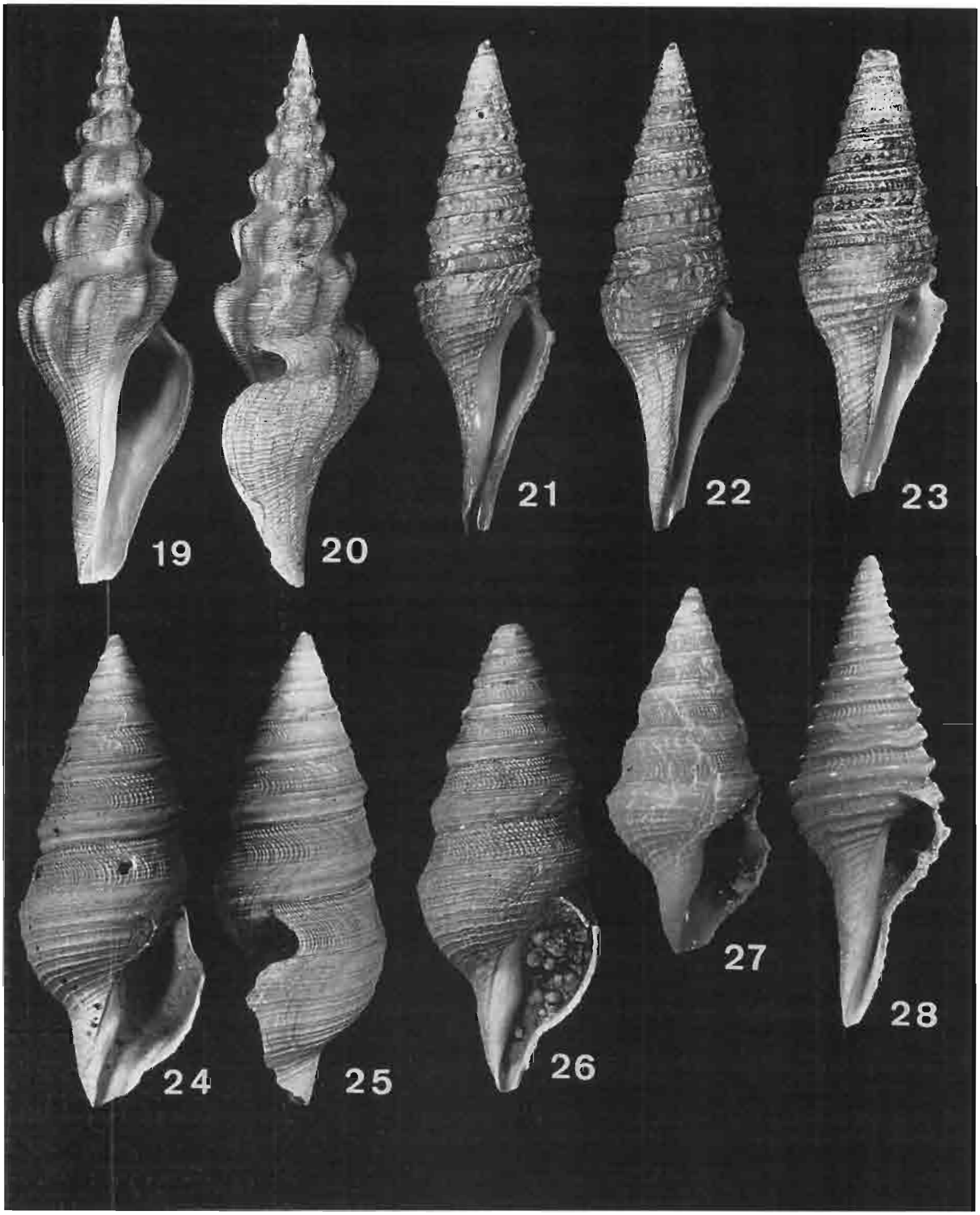
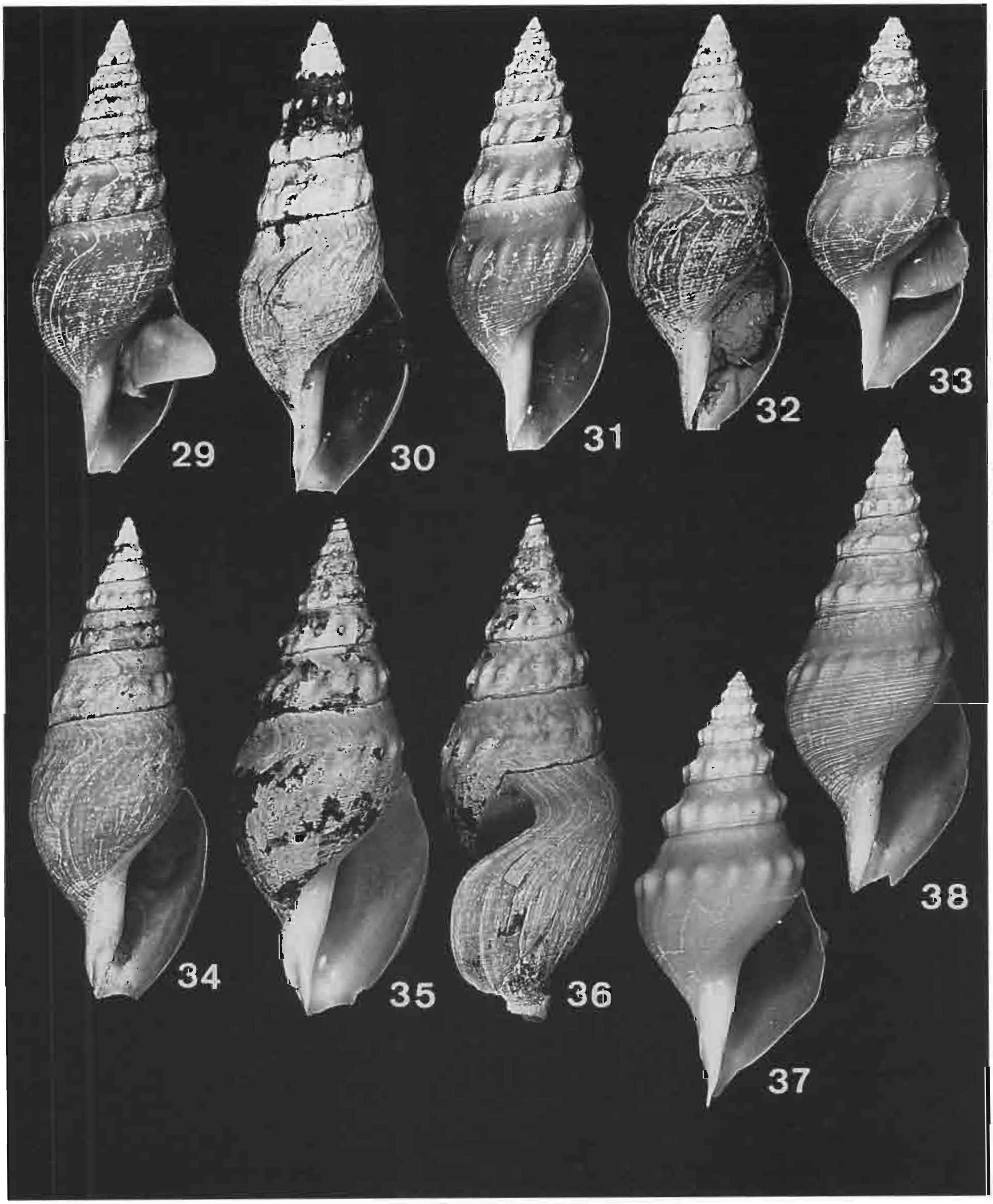


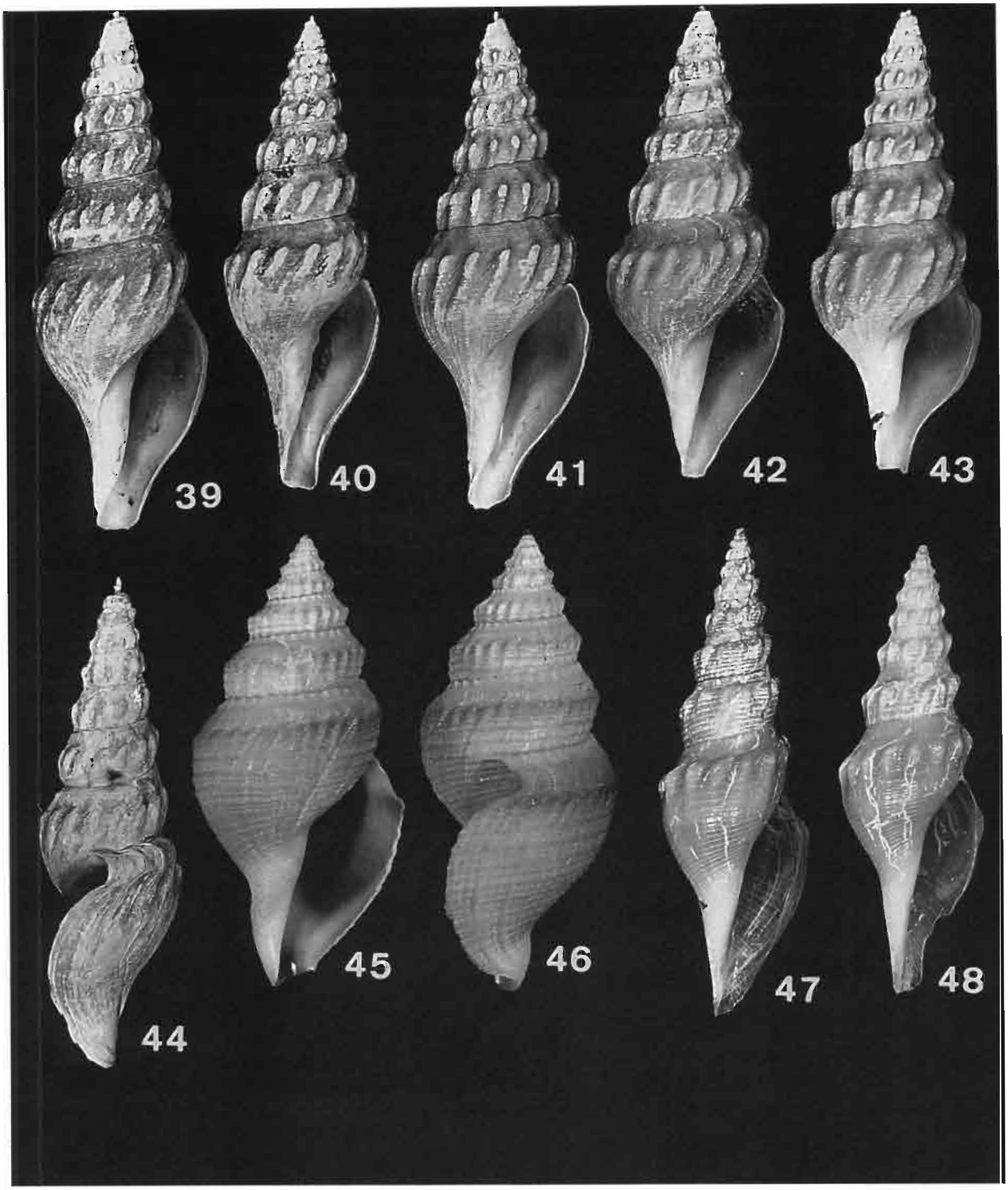
FIGS 11-18. — Genera *Gemmula*, *Nihonia*, and *Clavosurcula*. **11-12, 16**, *Gemmula closterion*: **11**, paratype, KARUBAR stn CP 79, 22.1 x 5.8 mm; **12**, holotype; **16**, paratype, KARUBAR stn CP 67, 14.9 x 4.3 mm. — **13-15**, *Nihonia maxima*, holotype. — **17-18**, *Clavosurcula schepmani*, holotype.



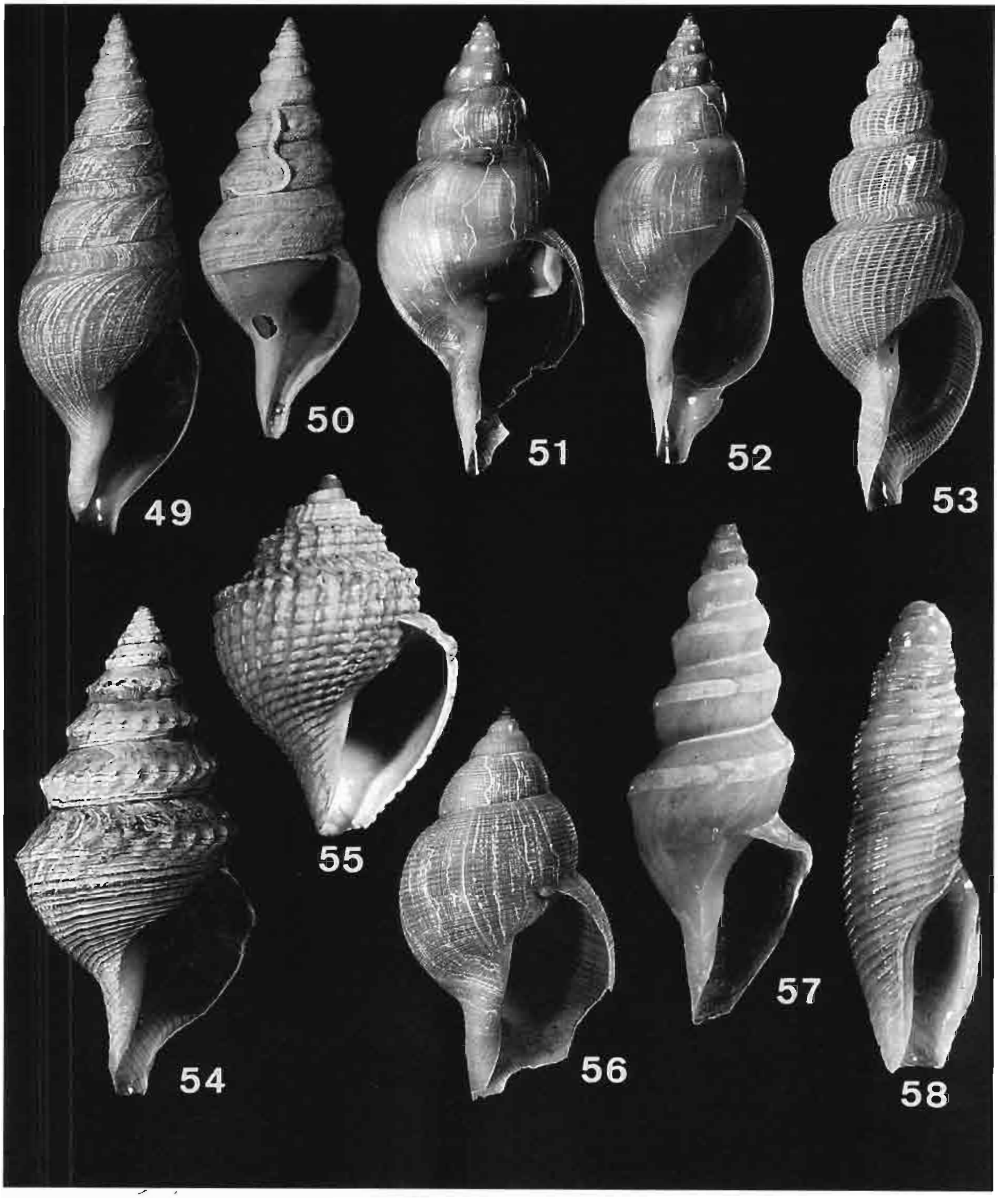
FIGS 19-28. — Genera *Comitas*, *Heteroturris*, and *Cryptodaphne*. **19-20**, *Comitas rex*, holotype. — **21-23**, *Heteroturris gemmuloides*: **21**, paratype, KARUBAR stn CP 59, 38.5 x 11.1 mm; **22**, holotype; **23**, paratype, MUSORSTOM 2 stn CP 75, 27.8 x 9.1 mm. — **24-27**, *Cryptodaphne rugosa*: **24-25**, holotype; **26**, paratype, KARUBAR stn DW 24, 12.8 x 5.1 mm; **27**, paratype, KARUBAR stn DW 44, 7.7 x 3.4 mm. — **28**, *Heteroturris serta*, holotype.



FIGS 29-38. — Genus *Gymnobela*. **29-33**, *G. ioessa*: **29**, holotype; **30-33**, paratypes, KARUBAR stn CP 54, 46.6 x 16.4, 37.2 x 13.9, 35.9 x 14.2, and 30.3 x 12.9 mm, respectively. — **34-38**, *G. muricata*: **34**, holotype; **35-36**, paratype, KARUBAR stn CP 73, 52.1 x 20.6 mm; **37-38**, paratypes, KARUBAR stn CP 54, 29.4 x 12.8 and 43.3 x 17.5 mm, respectively.



FIGS 39-48. — Genera *Borsonia* and *Gymnobela*. **39-44**, *Borsonia jaya*: **39**, holotype; **40**, paratype, KARUBAR stn CP 91, 61.5 x 20.4 mm; **41**, paratype, KARUBAR stn CP 87, 58.0 x 20.8 mm; **42**, paratype, KARUBAR stn CP 72, 51.9 x 19.6 mm; **43**, paratype, KARUBAR stn CP 87, 43.8 x 16.0 mm; **44**, paratype, KARUBAR stn CP 89, 70.5 x 22.2 mm. — **45-46**, *Gymnobela mitrodeta*, holotype. — **47-48**, *Gymnobela micraulax*, holotype.



FIGS 49-58. — Genera *Gymnobela, Xanthodaphne, Veprecula, Clinura, Mioawateria, Lusitanops, Aliceia*, and *Thelecytharella*. **49-50**, *Gymnobela baruna*, holotype and paratype, respectively. — **51-52**, *Xanthodaphne cladara*, holotype and paratype, respectively. — **53**, *Veprecula bandensis*, holotype. — **54**, *Clinura vitrea*, holotype. — **55**, *Mioawateria asarotum*, holotype. — **56**, *Lusitanops dictyota*, holotype. — **57**, *Aliceia simplicissima* KARUBAR stn CP 69, 5.75 x 2.2 mm. — **58**, *Thelecytharella kecil*, holotype.

7

Mollusca Cephalopoda: Mid-depth octopuses (200-1000 m) of the Banda and Arafura Seas (Octopodidae and Alloposidae)

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ABSTRACT

Six mid-depth octopuses of the Order Octopoda are reported from the Banda and Arafura Seas off Indonesia and northern Australia, based on material collected through the collaborative French-Indonesian KARUBAR cruise of 1991. Octopod material was collected through benthic trawls at 18 of 91 stations, at depths between 199 and 869 metres. Two new species are described here, ***Benthoctopus karubar*** sp. nov. and ***Octopus pyrum*** sp. nov. An additional species of the genus *Octopus* is reported as indeterminate but distinct from *O. pyrum*. The genus *Pteroctopus* is reported from Indo-Pacific waters for the first time, based on female material collected through the KARUBAR cruise and linked with additional male material collected off New Caledonia and Vanuatu. *Eledone palari* is recorded as a northerly extension to the Australian distribution reported in the original description for this species. A single submature female of the pelagic octopod, *Haliphron atlanticus* (previously treated under the name *Alloposus mollis*), is also reported from the region. The depth distributions and phylogenetic affinities of this fauna are discussed.

RÉSUMÉ

Mollusca Cephalopoda : Pieuvres bathyales (200-1000 m) des mers de Banda et d'Arafura (Octopodidae et Alloposidae).

La campagne franco-indonésienne KARUBAR dans les mers de Banda et d'Arafura, au large de l'Indonésie et du nord de l'Australie, a permis la capture de six espèces de pieuvres de l'ordre des Octopoda dans 18 des 91 stations prospectées entre

NORMAN, M.D., HOCHBERG, F.G. & LU, C.C., 1997. — Mollusca Cephalopoda: Mid-depth octopuses (200-1000 m) of the Banda and Arafura Seas (Octopodidae and Alloposidae). *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172** : 357-383. Paris ISBN: 2-85653-506-2.

199 et 869 mètres de profondeur. Deux espèces nouvelles sont décrites : *Benthoctopus karubar* sp. nov. et *Octopus pyrum* sp. nov. Une autre espèce d'*Octopus*, distincte d'*O. pyrum*, est présente, mais reste indéterminée. Le genre *Pteroctopus* est signalé pour la première fois du domaine indo-pacifique sur la base d'une femelle récoltée pendant la campagne KARUBAR, et ce matériel est conspécifique avec des individus mâles récoltés en Nouvelle-Calédonie et au Vanuatu. La présence d'*Eledone palari* en mer d'Arafura étend un peu au nord l'aire de distribution connue de cette espèce, récemment décrite d'Australie. Enfin, l'octopode pélagique *Haliphron atlanticus* (plus connu sous le nom *Alloposus mollis*) est également représenté par un seul individu, une femelle pré-mature. La répartition bathymétrique et les affinités phylogénétiques de cette faune sont discutées par rapport à celles d'Australie et du reste de l'Indo-Pacifique.

INTRODUCTION

The octopod fauna of the tropical Indo-West Pacific region is still poorly known, despite many species having high profiles in commercial and subsistence fisheries. Recent research into shallow-water octopuses of this region, particularly the Indo-Malayan region, has encountered a diverse, largely undescribed fauna (NORMAN, 1992a, 1992b, 1993a, 1993b, 1993c, 1993d; NORMAN & HOCHBERG, 1994; NORMAN & SWEENEY, 1997; NORMAN, in press).

Octopuses from beyond the continental shelves (> 200 m) in the Indo-West Pacific have received even less attention than shallow taxa. This is a product of the few deep-water surveys undertaken in this region and/or the limited retention of cephalopod material on such cruises. The expeditions of the "*Dana*" (THORE, 1949) and "*Siboga*" (ADAM, 1954) are two of the few exceptions. ROBSON (1925, 1932), VOSS (1967, 1988a, 1988b) and NESIS (1987) provided reviews of deeper sea octopods of the world, collating available information on animals found at such depths. These authors recognised that the majority of described species are based on limited (often poorly preserved) material, from few stations. Few works have provided detailed morphological comparison of species occurring in deeper waters [exceptions being VOSS & PEARCY (1990) and LU & STRANKS (1994)].

In 1991, French-Indonesian collaboration resulted in the KARUBAR research cruise to the Banda and Arafura Seas. A series of 91 benthic trawl stations were carried out employing the Indonesian research vessel, "*Baruna Jaya 1*", at depths between 100 and 1250 metres. Material collected through this cruise is lodged in the collections of the Muséum National d'Histoire Naturelle, Paris (MNHN) and the Puslitbang Oseanologi - LIPI, Jakarta (POLIPI).

In a visit to the Paris museum by the first two authors in November 1995, octopod material collected through the KARUBAR cruise was examined. Benthic (incirrate) octopuses originated from 18 stations at depths ranging between 199 and 869 metres. Finned octopods (Cirroctopoda) were also encountered at a number of stations and this material will be treated elsewhere.

MATERIAL AND METHODOLOGY

Trawls were carried out on board the "*Baruna Jaya 1*" from October 22 to November 5, 1991. Four gear types were employed of which 3 captured octopods: Waren dredge, (Drague Waren, station code: DW), Beam trawl (chalut à perche, station code: CP) and shrimp trawl (chalut à panneaux [crevettes], station code: CC). All molluscs collected in these trawls (including cephalopods) were separated on board by P. BOUCHET, W. KASTORO and B. MÉTIVIER.

Octopod material was collected from 18 KARUBAR stations. Locality details for these stations are provided in Table 1 (p. 379). Type material for the 2 new species described here are lodged in the cephalopod collections of the Muséum National d'Histoire Naturelle (MNHN), Paris, the Puslitbang Oseanologi - LIPI (POLIPI), Jakarta and the Museum of Victoria (MV), Melbourne.

Morphological characters and measurements used in the descriptions below are illustrated in Figure 1. Gill counts refer to the number of lamellae on each side of each gill (= per *demibranch*, an inner and outer demibranch on each gill). Count per demibranch excludes central terminal (anterior) lamella, e.g., animals illustrated in Figures 1e-f have a gill count of 10.

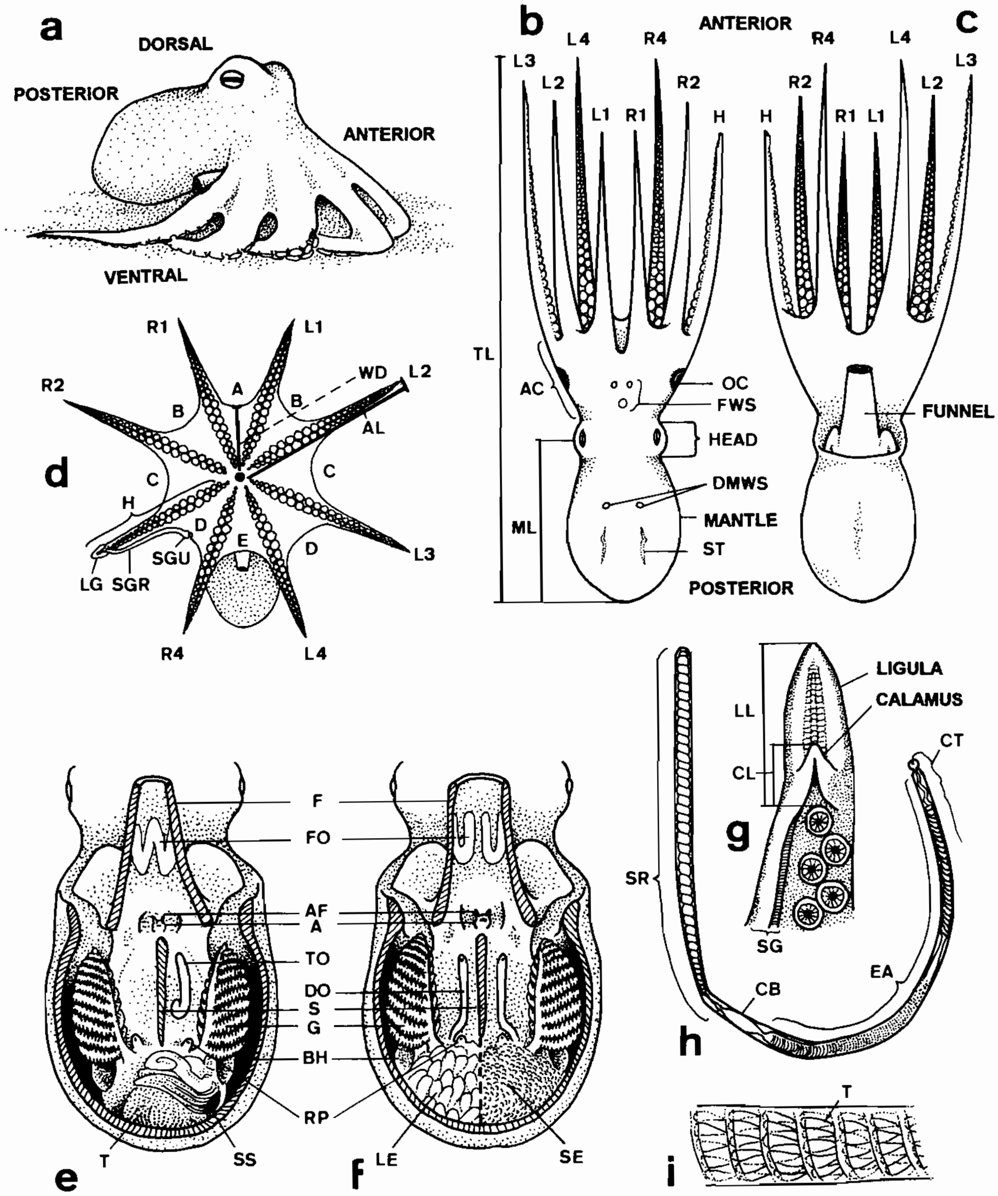

FIG. 1. — Orientation, terminology and measurements. L = left; R = right. — **a**, orientation relative to live animal. — **b**, whole animal, dorsal view. Arms numbered from dorsal to ventral as 1 to 4: AC = arm crown; DMWS = dorsal mantle white spots (*sensu* PACKARD & SANDERS, 1971); FWS = frontal white spots (*sensu* PACKARD & SANDERS, 1971); H = typical right-hand position of hectocotylised arm in males (left hand in certain genera); ML = mantle length; OC = position of ocellus in ocellate octopuses; ST = position of stylets; TL = total length. — **c**, whole animal, ventral view. — **d**, oral view of arms and webs in males: AL = arm length; H = hectocotylised arm; LG = ligula; SGR = spermatophore groove; SGU = spermatophore guide; WD = web depth. Webs designated from dorsal to ventral sectors by letters A to E. — **e-f**, mantle cavity contents: A = anus; AF = anal flaps; BH = branchial hearts; F = funnel; FO = funnel organ (W shape shown on male, UU shape shown on female); G = gills; S = septum; RP = renal papillae. — **e**, mantle cavity contents of mature male: SS = spermatophore storage sac; T = testis; TO = terminal organ ("penis"). — **f**, mantle cavity contents of mature female: DO = distal oviducts; LE = mature ovary as in "large-egg" species; SE = mature ovary as in "small-egg" species. — **g**, components of hectocotylised arm tip of mature male: CL = calamus length; LL = ligula length; SG = spermatophore groove. — **h**, components of spermatophores: CB = cement body; CT = cap thread; EA = ejaculatory apparatus; SR = sperm reservoir. — **i**, midsection of ejaculatory apparatus in intact "armed" spermatophore of *O. aegina* showing inward pointing teeth (T).

State of maturity is divided into 3 stages: Immature (or juvenile), Submature and Mature. In immature material reproductive organs are not visible or tiny. Submature specimens have developed reproductive ducts (visible as distinct terminal organ or oviducts), but lack spermatophores or a swollen ovary. Mature females possess a large ovary, which occupies one-third or more of the mantle cavity and contains distinct individual eggs (shown for large- or small-egg species in Fig. 1f).

Diagnoses and descriptions presented here are based on submature and mature specimens. Data for juvenile material is not included as counts and relative measurements (such as sucker counts and arm lengths versus mantle length) undergo considerable ontogenetic change in the early growth stages and can cause overlap in otherwise valid diagnostic characters. Weights are presented for specimens preserved in 80% ethanol.

RESULTS

A total of 37 specimens of 6 species of octopods were collected from between 200 and 900 metres. Of these species, sufficient material for 5 species was available to enable description and treatment here, including 2 new species.

A single submature male (21.8 mm ML) of an additional species of the genus *Octopus* was encountered in material from KARUBAR station CP 84, off the Tanimbar Islands between 246 and 275 metres. It is distinct from the new species, *Octopus pyrum*, in possessing significantly shorter arms (~2 times mantle length) and a distinctive large pink leucophore on the posterior tip of the mantle. It lacks the diagnostic band of founder chromatophores found on the ventral mantle of *O. pyrum*. The submature state and poor condition of this specimen, however, prevents identification.

Additional material of 2 species collected from the same or adjacent regions were encountered in the collections of two Australian museums: the Northern Territory Museum in Darwin (NTM) and the Museum of Victoria, Melbourne (MV).

Species collected in the KARUBAR cruises and housed in the Muséum National d'Histoire Naturelle, Paris and the Pulitsbang Oseanologi, Jakarta, are presented below, with depth ranges:

Family Octopodidae	
Benthoctopus karubar sp. nov.	410-869 m
Octopus pyrum sp. nov.	329-511 m
Octopus sp. indeterminate	246-275 m
Pteroctopus sp.	205-620 m
Eledone palari Lu & Stranks, 1992	200-300 m
Family Alloposidae	
Haliphron atlanticus Steenstrup, 1859	284-295 m

SYSTEMATIC ACCOUNT

Family OCTOPODIDAE

Genus *BENTHOCTOPUS* Grimpe, 1921

Benthoctopus karubar sp. nov.

Figs 2-4, 11a

? *Benthoctopus* sp. C - ADAM, 1954: 186, fig. 37, pl. III, fig. 3.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 19, 576-605 m: 1 juv., 18.6 mm ML (MNHN 2063). — Stn CP 20, 769-809 m: 2 juv., 16.0, 17.1 mm (MNHN 2021).

Tanimbar Islands: stn CP 54, 836-869 m: 1 ♀, 70.9 mm ML (paratype MNHN 2038). — Stn CC 57, 603-620 m: 1 ♀, 96.8 mm ML (paratype MNHN 2049). — Stn CP 70, 410-413 m: 1 ♂, 59.6 mm ML (holotype MNHN 2026); 1 ♂, 51.0 mm ML (paratype POLIPI). — Stn CP 71, 477-480 m: 1 ♂, 46.0 mm ML (paratype MNHN 2027).

TYPE MATERIAL. — Holotype MNHN. Paratypes: 3 MNHN, 1 POLIPI. See above listing.

TYPE LOCALITY. — Off Tanimbar Islands, Arafura Sea, 08°41'S, 131°47'E, 410-413 m.

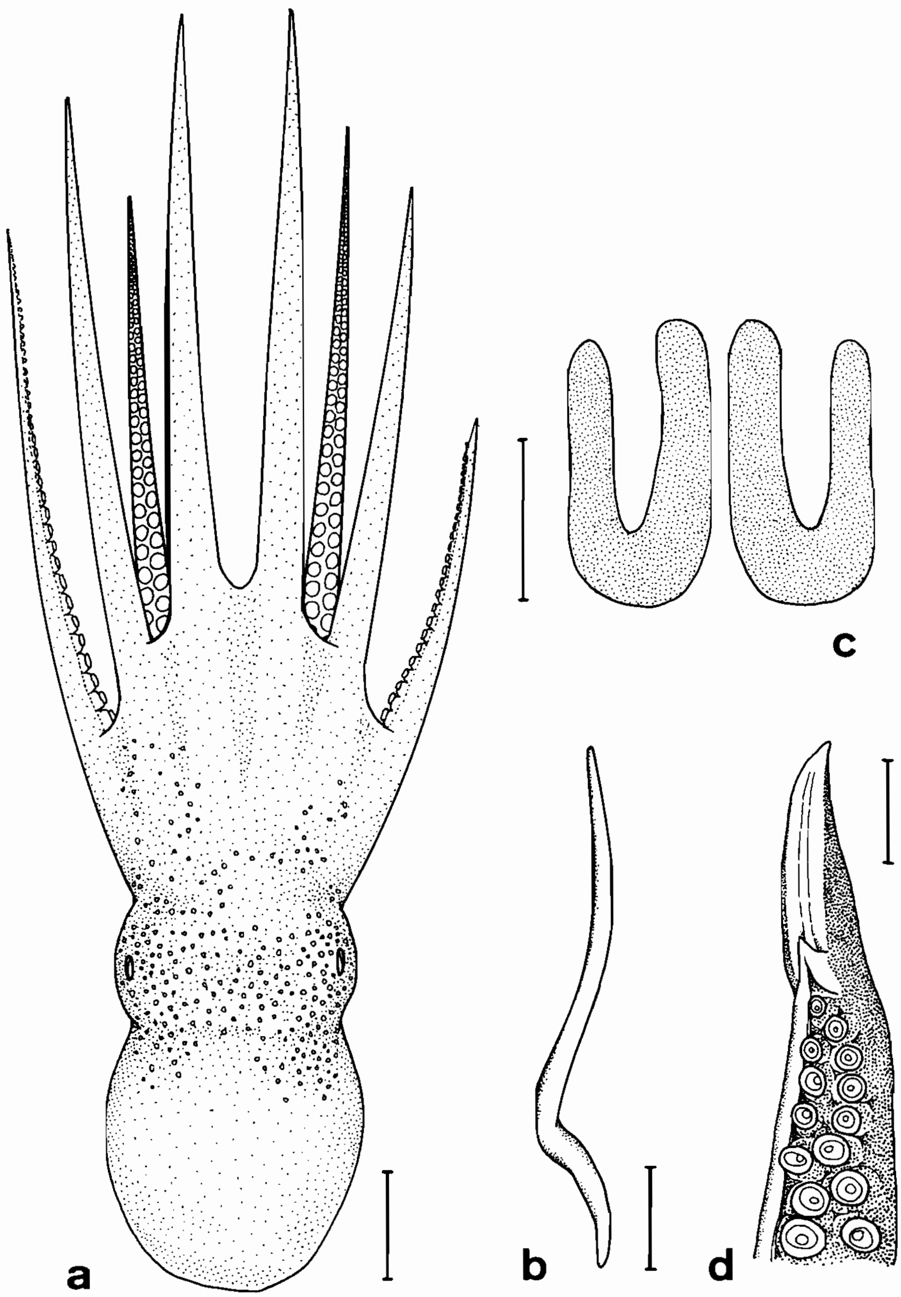

FIG. 2. — *Benthoctopus karubar* sp. nov. — **a**, dorsal whole animal, 59.6 mm ML male holotype (MNHN 2026). Scale bar = 20 mm. — **b**, stylet, 70.9 mm ML female (MNHN 2038). Scale bar = 5 mm. — **c**, funnel organ, 51.0 mm ML male, paratype (POLIPI). Scale bar = 5 mm. — **d**, ligula, holotype. Scale bar = 5 mm.

DIAGNOSIS. — Large species, ML to at least 100 mm. Arms short to moderate, around 2-3 times ML. Dorsal arms slightly longer than other arms. Webs deep, >33% of longest arm, approximately equal in length, ventral web slightly shallower. Suckers moderate sized, 7-10% of ML, forming two rows. Sucker counts to around 100 in males, 150 in females on normal arms, 47-55 on hectocotylised arm of males. Enlarged suckers absent in both sexes. Funnel organ UU-shaped. Gill count 8-9 lamellae per demibranch. Ink sac and anal flaps absent. Hectocotylus on right third arm. Ligula large (>10% of arm length in mature males), pointed with an open

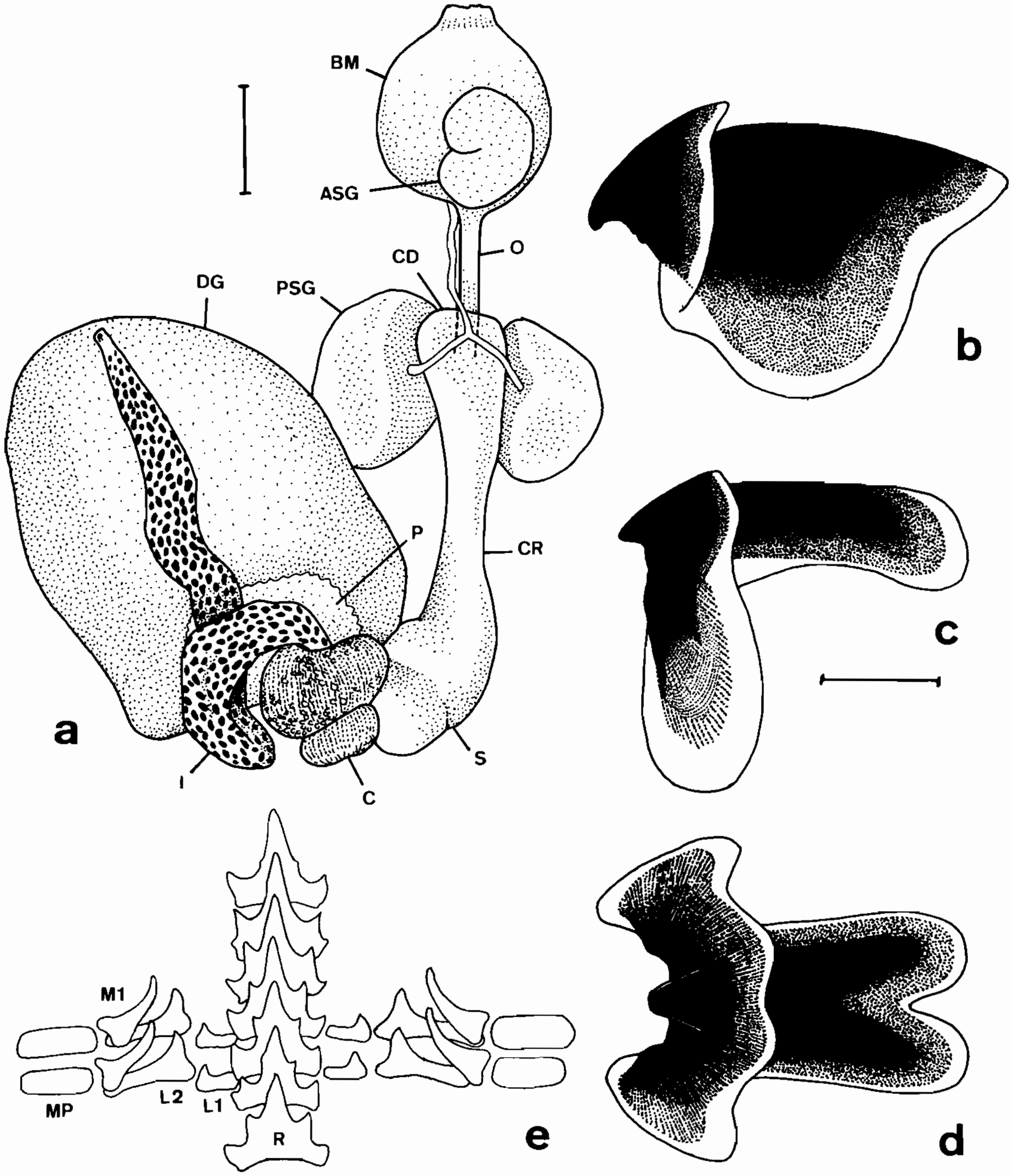

FIG. 3. — *Benthoctopus karubar* sp. nov. — **a-e**, digestive components of 70.9 mm ML female (MNHN 2038): **a**, digestive tract: ASG = anterior salivary gland; BM = buccal mass; C = caecum; CD = crop diverticulum; CR = crop; DG = digestive gland; I = intestine; O = oesophagous; P = pancreatic tissue; PSG = posterior salivary gland; S = stomach. Scale bar = 10 mm. — **b**, lateral view of upper beak. Scale bar for all beaks = 5 mm. — **c**. lateral view of lower beak. — **d**, ventral view of lower beak. — **e**, radula: R = rhachidian tooth; L1 = first lateral tooth; L2 = second lateral tooth; M1 = first marginal tooth; MP = marginal plate.

shallow groove. Calamus small and pointed (around 25% of ligula length). Spermatophores of moderate length (40.5mm, 70% of ML), produced in moderate numbers (26 in storage sac of holotype). Eggs large. Colour pattern: Pink to purple on all surfaces. Oral web dark purple. Skin sculpture: scattered with small low round papillae over dorsal head and some of mantle.

DESCRIPTION. — Counts and measurements are presented in Table 2 (p. 380). Data presented below is presented as ranges and means (latter in italics) for four KARUBAR specimens (1 mature and 1 submature male, 2 submature females).

Large species (Figs 2a, 11a); mantle length to at least 100 mm, total length to at least 400 mm; weight to at least 750 g. Mantle round to ovoid, longer than wide (width 48.0-*74.4*-97.7% of ML). Head wide (52.1-*66.2*-74.5% of ML, 72.1-*91.9*-108.6% of mantle width). Skin soft, semi-gelatinous in majority of specimens examined. Eyes large, slightly pronounced. Stylets present as thin and clear non-mineralized rods (Fig. 2b), length around 40% of ML. Mantle opening moderately wide, approximately 50% of circumference of body at level of opening. Funnel of moderate length, approximately 35% (30.8-*34.7*-40.6%) of mantle length, free portion approximately one-third (24.3-*32.5*-38.5%) of funnel length. Funnel organ UU-shaped (Fig. 2c), outer limbs approximately equal in length to median ones (outer limbs 96.8-*98.7*-102.2% of median limbs). Funnel organ occupies approximately 55% (54.1-*56.7*-59.2%) of funnel length.

Arms moderate length, around 2-3 times (2.2-*2.7*-3.1) mantle length. Arms robust, sub-cylindrical along length, tapering in distal third. Arm autotomy at base of arms absent. Arms approximately equal in length, dorsal lateral arms slightly longer. Suckers forming 2 rows and small to moderate sized, 7-10% of mantle length, slightly larger in female specimens (M: 7.6, 7.2; F: 9.9, 10.7% of ML). Enlarged suckers absent in both sexes. Up to 100 suckers on intact normal arms of males, up to 150 in females (maximums in males: 96, 102; females: 124, 146). Webs deep (deepest webs 33.1-*35.4*-37.7% of longest arm). Webs approximately equal in depth, ventral web shallower than other sectors.

Third right arm of males hectocotylised. Modified arm slightly shorter than opposite arm, approximately twice (1.7, 1.6 times) mantle length and around 80% (83.7, 72.7%) length of opposite arm. Ligula large (6.4 [in submature male], 13.3 [in holotype] % of arm length) and sharp (Fig. 2d). Ligula groove open. Floor of groove with medial rib lacking distinct transverse ridges. Calamus small and sharp, around 25% of ligula length (26.6% of ligula in holotype). Spermatophore groove well developed, wide and thin with fine transverse ridges. Spermatophore guide distinct, bordered by small ridges or digits of skin. Approximately 50 suckers on hectocotylised arm (47, 53 and 55 in three males).

Gills with 8-9 lamellae on both inner and outer demibranchs, plus terminal lamella.

Digestive tract illustrated in Fig. 3a. Anterior salivary glands large, longest dimension over 50% of length of buccal mass. Posterior salivary glands moderate sized (equal in length with buccal mass, approximately 40% of digestive gland length). Crop diverticulum well developed. Stomach bipartite. Caecum coiled to form more than 1.5 whorls, distinctly striated. Digestive gland approximately ovoid. Ink sac and anal flaps absent. Buccal mass, digestive gland and intestine covered in large purple chromatophores, potentially used as a means of masking light produced by bioluminescent prey. Beaks illustrated in Figs 3b-d. Upper beak with a short, slightly hooked rostrum and narrow hood (Fig. 3b). Lower beak with distinct rostrum, narrow hood and relatively parallel lateral walls separated in posterior 20% (Figs 3c-d). Radula with seven teeth and two marginal plates in each transverse row (Fig. 3e). Rhachidian tooth with 1-2 lateral cusps, typically 2, on each side of large medial cone. Lateral cusps in symmetrical to slightly asymmetrical seriation, migrating from lateral to medial position over approximately 6-7 transverse rows.

Male genitalia illustrated in Fig. 4a. Terminal organ ("penis") in mature males T-shaped with diverticulum distinctly longer than distal portion of organ. Spermatophores (Fig. 4b) of moderate length (40.5 mm, 67.9% of ML), produced in moderate numbers (26 in storage sac). Sperm reservoir under half spermatophore length (37.0%), containing thin sperm cord coiled in around 42 coils. Ejaculatory apparatus of spermatophore with 6-10 thin regular coils towards oral end.

Female genitalia illustrated in Fig. 4c. The largest female examined (96.8 mm ML, MNHN 2049) was almost mature and contained around 150 large eggs, reaching 14 mm long. One of the larger eggs showing follicular folds is illustrated in Fig. 4d.

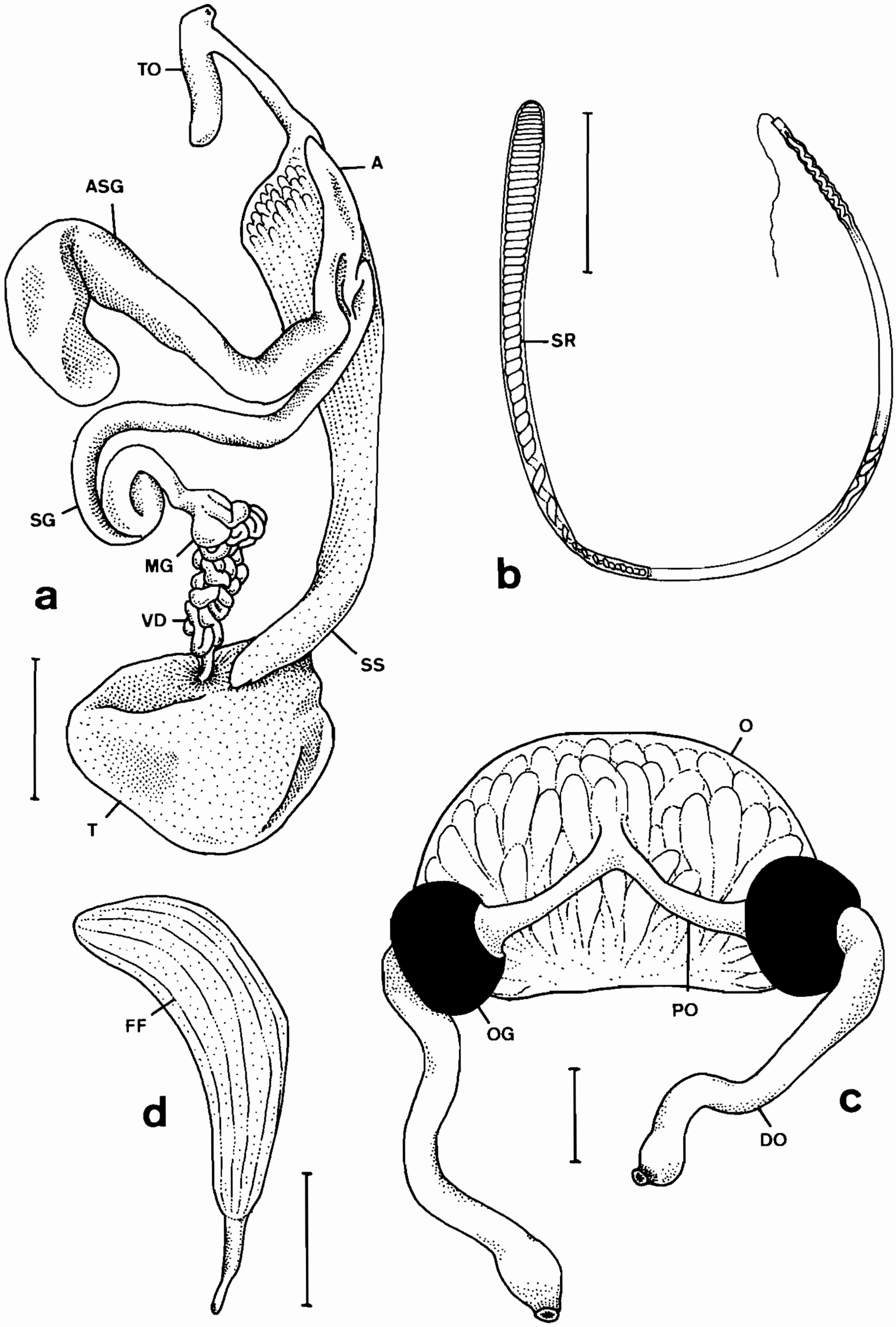

FIG. 4. — *Benthoctopus karubar* sp. nov. — **a-b**, male reproductive system of 59.6 mm ML holotype (MNHN 2026): **a**, reproductive tract: A = appendix; ASG = accessory spermatophoric gland; MG = mucilagenous gland; SG = spermatophoric gland; SS = spermatophore storage sac; T = testis; TO = terminal organ; VD = vas deferens. Scale bar = 10 mm. — **b**, spermatophore: SR = sperm reservoir. Scale bar = 5 mm. — **c-d**, female reproductive system of 96.8 mm ML female, paratype (MNHN 2049). — **c**, ovary: DO = distal oviduct; O = ovary; OG = oviducal gland; PO = proximal oviduct. Scale bar = 10 mm. — **d**, submature eggs showing follicular folds (FF). Scale bar = 5 mm.

Colour pattern of pink to dark purple colour produced by tiny crimson to purple chromatophores. Oral web dark purple in most specimens. Multiple (~8) irregular rows of subdermal founder chromatophores on arms. Little skin sculpture. Dorsal head and some of mantle scattered with small low rounded papillae (Fig. 2a). Lateral ridge absent.

REMARKS. — ADAM (1954) reported four specimens of *Benthoctopus* from the *"Siboga"* Expedition in Indonesian waters (in the region covered by the 1991 KARUBAR cruise), which he treated as 4 distinct undescribed taxa (species A-D). Collection depths ranged from 304 to 1886 m. Only ADAM's *Benthoctopus* sp. C, a female, shows similarities with the species described here, matching gill counts and radula dentition, and sharing similar arm lengths (longest 2.9 times mantle length), web depths (deepest 36% of longest arm) and dark skin colouration. ADAM provides no details of funnel organ shape.

ADAM's remaining species are distinct from *B. karubar*: *Benthoctopus* sp. A (female from 304 m) possesses a W-shaped funnel organ. *Benthoctopus* sp. B (male from 1886 m) has a distinctive radula with very large first lateral teeth (ADAM, fig. 36). *Benthoctopus* sp. D (female from 1158 m) possesses a much lower gill count, 5-6 lamellae per demibranch. *Benthoctopus* sp. C, collected from 794 m at 7°24'S, 118°15.2'E, was also the only specimen of the 4 to fall within the depth range of 400-800 m reported here for *B. karubar*.

As noted by NESIS (1987), the genus *Benthoctopus* is poorly studied. Most species are ill-defined with the proposed diagnostic characters often overlapping between taxa. Of the described species of *Benthoctopus*, only six species share with *B. karubar* a UU-shaped funnel organ and the absence of distinctly enlarged suckers in either sex. These taxa are compared to *B. karubar* in Table 3 (p. 380). The only described species close to the new species treated here is *B. levis*, described from the Antarctic waters surrounding Heard Island in the southern Indian Ocean. *Benthoctopus karubar* females lay large eggs (at least 14 mm long) and hence hatchlings would be benthic with limited capacity for dispersal. The distance between records for these 2 taxa, coupled with temperature differences between Antarctic waters and those of the Banda and Arafura Seas, are sufficient to consider these species distinct.

VOSS & PEARCY (1990) reviewed members of the genus *Benthoctopus* and described 5 new species from the north-east Pacific Ocean. All are distinct from *Benthoctopus karubar*, as all possess a W-shaped funnel organ.

The systematics of the genus *Benthoctopus* and its relationships with members of the genus *Bathypolypus* Grimpe, 1921 require significant revision. Members of the genus *Benthoctopus*, as it currently stands, are primarily grouped on the basis of a single character, the absence of a functional ink sac. It is likely that ancestral octopuses of different shallow-water lineages have been convergent in loss of the ink sac, as their ancestors shifted to lightless depths (where an ink sac offers no selective advantage). It is possible that this genus, as it currently stands, will prove to be polyphyletic.

ETYMOLOGY. — This species derives its names from the 1991 KARUBAR cruise, during which the known specimens were collected.

DISTRIBUTION. — *Benthoctopus karubar* is reported here from the Arafura Sea, Indonesia (near Kai and Tanimbar Islands). Material examined here was collected between 400 and 800 m.

Genus *OCTOPUS* Lamarck, 1798

Octopus pyrum sp. nov.

Figs 5-7, 11b

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 10, 329-389 m: 1 ♂, 31.8 mm ML (holotype MNHN 2029): 1 ♂, 34.8; 2 ♀, 22.4, 29.9 mm ML (paratypes POLIPI).

Tanimbar Islands: stn CP 69, 356-368 m: 1 ♀, 29.1 mm ML, (paratype MNHN 2033); 1 ♀, 30.1 mm ML (MNHN 2208).

Australia. RV *"Soela"*: stn SO6/85/27, off Townsville coast, 20°25.8'S, 152°57.7'E - 20°23.6'S, 152°57.7'E, 511 m, coll. CSIRO: 1 ♂, 22.9 mm ML (paratype MV F78818).

TYPE MATERIAL. — Holotype MNHN. Paratypes: 1 MNHN, 3 POLIPI, 1 MV.

TYPE LOCALITY. — Off Kai Islands, Banda Sea, 05°21'S, 132°30'E, 329-389 m.

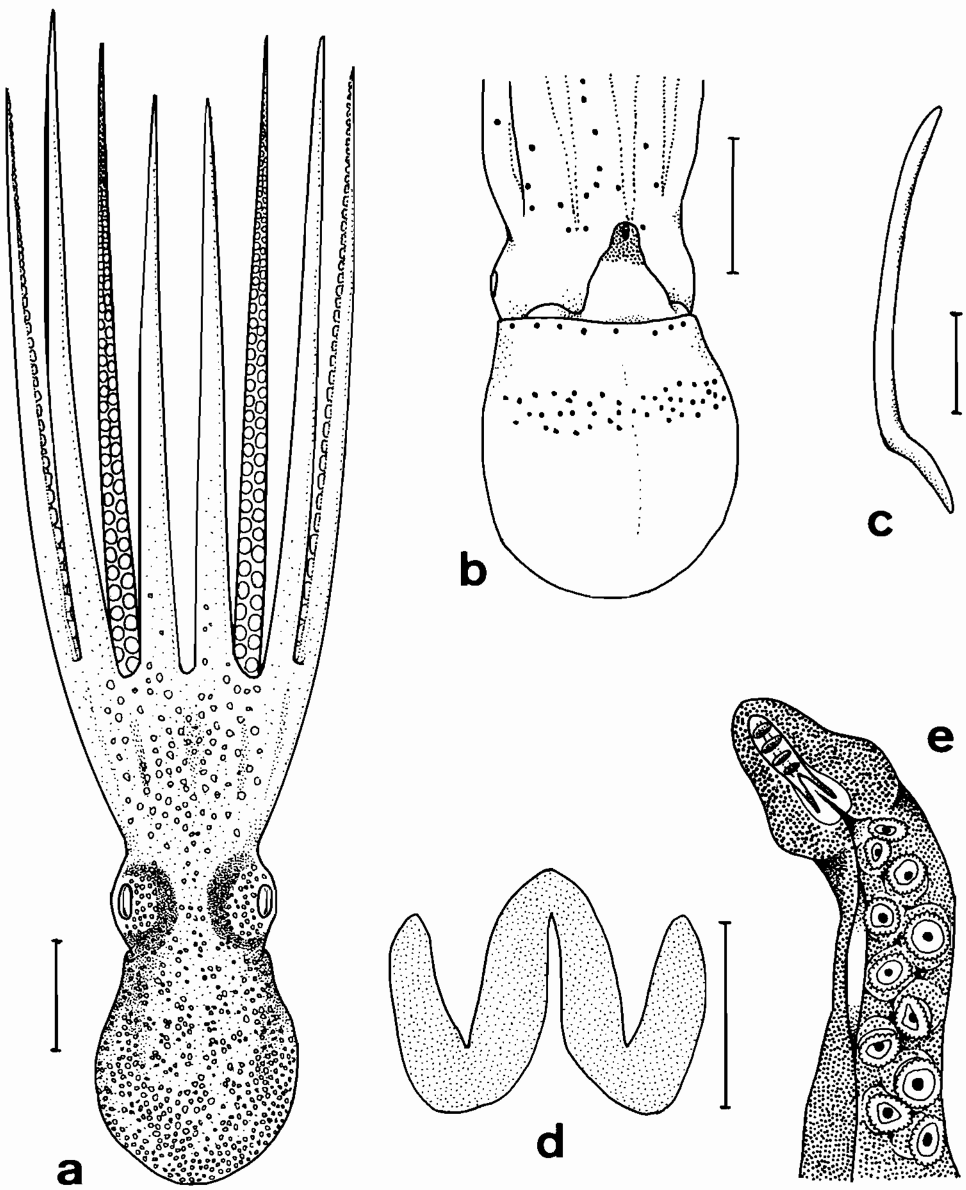

FIG. 5. — *Octopus pyrum* sp. nov. — **a**, dorsal whole animal, 29.1 mm ML female paratype (MNHN 2033). Scale bar = 10 mm. — **b**, ventral mantle, 22.4 mm ML female paratype (POLIPI). Scale bar = 10 mm. — **c**, stylet, 34.8 mm ML male paratype (POLIPI). Scale bar = 2 mm. — **d**, funnel organ, 31.8 mm ML male holotype (MNHN 2029). Scale bar = 5 mm. — **e**, ligula, holotype. Scale bar = 5 mm.

DIAGNOSIS. — Small to moderate size, ML to 35 mm. Arms moderately long, around 3-4 times ML. Arms approximately equal in length, lateral arms sometimes slightly longer than other arms. Webs moderately deep, deepest 20-30% of longest arm. Webs approximately equal in depth, lateral webs sometimes slightly deeper. Suckers small, 5.5-8% of ML, forming 2 rows. Sucker counts to around 120 on normal arms, 46-55 on hectocotylized arm of males. Enlarged suckers absent in both sexes. Funnel organ W-shaped. Gill count

7-8 lamellae per demibranch. Ink sac present. Hectocotylus on right third arm. Ligula large (8-10% of arm length), robust and pear-shaped with thickened sides to the ligula groove at the base. Calamus large and pointed (around 50% of ligula length). Spermatophores of moderate length (15-26 mm, 67-75% of ML), produced in low numbers (1-3 in storage sacs). Egg size unknown. Colour pattern: Orange to crimson base colour on dorsal surfaces, cream on ventral surfaces. Dorsal surfaces scattered with numerous raised leucophores, cream to gold in colour. Distinctive transverse band of around 50 founder chromatophores across midsection of ventral mantle. Large chromatophores on ventral digestive gland, visible within mantle cavity adjacent to gills. Skin sculpture: scattered with numerous raised round papillae over dorsal surfaces, including many over eyes.

DESCRIPTION. — Counts and measurements are presented in Table 4 (p. 381). The description below is based on 6 KARUBAR specimens (2 mature males and 4 submature females). Data is presented as ranges and means (latter in italics). Raw data for the Australian male specimen is also presented in Table 4 (see Remarks below).

Small to moderate sized species (Figs 5a, 11b); mantle length (ML) to at least 35 mm, total length to at least 170 mm; weight to at least 19 g. Mantle ovoid, longer than wide (width 55.2-*71.7*-87.9% of ML, 50.2% in slightly squashed Australian male). Head of moderate width (47.5-*54.1*-63.8% of ML, 67.0-*76.7*-86.9% of mantle width, 52.8% and 109.0% respectively for Australian male). Eyes large, slightly pronounced. Stylets present as thin and clear non-mineralized rods (Fig. 5c), length around 25% of ML. Mantle opening moderately wide, approximately 50% of circumference of body at level of opening. Funnel of moderate length, approximately 40% of mantle length (36.5-*41.1*-45.1% of ML, 36.7% in Australian male), free portion approximately half funnel length (42.2-*47.5*-52.3% of funnel length, 41.7% in Australian male). Funnel organ W-shaped (Fig. 5d), outer limbs shorter than median ones (outer limbs 71.4-*76.8*-82.5% of median limbs, 83.0% in Australian male). Funnel organ occupies approximately 50% of funnel length (45.0-*51.7*-57.9%, 55.9% in Australian male).

Arms of moderate length, around 3-4 times (2.8-*3.2*-3.9 x ML, 2.8 in Australian male) mantle length. Arms sub-cylindrical along length, tapering evenly along length to narrow tips. Arm autotomy at base of arms absent. Arms approximately equal in length, lateral arms sometimes slightly longer. Suckers small, less than 8% of mantle length in both sexes (5.5-*6.8*-7.6% of ML, 6.1% in Australian male), forming 2 rows. Enlarged suckers absent in both sexes. Up to 126 suckers on intact normal arms in submature and mature specimens (maximums 106 to 126 in material examined). Webs of moderate depth (deepest webs 19.4-*22.6*-27.8% of longest arm, 25.4% in Australian male). Webs approximately equal in depth, lateral webs slightly deeper in some specimens.

Third right arm of males hectocotylized. Modified arm short, approximately twice mantle length (1.8-2.0 times ML, 1.7 in Australian male) and around 65% length of opposite arm. Ligula large (8.0-10.0% of arm length, 8.8% in Australian male), robust and pear-shaped (Fig. 5e). Ligula groove deep with thickened lips near base forming pear shape. Floor of groove with medial rib and transverse ridges. Calamus large, narrow and sharp, around 50% of ligula length (45.3 and 55.8% of ligula in KARUBAR males, 51.4% in Australian male). Spermatophore groove well developed, wide and thin with fine transverse ridges. Spermatophore guide distinct, bordered by flattened papillae or digits of skin. Approximately 50 suckers on hectocotylized arm (46 and 55 in KARUBAR males, 47 in Australian male).

Gills with 7-8 lamellae on both inner and outer demibranchs, plus terminal lamella.

Digestive tract illustrated in Fig. 6a. Anterior salivary gland length approximately one third length of buccal mass. Posterior salivary glands large (almost as large as digestive gland). Crop diverticulum well developed. Stomach bipartite. Caecum coiled to form single whorl, distinctly striated. Digestive gland approximately ovoid with no evidence of pancreatic tissue. Ink sac present but small, partially embedded in ventral surface of digestive gland. Anal flaps present. Beaks illustrated in Figs 6b-d. Upper beak with a short, slightly hooked rostrum and narrow hood (Fig. 6b). Lower beak with worn rostrum in both dissected specimens (Fig. 6d), narrow hood, widely spread wings and flared lateral walls separated in posterior third (Fig. 6d). Radula with 7 teeth and 2 marginal plates in each transverse row (Fig. 6e). Rhachidian tooth with 1-2 lateral cusps on each side of large medial cone. Lateral cusps in asymmetrical seriation, migrating from lateral to medial position over 5-6 transverse rows.

Male genitalia illustrated in Fig. 7a. Terminal organ ("penis") in mature males T-shaped with diverticulum equal in size to distal portion of organ. Holotype with spermatophore within terminal organ, causing the diverticulum to stretch forming a plate-like portion (Fig. 7c). Spermatophores (Fig. 7b) of moderate length

(15-26 mm, 67-75% of ML), produced in low numbers (1-3 in spermatophore storage sac). Sperm reservoir under half spermatophore length (38.5%), containing fine to robust sperm cord (coiled in around 17 coils in partially discharged spermatophore of KARUBAR paratype, around 32 coils in better condition spermatophore of Australian male). Ejaculatory apparatus of spermatophore with irregularly placed segments, followed by a distinctive white cylindrical portion towards oral end.

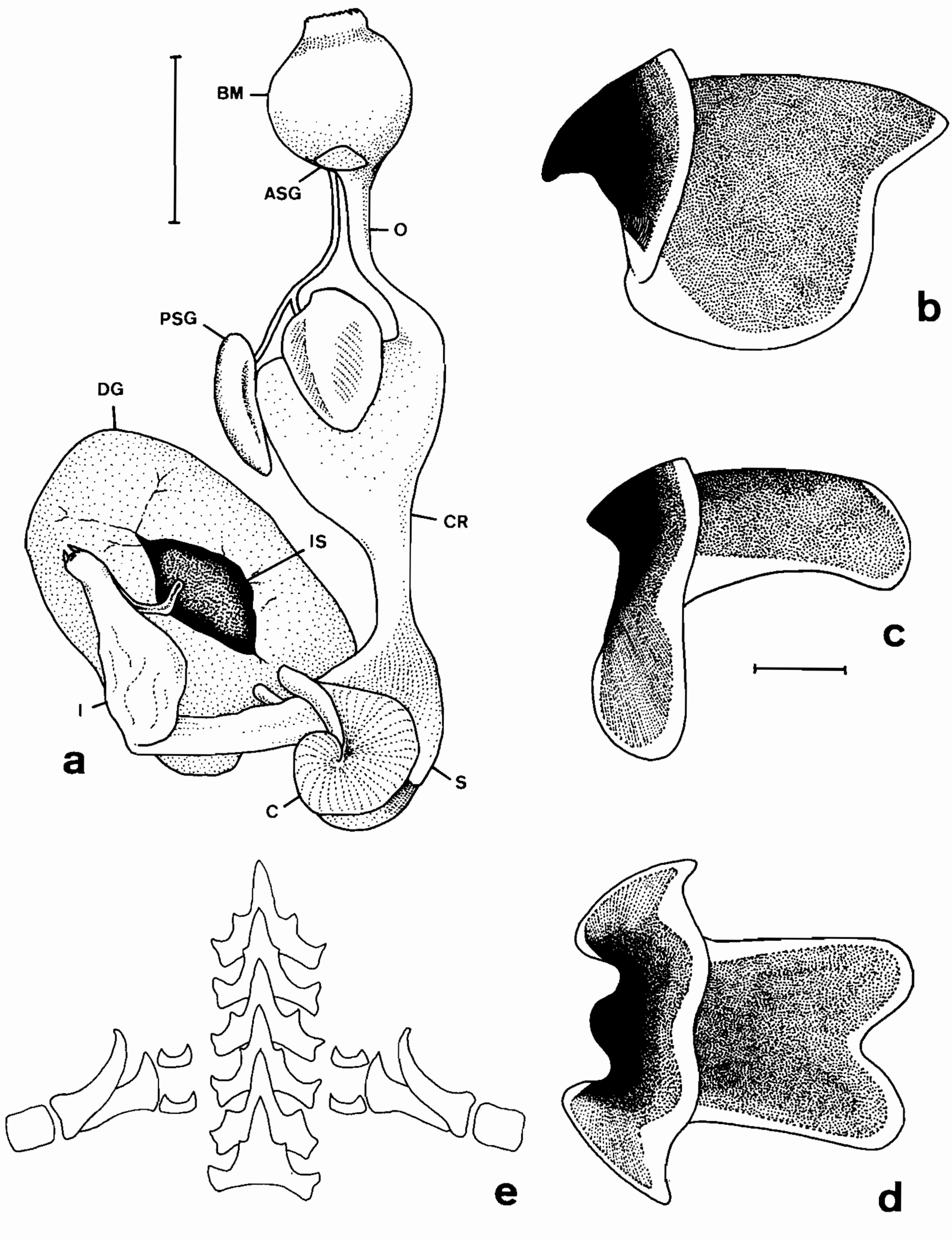

FIG. 6. — *Octopus pyrum* sp. nov. — **a-e**, digestive components, 34.8 mm ML male paratype (POLIPI): **a**, digestive tract. Symbols as in Fig. 3a, plus IS = ink sac. Scale bar = 10 mm. — **b**, lateral view of upper beak. Scale bar for all beaks = 2 mm. — **c**, lateral view of lower beak. — **d**, ventral view of lower beak. — **e**, radula.

No mature females were encountered in this study. Egg size and number unknown.

Basal colour pattern of orange to crimson on dorsal surfaces, cream on ventral surfaces. Dorsal surfaces covered in numerous round papillae, cream to gold in colour, colouration probably produced by fixed leucophores (Fig. 5a). Blue-black subdermal colour often visible over each eye. Ventral mantle with diagnostic transverse band of around 50 founder chromatophores at anterior third of mantle (Fig. 5b). Single row of founder chromatophores down midline of ventral arms. Large chromatophores also visible on ventral visceral envelope within mantle cavity, adjacent to gills (Fig. 7c).

Skin sculpture of loose granular texture formed by raised leucophore papillae over dorsal mantle, head, arm crown and arm bases. Lateral ridge absent.

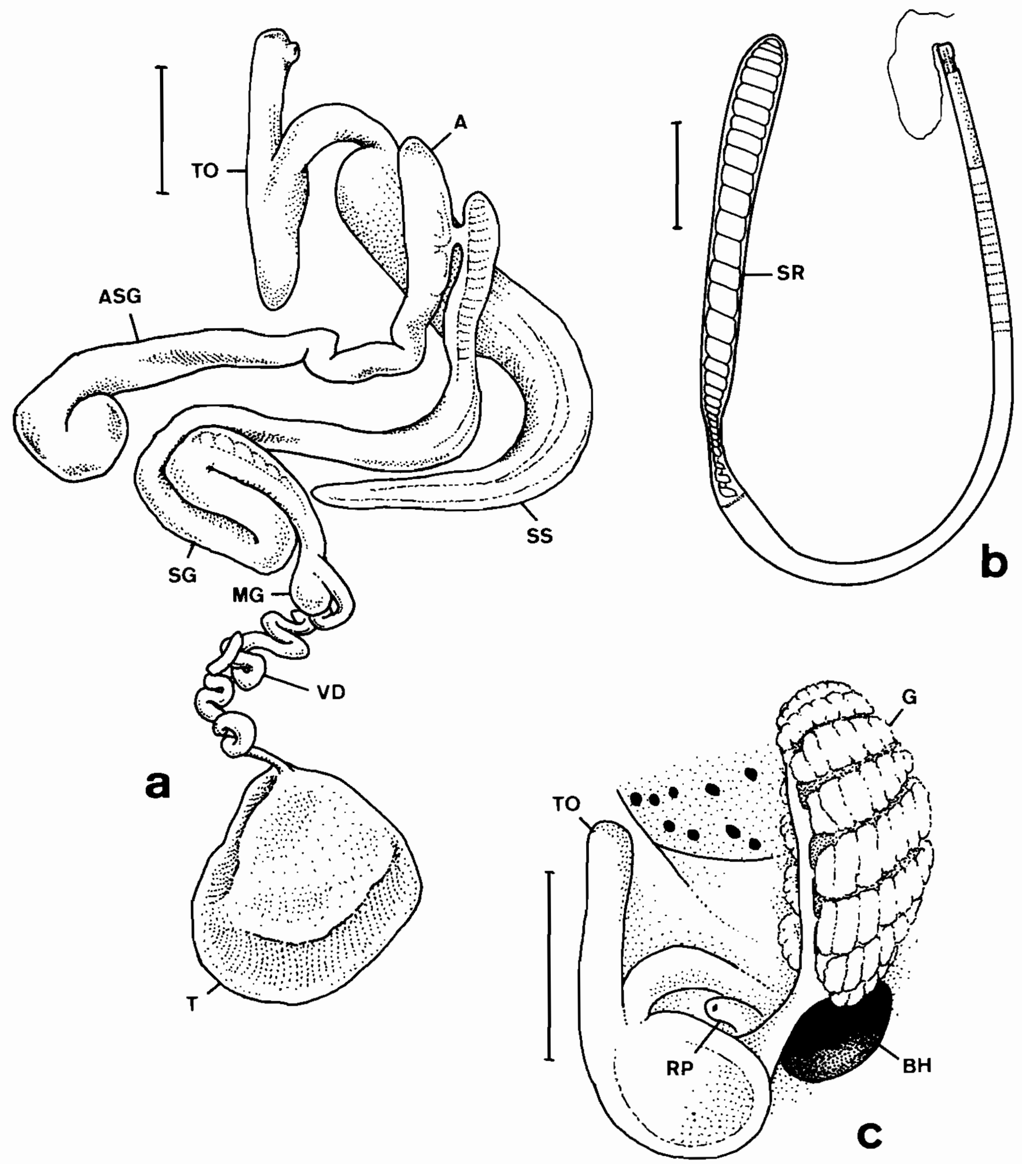

FIG. 7. — *Octopus pyrum* sp. nov. — **a**, reproductive tract, 34.8 mm ML male paratype (POLIPI). Symbols as in Fig. 4a. Scale bar = 5 mm. — **b**, spermatophore, holotype: SR = sperm reservoir. Scale bar = 2 mm. — **c**, terminal organ (TO), holotype: BH = branchial heart; G = gill; RP = renal papilla. Scale bar = 5 mm.

REMARKS. — The mature male specimen from off north-east Australia matched the Indonesian material in all characters and is accordingly included here. This specimen is slightly distorted but still possesses the diagnostic ligula, ventral mantle founder chromatophores, leucophores and matching sucker and gill counts.

There is only one recognised taxon which shows similarities with *Octopus pyrum*. The distinctive pear-shaped ligula with the swollen basal edges (Fig. 5e) shows some similarities with that of *Bathypolypus valdiviae* described by THIELE (*in* CHUN, 1915, pl. LXXX) from 500 m on the Agulhas Banks, off South Africa. These two taxa, however, are easily distinguished by the following characters in *B. valdiviae*: absence of an ink sac and crop diverticulum; a VV-shaped funnel organ; shorter arms (twice mantle length); deeper webs (33-40% of longest arm); larger ligula (13-18% of hectocotylized arm) and a radula with a rhachidian tooth which lacks lateral cusps.

ETYMOLOGY. — Derived from the Latin *pyrum* meaning "pear", which refers to the distinctive pear-shaped ligula of this species.

DISTRIBUTION. — *Octopus pyrum* is reported here from the waters of the Banda and Arafura Seas, Indonesia (from off the Kai and Tanimbar Islands) and north-east Australia (off Townsville, Queensland). Indonesian material was trawled from between 329-389 m, while the male specimen from off Townsville, Australia was collected from 511 m.

Genus ***PTEROCTOPUS*** P. Fischer, 1882

Pteroctopus sp.

Figs 8-10, 11c

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 10, 329-389 m: 1 ♀, 50.3 mm ML (MNHN 2030). — Stn DW 18, 205-212 m: 1 ♀, 43.0 mm ML (MNHN 2019).
Tanimbar Islands: stn CC 57, 603-620 m: 1 ♀, 30.2 mm ML (MNHN 2064).

DIAGNOSIS. — Moderate sized species, ML to at least 50 mm. Small eye openings, broad head. Narrow mantle opening, less than 40% of circumference of body at level of opening. Arm lengths approximately 3 times mantle length. Arms approximately equal in length. Webs deep, >30% of longest arm length. Webs approximately equal in depth, lateral webs slightly deeper. Webs extend as membranous flared margins along entire length of arms, very well developed at arm tips. Suckers small, around 7% of ML, forming 2 rows. Sucker counts to around 150 in females on normal arms. Enlarged suckers absent in females. Large VV-shaped funnel organ. Gill count 8-9 lamellae per demibranch. Ink sac and anal flaps present. Eggs appear large-type in submature ovary. Colour pattern: crimson brown dorsally, pink ventrally. Skin sculpture: scattered with regular small round papillae over all dorsal surfaces. Two narrow elongate papillae over each eye.

DESCRIPTION. — Counts and measurements are presented in Table 5 (p. 381). Data presented below are raw data for the 2 larger KARUBAR females, both submature.

Moderate sized species (Figs 8a, 11c); mantle length to at least 50 mm, total length to at least 230 mm; weight to at least 110 g. Mantle ovoid, slightly flattened dorso-ventrally and longer than wide (width 77.4, 89.9% of ML). Head wide (64.7, 80.7% of ML, 83.5, 89.8% of mantle width). Skin soft, semi-gelatinous. Eyes moderate sized with small openings (Figs 8a, 8e). Stylets present as thin and clear non-mineralized rods (Fig. 8c), length around 40% of ML. Mantle opening narrow, less than 40% of circumference of body at level of opening (Fig. 8b). Funnel of moderate length, approximately 40% of mantle length (43.9, 35.1% of ML), free portion short, approximately 20% (22.6, 20.5%) of funnel length. Funnel organ VV-shaped (Fig. 8d), outer limbs approximately equal in length to median ones (outer limbs 87.1, 108.0% of median limbs). Funnel organ occupies approximately 40-50% (39.4, 56.3%) of funnel length.

Arms of moderate length, around 3 times (2.9, 3.3 x ML) mantle length. Arms moderately robust, sub-cylindrical along length, tapering in distal 20%. Arm autotomy at base of arms absent. Arms approximately equal in length. Suckers small, around 7% (6.3, 7.0%) of mantle length, forming 2 rows. Enlarged suckers absent in

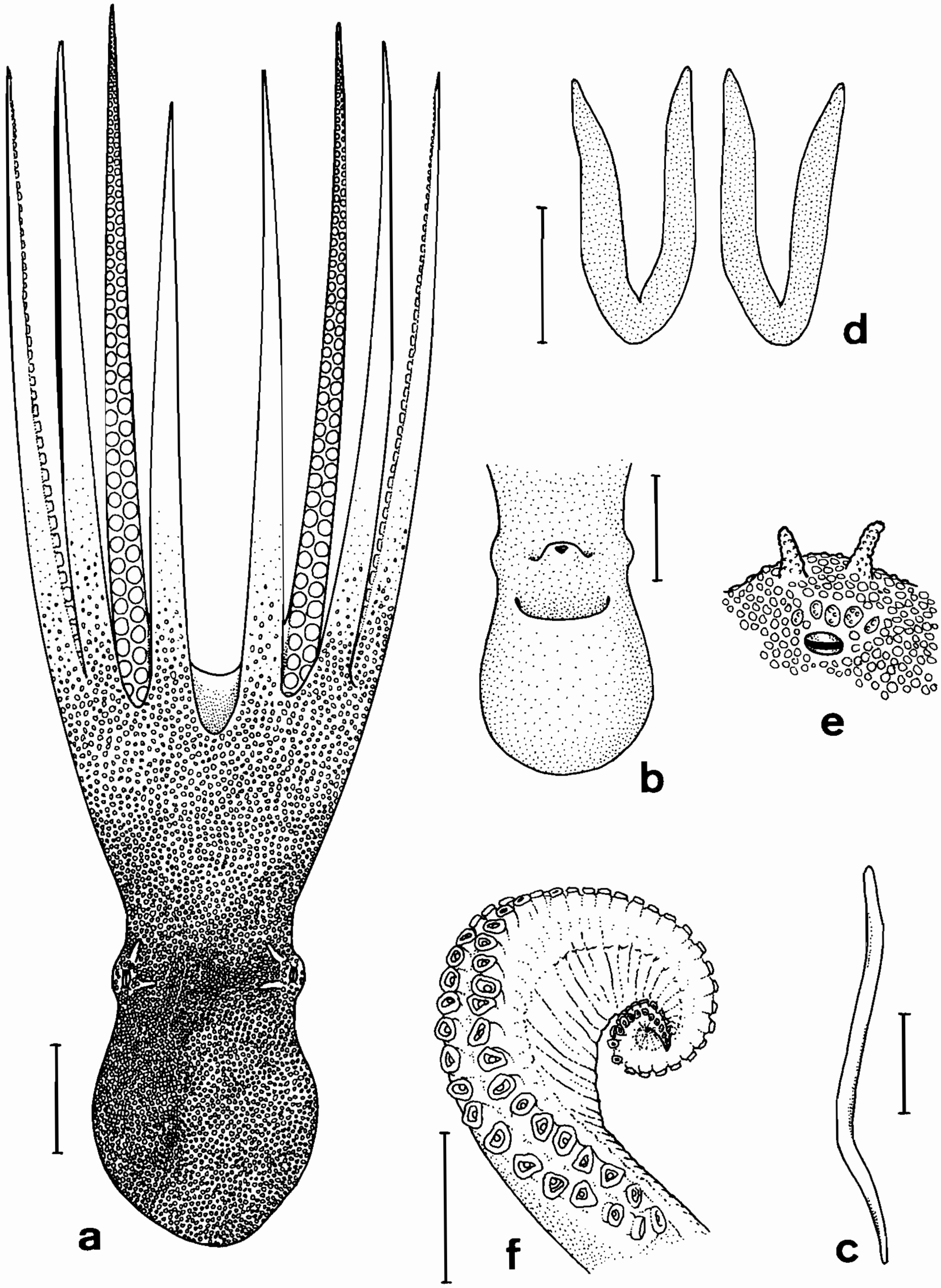

FIG. 8. — *Pteroctopus* sp. — **a**, dorsal whole animal, 50.3 mm ML female (MNHN 2030). Scale bar = 20 mm. — **b**, ventral mantle, 43.0 mm ML female (MNHN 2019). Scale bar = 20 mm. — **c**, stylet, 50.3 mm ML female (MNHN 2030). Scale bar = 5 mm. — **d**, funnel organ, 50.3 mm ML female, (MNHN 2030). Scale bar = 5 mm. — **e**, lateral view of head of 43.0 mm ML female (MNHN 2019), showing pair of papillae over each eye. Scale bar = 5 mm. — **f**, flared web margin on distal arms, 43.0 mm ML female (MNHN 2019). Scale bar = 5 mm.

females. Up to 150 suckers on intact arms of females (maximums in females: 144, 148). Webs deep (deepest webs 31.7, 36.3% of longest arm). Webs approximately equal in depth, laterals slightly deeper than dorsal and ventral webs. Webs extend as membranous flared margins along entire length of arms, very well developed at arm tips (Fig. 8f).

Gills with 8-9 lamellae on both inner and outer demibranchs, plus terminal lamella.

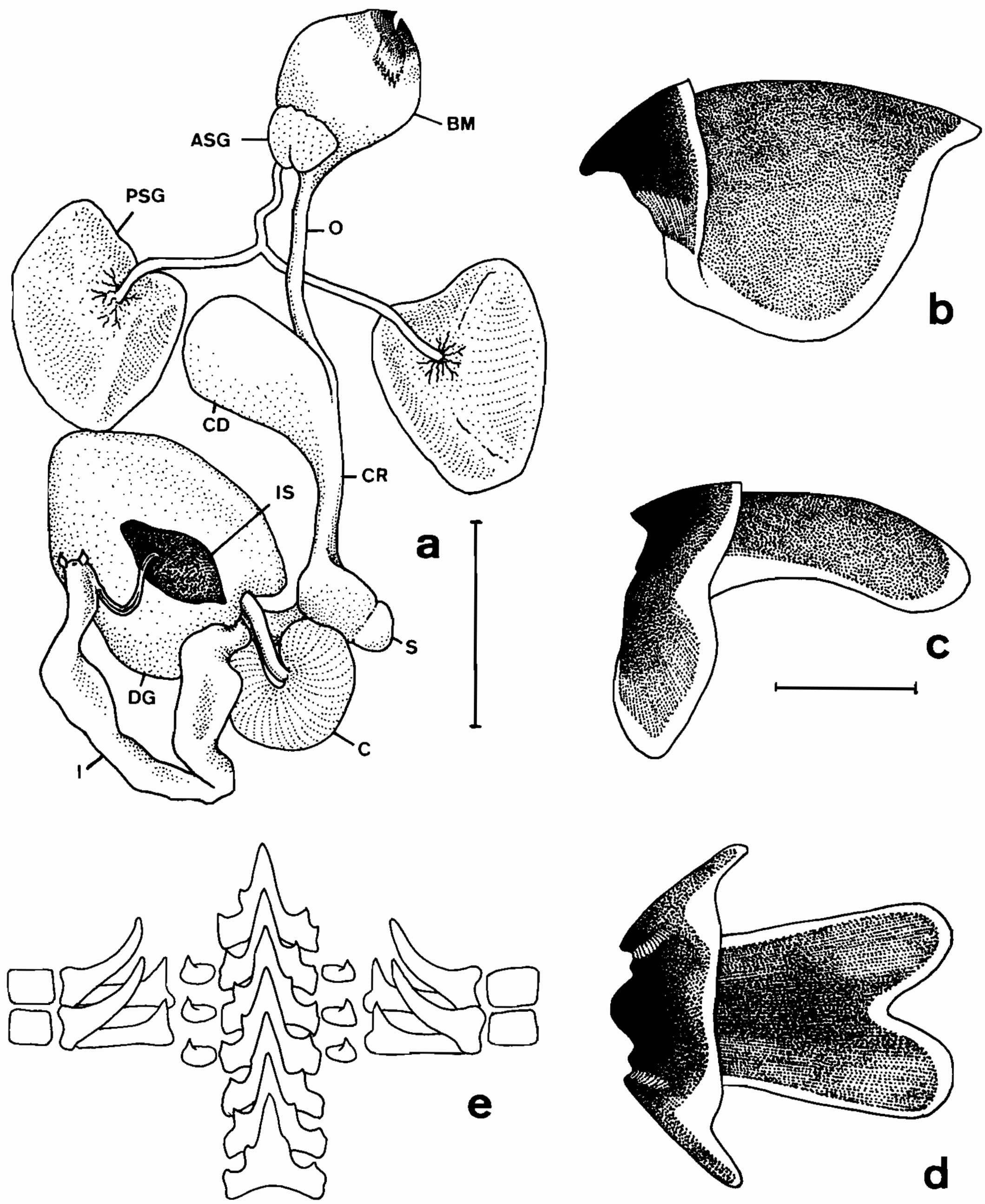

FIG. 9. — *Pteroctopus* sp. — **a-e**, digestive tract components of 43.0 mm ML female (MNHN 2019): **a**, digestive tract. Symbols as in Fig. 3a, plus IS = ink sac. Scale bar = 10 mm. — **b**, upper beak, lateral view. Scale bar for all beaks = 2 mm. — **c**, lower beak, lateral view. — **d**. lower beak, ventral view. — **e**, radula.

Digestive tract illustrated in Fig. 9a. Anterior salivary glands small, less than 20% of length of buccal mass. Posterior salivary glands moderate sized (longest dimension almost equal in length with buccal mass, approximately 40% of digestive gland length). Crop swollen, but not distinctly branched to form a diverticulum. Stomach bipartite. Caecum coiled in single whorl, distinctly striated. Digestive gland approximately ovoid. Ink sac and anal flaps present. Beaks illustrated in Figs 9b-d. Upper beak with a short, slightly hooked rostrum and moderate hood (Fig. 9b). Lower beak with rounded rostrum, narrow hood and relatively parallel lateral walls separated in posterior 15% (Figs 9c-d). Radula with 7 teeth and 2 marginal plates in each transverse row (Fig. 9e). Rhachidian tooth with 1-2 lateral cusps, typically 1, on each side of large medial cone. Lateral cusps in symmetrical seriation, migrating from lateral to medial position over approximately 4 transverse rows.

No males encountered in the KARUBAR cruise. A full description of male material from the Coral Sea and New Caledonia is in preparation.

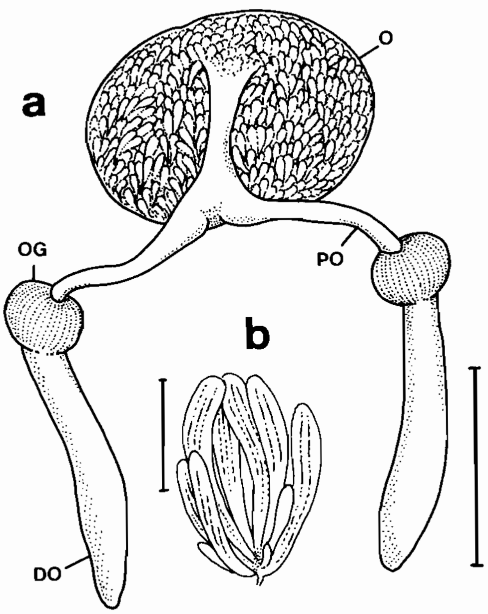

FIG. 10 — *Pteroctopus* sp.
a-b, reproductive system of 50.3 mm ML submature female (MNHN 2030): **a**, ovary. Symbols as in Fig. 4c. Scale bar = 10 mm. — **b**, cluster of immature ovarian eggs. Scale bar = 2 mm.

Submature female genitalia illustrated in Fig. 10a. The larger female (50.3 mm ML, MNHN 2030) was submature with a small ovary, but possessed well-developed muscular distal oviducts. Eggs were forming in clusters throughout the submature ovary (Fig. 10b). These eggs are already 4 mm long in this small ovary and would thus be large-type eggs when mature (>10% of mantle length).

Basal colour crimson brown dorsally and pink ventrally, formed by tiny crimson chromatophores. Skin sculptured in numerous small rounded papillae in regular texture over all dorsal surfaces (Figs 8a, 11c). Few slightly larger bumps scattered over dorsal mantle. Two long papillae over each eye (Figs 8a, 8e). Lateral ridge absent.

REMARKS. — Considerable confusion surrounds a distinctive group of mid-depth octopuses, coined here as the *Pteroctopus/Danoctopus* complex, identified by the following diagnostic characters:

- muscular animals with loose, semi-gelatinous skin sculptured in small and regular low patches,
- distinctive narrow mantle aperture,
- VV-shaped funnel organ with narrow limbs,
- two narrow elongate papillae over each eye,
- flared web membranes extending to the arm tips, and
- a wide head with small eye apertures.

Members of this group occur in mid-depth habitats from around 100 to 1000 m in the Atlantic, Indian and Pacific Oceans. Within this group are two separate subgroups, (1) those species treated under the genus *Danoctopus* Joubin, 1933 (and its synonyms *Berrya* Hoyle, 1939 and *Hapaloctopus* Taki, 1962) in which the hectocotylus of males is the third right arm; and (2) others treated under the genus *Pteroctopus*, where the third left arm of males is hectocotylised. A fifth nominal genus within this group, *Sasakinella* Taki, 1964 is based on a single female specimen from this group. As no males have been connected with TAKI's type specimen, the status of this generic name remains unresolved. NESIS (1987) recognised *Danoctopus*, *Pteroctopus* and *Sasakinella* as valid, though ill-defined, genera containing equally ill-defined species.

The 3 female KARUBAR specimens reported here clearly belong within this complex but were difficult to identify at both generic and species levels. The absence of male material prevented identification at the generic level, using the existing generic character of the side of the hectocotylised arm. Identification of these specimens was resolved on examination of material from comparable depths in the adjacent waters of the Coral Sea and New Caledonia, housed in MNHN. Amongst this material were numerous specimens from this group, including

4 males, all with the third left arm hectocotylised. This attribute clearly identifies them as members of the genus *Pteroctopus* and constitutes the first record of this genus from tropical Indo-West Pacific waters. This material matched the KARUBAR females in counts, dimensions, skin sculpture and colour, and we consider them conspecific.

Only 2 species have been coined in the genus *Pteroctopus, P. tetracirrhus* delle Chiaje, 1830 (described from the Mediterranean Sea) and *P. witjazi* Akimushkin, 1963 (described from the Sea of Okhotsk, Russia, far northern Pacific). NESIS (1987) considers the differences distinguishing the latter species as minor and ill-defined. As a consequence of this lack of resolution, we have chosen to treat the taxon reported here as an indeterminate species of the genus *Pteroctopus*. Material from the Coral Sea and New Caledonia is currently being worked up and species level resolution for this taxon will be undertaken in that work.

The *Pteroctopus/Danoctopus* complex requires extensive revision, particularly development of characters which may aid to identify female specimens of all genera, as well as distinguish species within each member genus.

DISTRIBUTION. — KARUBAR material was collected off the Kai Islands, Banda Sea and Tanimbar Islands, Arafura Sea, between 205 and 620 m. Additional material discussed above from the Coral Sea and New Caledonia was collected between 383 and 600 m.

Genus *ELEDONE* Leach, 1817

Eledone palari Lu & Stranks, 1992

Fig. 11d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 62, 246-253 m: 1 juv., 21.8 mm ML (MNHN 2034). — Stn CP 63, 214-215 m: 1 ♀, 32.6 mm ML (MNHN 2031). — Stn CP 78, 284-295 m: 1 ♀, 53.6 mm ML (MNHN 2024). — Stn CP 79, 239-250 m: 1 juv., 19.7; 1 ♂, 35.8; 1 ♀, 45.5 mm ML (MNHN 2020). — Stn DW 80, 199-201 m: 1 juv., 19.5 mm ML (MNHN 2058). — Stn CP 82, 215-219 m: 1 juv., 19.7 mm ML (MNHN 2067). — Stn CP 83, 285-297 m: 1 ♀, 64.5 mm (MNHN 2025). — Stn CP 84, 246-275 m: 2 juv., 19.3, 20.3; 1 ♀, 46.4 mm ML (MNHN 2035). — Stn CP 85, 240-245 m: 1 juv., 26.8; 1 ♀, 29.8; 1 ♂, 51.9 mm ML (POLIPI). — Stn CP 86, 223-225 m: 3 ♂, 44.6-54.2; 1 ♀, 62.8 mm ML (MNHN 2032).

Australia. Arafura Sea, Northern Territory, 9°46'S, 130°14'E, 270-300 m, 15 Sept. 1987: 1 ♀, 23.0 mm ML (NTM P1385).

DESCRIPTION (KARUBAR material). — The following brief description is based on KARUBAR specimens: 1 mature + 2 submature males, and 1 mature + 2 submature females. Counts and measurements for this material are presented in Table 6 (p. 382).

Moderate sized, robust octopuses (Fig. 11d), ML to 63 mm, wet weight to 120 g. Arms short, 1.5-2.0 times mantle length. Arm formula typically 1.2.3.4. Webs deep, 50-60 % of longest arm length. Webs decrease in depth from dorsal to ventral web. Suckers small, 5-7% of ML, forming a single row. Sucker counts, up to 50 in males, 76 in females. Hectocotylized arm of male (third right arm) with 44-45 suckers. No enlarged suckers in either sex. UU-shaped funnel organ. Gill count 5. Ink sac present. Ink duct opens anterior to opening of anus. Anal flaps absent. Ligula robust with large calamus. Tips of non-hectocotylized arms in males with spongiform tissue replacing suckers, modified portions up to 20% of arm length. Single spermatophore of mature male robust and armed with inward pointing teeth within ejaculatory apparatus. Sperm cord with ~15 cord whorls. Eggs large, up to 15 mm (~24% of ML), produced in low numbers. Colour pattern: pink cream-brown, to red-brown dorsally. White with scattered small crimson chromatophores on ventral surfaces. Skin sculpture: pairs of large papillae on dorsal mantle and arm crown, set within ring of smaller papillae. Lateral ridge well developed (Fig. 11d).

REMARKS. — The original description of the species by LU & STRANKS (1992) provided details of the morphology and distribution for this distinctive octopus. Additional notes on morphology, supplementing the earlier description, are provided below.

Stylets, the shell vestige of octopodids, are well developed in *Eledone palari*. They are keratin-like (non-mineralised) and approximately one-third of mantle length (21 mm in 62.8 mm ML female).

The inner margin of the mantle aperture is distinct from the form common to other members of the family Octopodidae. A well-developed flange on the posterior margin of the funnel corresponds with a matching deep fold inside the anterior edge of the ventral mantle. This structure is reminiscent of the flap-type mantle locking apparatus found in the pelagic octopods, *Tremoctopus violaceus* delle Chiaje, 1830 (Family Tremoctopodidae) and *Haliphron atlanticus* (Family Alloposidae).

Sucker counts on normal arms are low. Males possess up to 50 suckers proximal to the modified glandular tips. Females possess up to 76 suckers on the normal arms, which lack the glandular tissue found in the males.

Spermatophores are produced in low numbers (1-5 in storage sac) and are "armed". The inside of the ejaculatory apparatus is armed with sharp inward pointing teeth (as for example in Fig. 1i), which would splay out on the outer surfaces of the spermatophore on eversion. MANGOLD (1989) illustrated such armature in the intact and everted spermatophores of *Eledone cirrhosa* (Lamarck, 1798).

The generic status of this octopus requires review as it has a suite of morphological characters distinct from remaining species of the genus *Eledone*. All other members of the genus *Eledone* are restricted to the Atlantic Ocean and Mediterranean Sea.

DISTRIBUTION. — KARUBAR material was collected from east of the Tanimbar Islands in the Arafura Sea, between 8°S and 10°S, at depths of around 200 to 300 m. LU & STRANKS (1992) report the distribution of this species as the continental slope of Australia, from the Great Australian Bight, South Australia north to the southern Arafura Sea (~10°S), at depths between 110 and 620 m. All depth records reported by LU & STRANKS from shallower than 200 m are from cooler latitudes, south of 26°S.

Family ALLOPOSIDAE

Genus *HALIPHRON* Steenstrup, 1859

Haliphron atlanticus Steenstrup, 1859

Fig. 11e

Synonyms: *Alloposus mollis* Verrill, 1880; *Heptapus danai* Joubin, 1929. (See full synonymy in THORE, 1949).

MATERIAL EXAMINED. — KARUBAR, *Tanimbar Islands*: stn CP 78, 284-295: 1 ♀, 73.2 mm ML (MNHN 2046).

DESCRIPTION. — Counts and measurements are provided in Table 7 (p. 382). Mantle length 73.2 mm, total length approximately 300 mm, wet weight 165 g. Mantle round and semi-gelatinous with no constriction between the mantle and the head (Fig. 11e). Head broad, as wide as mantle. Eyes almost ventro-lateral in aspect. Mantle opening very wide, >60% of circumference at level of opening (Fig. 11e). Funnel-locking apparatus present as transverse flap on funnel, locking into corresponding crease on mantle wall. Arms short, longest 1.7 times ML. Arm formula unclear due to damaged arms in this specimen. Webs deep, >40% of longest arm length. Undamaged webs of similar depths. Suckers small, 6.0% of ML, first 6 suckers forming a single row from mouth to web margin, remaining suckers in 2 rows. At least 50 suckers on third arms, with 10-12 tiny suckers on tips. No enlarged suckers in single specimen. Large W-shaped funnel organ, lateral limbs equal in length with medial ones (Fig. 11e). Gill count 10 in outer demibranch, 9 in smaller inner demibranch. Ink sac and rudimentary anal flaps present with ink duct emerging anterior to opening of anus. Single female immature, reproductive tract not developed. Colour pattern: large pink chromatophores on smooth, loose and torn skin. Specimen coated in coagulated mucous and/or fine mud.

REMARKS. — We follow the works of KRISTENSEN & KNUDSEN (1983) and WILLASSEN (1986) in adopting the name *Haliphron atlanticus* Steenstrup, 1859 as senior synonym over the name *Alloposus mollis* Verrill, 1880.

THORE (1949) treated this taxon under the name *A. mollis*, reporting a large submature female (400 mm total length) from the Banda Sea (05°52'S, 131°14'E), close to the collection site for the KARUBAR specimen.

Our record is based on a single immature female, 73.2 mm in mantle length, ~300 mm in total length and weighing 165 grams. WILLASSEN (1986) reported two much larger females from off the coast of Norway, the largest being mature at a mantle length over 450 mm and weighing over 4.1 kg.

Little is known of the biology of this semi-gelatinous pelagic octopus. THORE discussed the funnel locking apparatus and muscular septa within the mantle cavity of this taxon, stating that "these septa give the impression that the power of expulsion of water from the mantle cavity must be great, thus making the animal a rather fast backward swimmer" (1949: 70). Fast jet propulsion may account for the scarcity of material captured in trawls compared with higher catches made of other, potentially slower, semi-gelatinous octopods such as *Japetella diaphana* Hoyle, 1885.

The habits of this species are not known. THORE (1949) captured specimens of this species between 20 and 350 m where the sea floor was over 2400 m deep. Other specimens have been collected in benthic dredges (VERRILL, 1882). Our specimen was collected in a beam trawl around 290 m, however the open net may have captured the animal as the net travelled through the water column. ALVARINO & HUNTER (1981) reported net avoidance in this species as observations of a young animal in surface waters fleeing ahead of the net, swimming faster than the towed net. The specimen was eventually captured enabling identification.

DISTRIBUTION. — The KARUBAR female was collected off the Tanimbar Islands, Arafura Sea. THORE (1949) reported the broader distribution of this species (under the name *Alloposus mollis*) as circumglobal in Atlantic, Indian and Pacific Oceans, between latitudes 40°N and 40°S.

DISCUSSION

Benthic octopuses reported here from the KARUBAR cruise to the Banda and Arafura Seas were collected between 199 and 869 m, from trawls between 100 and 1200 m. In these tropical latitudes, there appears to be a marked transition of the octopod fauna between shallow waters (< 200 m) and those of deeper waters. This faunal transition corresponds with temperature changes with depth. THORE (1949) presented temperature-depth profiles for tropical latitudes including stations within the Indo-Malayan Archipelago. THORE's data demonstrates a rapid drop in water temperatures from more than 25°C at the surface to around 13°C at 200 m. Temperature changes at greater depths are more gradual, dropping to around 10°C at 500 m and 8°C at 1000 m.

This faunal transition around 200 m is visible in the octopuses of northern Australia. Over 20 shallow-water species have been recognised from the waters of the Great Barrier Reef and northern Australia (NORMAN, 1993c). None of these species occur at depths greater than 185 m, despite considerable trawling activity at greater depths in the region. Trawls at depths over 200 m have encountered, instead, a distinct octopod fauna consisting of *Eledone palari* and at least 6 undescribed species (LU & STRANKS, 1992; NORMAN & LU, unpublished data).

The shallow-water octopuses of Indonesia have received little attention and require thorough revision. However, preliminary investigation of museum material collected from Indonesia has found a fauna consisting of the same species groups as found throughout the shallow waters of the Indo-Malayan Archipelago including northern Australia (see discussion of these species groups in NORMAN & SWEENEY, 1997).

The mid-depth octopuses reported here from the KARUBAR cruise show no affinities with the shallow-water faunas of either Indonesia or northern Australia. No members of the shallow waters species groups mentioned above are present in this fauna. The clear demarcation in composition and affinities between shallow and deeper faunas is reflected in a single specimen collected in the KARUBAR cruise from less than 200 m. One individual of an undescribed ocellate species of the genus *Octopus* (belonging in the shallow-water species group, the *O. aegina* group) was collected from 174-176 m (station CP 65, 09°14'S, 132°27'E, 1 Nov. 1991). This species was not encountered at greater depths.

The phylogenetic affinities of the mid-depth KARUBAR species are less clear. Members of the genus *Benthoctopus* are reported from throughout the world's oceans (NESIS, 1987). *Benthoctopus* requires extensive revision with most species placed in this genus solely on the basis of absence of an ink sac. As discussed above, it is premature to discuss phylogenetic affinities of *Benthoctopus* species.

The new species described here, *Octopus pyrum*, shows no affinities with any known shallow-water taxa. The distinctive pear-shaped ligula shows superficial similarities with that of *Bathypolypus valdiviae*, however the two species are distinct in a suite of other characters (see above).

As discussed above, the *Pteroctopus* species reported here belongs in the *Pteroctopus/Danoctopus* group, with members occurring in mid-depths (100-1000 m) throughout temperate and tropical latitudes of all oceans. The wide distribution of this group suggests an older lineage, potentially dating back to times of the circumglobal and equatorial Tethys Sea, potentially accounting for representation of this group in all oceans at these latitudes.

The anomalous *Eledone palari* shares a single row of suckers with the remaining members of the genus *Eledone*, all of which are restricted to the temperate and tropical waters of the Atlantic Ocean and Mediterranean Sea. It is distinct, however, in a number of morphological characters, including a different floorplan to the male reproductive tract, normal octopodid ligula and calamus, spongiform tissue on the modified arm tips of mature males, deep webs and distinct skin sculpture (regular paired papillae). The generic status of this species requires revision as it is likely to be distinct from the genuine *Eledone*, as represented in the Atlantic Ocean.

Eledone palari is restricted to the continental slopes surrounding the entire Australian land mass between 110 and 620 m. It produces large eggs (up to 15 mm) and as a consequence its hatchlings would be benthic in habit with limited capacity for dispersal. The geological stability and isolation of the Australian land mass over the last 350 million years (as it has travelled north from the fragmenting continent of Gondwana) may explain the distribution and unique nature of this taxon. It is possible that the ancestors of *E. palari* were carried north on this migrating land mass from southern polar waters, over sufficient time that direct ancestors of this unique octopus no longer exist. Conversely, the nearest relatives may prove to be the south polar genera *Bentheledone* Robson, 1932, *Thaumeledone* Robson, 1930 and *Megaleledone* Taki, 1961, all of which share a hectocotylus with well-developed calamus. All of these genera possess a single row of suckers and occur in deep and cold polar waters between 800 and 5300 m.

The reported circumglobal distribution of *Haliphron atlanticus* may reflect its pelagic habit. Nothing is known of the origins and phylogeny of this distinct animal.

Limited octopod material has been collected from greater depths (>1000 m) in tropical latitudes of the Indo-West Pacific region. The limited material collected from these depths includes benthic octopuses placed in the genus *Benthoctopus* Grimpe, 1921 (*e.g.*, ADAM, 1954), pelagic gelatinous octopuses such as species of *Japetella* Hoyle, 1885, *Eledonella* Verrill, 1884 and *Vitreledonella* Joubin, 1918 (see THORE, 1949), and finned cirrate octopuses, such as *Grimpoteuthis pacifica* (Hoyle, 1885, collected from 4465 m).

The benthic octopod faunas which exist above and below 200 m in this tropical region hence appear phylogenetically distinct. These differences suggest that there have been no successful regional or recent descents of shallow-water lines into these darker cooler depths, at least within this region of the Indo-Malayan Archipelago. In order to further our knowledge of the nature and origins of these little known animals, further sampling, detailed morphological descriptions and appropriate molecular analyses are all required.

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TABLES

TABLE 1. — Summary of KARUBAR station data referred to in this paper.

KARUBAR Station N°	Latitude & Longitude	Depth (m)	Date (1991)	Local time	Species recorded
Kai Islands					
CC10	05°21'S, 132°30'E	329-389	23 Oct	10h55	*Octopus pyrum* sp. nov. *Pteroctopus* sp.
DW18	05°18'S, 133°01'E	205-212	24 Oct	20h22	*Pteroctopus* sp.
CP19	05°15'S, 133°01'E	576-605	25 Oct	06h40	*Benthoctopus karubar* sp. nov.
CP20	05°15'S, 132°59'E	769-809	25 Oct	09h53	*Benthoctopus karubar* sp. nov.
Tanimbar Islands					
CP54	08°21'S, 131°43'E	836-869	30 Oct	16h11	*Benthoctopus karubar* sp. nov.
CC57	08°19'S, 131°53'E	603-620	31 Oct	09h56	*Benthoctopus karubar* sp. nov. *Pteroctopus* sp.
CP62	09°01'S, 132°42'E	246-253	01 Nov	06h32	*Eledone palari*
CP63	09°00'S, 132°58'E	214-215	01 Nov	09h24	*Eledone palari*
CP69	08°42'S, 131°53'E	356-368	02 Nov	06h35	*Octopus pyrum* sp. nov.
CP70	08°41'S, 131°47'E	410-413	02 Nov	09h10	*Benthoctopus karubar* sp. nov.
CP71	08°38'S, 131°44'E	477-480	02 Nov	11h48	*Benthoctopus karubar* sp. nov.
CP78	09°06'S, 131°24'E	284-295	03 Nov	15h47	*Eledone palari* *Haliphron atlanticus*
CP79	09°16'S, 131°22'E	239-250	03 Nov	18h09	*Eledone palari*
DW80	09°37'S, 131°02'E	199-201	04 Nov	06h03	*Eledone palari*
CP82	09°32'S, 131°02'E	215-219	04 Nov	10h26	*Eledone palari*
CP83	09°23'S, 131°00'E	285-297	04 Nov	13h01	*Eledone palari*
CP84	09°23'S, 131°09'E	246-275	04 Nov	15h13	*Octopus* sp. indeterm. *Eledone palari*
CP85	09°22'S, 131°14'E	240-245	04 Nov	16h42	*Eledone palari*
CP86	09°26'S, 131°13'E	223-225	04 Nov	18h16	*Eledone palari*

TABLE 2. — Counts and measurements (raw data, measurements in mm) for 2 males and 2 females of *Benthoctopus karubar* sp. nov. D = damaged, H = hectocotylized arm.

Registration number	POLIPI	MNHN 2026	MNHN 2038	MNHN 2049
KARUBAR station:	CP70	CP70	CP54	CC57
Status	Paratype	Holotype	Paratype	Paratype
Sex	Male	Male	Female	Female
Maturity	late submature	mature	submature	late submature
Mantle length	51.0	59.6	70.9	96.8
Total length	174	243	301	422
Weight (g)	49.5	117.1	229.5	765.2
Mantle width	24.5	43.1	56.6	94.6
Head width	26.6	40.3	52.8	68.2
Shallowest web depth	ventral: 35	ventral: 35	ventral: 49	ventral: 82
Deepest web depth	dorsal: 41	dorsal: 55	dorso-lat: 74	dorsal 106
Arm lengths (L/R): 1	110 105	155 166	207 195	297 298
2	105 102	150 135	195 D	291 287
3	104 87H	128 93H	178 176	284 283
4	104 D	130 142	175 172	289 287
Sucker diameter	3.9	4.3	7.0	10.4
Sucker count: R3	55H	47H	124	139
L3	96	102	120	146
Ligula length	5.6	12.4	-	-
Calamus length	1.7	3.3	-	-
Spermatophore number	-	26	-	-
Spermatophore length	-	40.5	-	-
Spermatophore width	-	1.1	-	-
Sperm reservoir length	-	15.0	-	-
Sperm cord whorls	-	42	-	-
Egg number	-	-	submature	~150
Egg length	-	-	-	14
Egg width	-	-	-	4

TABLE 3. — Comparison of *Benthoctopus karubar* sp. nov. with similar described species. ALI = Arm Length Index, longest arm/mantle length. - LLI = Ligula Length Index, ligula length/hectocotylised arm length. - M = mature. - SDI = Sucker Diameter Index, largest sucker diameter/mantle length. - Sub = submature. - WDI = web depth index, depth of deepest web/ length of longest arm.

Species	Type locality	Depth (metres)	ALI (%)	LLI (%)	SDI (%)	WDI (%)
Benthoctopus karubar sp. nov.	Arafura Sea, Indonesia	400-800	2.2-3.1	6.3Sub 13.3M	7-10	33-38
B. ergasticus (P. & H. Fischer, 1892)	North-east Atlantic	450-1500	3.3-6.7	7	3.3-8	28
B. fuscus Taki, 1964	E of Honshu, Japan	Unknown	4.1	5	6.1	21
B. januarii (Hoyle, 1885)	Gulf of Mexico, NE Brazil	640	4-6	6-9	7.3	22
B. levis (Hoyle, 1885)	Heard Island, Indian Ocean (Antarctic)	137	2-3	7	6-8	33-40
B. thielei Robson, 1932	Kerguelen Is., Indian Ocean (Subantarctic)	Shore	2.2-2.7	13	9	25

TABLE 4. — Counts and measurements (raw data, measurements in mm) for material of *Octopus pyrum* sp. nov. D = damaged. - H = hectocotylized arm. - pd = sperm reservoir partially discharged.

Registration number	MNHN 2029	POLIPI	MV F78818	POLIPI	MNHN 2033	POLIPI	MNHN 2208
KARUBAR station	CC10	CC10	Australia	CC10	CP69	CC10	CP69
Status	Holotype	Paratype	Paratype	Paratype	Paratype	Paratype	-
Sex	Male	Male	Male	Female	Female	Female	Female
Maturity	Mature	Mature	Mature	Submature	Submature	Submature	Submature
Mantle length	31.8	34.8	22.9	22.4	29.1	29.9	30.1
Total length	148	174	92	101	120	128	120
Weight (g)	18.7	18.3	4.6	6.2	9.4	10.0	11.0
Mantle width	25.8	19.1	11.5	19.7	19.6	16.5	25.2
Head width	17.6	16.6	12.1	13.2	14.9	14.2	19.2
Shallowest web depth	22	22	12	17	15	14	18
Deepest web depth	lateral: 26	lateral: 26	dorso-lat: 16	lateral: 20	17	lateral: 19	20
Arm lengths (L/R): 1	100 98	105 104	D 61	58 62	78 75	63 76	75D 71
2	102 110	134 103	63 D	63 63	86 82	81 65D	83 81
3	101 65H	103D 64H	63 40H	72 68	79 81	91 87	79 84
4	102 85D	103 104	D 53	60 66	82 82	81 83	78 75D
Sucker diameter	2.4	2.4	1.4	1.7	1.6	1.9	2.0
Sucker count R3	55H	46H	47H	106	114	120	117
Sucker count L3	115	126	D	100	119	112	112
Ligula length	5.2	6.4	3.5	-	-	-	-
Calamus length	2.9	2.9	1.8	-	-	-	-
Spermatophore number	3	3	3	-	-	-	-
Spermatophore length	not dissected	26.0	15.4	-	-	-	-
Spermatophore width	-	1.0	0.9	-	-	-	-
Sperm reservoir length	-	10.0	5.7	-	-	-	-
Sperm cord whorls	-	~17pd	~32	-	-	-	-

TABLE 5. — Counts and measurements (raw data, measurements in mm) for two females of *Pteroctopus* sp. collected in KARUBAR cruise. D = damaged.

Registration number	MNHN 2019	MNHN 2030
KARUBAR station	DW18	CC10
Sex	Female	Female
Maturity	submature	submature
Mantle length	43.0	50.3
Total length	183	231
Weight (g)	37.3	113.2
Mantle width	33.3	45.2
Head width	27.8	40.6
Shallowest web depth	ventral: 22	dorsal: 30
Deepest web depth	lateral: 45	ventro-lateral: 53
Arm lengths (L/R): 1	124 116	147 153
2	120 101	160 D
3	105 104D	158 D
4	97 94D	167 D
Sucker diameter	2.7	3.5
Sucker count: R3	D	D
L3	144	148
Egg number	low	low
Egg length	large-type (submature)	large-type (submature)
Egg width	submature	submature

TABLE 6. — Counts and measurements (raw data, measurements in mm) for 3 males and 3 females of *Eledone palari*. D = damaged. - H = hectocotylized arm.

Registration number	MNHN 2032	MNHN 2032	MNHN 2032	MNHN 2024	MNHN 2025	MNHN 2032
KARUBAR station	CP86	CP86	CP86	CP78	CP83	CP86
Sex	Male	Male	Male	Female	Female	Female
Maturity	Submature	Submature	Mature	Submature	Submature	Mature
Mantle length	44.6	46.6	54.2	53.5	64.5	62.8
Total length	124	128	152	154	178	170
Weight (g)	41.0	40.6	64.0	80.6	120.1	124.0
Mantle width	29.1	24.6	34.9	40.4	49.3	48.7
Head width	29.5	25.6	27.9	33.7	34.8	37.6
Shallowest web depth	ventral: 29	ventral: 27	ventral: 36	ventral: 40	ventral: 40	ventral: 50
Deepest web depth	dorsal: 42	dorsal: 41	dorsal: 45	dorsal: 50	dorsal: 62	dorsal: 59
Arm lengths (L/R) :1	74 76	71 75	90 91	91 89	104 97	101 98
2	74 64	68 70	80 81	90 83	98 90	90 94
3	72 53H	66 61H	82 65H	85 83	92 96	90 91
4	62 63	65 65	76 75	82 80	87 D	95 89
Male modified arm tip: 1	- 9	- 12	11 14	-	-	-
2	- 9	- 11	10D 13	-	-	-
3	- H	13 H	12 H	-	-	-
4	- 8	- 9	8 13	-	-	-
Sucker diameter	2.4	2.7	2.8	3.4	3.6	3.7
Sucker count R3	45H	44H	44H	72	76	74
Sucker count L3	50	46	48	73	74	71
Ligula length	2.7	3.0	3.6	-	-	-
Calamus length	1.5	1.8	2.2	-	-	-
Spermatophore number	-	-	1	-	-	-
Spermatophore length	-	-	25.1	-	-	-
Spermatophore width	-	-	1.2	-	-	-
Sperm reservoir length	-	-	10.1	-	-	-
Sperm cord whorls	-	-	~15 damaged	-	-	-
Egg number	-	-	-	submature	submature	25 mature 20-30 immature
Egg length	-	-	-	-	-	15.0
Egg width	-	-	-	-	-	6.0

TABLE 7. — Counts and measurements (raw data, measurements in mm) for female of *Haliphron atlanticus*, KARUBAR Stn CP 78 (MNHN 2021). D = damaged.

Sex	Female
Maturity	submature
Mantle length	73.2
Total length	many arms D
Weight (g)	165.0
Mantle width	50
Head width	48
Shallowest web depth	dorsal: 35D?
Deepest web depth	ventro-lateral: 55
Arm lengths (L/R): 1	D D
2	D D
3	124 110
4	95 D
Sucker diameter	4.4
Sucker count: R3	50+
L3	54
Egg number	submature
Egg length	-
Egg width	-

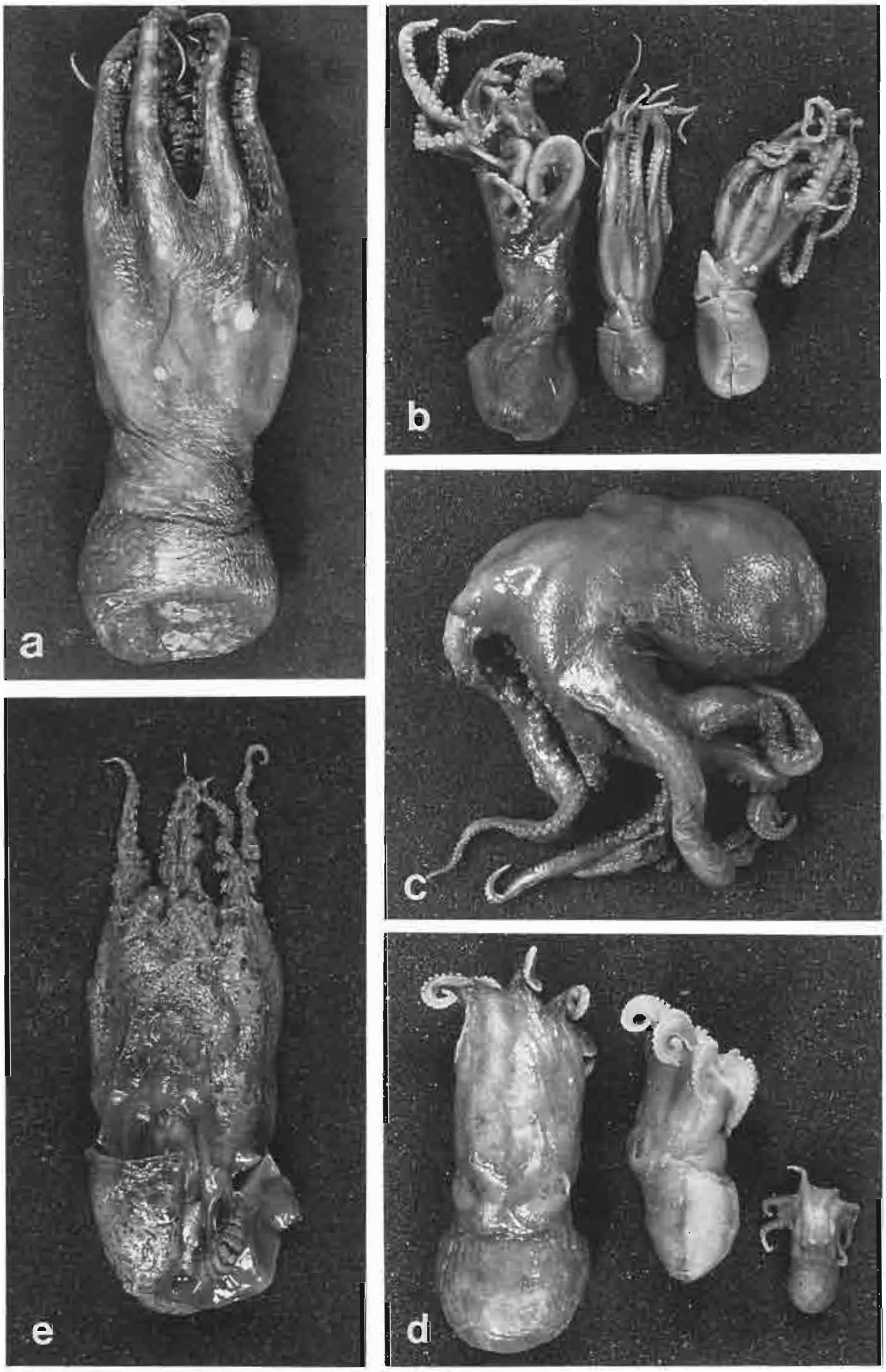

FIG. 11. — **a**, *Benthoctopus karubar* sp. nov. Dorsal view of 96.8 mm ML female, paratype (MNHN 2049). — **b**, *Octopus pyrum* sp. nov. From left: dorsal view of male paratype (34.8 mm ML, POLIPI) and ventral views of female paratype (22.4 mm ML, POLIPI) and male holotype (31.8 mm ML, MNHN 2029). — **c**, *Pteroctopus* sp. Dorsal view of 50.3 mm ML female (MNHN 2030). — **d**, *Eledone palari*. From left: dorsal view of 45.5 mm ML female, lateral view of 35.8 mm ML male, ventral view of 19.7 mm ML juvenile, (all MNHN 2020). — **e**, *Haliphron atlanticus*. Ventral view of 73.2 mm ML female (MNHN 2046). Mantle and funnel dissected open to display gills and funnel organ respectively.

8

Crustacea Decapoda : Stylodactylidae récoltés en Indonésie, aux îles Wallis et Futuna et au Vanuatu (campagnes KARUBAR, MUSORSTOM 7 et 8) Données complémentaires sur les Stylodactylidae de Nouvelle-Calédonie

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RÉSUMÉ

De nombreux spécimens de Stylodactylidae ont été récoltés, en 1991, aux îles Kai et Tanimbar (Moluques) lors de la campagne franco-indonésienne KARUBAR. Ce matériel renferme huit espèces, dont une nouvelle du genre *Parastylodactylus, P. moluccensis*. Deux espèces sont signalées pour la première fois de la région : *Parastylodactylus richeri* Cleva, 1990, et *Neostylodactylus affinis* Hayashi & Miyake, 1968. Les cinq autres étaient déja connues de la faune carcinologique indonésienne : *Stylodactylus tokarensis* Zarenkov, 1968, *S. multidentatus* Kubo, 1942, *S. libratus* Chace, 1983, *Parastylodactylus bimaxillaris* (Bate, 1888), et *Stylodactylus licinus* Chace, 1983, cette dernière signalée tout récemment par TAKEDA et HANAMURA (1994). Par ailleurs, certains spécimens, tout d'abord identifiés à *S. libratus* avec doute et présentant des caractères qui les rapprochent de *Stylodactylus pubescens* Burukovsky, 1990, nous posent un problème qui n'a pas trouvé de solution satisfaisante ; ils sont cités ici comme *Stylodactylus* sp. *Stylodactylus brevidactylus* Cleva, 1990, compte tenu de la variabilité observée chez 49 spécimens de *S. multidentatus* Kubo, récoltés lors de cette campagne, est mis en synonymie avec cette espèce.

Nous avons ajouté au matériel indonésien, pour chacune des différentes espèces, les spécimens rapportés récemment de Wallis et Futuna, du Vanuatu et de Nouvelle-Calédonie. Les espèces de ces trois dernières régions qui ne figurent pas parmi celles de la campagne KARUBAR, sont mentionnées à la fin de cette étude.

ABSTRACT

Crustacea Decapoda: Stylodactylidae collected in Indonesia, the Wallis and Futuna Islands and the Vanuatu (KARUBAR, MUSORSTOM 7 and 8 cruises). Additional information on the Stylodactylidae from New Caledonia.

During the French-Indonesian expedition KARUBAR off Kai and Tanimbar Islands (Moluccas) in 1991, eight species of Stylodactylidae were collected. One of these species, *Parastylodactylus moluccensis* was new. Two other species,

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Parastylodactylus richeri Cleva, 1990, and *Neostylodactylus affinis* Hayashi & Miyake, 1968, are recorded from the region for the first time and the remaining five species, *Stylodactylus tokarensis* Zarenkov, 1968, *S. multidentatus* Kubo, 1942, *S. libratus* Chace, 1983, *Parastylodactylus bimaxillaris* (Bate, 1888), and *Stylodactylus licinus* Chace, 1983, are already known from the Indonesian area, the last one having been recorded recently by TAKEDA and HANAMURA (1994). On the other hand, some specimens, at first identified doubtfully as *Stylodactylus libratus,* and related to *Stylodactylus pubescens* Burukovsky, 1990, have been causing trouble to us, and we have not find till now a satisfying solution : they are mentionned here as *Stylodactylus* sp. *Stylodactylus brevidactylus* Cleva, 1990, considering the variability observed through 49 specimens of *S. multidentatus* Kubo collected during this cruise, is synonymised with this species.

We added to the indonesian material, for each different species, the specimens collected recently from Wallis and Futuna, the Vanuatu and New-Caledonia. The species from these three countries which have not been collected during the KARUBAR expedition are mentionned at the end of this study.

INTRODUCTION

La campagne franco-indonésienne KARUBAR, effectuée au large des îles Kai et Tanimbar (Moluques) par le navire océanographique *"Baruna Jaya I"*, entre 150 et 1250 m de profondeur, du 21 octobre au 6 novembre 1991, a rapporté de nombreux échantillons de Stylodactylidae (CROSNIER, RICHER DE FORGES & BOUCHET, 1997).

D'autres récoltes de spécimens appartenant à cette famille ont été faites, depuis, au large des îles Wallis et Futuna, lors de la campagne MUSORSTOM 7, effectuée par le navire de l'ORSTOM, *"Alis"*, jusqu'à des profondeurs de 1300 m, du 5 mai au 4 juin 1992 (RICHER DE FORGES & MENOU, 1993) et au large de la Nouvelle-Calédonie lors de diverses campagnes en eaux profondes, toutes faites avec l' *"Alis"* : BERYX 11, du 13 au 23 octobre 1992 (LEHODEY *et all.*, 1992), SMIB 8, du 27 janvier au 2 février 1993, BATHUS 1, du 10 au 19 mars 1993, BATHUS 2, du 10 au 18 mai 1993, BATHUS 3, du 23 novembre au 1er décembre 1993, HALIPRO 1, du 19 au 31 mars 1994, BATHUS 4, du 1er au 11 août 1994 (RICHER DE FORGES & CHEVILLON, 1996).

À cela s'ajoutent une récolte faite, toujours en Nouvelle-Calédonie, lors de l'expédition MONTROUZIER, à une profondeur de 52 m (BOUCHET, 1994) et, enfin, des récoltes faites au Vanuatu, lors de la campagne MUSORSTOM 8 effectuée à bord de l' *"Alis"*, du 19 septembre au 14 octobre 1994, entre 100 et 1600 m de profondeur (RICHER DE FORGES *et al.*, 1996).

Ce sont toutes ces récoltes qui sont étudiées dans la présente note.

Les spécimens étudiés sont déposés dans les collections du Muséum national d'Histoire naturelle, à Paris (MNHN), au Puslitbang Oseanologi - LIPI, à Jakarta (POLIPI) et au National Museum of Natural History, à Washington (USNM).

Les abréviations utilisées dans les pages qui suivent sont : LC : longueur de la carapace mesurée du fond de l'orbite au milieu du bord postérieur de la carapace ; LR : longueur du rostre ; MxP3, P3, P4, P5 : troisième paire de maxillipèdes, troisième, quatrième et cinquième paires de péréiopodes.

LISTE DES STATIONS

Abréviations utilisées : CP : Chalut à Perche ; CC : Chalut à Crevettes ; DW : Drague Warren.

KARUBAR. **Indonésie.**

St. CP 05. — 22.10.1991, 05°46'39"S-132°20'4"E, 285-323 m : *Stylodactylus tokarensis.*

St. CP 09. — 23.10.1991, 05°19'21"S-132°30'35"E, 361-389 m : *Parastylodactylus bimaxillaris.*

St. CC 10. — 23.10.1991, 05°26'11"S-132°27'37"E, 329-389 m : *Parastylodactylus bimaxillaris.*

St. CP 16. — 24.10.1991, 05°17'06"S- 132°51'19"E, 315-348 m : *Stylodactylus libratus, Parastylodactylus moluccensis.*

St. CP 17. — 24.10.1991, 05°17'03"S-133°00'24"E, 459-439 m : *Stylodactylus tokarensis, S. libratus, S.* sp.

St. DW 18. — 24.10.1991, 05°17'49"S-133°00'51"E, 205-212 m : *Neostylodactylus affinis.*

St. CP 19. — 25.10.1991, 05°15'52"S-133°00'01"E, 604-576 m : *Stylodactylus licinus.*

St. CP 20. — 25.10.1991, 05°16'30"S-132°58'20"E, 768-810 m : *Stylodactylus licinus.*

St. CC 21. — 25.10.1991, 05°16'25"S-132°59'03"E, 688-694 m : *Stylodactylus licinus.*

St. DW 24. — 26.10.1991, 05°31'35"S-132°51'15"E, 243-240 m : *Stylodactylus multidentatus multidentatus.*

St. CP 27. — 26.10.1991, 05°34'22"S-132°51'29"E, 304-314 m : *Stylodactylus tokarensis, S. multidentatus multidentatus, Parastylodactylus richeri, P. moluccensis.*

St. DW 32. — 26.10.1991, 05°46'31"S-132°50'42"E, 170-206 m : *Neostylodactylus affinis.*

St. CP 33. — 27.10.1991, 06°02'10"S-132°38'21"E, 281-311 m : *Parastylodactylus bimaxillaris.*

St. CP 35. — 27.10.1991, 06°07'22"S-132°43'45"E, 390-502 m : *Stylodactylus licinus.*

St. CP 36. — 27.10.1991, 06°05'50"S-132°44'29"E, 268-210 m : *Parastylodactylus bimaxillaris.*

St. CP 38. — 28.10.1991, 07°38'41"S-132°29'22"E, 666-620 m : *Stylodactylus licinus.*

St. CC 41. — 28.10.1991, 07°47'28"S-132°39'04"E, 401-393 m : *Parastylodactylus bimaxillaris.*

St. CP 45. — 29.10.1991, 07°53'11"S-132°47'20"E, 301-305 m : *Parastylodactylus bimaxillaris.*

St. DW 50. — 29.10.1991, 07°59'09"S-133°01'56"E, 184-185 m : *Neostylodactylus affinis.*

St. CC 56. — 31.10.1991, 08°12'39"S-132°01'15"E, 552-549 m : *Stylodactylus licinus.*

St. CC 57. — 31.10.1991, 08°15'48"S-131°56'38"E, 603-622 m : *Stylodactylus licinus.*

St. CP 66. — 01.11.1991, 09°02'19"S-132°10'49"E, 211-217 m : *Stylodactylus multidentatus multidentatus.*

St. CP 67. — 01.11.1991, 08°58'59"S-132°07'20"E, 233-246 m : *Stylodactylus multidentatus multidentatus.*

St. CP 69. — 02.11.1991, 08°45'17"S-131°51'35"E, 356-367 m : *Parastylodactylus bimaxillaris.*

St. CP 70. — 02.11.1991, 08°39'14"S-131°49'16"E, 411-410 m : *Parastylodactylus bimaxillaris.*

St. CP 71. — 02.11.1991, 08°39'39"S-131°42'29"E, 477-480 m : *Stylodactylus licinus.*

St. CP 76. — 03.11.1991, 08°49'08"S-131°35'36"E, 400 m : *Parastylodactylus bimaxillaris.*

St. CP 79. — 03.11.1991, 09°13'34"S-131°22'35"E, 250-239 m : *Stylodactylus multidentatus multidentatus.*

St. CP 83. — 04.11.1991, 09°24'28"S-130°59'48"E, 285-298 m : *Stylodactylus multidentatus multidentatus, Parastylodactylus bimaxillaris.*

St. CP 84. — 04.11.1991, 09°22'41"S-131°07'17"E, 275-246 m : *Stylodactylus multidentatus multidentatus.*

St. CP 85. — 04.11.1991, 09°22'51"S-131°12'04"E, 244-239 m : *Stylodactylus multidentatus multidentatus.*

St. CP 86. — 04.11.1991, 09°23'59"S-131°14'29"E, 226-222 m : *Stylodactylus multidentatus multidentatus, Parastylodactylus bimaxillaris.*

MUSORSTOM 7. **Îles Wallis et Futuna**.

St. CP 531. — 16.05.1992, 12°32'S-176°39'W, 580-600 m: *Stylodactylus licinus.*

St. CP 550. — 18.05.1992, 12°15'S-177°28'W, 800-810 m : *Stylodactylus licinus.*

St. CC 554. — 18.05.1992, 12°14'S-177°28'W, 795-820 m : *Stylodactylus licinus.*

St. CP 565. — 20.05.1992, 11°47'S-178°25'W, 900 m : *Stylodactylus licinus.*

St. CP 638. — 30.05.1992, 13°37'S-179°56'E, 820-840 m : *Stylodactylus brucei.*

Sans numéro de station, 05.1992, drague, 500-610 m : *Parastylodactylus semblatae.*

BERYX 11. **Nouvelle-Calédonie**.

St. CP 08. — 15.10.1992, 24°54'S-168°21'E, 540-570 m : *Parastylodactylus tranterae.*

St. DW 09. — 26.10.1991, 24°44'S-170°07'E, 790-825 m : *Stylodactylus* sp.

St. DW 27. — 18.10.1992, 23°37'S-167°41'E, 460-470 m : *Stylodactylus laurentae.*

St. CP 53. — 21.10.1992, 23°48'S-168°17'E, 540-950 m : *Stylodactylus* sp.

St. CP 58. — 22.10.1992, 23°19'S-167°59'E, 850-920 m : *Stylodactylus licinus.*

St. CP 59. — 22.10.1992, 23°19'S-167°59'E, 750-800 m : *Stylodactylus licinus.*

St. CP 60. — 22.10.1992, 23°19'S-168°00'E, 580-600 m : *Stylodactylus licinus, S.* sp.

SMIB 8. **Nouvelle-Calédonie**.

St. DW 146. — 27.01.1993, 24°55,2'S-168°21,7'E, 514-522 m : *Stylodactylus laurentae.*

St. DW 150. — 27.01.1993, 24°54,3'S-168°22,2'E, 519-530 m : *Parastylodactylus tranterae.*

St. DW 160. — 28.01.1993, 24°46,1'S-168°08,1'E, 280-282 m : *Stylodactylus libratus.*

St. DW 180. — 30.01.1993, 23°47,7'S-168°18,1'E, 460-525 m : *Stylodactyloides crosnieri.*

St. DW 183. — 31.01.1993, 23°18,3'S-168°04,9'E, 330-367 m : *Stylodactyloides crosnieri.*

St. DW 185. — 31.01.1993, 23°16'S-168°04,3'E, 305-355 m : *Stylodactylus laurentae.*
St. DW 187. — 31.01.1993, 23°17,7'S-168°05,6'E, 390-540 m : *Stylodactyloides crosnieri.*
St. DW 191. — 01.02.1993, 22°57,0'S-168°19,2'E, 564-580 m : *Parastylodactylus semblatae.*
St. DW 193. — 01.02.1993, 22°58,7'S-168°20,1'E, 500-508 m : *Stylodactylus laurentae.*
St. DW 194. — 01.02.1993, 22°59,6'S-168°22,5'E, 491 m : *Stylodactylus laurentae.*
St. DW 195. — 01.02.1993, 22°58,9'S-167°20,2'E, 508-514 m : *Stylodactylus laurentae.*
St. DW 201. — 02.02.1993, 22°58,6'S-167°20,3'E, 500-504 m : *Stylodactylus laurentae, Parastylodactylus semblatae.*

BATHUS 1. **Nouvelle-Calédonie**.

St. CP 657. — 12.03.1993, 21°14'S-165°54'E, 490-530 m : *Parastylodactylus tranterae.*
St. CP 660. — 13.03.1993, 21°10'S-165°53'E, 786-800 m : *Stylodactylus licinus.*
St. CP 668. — 14.03.1993, 20°57'S-165°34'E, 205-219 m : *Stylodactylus multidentatus multidentatus.*
St. CP 670. — 14.03.1993, 20°54'S-165°53'E, 394-397 m : *Parastylodactylus richeri.*
St. CP 671. — 14.03.1993, 20°51'S-165°28'E, 450-470 m : *Parastylodactylus tranterae.*
St. DW 687. — 16.03.1993, 20°34'S-165°07'E, 408-440 m : *Parastylodactylus richeri.*
St. CP 701. — 18.03.1993, 20°57'S-165°35'E, 302-335 m : *Stylodactylus multidentatus multidentatus.*
St. CP 709. — 19.03.1993, 21°41'S-166°37'E, 650-800 m : *Stylodactylus licinus.*

BATHUS 2. **Nouvelle-Calédonie**.

St. DW 721. — 11.05.1993, 22°53'S-167°17'E, 525-547 m : *Parastylodactylus semblatae.*
St. DW 731. — 13.05.1993, 22°49'S-166°44'E, 300-370 m : *Stylodactylus multidentatus multidentatus.*
St. CP 737. — 13.05.1993, 23°03'S-167°00'E, 350-400 m : *Stylodactylus laurentae.*
St. CP 738. — 13.05.1993, 23°02'S-166°56'E, 558-647 m : *Parastylodactylus tranterae.*
St. CP 742. — 14.05.1993, 22°33'S-166°25'E, 340-370 m : *Stylodactylus multidentatus multidentatus.*
St. DW 758. — 16.05.1993, 22°18'S-166°10'E, 377-386 m : *Stylodactylus multidentatus multidentatus.*
St. CP 760. — 16.05.1993, 22°18'S-166°10'E, 455 m : *Stylodactylus multidentatus multidentatus.*

OPÉRATION MONTROUZIER. **Nouvelle-Calédonie**.

Chenal de Touho, 04.09.1993, 52 m : *Neostylodactylus amarynthis.*

BATHUS 3. **Nouvelle-Calédonie**.

St. DW 776. — 24.11.1993, 24°44'S-170°08'E, 770-830 m : *Stylodactylus* sp.
St. DW 786. — 25.11.1993, 23°54'S-169°49'E, 699-715 m : *Stylodactylus* sp.
St. DW 794. — 26.11.1993, 23°48'S-169°49'E, 751-755 m : *Stylodactylus* sp.
St. DW 830. — 29.11.1993, 23°19'S-168°01'E, 361-365 m : *Stylodactyloides crosnieri.*
St. CP 831. — 30.11.1993, 23°04'S-166°55'E, 650-658 m : *Stylodactylus licinus.*
St. CP 832. — 30.11.1993, 23°03'S-166°53'E, 650-669 m : *Stylodactylus licinus, Parastylodactylus tranterae.*
St. CP 833. — 30.11.1993, 23°03'S-166°58'E, 441-444 m : *Parastylodactylus tranterae.*
St. DW 836. — 30.11.1993, 23°02'S-166°59'E, 295-306 m : *Stylodactyloides crosnieri.*
St. CC 841. — 30.11.1993, 23°02'S-166°53'E, 640-680 m : *Stylodactylus licinus.*
St. CP 842. — 01.12.1993, 23°05'S-166°48'E, 830 m : *Stylodactylus licinus.*
St. CP 844. — 01.12.1993, 23°06'S-166°45'E, 908 m : *Stylodactylus licinus.*
St. CP 846. — 01.12.1993, 23°02'S-166°57'E, 500-514 m : *Parastylodactylus tranterae.*
St. CC 848. — 01.12.1993, 23°02'S-166°52'E, 680-700 m : *Stylodactylus licinus.*

HALIPRO 1. **Nouvelle-Calédonie**.

St. CP 867. — 22.03.1994, 21°26'S-166°18'E, 720-950 m : *Stylodactylus licinus.*
St. CP 869. — 23.03.1994, 21°14'S-165°55'E, 450-490 m : *Stylodactylus multidentatus multidentatus.*
St. CH 874. — 30.03.1994, 23°05'S-166°48'E, 708-830 m : *Stylodactylus licinus.*

St. CP 877. — 31.03.1994, 23°03'S-166°59'E, 464-480 m : *Stylodactylus laurentae.*

BATHUS 4. **Nouvelle-Calédonie**.

St. CP 892. — 02.08.1994, 21°01'S-164°27'E, 580-600 m : *Parastylodactylus tranterae.*
St. CP 897. — 03.08.1994, 20°15'S-163°51'E, 305-350 m : *Stylodactylus multidentatus multidentatus.*
St. CP 900. — 03.08.1994, 20°16'S-163°50'E, 580 m : *Stylodactylus multidentatus multidentatus.*
St. CP 905. — 04.08.1994, 19°02'S-163°15'E, 294-296 m : *Stylodactylus multidentatus multidentatus.*
St. CP 910. — 05.08.1994, 18°59'S-163°08'E, 560-608 m : *Parastylodactylus bimaxillaris, P. semblatae.*
St. CP 911. — 05.08.1994, 18°57'S-163°08'E, 566-558 m : *Parastylodactylus semblatae.*
St. CP 912. — 05.08.1994, 18°55'S-163°07'E, 702-690 m : *Parastylodactylus tranterae, P. semblatae.*
St. CP 921. — 06.08.1994, 18°46'S-163°17'E, 613-610 m : *Parastylodactylus semblatae.*
St. CP 922. — 06.08.1994, 18°48'S-163°18'E, 600 m : *Parastylodactylus semblatae.*
St. DW 923. — 06.08.1994, 18°51'S-163°24'E, 502-470 m : *Stylodactylus laurentae.*
St. DW 924. — 07.08.1994, 18°54'S-163°24'E, 344-360 m : *Stylodactylus laurentae.*
St. DW 929. — 07.08.1994, 18°51'S-163°23'E, 502-516 m : *Parastylodactylus semblatae.*
St. CP 930. — 07.08.1994, 18°51'S-163°23'E, 530-520 m : *Parastylodactylus semblatae.*
St. DW 931. — 07.08.1994, 18°55'S-163°24'E, 360-377 m : *Stylodactylus laurentae.*
St. DW 934. — 08.08.1994, 19°05'S-163°28'E, 231-240 m : *Neostylodactylus affinis.*
St. CP 953. — 11.08.1994, 21°45'S-166°36'E, 220-234 m : *Stylodactylus multidentatus multidentatus.*

RFO. **Nouvelle-Calédonie**, 12.09.1994, 22°33,41'S-166°25,74'E, 300 m : *Parastylodactylus richeri.*

MUSORSTOM 8. **Vanuatu**.

St. CP 974. — 22.09.1994, 19°21'S-169°28'E, 492-520 m : *Parastylodactylus semblatae.*
St. CP 980. — 22.09.1994, 19°21'S-169°25'E, 450-433 m : *Parastylodactylus richeri.*
St. CP 990. — 24.09.1994, 18°51'S-168°50'E, 980-990 m : *Stylodactylus licinus.*
St. CP 991. — 24.09.1994, 18°51'S-168°52'E, 936-910 m : *Stylodactylus licinus.*
St. CP 992. — 24.09.1994, 18°52'S-168°55'E, 775-748 m : *Stylodactylus licinus, S. macropus.*
St. CP 1007. — 25.09.1994, 18°51'S-168°55'E, 720-830 m : *Stylodactylus licinus, S. multidentatus multidentatus.*
St. CP 1024. — 28.09.1994, 17°48'S-168°38'E, 335-370 m : *Parastylodactylus richeri.*
St. CP 1025. — 28.09.1994, 17°49'S-168°39'E, 385-410 m : *Parastylodactylus richeri.*
St. CP 1027. — 28.09.1994, 17°53'S-168°39'E, 550-571 m : *Parastylodactylus semblatae.*
St. CC 1034. — 29.09.1994, 17°54'S-168°42'E, 690-750 m : *Stylodactylus licinus.*
St. CP 1035. — 29.09.1994, 17°56'S-168°44'E, 765-780 m : *Stylodactylus licinus.*
St. CP 1050. — 01.10.1994, 16°39'S-168°01'E, 541-577 m : *Stylodactylus licinus.*
St. CP 1055. — 01.10.1994, 16°30'S-167°55'E, 572-580 m : *Stylodactylus licinus.*
St. CC 1056. — 01.10.1994, 16°33'S-167°55'E, 602-620 m : *Stylodactylus licinus.*
St. DW 1061. — 02.10.1994, 16°14'S-167°20'E, 458-512 m : *Stylodactylus multidentatus multidentatus.*
St. DW 1065. — 02.10.1994, 16°16'S-167°21'E, 360-419 m : *Stylodactylus multidentatus multidentatus.*
St. CP 1074. — 04.10.1994, 15°48'S-167°24'E, 775-798 m : *Stylodactylus licinus.*
St. CP 1075. — 04.10.1994, 15°53'S-167°27'E, 956-944 m : *Stylodactylus licinus.*
St. CP 1080. — 05.10.1994, 15°57'S-167°27'E, 799-850 m : *Stylodactylus licinus.*
St. CP 1087. — 06.10.1994, 15°10'S-167°14'E, 394-421 m : *Stylodactylus multidentatus multidentatus.*
St. CP 1088. — 06.10.1994, 15°09'S-167°15'E, 425-455 m : *Stylodactylus multidentatus multidentatus.*
St. CP 1091. — 06.10.1994, 15°10'S-167°13'E, 344-350 m : *Parastylodactylus bimaxillaris.*
St. CP 1092. — 06.10.1994, 15°10'S-167°12'E, 314-321 m : *Stylodactylus multidentatus multidentatus.*
St. CP 1114. — 08.10.1994, 14°52'S-167°03'E, 647 m : *Stylodactylus licinus.*
St. CP 1135. — 11.10.1994, 15°40'S-167°02'E, 282-375 m : *Neostylodactylus affinis.*
St. CP 1136. — 11.10.1994, 15°40'S-167°01'E, 398-400 m : *Stylodactylus multidentatus multidentatus.*

St. CP 1137. — 11.10.1994, 15°41'S-167°02'E, 360-371 m : *Stylodactylus multidentatus multidentatus, Parastylodactylus richeri.*

ÉTUDE SYSTÉMATIQUE

Genre *STYLODACTYLUS* A. Milne Edwards, 1881

Stylodactylus licinus Chace, 1983

Fig. 4 A-D

Stylodactylus licinus Chace,1983 : 14, fig. 6. — HAYASHI, 1986 : 93, fig. 52 (photo couleurs) ; 1991 : 41. — CLEVA, 1990 : 87, fig. 3 a-j, 18 f-g ; 1994 : 58. — TAKEDA & HANAMURA, 1994 : 17, fig. 8 a.

Stylodactylus tokarensis Zarenkov, 1968 : 58 (*pro parte*), fig. 2 (péréiopode 3) et fig. 3 (non autres dessins de la fig. 2 = *Stylodactylus tokarensis* Zarenkov, 1968).

Stylodactylus stebbingi - TORIYAMA & HAYASHI, 1982 : 90, 92, 95, 105 (non Hayashi & Miyake, 1968, *fide* HAYASHI *in* BABA, HAYASHI & TORIYAMA, 1986 : 93). — KING, 1984 : 178, 179 (fig.), 181 ; 1986 : 12, fig. 9 (non Hayashi & Miyake, 1968).

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 19, 604-576 m : 8 ♂ 6 à 12,5 mm ; 7 ♀ 7 à 15 mm (4 ov.) (USNM) ; 1 ♀ avec bopyre (MNHN-Na 12150). — St. CP 20, 768-810 m : 10 ♂ 6 à 13 mm ; 21 ♀ (9 ov. et 1 non ov. avec bopyre) 6 à 15 mm (MNHN-Na 12134). — St. CC 21, 688-694 m : 9 ♂ 7,5 à 12,5 mm ; 22 ♀ (11 ov.) 6 à 15 mm (POLIPI). — St. CP 35, 390-502 m : 1 ♀ 9 mm (MNHN-Na 12136). — St. CP 38, 666-620 m : 9 ♀ (5 ov.) 6 à 17 mm (MNHN-Na.12135). — St. CC 56, 552-549 m : 1 ♀ ov. 16,5 mm (POLIPI). — St. CC 57, 603-622 m : 1 ♂ avec bopyre, 16 mm (MNHN-Na 12151) ; 1 ♀ ov. 14,5 mm (POLIPI). — St. CP 71, 477-480 m : 1 ♀ ov. 13,5 mm (MNHN-Na 12137).

Wallis et Futuna. MUSORSTOM 7 : st. CP 531, 580-600 m : 1 ♂ 10,5 mm (MNHN-Na.14454). — St. CP 550, 800-810 m : 1 ♀ ov. 16,5 mm (MNHN-Na 14455). — St. CC 554, 795-820 m : 1 ♀ 13 mm (MNHN-Na 14457). — St. CP 565, 900 m : 1 ♂ 14,5 mm (MNHN-Na 14456).

Nouvelle-Calédonie. BERYX 11 : st. CP 58, 850-920 m : 1 ♂ 12,5mm (MNHN-Na 14625). — St. CP 59, 750-800 m : 1 ♂ 8,5mm, 3 ♀ 10 à 12 mm (MNHN-Na 14619) ; 1 ♂ 9 mm, 1 ♀ ov. 15,5 mm (MNHN-Na 14624). — St. CP 60, 580-600 m : 1 ♀ 11 mm (MNHN-Na 14621).

BATHUS 1 : st. CP 660, 786-800 m : 1 ♂ 6,5 mm, 1 ♀ ov. 12 mm (MNHN-Na 14617). — St. CP 709, 650-800 m : 1 ♀ 8,5 mm (MNHN-Na 14623).

BATHUS 3 : st. CP 831, 650-658 m : 1 ♀ 9,5 mm (MNHN-Na 14484). — St. CP 832, 650-669 m : 1 ♀ 7 mm (MNHN-Na 14475). — St. CC 841, 640-680 m : 1 ♀ 12 mm (MNHN-Na 14476). — St. CP 842, 830 m : 1 ♀ ov. 15 mm (MNHN-Na 13193). — St. CC 844, 908 m : 1 ♂ 11 mm (MNHN-Na 14462). — St. CC 848, 680-700 m : 1 ♀ ov. 12,5 mm (MNHN-Na 14483).

HALIPRO 1 : st. CP 867, 720-950 m : 1 ♂ 9 mm (MNHN-Na 14479). — St. CH 874, 708-830 m : 1 ♀ ov. 16 mm (MNHN-Na 13192).

Vanuatu. MUSORSTOM 8 : st CP 990, 980-990 m : 1 ♂ 8 mm, 1 ♀ 10,5 mm (MNHN-Na 13194). — St. CP 991, 936-910 m : 2 ♂ 12 et 13 mm, 1 ♀ 9,5 mm (MNHN-Na 13195). — St. CP 992, 775-748 m : 1 ♂ 11,5 mm (MNHN-Na 13196), 1 ♀ ov. 13 mm (MNHN-Na 14458). — St. CP 1007, 720-830 m : 1 ♀ 15 mm (MNHN-Na 13197). — St. CC 1034, 690-750 m : 1 ♂ 10 mm, 1 ♀ 10,5 mm (MNHN-Na 13198). — St. CP 1035, 765-780 m : 5 ♂ 7,5 à 15 mm, 3 ♀ (1 ov.) 10 à 14 mm (MNHN-Na 13199). — St. CP 1050, 541-577 m : 2 ♂ 10 et 11,5 mm, 1 ♀ 10 mm (MNHN-Na 13200) ; 1 ♀ 13 mm (MNHN-Na 14460). — St. CP 1055, 572-580 m : 1 ♂ 15 mm (MNHN-Na 14459), 1 ♂ 16 mm (MNHN-Na 13201), 1 ♂ 16,5 mm (MNHN-Na 14461). — St. CC 1056, 602-620 m : 2 ♂ 9 et 9,5 mm (MNHN-Na 13202). — St. CP 1074, 775-798 m : 1 ♂ 14 mm (MNHN-Na 13203). — St. CP 1075, 956-944 m : 1 ♂ 13 mm (MNHN-Na 13204). — St. CP 1080, 799-850 m : 1 ♀ ov. 15 mm (MNHN-Na 13205). — St. CP 1114, 647 m : 1 ♂ 10 mm (MNHN-Na 13206).

Le grand nombre de spécimens identifiés ici à *Stylodactylus licinus* (146 au total, dont 92 indonésiens) permet d'étendre les variations individuelles relevées lors de notre étude de 1990 (CLEVA, 1990 : 88), principalement en ce qui concerne la longueur relative du rostre, ainsi que le nombre de ses épines. C'est ainsi que, sur les 77 spécimens dont le rostre est intact, le rapport des longueurs du rostre à la carapace (LR/LC) varie de 1,2 à 2,1 (moyenne = environ 1,65), alors qu'en 1990 nous avions relevé des variations comprises entre 1,5 et 2,0. On compte de 32 à 46 épines dorsales (moyenne = 38), et de 14 à 29 épines ventrales (moyenne = 20), contre respectivement 34 à 45 et 18 à 27 relevés alors (un mâle d'Australie, étudié en 1994, présente 12 épines ventrales seulement).

Ces chiffres nous permettent de lever l'incertitude concernant l'identification d'un spécimen japonais de la baie de Tosa, prêté par K.-I. HAYASHI en 1990, dont le rostre, plus court que celui des spécimens que nous avions alors examinés, nous faisait douter du statut exact de cet individu (CLEVA, 1990 : 90). HAYASHI (1991 : 42) a de nouveau signalé *S. licinus* du sud de Kyushu, où une femelle ovigère a été capturée à 808-826 m de profondeur.

Les autres différences individuelles relevées sont les suivantes : absence d'épines supra-orbitaires chez une jeune femelle indonésienne de 6 mm (station CC 21), et chez un mâle du Vanuatu de 9 mm (station CC 1056) ; 4ème pleuron abdominal non terminé en pointe (d'un seul côté ou des deux côtés) chez une quinzaine de spécimens. Ces variations ne sont apparemment pas en relation avec la taille des animaux.

La courbure du rostre, plus ou moins accentuée, ne permet pas d'indiquer avec certitude le sexe des spécimens : on peut cependant remarquer que chez les mâles, et notamment les plus grands, le rostre est presque horizontal, tandis que sa courbure vers le haut est plus prononcée chez les femelles et les jeunes mâles.

REMARQUES. — TAKEDA et HANAMURA (1994) ont tout récemment signalé *Stylodactylus licinus* de l'Indonésie (Mer de Flores, 280 m, 1 ♀ ov.).

Dans le matériel qu'ils ont étudié figure également un spécimen mâle, identifié *Stylodactylus* sp. (1994 : 18, fig. b-c), capturé entre 558 et 593 m. Il y a tout lieu de penser, à la lecture de leur description et de leurs remarques, qu'il s'agit en fait d'un exemplaire de *Stylodactylus licinus* : le rostre plutôt droit et plus fin doit correspondre au fait qu'il s'agit d'un mâle, de taille moyenne. Un examen de ce spécimen s'avère toutefois indispensable pour en confirmer l'identification.

COLORATION. — La couleur de fond des spécimens varie assez sensiblement du rose au rouge (Fig. 4 A-D).

DISTRIBUTION. — *Stylodactylus licinus* est connu des Philippines (550-970 m), de la Nouvelle Calédonie (580-950 m), des îles Chesterfield (650-970 m), du Vanuatu (541-990 m), des îles Fidji (494 m), des îles Wallis et Futuna (580-900 m), du Japon (432-826 m), de l'Australie (222-1000 m) et de l'Indonésie (280-810 m). La distribution bathymétrique de l'espèce semble concentrée entre 500 et 1000 m, les récoltes à des profondeurs moindres (Australie, 222 m et Indonésie, 280 m) semblant assez exceptionnelles.

Stylodactylus tokarensis Zarenkov, 1968

Stylodactylus tokarensis Zarenkov, 1968 : 58 (*pro parte*), fig. 2 (non fig. 2, dessin du troisième péréiopode, et fig. 3 = *Stylodactylus licinus* Chace, 1983). — CLEVA, 1990 : 91, fig. 3 k-p, 4-5.

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 05, 285-323 m : 1 ♂ 7,5 mm (POLIPI). — St. CP 17, 459-439 m : 1 ♂ 8 mm (MNHN-Na 12138). — St. CP 27, 304-314 m : 1 ♂ très abimé et incomplet (POLIPI).

Chez les deux mâles en bon état, le rapport des longueurs LR/LC est égal ou à peine supérieur à 1. Les formules rostrales s'écrivent 30(7)/7 ; 28(7)/6 ; 30(6)/6, nombres qui s'inscrivent dans les limites des variations observées dans notre travail de 1990.

DISTRIBUTION. — Nous avions déjà signalé *Stylodactylus tokarensis* de l'Indonésie (Détroit de Macassar, 595-592 m, CLEVA, 1990 : 91) ; les récoltes de 1991 ont été réalisées entre 285 et 459 m. Cette espèce, décrite à partir d'un spécimen mâle capturé en mer de Chine orientale, à 820 m de profondeur, est également présente en Nouvelle-Calédonie (485-850 m) et aux îles Chesterfield (500-570 m).

Stylodactylus multidentatus multidentatus Kubo, 1942

Stylodactylus multidentatus Kubo, 1942 : 34, fig. 4-5. — HAYASHI & MIYAKE, 1968 : 586, fig. 1. — MIYAKE, 1982 : 26, pl. 9, fig. 5 (photo couleur). — CHACE, 1983 : 11 (clé), 20, fig. 8 a-o. — CHAN & YU, 1985 : 290, pl. I E-F (photos couleurs). — HAYASHI, 1986 : 93, fig. 53 (photo couleur). — KENSLEY, TRANTER & GRIFFIN, 1987 : 293.
Stylodactylus multidentatus multidentatus - CLEVA, 1990 : 100, fig. 7, 8 h-m ; 1994 : 59.

Stylodactylus discissipes - BALSS, 1933 : 84 (non Bate, 1888).
Stylodactylus bimaxillaris - MIYAKE, 1982, pl. 9, fig. 4 (non Bate, 1888).
Stylodactylus brevidactylus - CLEVA, 1990 : 106, fig. 8 a-g.

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. DW 24, 243-240 m : céphalothorax seulement. — St. CP 27, 304-314 m : 3 ♂ 9,5 à 16,5 mm (MNHN-Na 12139). — St. CP 66, 211-217 m : 1 ♀ 14,5 mm (POLIPI). — St. CP 67, 233-246 m : 9 ♂ 14,5 à 18 mm ; 4 ♀ (3 ov.) 16,5 à 19,5 mm (MNHN-Na 12140). — St. CP 79, 250-239 m : 8 ♂ 15 à 17 mm ; 9 ♀ (8 ov.) 10,5 à 18,5 mm (POLIPI). — St. CP 83, 285-298 m : 3 ♂ 14,5 à 18,5 mm (MNHN-Na 12156). — St. CP 84, 275-246 m : 3 ♂ 16 à 19 mm ; 1 ♀ ov. 13,5 mm (USNM). — St. CP 85, 244-239 m : 1 ♂ 16,5 mm (POLIPI). — St. CP 86, 226-222 m : 3 ♂ 16,5 à 18,5 mm ; 4 ♀ (3 ov.) 9 à 20,5 mm (MNHN-Na 12141).

Vanuatu. MUSORSTOM 8 : st. CP 1007, 720-830 m : 1 ♀ 13 mm (MNHN-Na 13210). — St. DW 1061, 458-512 m : 1 ♂ 14 mm (MNHN-Na 13211). — St. DW 1065, 360-419 m : 1 ♂ 12 mm (MNHN-Na 13212), 1 ♀ 12 mm (MNHN-Na 14472). — St. CP 1087, 394-421 m : 4 ♀ (1 ov.) 8,5 à 14 mm (MNHN-Na 13213). — St. CP 1088, 425-455 m : 1 ♂ 14,5 mm (MNHN-Na 13214). — St. CP 1092, 314-321 m : 1 ♀ 8,5 mm (MNHN-Na 13215). — St. CP 1136, 398-400 m : 25 ♂ 10,5 à 15,5 mm, 9 ♀ (6 ov.) 10,5 à 15 mm (MNHN-Na 13216). — St. CP 1137, 360-371 m : 29 ♂ 9,5 à 14,5 mm (1 sp. avec bopyre), 20 ♀ (8 ov.) 8 à 14 mm (MNHN-Na 13217).

Nouvelle-Calédonie. BATHUS 1 : st. CP 668, 205-219 m : 1 ♂ 8,5 mm, 3 ♀ 5 à 6,5 mm (MNHN-Na 14641). — St. CP 701, 302-335 m : 1 ♀ 6 mm (MNHN-Na 14639).

BATHUS 2 : st. DW 731, 300-370 m : 1 ♂ 14 mm (MNHN-Na 14637). — St. CP 742, 340-470 m : 1 ♂ 11 mm, 1 ♀ 11,5 mm (MNHN-Na 14629). — St. DW 758, 377-386 m : 1 ♂ 8,5 mm (MNHN-Na 14638). — St. CP 760, 455 m : 1 ♂ 8 mm (MNHN-Na 14636).

HALIPRO 1 : st. CP 869, 450-490 m : 1 ♂ 14,5 mm (MNHN-Na 14478).

BATHUS 4 : st. CP 897, 305-350 m : 1 ♂ 11 mm (MNHN-Na 14380). — St. CP 900, 580 m : 1 ♂ 12 mm (MNHN-Na 14379), 1 ♂ 14 mm (MNHN-Na 13207). — St. CP 905, 294-296 m : 1 ♀ 8,5 mm (MNHN-Na 13208). — St. CP 953, 220-234 m : 1 ♂ 11,5 mm (MNHN-Na 13209).

L'observation de ce matériel complémentaire confirme, là encore, la variabilité intraspécifique importante de cette espèce, et nous a conduit à reconsidérer le statut de *Stylodactylus brevidactylus*, décrit lors de notre étude de 1990 à partir d'un spécimen unique, aux dactyles des P3 à P5 particulièrement courts par rapport à ce que l'on observe habituellement chez *Stylodactylus multidentatus*. Dans les collections étudiées, deux spécimens indonésiens de la station CP 27 montrent en effet des dactyles courts, mais dont les longueurs relatives par rapport au propode sont intermédiaires entre celles notées chez *S. multidentatus* (CLEVA, 1990 : 102) et celles indiquées pour *S. brevidactylus* (CLEVA, 1990 : 106) ; ce dernier peut alors être considéré comme le terme extrême, observé jusqu'à présent pour ce caractère chez *S. multidentatus* et, avec cette hypothèse, doit être mis en synonymie avec lui. Ceci semble d'autant plus justifié que les autres caractères retenus pour définir *S. brevidactylus* (taille des spinules de l'écaille antennaire, longueur relative des péréiopodes) sont, eux aussi, sujet à des variations notables, même si une tendance moyenne semble se dégager (un relevé précis de chaque caractère conduirait de toute évidence à une courbe de Gauss). C'est ainsi, par exemple, que dans la très grande majorité des cas, les spinules qui ornent le bord de l'écaille antennaire sont peu nombreuses et de petite taille.

Les variations observées dans la longueur relative du rostre et de son armature, chez les spécimens indonésiens, s'inscrivent tout à fait dans celles notées en 1990 pour les exemplaires des Philippines : le rapport LR/LC varie de 0,9 à 1,2 (moyenne 1,05 pour 39 spécimens) ; on compte de 40 à 63 épines rostrales dorsales (moyenne = 48), et de 15 à 28 épines ventrales (moyenne = 21). Par ailleurs, le rapport LR/LC des spécimens de Nouvelle-Calédonie est sensiblement plus grand que chez les spécimens indonésiens, comme nous l'avions déjà noté en ce qui concerne les spécimens philipppins (CLEVA, 1990 : 104) : chez 11 spécimens au rostre en bon état, il varie entre 1,20 et plus de 1,35.

Pour les spécimens du Vanuatu, nous avons relevé que, sur 70 spécimens au rostre complet, le rapport LR/LC varie entre 1,0 et 1,4 (moyenne = 1,3). Le nombre d'épines rostrales dorsales varie entre 34 et 52 (moyenne = 44), et celui des épines ventrales entre 16 et 31 (moyenne = 22). Les rapports des longueurs propode/dactyle des P3 et P4 varient respectivement de 1,8 à 3,2 et de 2,4 à 3,7 (rappels : spécimens philippins : P3 : 1,8 à 2,2 ; P4 : 2,2 à 3,1 ; *Stylodactylus "brevidactylus"* : P3 : 3,0 ; P4 : 3,5) : cette importante variabilité vient conforter la mise en synonymie de *S. brevidactylus* avec *S. multidentatus*.

DISTRIBUTION. — Largement répandue dans l'Indo-Ouest Pacifique : Japon (225-300 m), Philippines (152-366 m), Taïwan (150-250 m), Australie (237-412 m), Nouvelle-Calédonie (205-580 m), Vanuatu (314-830 m), Indonésie (146-314 m). La répartition bathymétrique semble concentrée entre 150 et 400-450 m environ. Un spécimen a été récolté entre 720 et 830 m lors de la station CP 1007 de MUSORSTOM 8, ce qui semble exceptionnel, pour ne pas dire douteux. Si l'on fait abstraction de ce cas particulier, la profondeur maximale observée est de 580 m.

Stylodactylus libratus Chace, 1983

Fig. 1 A, C, E ; 2 A, C

Stylodactylus libratus Chace, 1983 : 12, fig. 5. — KENSLEY, TRANTER & GRIFFIN, 1987 : 292 . — CLEVA, 1990 : 108, fig. 9 b, 18 a-b. — HAYASHI, 1991 : 40.

MATÉRIEL EXAMINÉ. — **Indonésie**. *"Albatross"* Expedition 1907-1910 : st. 5645, Célèbes, Selat Butung, 5°29'06"S-122°36'06"E, 377 m, 16.12.1909 : 1 ♂, holotype, 14 mm (USNM 196081).

KARUBAR : st. CP 16, 315-348 m : 1 ♂ 11,5 mm (MNHN-Na 12158). — St. CP 17, 459-439 m : 1 ♂ 12 mm (MNHN-Na 12967).

Nouvelle-Calédonie. BIOCAL : st. CP 105, 21°30'S-166°21'E, 335-330 m, 08.09.1985 : 1 ♂ 8,5 mm, 1 ♀ ov. 9 mm (MNHN-Na 10658).

SMIB 8 : st. DW 160, 280-282 m : 1 ♀ ov. 8 mm (MNHN-Na 14797).

Îles Loyauté. MUSORSTOM 6 : st. DW 391, 20°47,35'S-167°05,70'E, 390 m, 13.02.1989 : 1 ♀ 7,5 mm (MNHN-Na 11368). — St. CP 401, 20°42,15'S-167°00,35'E, 270 m, 14.02.1989 : 1 ♂ 7,5 mm (MNHN-Na 11899).

Îles Chesterfield. MUSORSTOM 5 : st.299, 22°47,70'S-159°23,70'E, 360-390 m, 11.10.1986 : 1 ♂ 5,5 mm (MNHN-Na 10919). — St. DW 301, 22°06,90'S-159°24,60'E, 487-610 m, 12.10.1986 : 1 ♂ 4,5 mm, 2 ♀ 5,5 et 7 mm (MNHN-Na 10918).

Les deux spécimens récoltés en Indonésie peuvent être rapportés avec une assez bonne approximation à l'espèce de CHACE, décrite d'après un spécimen unique provenant de la même région, même si existent entre eux quelques différences comme la taille relative du rostre et celle de l'œil par exemple (Fig. 1 E et 2 A). Les neuf spécimens de Nouvelle-Calédonie et des îles Loyauté et Chesterfield, déjà cités dans notre travail de 1990, beaucoup plus petits, ont également été identifiés à *S. libratus*. Tous ont en commun un rostre au moins aussi long que la carapace (LR/LC compris entre 1 et 1,3), armé ventralement d'au moins 5 épines (entre 5 et 13).

Un second “groupe” de spécimens, identifiés dans un premier temps à *S. libratus* avec des réserves, continue de nous interroger. Il est étudié ci-après, sous la dénomination *Stylodactylus* sp.

Stylodactylus sp.

Fig. 1 B, D, F ; 2 B, D, F

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 17, 459-439 m : 2 ♀ 13 et 16 mm (MNHN-Na 12142).

Nouvelle-Calédonie. BIOCAL : st. DW 51, 23°05'S-167°44'E, 680-700 m, 31.08.1985 : 1 ♀ 8,5 mm (MNHN-Na 10917) (identifié à *S. libratus* par CLEVA, 1990).

CHALCAL 2 : st. DW 72, 24°54,50'S-168°22,30'E, 527 m, 28.10.1986 : 1 ♀ 10,5 mm (MNHN-Na 10920) (identifié à *S. libratus* par CLEVA, 1990).

BERYX 11 : st. DW 09, 790-825 m : 1 ♂ 12,5 mm (MNHN-Na 12159). — St. CP 53, 540-950 m : 1 ♀ 11,5 mm (MNHN-Na 14649). — St. CP 60, 580-600 m : 1 ♂ 13 mm (MNHN-Na 14647) ; 1 ♂ 10 mm, 1 ♀ carapace abimée (MNHN-Na 14648).

BATHUS 3 : st. DW 776, 770-830 m : 1 ♂ 9 mm, 2 ♀ 5,5 et 10,5 mm (MNHN-Na 14480). — St. DW 786, 699-715 m : 1 ♀ 9 mm (MNHN-Na 12164). — St. DW 794, 751-755 m : 1 ♀ 7,5 mm (MNHN-Na 12163).

Outre le fait que ces spécimens possèdent un rostre court (LR/LC compris entre 0,7 et 0,85), armé ventralement de 5 épines au plus (2 à 5), d'autres différences apparaissent nettement lorsque l'on compare, deux à deux, des spécimens de ce type avec des spécimens identifiés à *S. libratus* de même taille et, si possible, de même sexe (Na 11368 ♀ *S. libratus* et Na 12163 ♀ *S.* sp., fig. 1A et 1B ; Na 10658 ♂ et Na 10917 ♀ ; Na 10658 ♀ et Na 12164 ♀, fig. 1C et 1D ; Na 12158 ♂ et Na 14649 ♀, fig. 1E et 1F). Ces différences semblent bien indiquer, à priori, que l'on est en présence de deux “lignées” : on peut noter en effet que, chez *Stylodactylus* sp.,

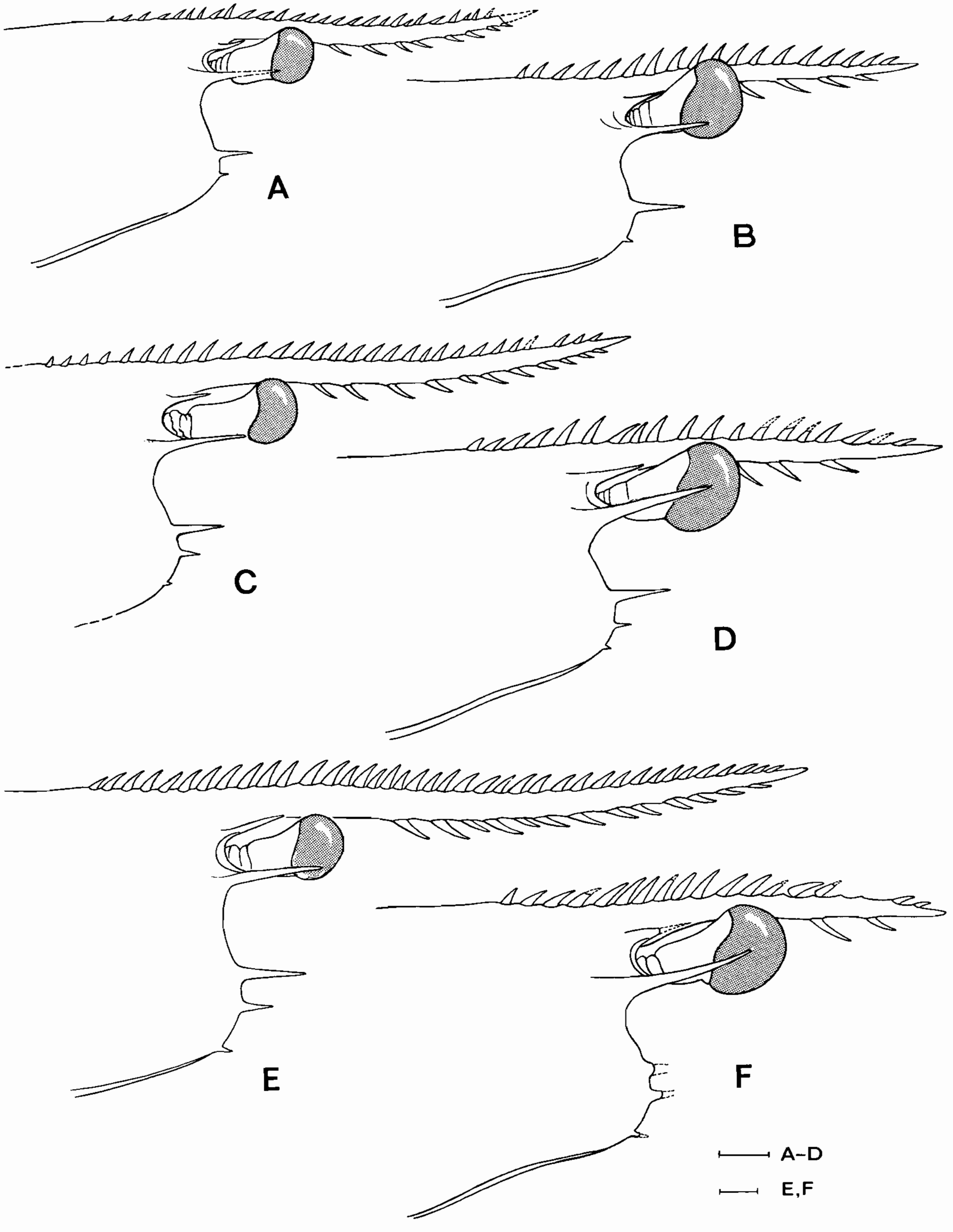

FIG. 1. — **A**, *Stylodactylus libratus*, Nouvelle-Calédonie, ♀ 7,5 mm (MNHN-Na 11368) ; **B**, *Stylodactylus* sp., Nouvelle-Calédonie, ♀ 7,5 mm (MNHN-Na 12163) ; **C**, *S. libratus*, Nouvelle-Calédonie, ♀ 9 mm (MNHN-Na 10658) ; **D**, *Stylodactylus* sp., Nouvelle-Calédonie, ♀ 9 mm (MNHN-Na 12164) ; **E**, *S. libratus*, Indonésie, ♂ 11,5 mm (MNHN-Na 12158) ; **F**, *Stylodactylus* sp., Nouvelle-Calédonie, ♀ 11,5 mm (MNHN-Na 14649). Échelles = 1 mm.

l'oeil est plus volumineux, les épines rostrales plus longues et plus robustes, les épines antennaires et branchiostèges plus longues. Les spinules qui ornent les écailles antennaires sont également plus longues.

Toutefois, lorsqu'il s'agit de spécimens plus grands, les différences sont plus difficiles à appréhender : ainsi le mâle 12159 *Stylodactylus* sp. possède des épines rostrales plus courtes que celles du mâle 12142 *S. libratus* (Fig. 2A et 2B), ce qui contredit ce qui précède. De même, le volume de la cornée est assez comparable chez les plus grands spécimens (Fig. 2A et 2B, 2C et 2D).

Ces spécimens à rostre court ont des affinités certaines avec *Stylodactylus pubescens* Burukovsky, espèce récoltée sur les rides sous-marines de Sala-y-Gomez et de Nasca, au large du Chili, dans l'Est Pacifique, par 545-800 m de profondeur. L'auteur nous a aimablement fait don de deux spécimens, un mâle de LC 9,5 mm et une femelle ovigère de LC 8,5 mm. Cette espèce, tout comme *Stylodactylus* sp., possède un rostre plus court que la carapace, armé ventralement de 2 à 4 épines, et des épines antennaires et branchiostèges longues. Comparés à des spécimens de *Stylodactylus* sp. de taille équivalente, ces 2 spécimens montrent des épines rostrales sensiblement plus fines, un rostre plus recourbé vers le bas, des péréiopodes sensiblement plus longs et plus grêles (Fig. 2E et 2F).

On comprendra dans ces conditions nos hésitations à décider du statut de *Stylodactylus* sp.

1) Les différences observées avec certains des spécimens identifiés à *S. libratus* , les différences de profondeur de récolte (de 439 à 950 m pour *Stylodactylus* sp., contre 270 à 610 m pour *S. libratus*), les quelques différences relevées avec *S. pubescens* ainsi que l'éloignement des zones de récoltes, font pencher pour l'hypothèse d'une espèce nouvelle.

2) Les caractères intermédiaires (et parfois contradictoires) présentés par certains spécimens font pencher pour une seconde hypothèse, celle d'une seule espèce, *S. libratus,* qui présenterait une grande variabilité intraspécifique, comme on a déjà pu l'observer chez d'autres espèces, à laquelle s'ajoute ici une probable variabilité géographique, notre matériel provenant d'Indonésie et de Nouvelle-Calédonie.

La seconde interrogation trouve d'autant plus sa justification que, dans notre travail de 1990, un spécimen récolté à Madagascar par 400 m de fond, identifié *S.* aff. *libratus*, n'est peut-être qu'un exemplaire de l'espèce de CHACE, au rostre sensiblement plus long, et avec des épines surnuméraires sous l'épine branchiostège (CLEVA, 1990 : 110).

Des informations sur la coloration des spécimens, malheureusement absentes actuellement, nous permettraient sans aucun doute de prendre une décision finale quant au statut réel de ces différents spécimens.

Signalons enfin que HAYASHI (1991 : 41) a récemment fait mention d'un spécimen mâle de *Stylodactylus libratus* récolté au Japon (Kyushu-Palau Ridge).

Genre *NEOSTYLODACTYLUS* Hayashi & Miyake, 1968

Neostylodactylus affinis Hayashi & Miyake, 1968

Fig. 4 E

Neostylodactylus affinis Hayashi & Miyake, 1968 : 605, fig. 7. — CHACE, 1983 : 4 (clé). — CLEVA, 1990 : 112 (clé), 113.

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. DW 18, 205-212 m : 1 ♀ 3 mm (POLIPI). — St. DW 32, 170-206 m : 1 ♀ 3,5 mm environ (carapace abimée) (MNHN-Na 12143). — St. DW 50, 184-185 m : 1 ♀ ov. 3,5 mm (POLIPI).

Nouvelle-Calédonie. BATHUS 4 : st. DW 934, 231-240 m : 1 ♀ 3,3 mm (MNHN-Na 14466).

Vanuatu. MUSORSTOM 8 : st. CP 1135, 282-375 m : 1 ♀ 3 mm (MNHN-Na 13218).

Les trois spécimens indonésiens, incomplets et pas en très bon état, ont cependant été identifiés avec une bonne approximation à *N. affinis*. Nous avons noté que, sur le spécimen de la station DW 32 et le spécimen néo-calédonien, dont les quatrièmes péréiopodes droits sont encore en place, ainsi que sur celui du Vanuatu dont les deux P4 sont présents, l'ischion et le mérus sont fusionnés (pas de ligne de suture visible). Une ligne de suture

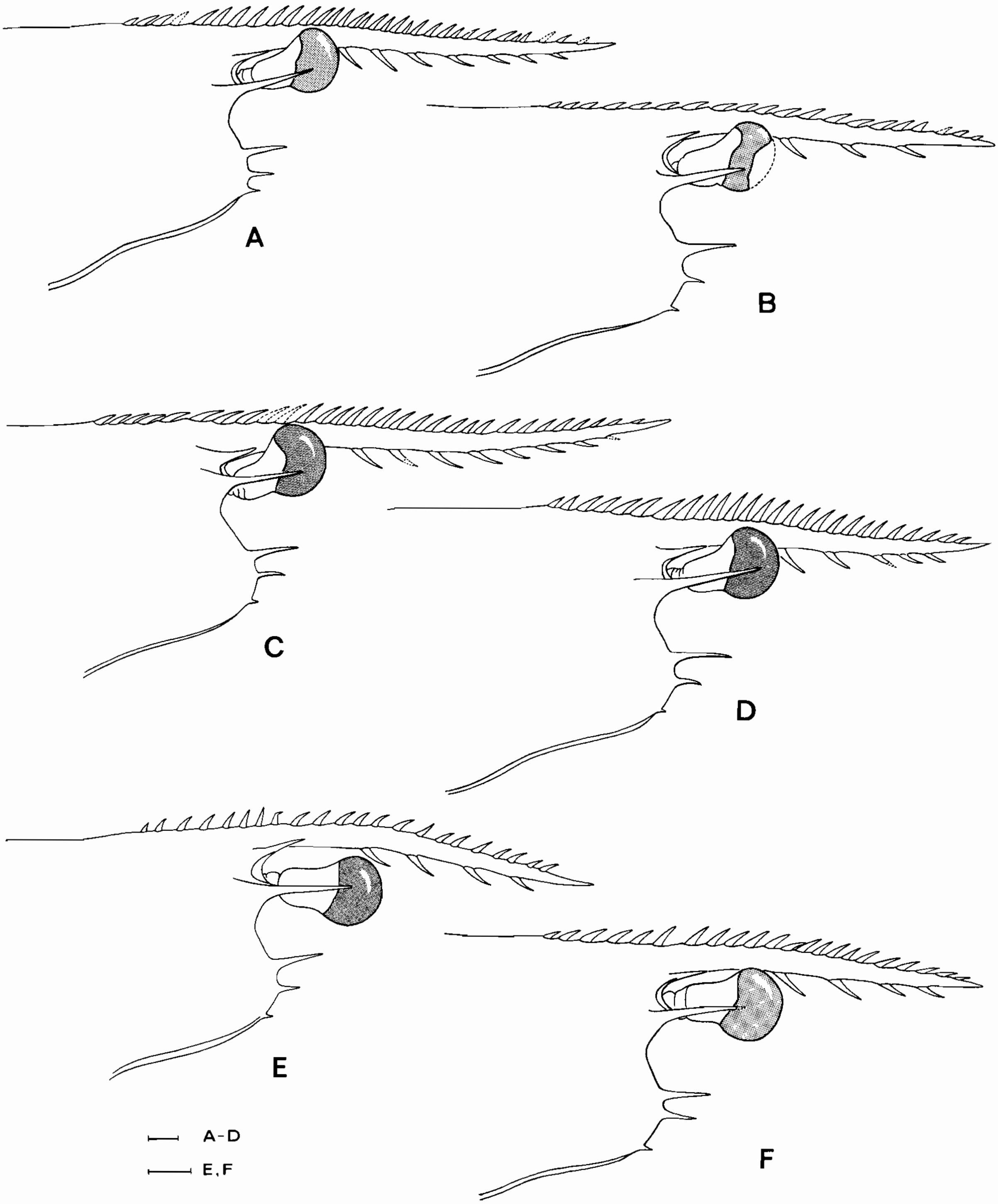

FIG. 2. — **A**, *Stylodactylus libratus*, Indonésie, ♂ 12 mm (MNHN-Na.12142) ; **B**, *Stylodactylus* sp., Nouvelle-Calédonie, ♂ 12,5 mm (MNHN-Na 12159) ; **C**, *S. libratus*, holotype, Indonésie, ♂ 14 mm ; **D**, *Stylodactylus* sp., Indonésie, ♀ 13 mm (MNHN-Na 12142) ; **E**, *S. pubescens*, ♂ 9,5 mm ; **F**, *Stylodactylus* sp., Nouvelle-Calédonie, ♂ 10 mm (MNHN-Na 14648). Échelles = 1 mm.

bien visible s'observe, par contre, au niveau des cinquièmes péréiopodes du spécimen de la station DW 50 et des spécimen de Nouvelle-Calédonie et du Vanuatu, ce qui confirme nos observations antérieures (CLEVA, 1990 : 112).

COLORATION. — La mention portée sur l'étiquette accompagnant le spécimen photographié indique "uniformément verdâtre", ce qui correspond mal à la photo que nous reproduisons (Fig. 4 E). Il est vraisemblable que cette photo est surexposée car l'animal apparaît plutôt jaune.

DISTRIBUTION. — Détroit de Corée, 120 m ; Nouvelle Calédonie et îles Chesterfield, 231-440 m ; Indonésie, premier signalement, 170-212 m ; Vanuatu, premier signalement, 282-375 m.

Genre *PARASTYLODACTYLUS* Figueira, 1971

Parastylodactylus bimaxillaris (Bate, 1888)

Fig. 4 F

Stylodactylus bimaxillaris Bate, 1888 : 855, pl. 138, fig. 3. — CALMAN, 1939 : 188. — HAYASHI & MIYAKE, 1968 : 599, fig. 5. — MIYAKE, 1982 : 25 (non pl. 9, fig. 4 = *Stylodactylus multidentatus* Kubo, 1942).
Parastylodactylus bimaxillaris - CHACE, 1983 : 8, fig. 4. — CHAN & YU, 1985 : 289, pl. I A-D (photos couleurs). — CLEVA, 1990 : 115, fig. 11 a, 12 a ; 1994 : 62.
Non *Stylodactylus bimaxillaris* - CALMAN, 1925 : 16. — BARNARD, 1950 : 652, fig.122 f-h (= *Stylodactylus stebbingi* Hayashi & Miyake, 1968).
Non *Stylodactylus bimaxillaris* - MIYAKE, 1982, pl. 9, fig. 4 (= *Stylodactylus multidentatus* Kubo, 1942).

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 09, 361-389 m : 9 ♂ 6 à 8 mm ; 14 ♀ (8 ov.) 4,5 à 8 mm (POLIPI) ; 1 ♂, 2 ♀ (1 ov.) avec bopyres (MNHN-Na 12152). — St. CC 10, 329-389 m : 1 ♀ ov. 7 mm (POLIPI). — St. CP 33, 281-311 m : 1 ♀ ov. 6,5 mm (USNM). — St. CP 36, 268-210 m : 1 ♂ 6 mm, 1 ♀ ov. 7 mm (MNHN-Na 12144). — St. CC 41, 401-393 m : 1 ♀ ov. 8,5 mm (MNHN-Na 12145). — St. CP 45, 301-305 m : 2 ♀ 5,5 mm (USNM). — St. CP 69, 356-367 m : 1 ♀ ov. 6,5 mm (MNHN-Na 12146). — St. CP 70, 411-410 m : 1 ♀ ov. 6,5 mm (POLIPI). — St. CP. 76, 400 m : 1 ♀ 6 mm (MNHN-Na 12147). — St. CP 83, 285-298 m : 1 ♀ ov. 6,5 mm (MNHN-Na 12148). — St. CP 86, 226-222 m : 1 ♀ 4,5 mm (MNHN-Na 12149).

Nouvelle-Calédonie. BATHUS 4 : st. CP 910, 560-608 m : 1 ♀ ov. 7 mm (MNHN-Na 13219).

Vanuatu. MUSORSTOM 8 : st. CP 1091, 344-350 m : 1 ♂ 4 mm (MNHN-Na 13220), 1 ♀ ov. 5 mm (MNHN-Na 14473).

Cet abondant matériel (40 spécimens) apporte quelques données nouvelles sur la variabilité de l'espèce : le rostre, qui mesure de 1,6 à 2 fois la longueur de la carapace, porte de 18 à 35 épines dorsales (dont 6 à 8 post-rostrales), et de 5 à 9 épines ventrales (moyennes sur les 29 spécimens au rostre intact : épines dorsales : 25 ; épines ventrales : 6). Les chiffres les plus bas relevés jusqu'ici semblent être ceux d'un spécimen australien chez qui l'on compte 17 épines dorsales et 4 ventrales (CLEVA, 1994 : 62).

Il semble se confirmer, par ailleurs, que le rostre est plus incurvé vers le haut chez les femelles que chez les mâles.

DISTRIBUTION. — Largement répandu dans l'Indo-Pacifique (Afrique du Sud, Mozambique, Madagascar, golfe d'Aden, Philippines, Taiwan, détroit de Corée et mer de Chine orientale, Japon, Australie, Nouvelle-Calédonie, Vanuatu), *Parastylodactylus bimaxillaris* était déja connu de la région indonésienne, puisque les types de BATE ont été récoltés au nord de la Nouvelle-Guinée. La distribution bathymétrique de l'espèce s'étend entre 106 et 608 m.

Parastylodactylus richeri Cleva, 1990

Fig. 4 G-H

Parastylodactylus richeri Cleva, 1990 : 127, fig. 15 c, 16 e-h.

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 27, 304-314 m : 1 ♀ moins de 3,5 mm (POLIPI).

Vanuatu. MUSORSTOM 8 : st. CP 980, 450-433 m : 1 ♀ ov. 5 mm (MNHN-Na 14468). — St. CP 1024, 335-370 m : 1 ♀ ov. 4,5 mm (MNHN-Na 14470). — St. CP 1025, 385-410 m : 1 ♀ ov. 6 mm (MNHN-Na 14469). — St. CP 1137, 360-371 m : 1 ♀ ov. 5,5 mm (MNHN-Na 13222).

Nouvelle-Calédonie. BATHUS 1 : st. CP 670, 394-397 m : 1 ♀ ov. 5 mm avec bopyre (MNHN-Na 14631). — St. DW 687, 408-440 m : 1 ♂ 3 mm (MNHN-Na 14645).

RFO, 300 m : 2 ♀ (1 ov.) 3,5 et 4,5 mm (MNHN-Na 13221).

Le spécimen indonésien, dont la carapace est abimée et le rostre incomplet, a pu toutefois être identifié à *Parastylodactylus richeri*, espèce décrite de la Nouvelle-Calédonie, et dont 4 autres spécimens ont été rapportés de cette région. Quelques différences ont été relevées par rapport au matériel type chez ces 9 nouveaux exemplaires. Elles sont indiquées ci-après. Entre parenthèses sont rapellés les chiffres notés pour le matériel type.

Le mérus des P3 porte 3 ou 4 épines latérales (4), et son dactyle est orné de 4 à 7 spinules (4 à 6) ; celui des P4 porte 1 ou 2 épines (2 ou 3) et son dactyle 3 à 7 spinules (4 à 6) ; celui des P5 porte 2 à 4 épines (2 à 4) et son dactyle 4 à 6 spinules (6). Le rapport des longueurs propode/dactyle est respectivement de : P3 : 1,8 à 3,1 (2,6) ; P4 : 2,1 à 3,7 (3,0 à 3,2) ; P5 : 4,7 à 7,4 (6,1 à 6,8).

Le rostre porte 21 à 26 épines dorsales (22 à 25 pour le matériel type) et 3 ou 4 épines ventrales (3), et le rapport des longueurs du rostre à la carapace varie entre 1,2 et 1,55 (1,35).

COLORATION. — Elle n'est pas très caractéristique. La teinte générale est rosâtre, avec quelques taches plus rouge ou orangé. Des anneaux de couleur rougeâtre s'observent sur les péréiopodes (Fig. 4 G-H).

REMARQUE. — *Parastylodactylus richeri* est très proche d'une autre espèce aux dactyles des P3 et P4 particulièrement longs (et inermes), *Parastylodactylus longidactylus* Cleva, 1990, décrite des Philippines et non retrouvée depuis.

DISTRIBUTION. — Nouvelle-Calédonie (300-440 m), Vanuatu (335-450 m), Indonésie, premier signalement, 304-314 m.

Parastylodactylus moluccensis sp. nov.

Fig. 3

MATÉRIEL EXAMINÉ. — **Indonésie**. KARUBAR : st. CP 16, 315-348 m : 1 ♀ 6,5 mm (MNHN-Na 12157). — St. CP 27, 304-314 m : 1 ♂ 7 mm environ (carapace abimée) (MNHN-Na 12122).

TYPES. — La femelle récoltée à la station CP 16 dont la carapace mesure 6,5 mm est l'holotype (MNHN-Na 12157), le mâle récolté lors de la station CP 27 est un paratype.

DESCRIPTION (d'après l'holotype) — Rostre mesurant environ 1,7 fois la longueur de la carapace. Sa moitié distale est assez fortement redressée vers le haut. Son extrémité manque. Il porte 16 épines dorsales (dont 5 implantées sur le bord dorsal de la carapace, en arrière du niveau du fond de l'orbite), de taille variable et d'implantation irrégulière, et 6 fortes épines ventrales, de taille plus homogène, sensiblement plus longues et plus robustes que les épines dorsales les plus fortes. Quelques soies plumeuses s'observent à la base ou entre certaines épines, et d'autres ont probablement dû se détacher.

Carapace avec épines supra-orbitaire, antennaire (émoussée), et branchiostège.

Cinquième pleuron abdominal arrondi, avec une forte épine sur sa marge postérieure.

Telson avec 2 rangées de 4 épines dorsales.

Œil à cornée bien développée ; une cornée secondaire (ocelle) bien individualisée ; pédoncule oculaire orné de 3 rangées de 2 à 4 soies plumeuses disposées comme suit : deux sont situées en position dorsale (l'une à la limite de la cornée principale et l'autre légèrement en arrière de la première, au niveau de l'ocelle), la troisième est placée latéralement, à la limite également de la cornée principale.

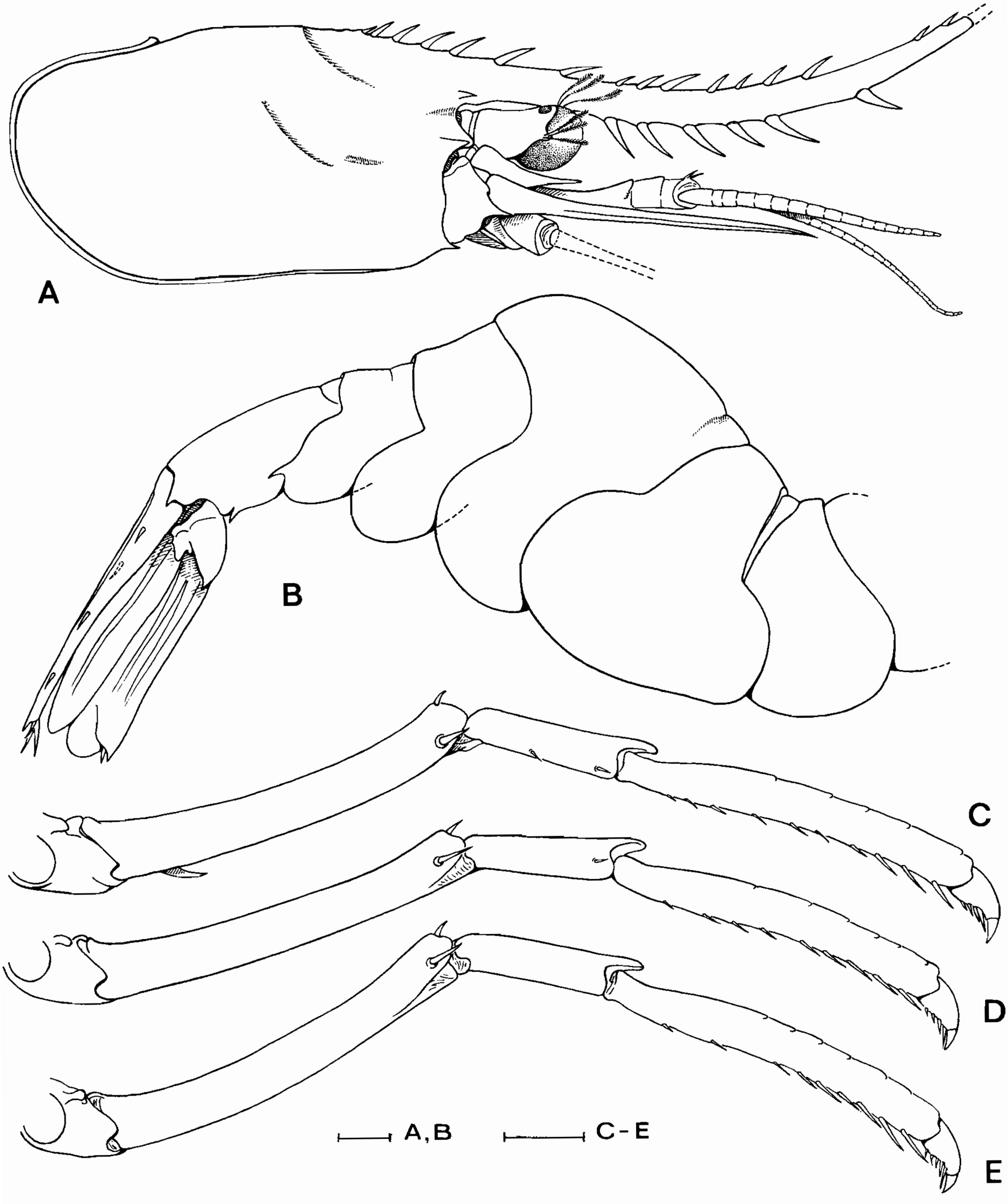

FIG. 3. — *Parastylodactylus moluccensis* sp. nov., ♀ holotype 6,5 mm., Indonésie (KARUBAR, st. CP 16, MNHN-Na 12157) : **A**, céphalothorax ; **B**, abdomen et telson ; **C**, **D**, **E** , troisième, quatrième et cinquième péréiopodes droits. Échelles = 1 mm.

Stylocérite terminé en pointe aigüe, atteignant le 2ème tiers du premier article du pédoncule antennulaire.

Écaille antennaire au bord externe inerme, de longueur égale à celle de la carapace.

Longueur des troisièmes maxillipèdes et des péréiopodes par rapport à l'extrémité de l'écaille antennaire : des MxP3 ne subsiste que le premier article ; chez le paratype, les MxP3 dépassent cette extrémité de la longueur du dernier article ; P1 d'un peu plus de la longueur du propode ; P2 des 2/3 de la longueur du propode ; P3 n'atteint pas tout à fait l'extrémité de l'écaille antennaire ; P4 atteint le milieu de l'écaille et P5 dépasse le niveau du premier tiers de l'écaille.

De longues soies plumeuses ornent les articles de tous les péréiopodes.

Ischion-mérus des troisièmes péréiopodes un peu plus de 2 fois plus long que le carpe (lobe distal compris), avec une épine ventrale près de sa base, une épine latérale sub-distale, et une petite épine distale dorsale ; propode environ 2 fois plus long que le carpe et 4,5 fois plus long que le dactyle ; dactyle avec 3 ou 4 spinules ventrales.

Ischion et mérus des quatrièmes péréiopodes complètement fusionnés (pas de ligne de suture visible), plus de 2 fois plus longs que le carpe ; mérus avec une épine latérale sub-distale et une petite épine dorsale distale ; propode environ deux fois plus long que le carpe, et 4,5 fois plus long que le dactyle ; dactyle avec 4 spinules ventrales (des 2 côtés).

Ischion et mérus des cinquièmes péréiopodes complètement fusionnés, environ 2 fois plus longs que le carpe ; spinulation du mérus identique à celle des quatrièmes péréiopodes ; propode environ 2 fois plus long que le carpe et 4,5 fois plus long que le dactyle ; dactyle avec 5 spinules ventrales (des 2 côtés).

Le paratype diffère de l'holotype par quelques points de détail :

— Telson avec 2 rangées de 4 et 5 épines dorsales.

— Péréiopodes un peu plus courts (par rapport à l'extrémité de l'écaille antennaire).

— Rapport des longueurs ischion-mérus/carpe des trois dernières paires de péréiopodes sensiblement plus grand.

ÉTYMOLOGIE. — Le terme *moluccensis* fait référence au lieu de récolte de cette nouvelle espèce.

DISCUSSION. — L'association de certains des caractères de ces deux spécimens : présence d'une épine supra-orbitaire, cinquième pleuron abdominal arrondi mais avec une forte épine, fusion complète de l'ischion et du mérus des P4 et P5, dactyles des trois dernières paires de péréiopodes courts et robustes en font indéniablement un taxon nouveau, le sixième du genre *Parastylodactylus.*

Il diffère :

— de *P. longidactylus* Cleva, 1990, et *P. richeri* Cleva, 1990, par la présence d'une épine supra-orbitaire et d'une forte épine sur le 5ème pleuron abdominal ; le rostre plus long (LR/LC = 1,7 contre 1,2 à 1,55), aux épines plus longues et robustes, et avec des épines ventrales plus nombreuses (6 au lieu de 4, 3 ou 2) ; les dactyles des P3 à P5 courts et robustes ; la fusion de l'ischion et du mérus des P4 et P5 ; l'ornementation du telson (4 ou 5 épines par rangée dorsale au lieu de 3).

— de *P. bimaxillaris* (Bate, 1888), par la fusion de l'ischion et du mérus des P4 et P5 ; la présence d'une épine proximo-ventrale sur l'ischion-mérus des P3 ; la position de l'épine sur le cinquième pleuron abdominal ; l'ornementation du pédoncule oculaire (3 rangées de soies au lieu d'une seule).

— de *P. tranterae* Cleva, 1990, par le nombre d'épines dorsales du rostre (16 dont 5 post-rostrales, contre 42 à 50 dont 11 à 16 post-rostrales) ; la présence d'une épine supra-orbitaire ; la fusion de l'ischion et du mérus des P4 et P5 ; l'ornementation du telson (3 paires d'épines chez *P. tranterae*).

— de *P. semblatae* Cleva, 1990, par le nombre d'épines dorsales du rostre (16 dont 5 post-rostrales, contre 30 à 39 dont 8 à 12 post-rostrales) ; la fusion de l'ischion et du mérus des P4 et P5 ; la présence d'une épine sur le cinquième pleuron abdominal.

COLORATION. — Inconnue.

DISTRIBUTION. — Indonésie, 304-348 m.

AUTRES ESPÈCES RÉCOLTÉES À WALLIS ET FUTUNA (MUSORSTOM 7) ET AU VANUATU (MUSORSTOM 8)

Stylodactylus brucei Cleva, 1994

Stylodactylus brucei Cleva, 1994 : 54, fig. 1A, C-F.

MATÉRIEL EXAMINÉ. — **Île Wallis**. MUSORSTOM 7 : st. CP 638, 820-840 m : 1 ♂ holotype, 37 mm (MNHN-Na 12121).

Cette espèce, la plus grande de la famille (longueur totale 220 mm), a été récemment décrite lors de l'étude d'une collection de Stylodactylidae d'Australie (CLEVA, 1994). L'exemplaire récolté à Wallis, en meilleur état que les spécimens australiens, a été choisi comme holotype.

DISTRIBUTION. — Australie (900-1000 m), île Wallis (820-840 m).

Stylodactylus macropus Chace, 1983

Stylodactylus macropus Chace, 1983 : 16, fig.7. — CLEVA, 1990 : 95.

MATERIEL EXAMINÉ. — **Vanuatu**. MUSORSTOM 8 : st. CP 992, 775-748 m : 1 ♀ 15 mm (MNHN-Na 13223).

DISTRIBUTION. — Philippines (700-925 m), Nouvelle-Calédonie (800-825 m), îles Chesterfield (745-825 m), Vanuatu, premier signalement (775-748 m).

Parastylodactylus semblatae Cleva, 1990

Parastylodactylus semblatae Cleva, 1990 : 122, fig. 12 c, 14, 18 c ; 1994 : 62.

MATÉRIEL EXAMINÉ. — **Îles Wallis et Futuna**. MUSORSTOM 7 : sans numéro de station, 500-610 m : 1 ♀ 5,5 mm (MNHN-Na 14464).
Vanuatu. MUSORSTOM 8 : st. CP 974, 492-520 m : 1 ♀ ov. 7 mm (MNHN-Na 14471). — St. CP 1027, 550-571 m : 1 ♀ 6 mm (MNHN-Na 14467).

DISTRIBUTION. — Australie (458-500 m), Nouvelle-Calédonie et îles Chesterfield (260-702 m), Vanuatu (492-571 m), Wallis et Futuna (500-610 m).

AUTRES ESPÈCES RÉCOLTÉES EN NOUVELLE-CALÉDONIE

Stylodactylus laurentae Cleva, 1990

Stylodactylus laurentae Cleva, 1990 : 96, fig. 6, 19.

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie**. BERYX 11 : st. DW 27, 460-470 m : 2 ♀ 4,5 et 6 mm (MNHN-Na 14646).
SMIB 8 : st. DW 146, 514-522 m : 1 ♀ ov. 8,5 mm (MNHN-Na 12133), 1 ♀ 8 mm (MNHN-Na 14633). — St. DW 185, 305-355 m : 1 ♂ 6 mm (MNHN-Na 14643). — St. DW 193, 500-508 m : 1 ♂ 8,5 mm, 1 ♀ ov. 7,5 mm (MNHN-Na 14618). — St. DW 194, 491 m : 1 ♂ 7,5 mm (MNHN-Na 14634). — St. DW 195, 508-514 m : 2 ♀ 5,5 et 7 mm (MNHN-Na 14627). — St. DW 201, 500-504 m : 1 ♀ ov. 7,5 mm (MNHN-Na 14644).
BATHUS 2 : st. CP 737, 350-400 m : 1 ♀ ov. 7,5 mm (MNHN-Na 14632).
HALIPRO 1 : st. CP 877, 464-480 m : 1 ♀ 4,5 mm (MNHN-Na 13224).
BATHUS 4 : st. DW 923, 502-470 m : 1 ♀ 8,5 mm (MNHN-Na 13225). — St. DW 924, 344-360 m : 2 ♀ 6 mm (MNHN-Na 13226). — St. DW 931, 360-377 m : 1 ♀ ov. 7 mm (MNHN-Na 13227).

DISTRIBUTION. — Nouvelle-Calédonie et îles Chesterfield (300-610 m).

Neostylodactylus amarynthis (de Man, 1902)

Stylodactylus sp.*(amarynthis)* de Man, 1902 : 897, pl. 27, fig. 64 a-b.
Stylodactylus Amarynthis - DE MAN, 1920 : 32, pl. 5, fig. 9, 9 a-h.
Stylodactylus amarynthis - KEMP, 1925 : 258.
Neostylodactylus amarynthis - HAYASHI & MIYAKE, 1968 : 603, fig. 6. — CHACE, 1983 : 4, fig. 1-3. — CLEVA, 1990 : 112 ; 1994 : 60, fig. 3.

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie**. MONTROUZIER : chenal de Touho, 52 m : 1 ♀ ov. 3 mm (MNHN-Na 12160).

DISTRIBUTION. — La Réunion, îles Andaman, Indonésie, Philippines, Japon, Australie, Nouvelle-Calédonie (premier signalement), entre 9 et 120 m (CLEVA, 1990 : 113).

Parastylodactylus tranterae Cleva, 1990

Parastylodactylus tranterae Cleva, 1990 : 119, fig. 11 b, 12 b, 13.

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie**. BERYX 11 : st. CP 08, 540-570 m : 1 ♀ ov. 8,5 mm (MNHN-Na 14626).

SMIB 8 : st. DW 150, 519-530 m : 1 ♀ 8,5 mm (MNHN-Na 14635).

BATHUS 1 : st. CP 657, 490-530 m : 1 ♂ 5 mm environ, 1 ♀ 7 mm avec bopyre (MNHN-Na 14622). — St. CP 671, 450-470 m : 1 ♀ ov. 9 mm (MNHN-Na 14620).

BATHUS 2 : st. CP 738, 558-647 m : 3 ♂ 4,5 à 7,5 mm (MNHN-Na 14628).

BATHUS 3 : st. CP 832, 650-669 m : 1 ♀ 9,5 mm (MNHN-Na 14474). — St. CP 833, 441-444 m : 2 ♀ 7,5 et 8,5 mm avec bopyre (MNHN-Na 12161). — St CP 846, 500-514 m : 1 ♀ 10,5 mm avec bopyre (MNHN-Na 14477).

BATHUS 4 : st. CP 892, 580-600 m : 1 ♀ 8 mm (MNHN-Na 14382). — St. CP 912, 702-690 m : 1 ♀ ov.9 mm (MNHN-Na 14381).

DISTRIBUTION. — Australie (540 m), îles Chesterfield (650-700 m), Nouvelle-Calédonie (441-702 m).

Parastylodactylus semblatae Cleva, 1990

Parastylodactylus semblatae Cleva, 1990 : 122, fig. 12 c, 14, 18 c ; 1994 : 62.

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie**. SMIB 8 : st. DW 191, 564-580 m : 1 ♀ 6 mm (MNHN-Na 14465). — St. DW 201, 500-504 m : 1 ♂ 5 mm, 1 ♀ 6 mm (MNHN-Na 14642).

BATHUS 2 : st. DW 721, 525-547 m : 1 ♂ 6,5 mm (MNHN-Na 14640).

BATHUS 4 : st. CP 910, 560-608 m : 1 ♂ 6,5 mm, 2 ♀ 6 et 6,5 mm (MNHN-Na 13228). — St. CP 911, 566-558 m : 1 ♂ 6,5 mm, 1 ♀ 6 mm (MNHN-Na 13229). — St. CP 912, 702-690 m : 1 ♀ 6 mm (MNHN-Na 13230). — St. CP 921, 613-610 m : 8 ♀ 5 à 6 mm (MNHN-Na 13231). — St. CP 922, 600 m : 1 ♂ 6,5 mm, 1 ♀ 6 mm (MNHN-Na 13232). — St. DW 929, 502-516 m : 1 ♀ ov. 6,5 mm (MNHN-Na 13233). — St. CP 930, 530-520 m : 3 ♂ 5 à 5,5 mm (MNHN-Na 13234), 1 ♀ 5,5 mm photographiée (MNHN-Na 13235).

Il est intéressant de noter que, chez quelques spécimens, on peut observer une petite épine sur le bord postérieur du 5ème pleuron abdominal, d'un seul côté (c'est le cas pour 3 femelles de BATHUS 4 et pour celle de MUSORSTOM 7) ou même des deux côtés (mâle de 5 mm récolté lors de la station CP 930 de BATHUS 4) : ce caractère, qui peut donc s'observer quelquefois, est à prendre en considération lors de l'utilisation de la clé des espèces du genre *Parastylodactylus*. Cette remarque est en mettre en parallèle avec celle faite à propos de *Stylodactylus licinus*, ou certains spécimens n'ont pas le pleuron abdominal 4 terminé en pointe aigüe (cf. supra).

DISTRIBUTION. — Australie (458-500 m), Nouvelle-Calédonie et îles Chesterfield (260-702 m), Vanuatu (492-571 m), îles Wallis et Futuna (500-610 m).

Stylodactyloides crosnieri Cleva, 1990

Stylodactyloides crosnieri Cleva, 1990 : 129, fig. 17, 18 d-e ; 1994 : 62.

MATÉRIEL EXAMINÉ. — **Nouvelle-Calédonie**. SMIB 8 : st. DW 180, 460-525 m : 1 ♀ 13,5 mm (MNHN-Na 12132). — St. DW 183, 330-367 m : 1 ♂ 15,5mm (MNHN-Na 14616). — St. DW 187, 390-540 m : 1 ♀ 14,5 mm (MNHN-Na 14630).

BATHUS 3 : st. DW 830, 361-365 m : 2 ♂ 15,5 et 16,5 mm, 1 ♀ 11,5 mm (MNHN-Na 14482). — St. DW 836, 295-306 m : 1 ♀ ov. 15,5 mm (MNHN-Na 12162).

DISTRIBUTION. — Nouvelle-Calédonie et îles Chesterfield (200-540 m), Australie (357 m), Nouvelle-Zélande (YALDWYN, 1991, *in litt.*).

CONCLUSIONS

Le grand nombre de spécimens de Stylodactylidae récoltés lors de ces campagnes, permettent d'apporter une intéressante contribution à la connaissance de cette famille, tout en laissant apparaître la complexité de la définition de certains taxons. Ainsi :

— Une espèce nouvelle, *Parastylodactylus moluccensis*, de l'Indonésie, est décrite.

— La distribution géographique de plusieurs autres est étendue ou leur présence, supposée, confirmée : *Stylodactylus licinus* à Wallis et Futuna et au Vanuatu, *S. multidentatus* au Vanuatu, *Stylodactylus macropus* au Vanuatu, *Neostylodactylus affinis* en Indonésie et au Vanuatu, *N. amarynthis* en Nouvelle-Calédonie, *Parastylodactylus bimaxillaris* au Vanuatu, *P. richeri* en Indonésie et au Vanuatu, *P. semblatae* à Wallis et Futuna et au Vanuatu.

— La variabilité intraspécifique de plusieurs espèces (*Stylodactylus licinus, S. multidentatus, Parastylodactylus bimaxillaris*, notamment) est désormais mieux connue, grâce aux importantes séries de spécimens récoltées.

Cette variabilité apparaît parfois très importante : il suffit de voir dans quelles proportions varient, pour une même espèce, la longueur relative du rostre ou le nombre de ses épines (pour ne citer que cet exemple facile à observer) pour s'en convaincre. Elle nous a ainsi conduit à mettre en synonymie *Stylodactylus brevidactylus* Cleva, 1990, décrit à partir d'un seul spécimen aux dactyles notablement courts, avec *S. multidentatus.* Elle nous conduira peut-être, aussi, à mettre en synonymie avec *S. libratus*, dont le matériel type est réduit à un spécimen unique, ou avec *S. pubescens*, les exemplaires identifiés dans un premier temps à *S. libratus* avec des réserves, et séparés provisoirement sous l'appellation *Stylodactylus* sp.

Dans le même ordre d'idées, des séries suffisamment importantes de spécimens de différentes régions s'avèrent indispensables pour mieux évaluer une probable variabilité géographique souvent seulement pressentie, et qui nous conduira peut-être à reconsidérer le statut de certains spécimens.

— La coloration de deux espèces, *Neostylodactylus affinis* et *Parastylodactylus richeri*, inconnue jusqu'à présent, est indiquée. Il est vraisemblable que, compte tenu de ce qui a été dit plus haut, beaucoup d'incertitudes et de questions restant en suspens pourraient être résolues si l'on disposait d'informations sur la couleur des animaux récoltés, particulièrement dans les cas ou apparaît un dessin caractéristique.

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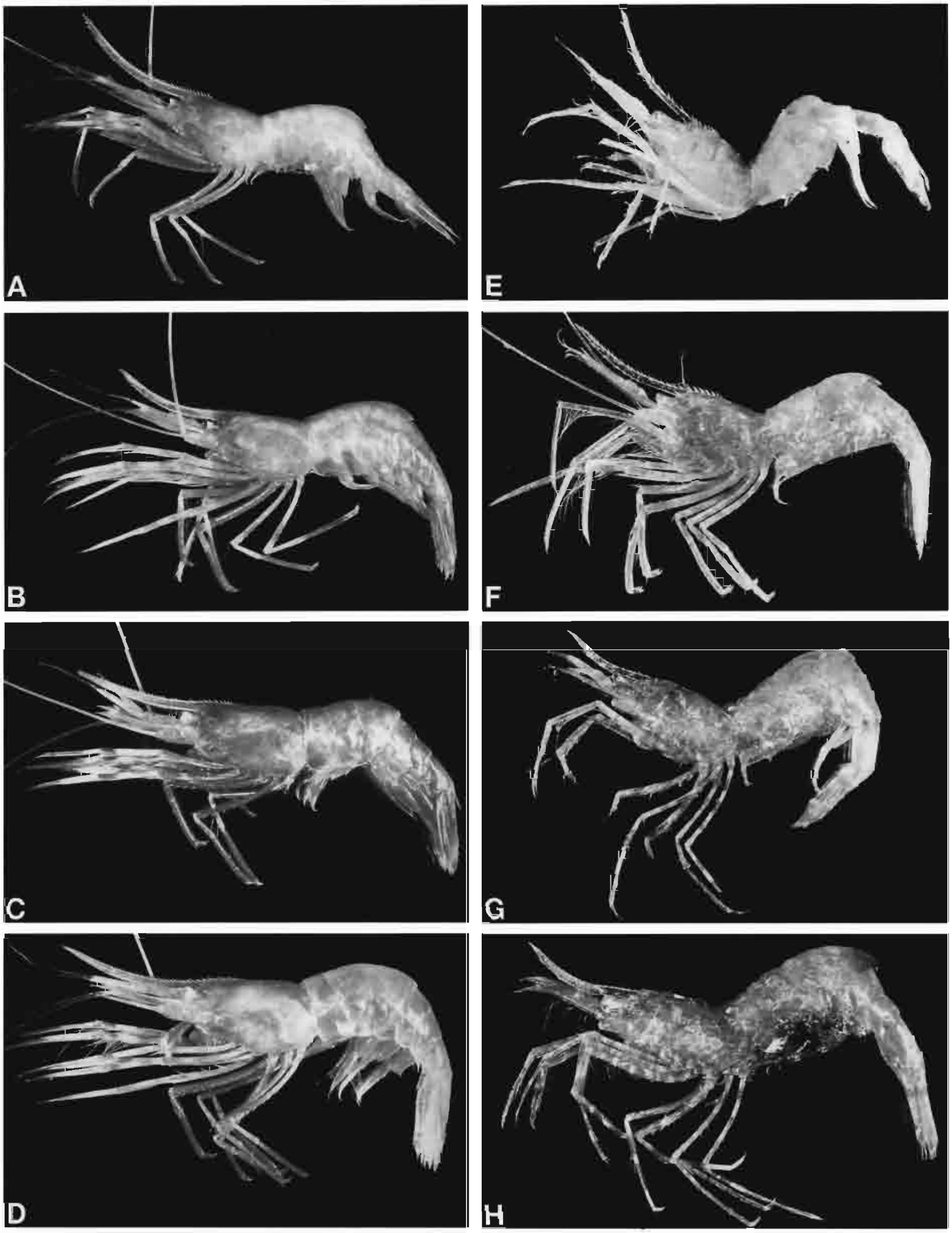
FIGURE 4

A-D, *Stylodactylus licinus*, Vanuatu, MUSORSTOM 8 : **A**, ♀ ov. 13 mm (MNHN-Na 14458) ; **B**, ♀ 13 mm (Na.14460) ; **C**, ♂ 16,5 mm (MNHN-Na 14461) ; **D**, ♂ 15 mm (MNHN-Na 14459) ; **E**, *Neostylodactylus affinis*, Nouvelle-Calédonie, BATHUS 4, ♀ (MNHN-Na 14466) ; **F**, *Parastylodactylus bimaxillaris*, Vanuatu, MUSORSTOM 8, ♀ ov. 5 mm (MNHN-Na 14473) ; **G-H**, *Parastylodactylus richeri*, Vanuatu, MUSORSTOM 8 : **G**, ♀ ov. 4,5 mm (MNHN-Na 14470) ; **H**, ♀ ov. 6 mm (MNHN-Na 14469).


A
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9

Crustacea Decapoda: Palinuridae, Scyllaridae and Nephropidae collected in Indonesia by the KARUBAR Cruise, with an identification key for the species of *Metanephrops*

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ABSTRACT

The lobsters collected by the KARUBAR cruise from Indonesia are examined. Twenty-one species are identified, ten of which being newly recorded in Indonesia. Moreover, the KARUBAR cruise obtained an intact specimen of *Metanephrops arafurensis* (de Man, 1905) and a re-description is given for this poorly known species. The four species groups in *Metanephrops* are redefined and a revised key to the species of *Metanephrops* is provided.

RÉSUMÉ

Crustacea Decapoda : Palinuridae, Scyllaridae et Nephropsidae récoltés en Indonésie lors de la campagne KARUBAR. Clé d'identification des espèces du genre *Metanephrops*.

Les espèces appartenant aux familles des Palinuridae, Scyllaridae et Nephropidae, récoltées lors de la campagne KARUBAR en Indonésie, ont été étudiées: 21 espèces ont été trouvées, dont 10 n'avaient pas encore été signalées en Indonésie. Un spécimen de *Metanephrops arafurensis* (de Man, 1905) ayant été récolté, cette espèce, mal connue, est redécrite. Les quatre groupes d'espèces du genre *Metanephrops* sont redéfinis et une clé d'identification de toutes les espèces de ce genre est proposée.

INTRODUCTION

The KARUBAR cruise in 1991 collected a number of deep-sea lobster specimens from Indonesia. The material is found to contain five species of palinurids, five species of scyllarids and 11 species of nephropids. Although no new species were found, the KARUBAR material extends the known distributions for many species, such as *Linuparus trigonus* (von Siebold, 1824), *Palinustus unicornutus* Berry, 1979, *Ibacus pubescens* Holthuis, 1960, *I. novemdentatus* Gibbes, 1850, *Nephropsis acanthura* Macpherson, 1990, *N. holthuisi* Macpherson, 1993,

CHAN, T.-Y., 1997. — Crustacea Decapoda: Palinuridae, Scyllaridae and Nephropidae collected in Indonesia by the KARUBAR Cruise, with an identification key for the species of *Metanephrops*. *In:* A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 409-431. Paris ISBN: 2-85653-506-2.

N. serrata Macpherson, 1993, *N. stewarti* Wood-Mason, 1872, *N. sulcata* Macpherson, 1990, and *Metanephrops australiensis* (Bruce, 1966). The most interesting finding is a complete specimen of *Metanephrops arafurensis* (de Man, 1905), which was previously known only from a mutilated type. Together with the additional knowledge gained of the characteristics of the other *Metanephrops* species, their relationships are discussed and a revised key to the species of this genus is provided.

MATERIAL AND METHODS

The specimens used in the present study are deposited at the Muséum national d'Histoire naturelle, Paris (MNHN), Puslitbang Oseanologi-LIPI, Indonesia (POLIPI), National Taiwan Ocean University (NTOU), National Museum of Natural History, Washington, D.C. (USNM), Nationaal Natuurhistorisch Museum, Leiden (RMNH) and Zoologisch Museum, University of Amsterdam, Amsterdam (ZMA). Furthermore, the collections of the MNHN and NTOU contain 15 of the 18 known species of *Metanephrops*. Only three species, namely *M. binghami* from the Caribbean, *M. motunauensis* and *M. challengeri* from New Zealand have not been examined. Their characteristics are mainly by referring to YALDWYN (1954), HOLTHUIS (1964, 1991), JENKINS (1972) and TAKEDA (1990).

The terminology used for the body parts of *Nephropsis* mainly follows MACPHERSON (1990), while that for *Metanephrops* follows CHAN & YU (1991). The measurements are of carapace length (cl) which is measured along the dorsal midline from the postorbital margin to the posterior margin of the carapace. Only restricted synonymies of Indonesian records and important works on the species are given.

In the lists of material, CP = beam trawl, CC = shrimp otter trawl, DW = Warren dredge.

SYSTEMATIC ACCOUNT

Family PALINURIDAE

Genus *LINUPARUS* White, 1847

Linuparus trigonus (von Siebold, 1824)

Palinurus Trigonus von Siebold, 1824: 15 (type-locality: Japan).
Linuparus trigonus - HOLTHUIS, 1991: 114, figs 215-216.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Tanimbar Islands*: stn CP 66, 09°01'S, 132°09'E, 1.11.1991, 211-217 m: 1 ♀ 91.2 mm (MNHN). — Stn CP 79, 09°16'S, 131°22'E, 250-239 m, 3.11.1991: 1 ♀ 72.3 mm (POLIPI). — Stn CP 83, 09°23'S, 131°00'E, 285-297 m, 4.11.1991: 1 ♂ 69.1 mm (POLIPI).

REMARKS. — Although this species is often reported in the western Pacific (Japan, Korea, China, Taiwan, the Philippines and Australia, at depths of 30-318 m), it is recorded here for the first time in Indonesia.

Genus *PALINUSTUS* A. Milne Edwards, 1880

Palinustus unicornutus Berry, 1979

Palinustus unicornutus Berry, 1979: 93, figs 1, 2, 3G (type-locality: Natal, South Africa). — HOLTHUIS, 1991: 126, figs 235-236. — CHAN & YU, 1995: 381, fig. 4, 8B, 9B, 10B.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ 17.1 mm (MNHN).

REMARKS. — *P. unicornutus* was previously thought to be restricted to the eastern coast of South Africa. Recently, however, it was found that this species actually has a wide distribution in the Indo-West-Pacific (CHAN & YU, 1995).

Palinustus waguensis Kubo, 1963

Palinustus waguensis Kubo, 1963: 63, figs 1-3 (type-locality: Japan). — HOLTHUIS, 1991: 126, figs 237-238. — CHAN & YU, 1995: 389, fig. 7, 8D, 9E, 10E.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 118-111 m, 26.10.1991: 1 ♂ 31.4 mm (MNHN).

REMARKS. — Similar to *P. unicornutus*, recent finds show that this species is also widely distributed in the Indo-West-Pacific (CHAN & YU, 1995). Nevertheless, its occurrence in Indonesia had already been suggested by HOLTHUIS (1991).

Genus ***PUERULUS*** Ortmann, 1897

Puerulus angulatus (Bate, 1888)

Panulirus angulatus Bate, 1888: 81, pl. 11-figs 1-4 (type-locality: New Guinea).
Puerulus angulatus - HOLTHUIS, 1991: 162, figs 301-302.
Not *Puerulus angulatus* - DE MAN, 1916: 36, pl. 2-fig. 5 (= *Puerulus velutinus* Holthuis, 1963).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn DW 2, 05°47'S, 132°13'E, 209-240 m, 22.10.1991: 1 juv. 14.3 mm (POLIPI). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ 50.3 mm (POLIPI). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 4 juv. 14.8-17.9 mm (MNHN).
Tanimbar Islands: stn CP 85, 09°22'S, 131°14'E, 245-240 m, 4.11.1991: 1 juv. 13.4 mm (MNHN). — Stn CP 88, 08°45'S, 130°47'E, 1188-1178 m, 5.11.1991: 1 juv. 13.0 mm (MNHN).

REMARKS. — This species is widely distributed in the Indo-West-Pacific (from 274 to 536 m deep) and has been reported from Indonesia by HOLTHUIS (1991). The specimen from Stn CP 88 has the body spines and pleopods exceptionally long and was collected from great depth (1188-1178 m). Since the arrangement of the spines on body in this specimen is very similar to those of the other juveniles of this species, it is probably still in the very early puerulus stage.

Puerulus velutinus Holthuis, 1963

Puerulus angulatus - DE MAN, 1916: 36, pl. 2-fig. 5 (*non* Bate, 1888).
Puerulus velutinus Holthuis, 1963: 55 (type-locality: Indonesia); 1966: 273; 1991: 165, figs 307-308.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991 : 1 ovig. ♀ 58.0 mm (MNHN).

REMARKS. — *P. velutinus* is unique in the genus, in bearing a large postorbital spine. It is known from the southern Philippines down to NW Australia (WADLEY & EVANS, 1991), at depths of 485-683 m.

Family SCYLLARIDAE

Genus ***IBACUS*** Leach, 1815

Ibacus brevipes Bate, 1888

Ibacus brevipes Bate, 1888: 62, pl. 9-fig. 1 (type-locality: Indonesia). — HOLTHUIS, 1985: 47, figs 13-14; 1991: 201, figs 384-385.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10. 1991: 6 ♂ 20.6-38.5 mm, 2 ♀ 21.7-40.3 mm (POLIPI).

REMARKS. — The KARUBAR specimens were taken from almost the same locality and depth as the type collected by the *"Challenger"* (i.e. 05°49.15'E, 132°14.14'E, 256 m) near the Kai Islands. In the KARUBAR material the number of posterolateral teeth on the carapace may be as high as 18 (12-17 in HOLTHUIS, 1985). As mentioned by HOLTHUIS (1985), the teeth on the anterior margin of the distal antennal segment are sometimes strongly reduced in the males. This species has been reported from the South China Sea, the Philippines, Indonesia and New Caledonia (at depths of 186-457 m).

Ibacus pubescens Holthuis, 1960, comb. nov.

Ibacus ciliatus pubescens Holthuis, 1960: 147 (type-locality: the Philippines); 1985: 33, fig. 8; 1991: 203, fig. 338-right.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 36, 06°5'S, 132°44'E, 268-210 m, 27.10. 1991: 1 ♀ 24.4 mm (POLIPI).
Tanimbar Islands: stn CP 82, 09°32'S, 131°02'E 219-215 m, 4.11.1991: 1 ♀ 35.3 mm (MNHN). — Stn CP 85, 09°22'S, 131°14'E, 245-240 m, 4.11.1991: 1 ♀ 21.8 mm (POLIPI).

REMARKS. — This present form differs from the typical *I. ciliatus* (von Siebold, 1824) by having the entire body distinctly pubescent and slightly more posterolateral teeth on the carapace (one KARUBAR specimen even has 15 posterolateral teeth on one side). The typical form has a northern distribution, from Japan to the South China Sea and northern Philippines. The pubescent form has been found in the southern range of the distribution of the species (i.e. southern Philippines and NW Australia), but is only reported for the first time from Indonesia here. Similar to the figure provided by HOLTHUIS (1985, 1991), the posterior margin of abdominal tergite V is evenly serrated in the KARUBAR material. However, all the specimens from Taiwan have the posterior margin of abdominal tergite V provided with only three or four distinct tubercles near the lateral ends (CHAN & YU, 1993: 187-upper photo). The figures of *I. ciliatus ciliatus* given by HOLTHUIS (1985, 1991) also show a similar arrangement of tubercles on abdominal tergite V. Thus, it seems justifiable to treat the pubescent, southern form as a distinct species, rather than subspecies, as in the comparable situation of *Metanephrops velutinus* and *M. andamanicus*. It is interesting that material from the Philippines to Australia often has the body more pubescent.

The depth range of this species is from 151-391 m (HOLTHUIS, 1985).

Ibacus novemdentatus Gibbes, 1850

Ibacus novemdentatus Gibbes, 1850: 19 (type-locality: unknown). — HOLTHUIS, 1985: 52, figs 15-17; 1991: 204, figs 390-391.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn 35, 06°08'S, 132°45'E, 390-502 m, 27.10. 1991 : 1 ♀ 7.0 mm (POLIPI).
Tanimbar Islands: stn CP 81, 09°35'S, 131°02'E, 200-207 m, 4.11.1991: 1 ♂ 52.0 mm (POLIPI).

REMARKS. — Although *I. novemdentatus* is widely distributed in the Indo-West-Pacific (at depths of 37-400 m), it has nevertheless not been reported from Indonesia before. This species generally bears 8 posterolateral teeth on the carapace, but the male from the KARUBAR cruise has 7, while the female has 9 posterolateral teeth.

Genus *SCYLLARUS* Fabricius, 1775

Scyllarus sp.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 5, 05°49'S, 132°18'E, 269-299 m, 22.10.1991: 1 juv. 7.4 mm (MNHN). — Stn DW 32, 05°47'S, 132°51'E, 170-106 m, 26.10.1991: 1 juv. 6.6 mm (MNHN).

REMARKS. — These two specimens are very young juveniles (probably at the very early postlarval stages). No trace of gonopores is found and their pleopods are extremely long. The thoracic sternum has the anterior process undeveloped (i.e. anterior end of the thoracic sternum truncate and not anteriorly protruded at all) and bears a pair of elongate posterolateral spines. The juvenile of *S. cultrifer* collected by the KARUBAR cruise (see below) has a similar size but the pleopods are rudimentary and the anterior extremity of the thoracic sternum already shows the characteristic shape of the species. Thus, it is highly likely that these two small specimens are the juveniles of a large *Scyllarus* species. They show some similarities to *S. crenatus* (WHITELEGGE, 1900), described from East Australia, in possessing a distinct rostrum, the arborescent markings on the abdomen being indistinct (almost absent in one specimen) and only the posterior margins of abdominal somites I to III medially incised. *S. crenatus* is still known only from the types and it is also likely that WHITELEGGE's (1900) specimens (about cl 5.2 mm) are juveniles of other species. This situation is further complicated because the taxonomic status of many species of *Scyllarus* is still unclear.

Scyllarus cultrifer (Ortmann, 1897)

Arctus cultrifer Ortmann, 1897: 272 (type-locality: Japan).
Arctus sordidus - BATE, 1888: 66, pl. 9-fig. 3 (*non* Stimpson, 1860).
Scyllarus cultrifer meridionalis Holthuis, 1960: 150 (type-locality: the Philippines).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn DW 24, 05°32'S, 132°51'E, 243-230 m, 26.10.1991: 1 ♀ 8.0 mm (MNHN).

REMARKS. — *S. cultrifer* is unique in the genus by having both the pereiopods III and IV subchelate. This species is widely distributed in the Indo-West-Pacific (from littoral to about 290 m deep). HOLTHUIS (1960) assigned the southern material (i.e. from the Philippines, Indonesia and east of South Africa) to a distinct subspecies, *S. cultrifer meridionalis* Holthuis, 1960. However, the KARUBAR specimen shows intermediate characters between the typical and southern forms. Its posterior margin of abdominal tergite IV lacks a median incision but the other characteristics all conform to the typical form. As suggested by HARADA (1962) and CHAN and YU (1993), it may not be necessary to divide this species into two subspecies. *S. cultrifer* has already been reported by BATE (1888, under the name "*Aractus sordidus*") from the Kai Islands.

Family NEPHROPIDAE

Genus ***NEPHROPSIS*** Wood-Mason, 1873

Nephropsis acanthura Macpherson, 1990

Nephropsis acanthura Macpherson, 1990: 311, figs 5d, 9d-f, 11a-b, 16d (type-locality: the Philippines). — HOLTHUIS, 1991: 35, fig. 61-62. — GRIFFIN & STODDART, 1995: 234.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Tanimbar Islands*: stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♂ 11.1 mm (POLIPI). — Stn CP 89, 08°39'S, 131°08'E, 1084-1058 m, 5.11.1991: 1 ovig. ♀ 18.9 mm (MNHN).

REMARKS. — Although this species is widely distributed in the Indo-West-Pacific (at depths of 720-1305 m), it is here recorded for the first time from Indonesia. *N. acanthura* is distinct in having an erect basal spine on the telson and can be distinguished from the closely related species *N. occidentalis* Faxon, 1893, from the eastern Pacific by the rostrum being distinctly longer than one-half the carapace length. The size of *N. acanthura* is also smaller than its eastern Pacific counterpart. However, the carapace is not granulate in the KARUBAR specimens and that of the female is rather heavily pubescent. Furthermore, the carapace of the male has some post-supraorbital spinules which are lacking in the female (see also GRIFFIN & STODDART, 1995).

Nephropsis ensirostris Alcock, 1901

Nephropsis ensirostris Alcock, 1901: 162, pl. 1-fig. 2 (type-locality: Arabian Sea). — DE MAN, 1916: 113. — MACPHERSON, 1990: 303, figs 5a, 6, 8a-b, 16a. — HOLTHUIS, 1991: 41, figs 71-72.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Tanimbar Islands*: stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♂ 19.5 mm (MNHN). — Stn CP 72, 08°36'S, 131°33'E, 699-676 m, 2.11.1991: 1 ♀ 16.8 mm (POLIPI).

REMARKS. — The present species is unique in the genus in lacking teeth on the rostrum. *N. ensirostris* is widely distributed in the Indo-West-Pacific (at depths of 315-1300 m) and its occurrence in Indonesia has been recorded by DE MAN (1916) and MACPHERSON (1990). The two KARUBAR males agree well with the description of MACPHERSON (1990), except that the outer spine on the terminal half of the carpus of large cheliped is absent in one specimen and poorly developed on one side in the other. The smaller male also has the left anterior spine of the subdorsal carina missing.

Nephropsis holthuisi Macpherson, 1993

Nephropsis holthuisi Macpherson, 1993: 55, figs 1-3 (type-locality: NW Australia). — GRIFFIN & STODDART, 1995: 234.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 ♀ 9,0 mm (MNHN).

Tanimbar Islands: stn CC 57, 08°19'S, 131°53'E, 603-620 m, 31.10.1991: 1 ♂ 32.1 mm, 1 ovig. ♀ 28.1 mm (MNHN).

REMARKS. — This species is extremely similar to *N. rosea* Bate, 1888, from the western Atlantic. MACPHERSON (1993) only used the relative position of the gastric tubercle on the carapace to separate them. Other than being smaller in size, the Indo-West-Pacific material appears to have the anterior margin of the abdominal pleuron II slightly more convex and the large chelae less granulate [three specimens of *N. rosea* from French Guyana (MNHN-AS 574) were compared]. Since, at present, only six specimens are known from north-western and eastern Australia and Indonesia (at depths of 603-1105 m), more material is necessary to determine the taxonomic status of this Indo-West-Pacific form.

Nephropsis serrata Macpherson, 1993

Nephropsis Stewarti - DE MAN, 1916: 112, pl. 3-fig. 17. (*non* Wood-Mason, 1872).
Nephropsis serrata Macpherson, 1993: 59, figs 4-6 (type-locality: NW Australia).
? *Nephropsis hamadai* Watabe & Ikeda, 1994: 102 (type-locality: Japan).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CC 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 3 ♂ 19.4-26.4 mm, 2 ♀ 22.5-32.3 mm (MNHN). — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 ♂ 26.3 mm, 12 ♀ 13.0-30.1 mm, 1 juv. 9.4 mm (POLIPI).

Tanimbar Islands: stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♀ 23.1 mm (MNHN).

REMARKS. — The present species is very similar to *N. stewarti* and they often occur together. Nevertheless, *N. serrata* differs constantly from the latter species in having some additional spines on the subdorsal carina. Thus, the *"Siboga"* specimen reported by DE MAN (1916) from the Kai Islands has the subdorsal carina denticulate and should belong to the present species instead of *N. stewarti*. The size of *N. serrata* is also much smaller than that of *N. stewarti*. However, the differences in the rostral length and large chela between these two species, mentioned by MACPHERSON, (1993), appear to be rather variable in *N. stewarti*.

N. hamadai Watabe & Ikeda, 1994, recently described from Japan, is very similar to *N. serrata*. The characters, such as the shape of the coxae of the pereiopods and the relative distances of the orbital margin, cervical groove and posterior margin of the carapace, used by WATABE and IKEDA to distinguish *N. hamadai* from *N. serrata*, are found to be very variable in the KARUBAR and North Western Australian specimens (10 specimens in NTOU, CSIRO in exchange). It is highly likely that *N. hamadai* belongs to the same species as *N. serrata*.

N. serrata was previously known from western Australia only. The present report extends its range northward to Indonesia, at depths of 300-694 m.

Nephropsis stewarti Wood-Mason, 1873

Nephropsis stewarti Wood-Mason, 1873: 60 (type-locality: Andaman Sea).
Nephropsis stewarti - MACPHERSON, 1990: 312, figs 5e, 10, 11c-d, 16. — HOLTHUIS, 1991: 45, figs 80-81.
Not *Nephropsis Stewarti* - DE MAN, 1916: 112, pl. 3-fig. 17 (= *N. serrata* Macpherson, 1993).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CP 12, 05°23'S, 132°37'E, 436-413 m, 23.10.1991: 2 ♂ 13.8-24.6 mm, 1 ♀ 25.3 mm (MNHN). — Stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♂ 53.9 mm (MNHN). — Stn CP 39, 07°47'S, 132°26'E, 477-466 m, 28.10.1991: 1 ♀ 51.8 mm (MNHN).

Tanimbar Islands: stn CC 56, 08°16'S, 131°59'E, 552-549 m, 31.10.1991: 1 spec. 58.0 mm (POLIPI). — Stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♂ 64.1 mm (MNHN). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 1 ♂ 32.5 mm (MNHN).

REMARKS. — This species is widely distributed in the Indo-West-Pacific (at depths of 170 to over 1060 m). However, the previous record in Indonesia by DE MAN (1916) actually represented *N. serrata*. Thus, it can be considered that *N. stewarti* is correctly reported from Indonesia only now. *N. stewarti* is probably the largest species of the genus, the body length (excluding the rostrum) of a male collected by the KARUBAR cruise reaching 18.2 cm.

Nephropsis sulcata Macpherson, 1990

Nephropsis sulcata Macpherson, 1990: 319, figs 13e-g, 14a-b, 15a-b, 16g (type-locality: the Philippines). — HOLTHUIS, 1991: 47, figs 84-85.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Tanimbar Islands*: stn CP 81, 09°35'S, 131°02'E, 200-207 m, 4.11.1991: 2 ovig. ♀ both 21.0 mm, 4 ♀ 15.7-21.5 mm (MNHN). — Stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♂ 22.1 mm, 2 ♀ 12.2-22.5 mm (POLIPI). — Stn CP 89, 08°39'S, 131°08'E, 1084-1058 m, 5.11.1991: 1 ♂ 15.6 mm (rostrum missing, tentatively identified as the present species) (MNHN).

REMARKS. — *N. sulcata* is widely distributed in the Indo-West-Pacific but has not been recorded in Indonesia before. Moreover, one lot of the KARUBAR specimens (Stn CP 81) was collected at a depth of only 200-207 m which is much shallower than previously thought for *N. sulcata* (415-1115 m deep in MACPHERSON, 1990; 1993).

It is found that some characteristics used by MACPHERSON (1990) to separate *N. sulcata* from the closely related Atlantic species *N. atlantica* Norman, 1882, are not very satisfactory [specimens of *N. sulcata* and *N. atlantica* in MNHN, mentioned by MACPHERSON (1990), have been compared]. The dorsal carina on the abdomen is also very distinct and the median groove of the rostrum may sometimes overreach the distal rostral teeth in the material from the Atlantic. On the other hand, the distance between the post-supraorbital spine and the gastric tubercle is often more than 0.5 (to about 0.6) times the distance between the gastric tubercle and the post-cervical groove in the Indo-West-Pacific material. Nevertheless, the size of Indo-West-Pacific specimens appears to be much smaller than that of the Atlantic material and the carpus of pereiopod II is always shorter than the palm. Furthermore, the posterior border of the abdominal somite V often bears a distinct spine in the Indo-West-Pacific specimens, but this spine is usually absent in the material from the Atlantic.

Genus *METANEPHROPS* Jenkins, 1972

Metanephrops arafurensis (de Man, 1905)

Figs 1, 2 a-c, 3, 4 b, 5 b

Nephrops arafurensis de Man, 1905: 587; 1916: 107, pl. 3-fig. 16 (type-locality: Indonesia). — YALDWYN, 1954: 730.
Metanephrops arafurensis - JENKINS, 1972: 171. — CHAN & YU, 1987: 184. — HOLTHUIS, 1991: 67, figs 130-131.

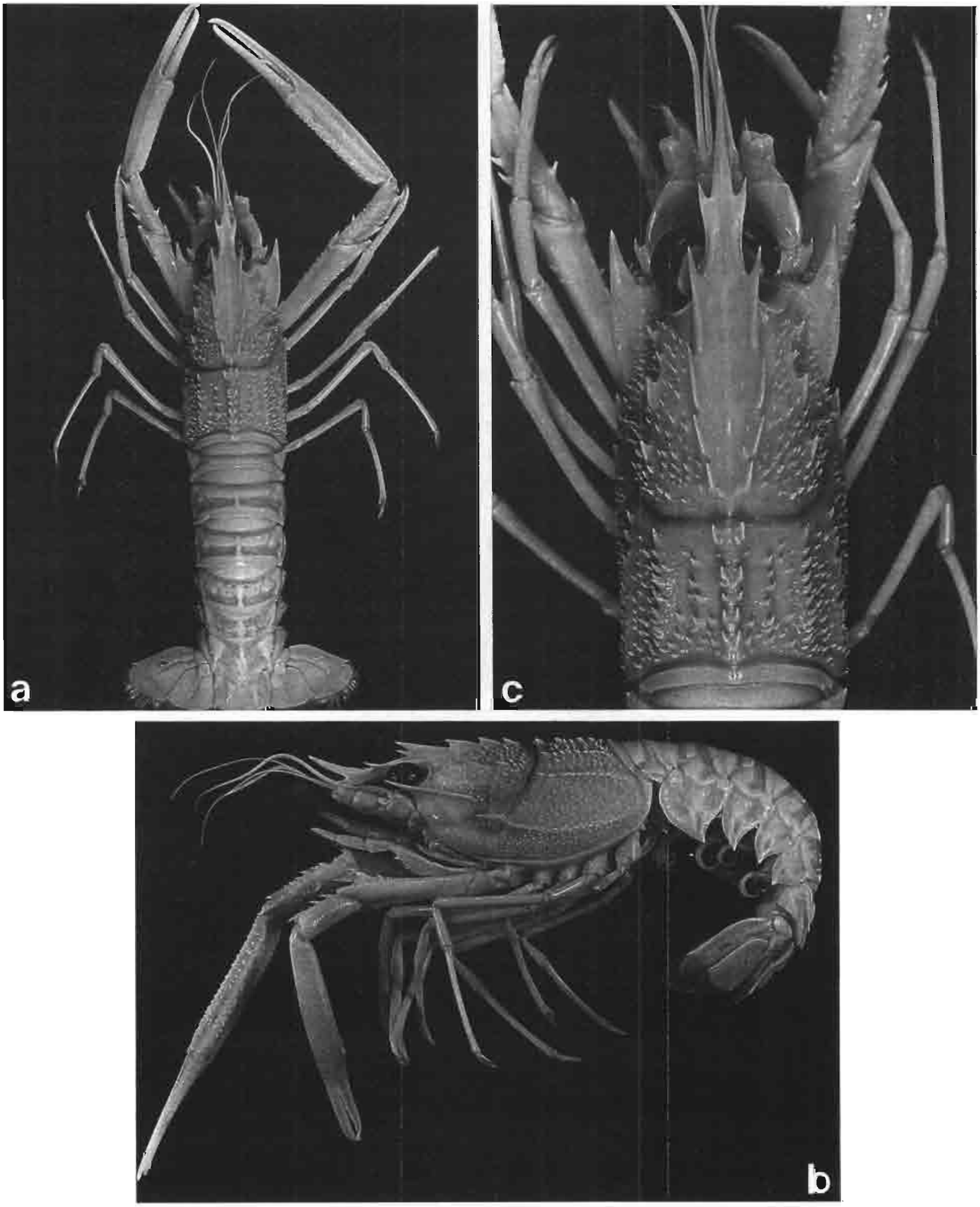

FIG. 1. — *Metanephrops arafurensis* (de Man, 1905). Indonesia, Tanimbar Islands, 7°46'S, 132°31'E, 443-468 m, ♂ 50.7 mm (MNHN): **a**, dorsal view; **b**, lateral view; **c**, dorsal view of carapace.

MATERIAL EXAMINED. — **Indonesia**. *"Siboga"*: stn 262, 05°53.8'S, 132°48.8'E, 560 m, 12.18.1899: 1 ♂ 34.0 mm, type (ZMA).

KARUBAR. *Tanimbar Islands*: stn CC 40, 07°46'S, 132°31'E, 443-468 m, 28.10.1991: 1 ♂ 50.7 mm (MNHN).

DESCRIPTION. — Carapace spinulose. 4-5 post-rostral teeth present. Region between post-rostral carinae only having some spinules on posterior part. Posterior margin of hepatic groove spinulose, but that of cervical groove lacking spines except those at anterior ends of post-cervical ridges. Three lateral, post-cervical ridges present. Antennal spine wing-like and with outer margin somewhat crenulated. Distal segment of maxilliped III rather long and slender. Large cheliped weakly ridged but covered with sharp tubercles, with inner margins bearing some large spines, and outer margin of chela angular.

Abdomen with distinct dorsal carina (that of somite I with only anterior end present); raised parts naked but depressed parts heavily pubescent; tergite I with deep, but short, lateral transverse furrows; tergites II and III with broad but medially interrupted transverse furrows (as wide as or wider than main facade and having intermediate, narrow, eroded, transverse carina between) and dorsally arched, lateral, longitudinal furrows, submedian notches rudimentary but some pits may be present on raised parts near dorsal carina; sculpture on tergite IV similar, but with main facade broader and having more (and larger) pits, while ventral end of lateral furrow recurved anterodorsally; non-articular surface of tergite V with raised parts less than depressed parts and mainly composed of an eroded cross at middle; tergite VI with median ridge bearing a pair of submedian spines, as well as strong spines at both anterior and posterior ends, posterolateral spine well-developed, lateral lobe terminated posteriorly by a strong spine and outer margin having 2-3 spines. Abdominal pleura ventrally pointed and with margins crenulated. Telson bearing 3 spinules at middle, with pair of elongate, submedian, basal spines and 2-3 large spines on dorsolateral ridges. Endopod of uropods covered with spinules and having a strong basal spine, exopod only with outer part spinulose. Posterolateral spines of telson and uropods all very well-developed.

COLORATION. — Body generally orange pink. Eyes dark brown. Anterior carapace somewhat pink. Large cheliped slightly banded with pale and deep orange bands. Distal 2/3 of fingers of large chelae and hinges of abdominal somites whitish.

SIZE. — The two males known are cl 34 mm and 50 mm.

DISTRIBUTION. — Only known near the Kai Islands in Indonesia, at depths of 443-560 m.

REMARKS. — *M. arafurensis* was originally described from a multilated specimen and no other material had been obtained since the original description. The finding of a complete specimen (although with left large cheliped smaller and probably regenerated) of this species by the KARUBAR cruise is therefore of particular importance.

The KARUBAR male is almost identical with the type (condition good except for original damage), except that the right post-rostral carina bears only four teeth (actually the fifth post-rostral tooth is rather small and situated more medially than the anterior teeth). Aside from lacking pits on the raised parts near the dorsal carina, the sculpture of the anterior three abdominal somites of the KARUBAR male is very similar to that of the type. Although no illustration was given by DE MAN (1916) of the posterior abdomen, a broken abdominal somite IV and the left third of somite V are present in the type. They are also very similar to those of the KARUBAR male and only differ in the arrangement of pits on the raised parts.

Many authors (eg. BRUCE, 1966; JENKINS, 1972; CHAN & YU, 1987; HOLTHUIS, 1991) suspected that *M. arafurensis* is most similar to *M. australiensis*. Indeed the spinulation of the carapace is almost identical between these two species, with only the spines being relatively more well-developed and the post-rostral carina sometimes bearing one more, small tooth in *M. arafurensis*. However, the large cheliped and abdominal sculpture of *M. arafurensis* are very different to those of *M. australiensis*. The presence of spinules on the exopods of the uropods and the middle of the telson also separate the former species from the latter.

The spinulose large cheliped and complicated abdominal sculpture of *M. arafurensis* show close resemblance with the fossil species *M. motunauensis* Jenkins, 1972, from the late Pliocene of New Zealand. The large chelipeds appear to be almost identical in these two species. The spinulation of the carapace and of the tail fan are also very similar, except that the entire posterior margin of the cervical groove is spinulose in *M. motunauensis*.

Although *M. motunauensis* seems to have fewer spinules on the posterodorsal carapace and tail fan, these spinules may well be eroded and become indistinct in fossils. The clearest difference between *M. arafurensis* and *M. motunauensis* is of the abdominal sculpture. Although the basic patterns of sculpture are similar [although JENKINS (1972) mentioned a difference in the shape of the lateral longitudinal furrows actually similarly arched dorsally in both species], the transverse furrows of *M. motunauensis* are narrow, as in most of the other species of the genus. However, the transverse furrows are very broad in *M. arafurensis* with the abdominal tergites IV and V having many pits and that of the latter even largely depressed. Furthermore, the median ridge of abdominal tergite VI bears three pairs of submedian spines in *M. motunauensis*, but the two anterior pairs of spines are represented by a single, large spine in *M. arafurensis*.

M. arafurensis seems to be very rare as only one specimen was obtained by the intensive samplings of the KARUBAR cruise and the specimen was collected from almost the same location and depth as the type.

Metanephrops australiensis (Bruce, 1966)

Fig. 2 d-e, 3, 4 b

Nephrops australiensis Bruce, 1966b: 245; pls 25-27 (type-locality: NW Australia).
Metanephrops australiensis - JENKINS, 1972: 171. — CHAN & YU, 1987: 184. — HOLTHUIS, 1991: 68, figs 134-135.

MATERIAL EXAMINED. — **Australia**. *"Umitaka Maru"*: N.E. of Port Hedland, 17°05'S, 119°48'E, 434 m, 26.11.1964: 1 ovig. ♀ 51.8 mm paratype (RMNH-D21151).

N.W. Shelf. 18°19'S, 117°49'E, 414 m, 25.2.1985: 1 ♂ 50.6 mm (NTOU, CSIRO in exchange). — 16°31'S, 120°16'E, 440 m, 28.8.1986: 4 juv. 19.4-21.5 mm (NTOU, CSIRO in exchange). — 16°32'S, 120°25'E, 440 m, 30.8.1986: 1 ♂ 57.2 mm (NTOU, CSIRO in exchange).

Indonesia. KARUBAR. *Kai Islands:* stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 juv. 11.1 mm (MNHN).

Philippines. *"Albatross"*: stn D5290, 13°40'09"N, 120°55'30"E, 391 m, 22.2.1908: 2 ♀ 31.8-35.3 mm (USNM 170461).

REMARKS. — It is interesting that the present species was supposed to be endemic to NW Australia (at depths of 418-500 m), but is now found in Indonesia. Although the specimen collected by the KARUBAR cruise is a small juvenile, it has the typical abdominal sculpture of the species, except for lacking distinct pits. However, its posteriormost post-rostral teeth are situated more medially and the posterior region between the post-rostral carinae bears more spinules. Moreover, the exopods of the uropods, as well as the middle and lateral parts of the telson, bear some spinules. These spinules are always absent in larger specimens (i.e. from cl 19.1 mm onwards). The fingers are also slightly longer than the palm (1.1 times) in the juvenile. Nevertheless, all these different characters in juveniles may merely represent the ancestral relationships between *M. australiensis* and *M. neptunus*.

The northward distribution of *M. australiensis* actually reaches as far as the Philippines. The *Metanephrops* collection in the USNM has a lot of two females obtained by the *"Albatross"* from the Philippines (USNM 170461) very similar to the present species. The only difference between the two Philippine specimens and the material of Australia (NTOU and RMNH) is that the lateral abdomen possess rudimentary longitudinal furrows. These longitudinal furrows on abdominal tergites II and III are quite distinct (though very shallow) in the smaller female (fig. 4e). Furthermore, the intermediate, eroded carinae within the transverse furrows of abdominal tergite II are very distinct in this female and the large chelae are slightly more granulate in the Philippine specimens. Nevertheless, since specimens from Australia sometimes also have rudimentary longitudinal furrows laterally on the abdomen (fig. 4d) and since these furrows are intermediately developed in the other female from the Philippines, it does not seems necessary to treat the Philippine material as a different species.

M. australiensis nonetheless mainly occurs in NW Australia. The extensive sampling in the Philippine-Indonesian region by many large expeditions has so far only obtained three specimens of this species (i.e. one juvenile by the KARUBAR cruise and two females by the *"Albatross"*).

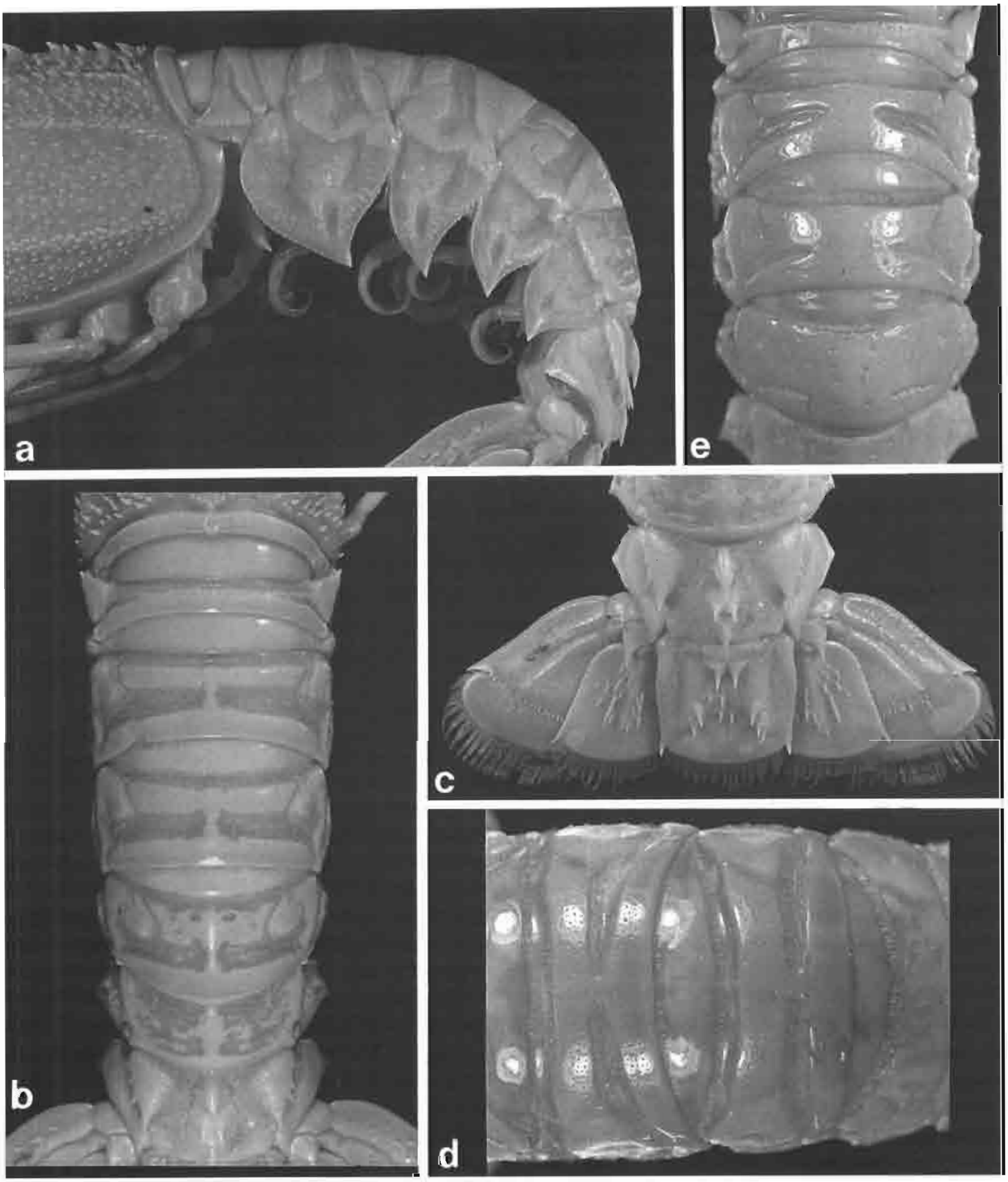

FIG. 2 a-c. — *Metanephrops arafurensis* (de Man, 1905), Indonesia, Tanimbar Islands, 7°46'S, 132°31'E, 443-468 m, ♂ 50.7 mm (MNHN): **a**, lateral view of abdomen; **b**, dorsal view of abdomen; **c**, dorsal view of posterior abdominal somites and tail fan.

FIG. 2 d-e. — *Metanephrops australiensis* (Bruce, 1966): **d**, NW Australia, 18°19'S, 117°49'E, 414 m, ♂ 50.6 mm (NTOU, CSIRO in exchange): dorsal view of abdominal tergites II and III. — **e**, The Philippines, 13°40.09'N, 120°55.3'E, 392 m, ♀ 31.8 mm (USNM 170461): dorsal view of abdominal tergites I-IV.

Metanephrops neptunus (Bruce, 1965)

Fig. 3, 4 b, 5 c-d

Nephrops neptunus Bruce, 1965: 274, pls 13-15 (type-locality: South China Sea).
Metanephrops neptunus - JENKINS, 1972: 171. — CHAN & YU, 1987: 184. — MACPHERSON, 1990: 299. — HOLTHUIS, 1991: 76, figs 148-149.

MATERIAL EXAMINED. — **South China Sea**. *"Cape St. Mary"*: stn 26, 19°25.5'-19°22'N, 114°07.5'-114°11'E, 732-795 m, 7.1.1964: 1 ♂ 59.0 mm allotype (RMNH-D21152).

Tungsha Tao (or Pratas), coll. Taiwan Fisheries Research Institute, Keelung: 1 spec.

Philippines. *"Albatross"*: stn 5423, 09°38.3'N, 121°11'E, 929 m, 31.3.1909: 1 ♀ 42.0 mm (USNM 170451).

Indonesia. KARUBAR. *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 25.10.1991: 1 ♂ 87.1 mm (MNHN). *Tanimbar Islands:* stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 juv. 15.3 mm (MNHN).

CORINDON 2: stn 214, Makassar Strait, 00°31.4'N, 117°50.1'E, 595 m, 1.11.1980: 1 spec. (MNHN-AS 257).

Australia. N.W. Shelf, 18°19'S, 117°49'E, 414 m: 2 ♂ 26.0-69.0 mm, 1 ovig. ♀ 71.6 mm, 1 ♀ 36.5 mm (NTOU, CSIRO in exchange).

REMARKS. — *M. neptunus* has been reported in Indonesia by MACPHERSON (1990), from Makassar. As mentioned by BRUCE (1965), the anterior transverse furrows of the abdominal tergites II and III are rather variable in this species. These furrows can be as long as the posterior transverse furrows (i.e. in the two large specimens of the KARUBAR and the Makassar specimen) or have the submedian parts variably raised and fused with the main facades [i.e. in the types, the specimen from Tungsha Tao, the specimen from the Philippines, the small specimen from KARUBAR and some specimens from Australia (WADLEY & EVENS, 1991 and specimens in NTOU)]. The red colour of the body also varies a lot in different individuals. Some have the body nearly all red (i.e. the female from KARUBAR, which has only the abdominal somites I to IV whitish, fig. 5 c) while some others are mainly white (i.e. the Australian specimen in WADLEY & EVANS, 1991). Half red and half white individuals can also be found (eg. the types, specimens from Tungsha Tao, Makassar, and the KARUBAR male, fig. 5 d). Since no correlation is found between colour patterns, shape of the anterior transverse furrows on the abdomen, localities, depth and sexes, they probably represent natural variations of the species.

Apart from its huge size and presence in deeper waters, the general appearance of *M. neptunus* rather differs from all the other species of the genus [eg. smaller eyes, only two lateral post-cervical ridges, large chelae with fingers considerably longer (1.3-1.5 times) than palm, each of abdominal tergites II to V bearing two transverse furrows, etc.]. The small juvenile obtained by the KARUBAR cruise already has all these "aberrant" characteristics. Thus, although juveniles of *M. australiensis* show some resemblances with *M. neptunus*, they can be readily distinguished from each other.

Although *M. neptunus* is widely distributed from the South China Sea to western Australia (at depths of 300-940 m and usually more than 500 m) and has a very large size (body length reaching 25 cm in HOLTHUIS, 1991), it is nowhere abundant. This may perhaps be due to this species inhabiting rather deep waters and suitable fishing grounds not having been located.

Metanephrops sibogae (de Man, 1916)

Fig. 3, 4 b

Nephrops sibogae de Man, 1916: 102, pl. 4-fig. 18 (type-locality: Indonesia). — YALDWYN, 1954: 730.
Metanephrops sibogae - JENKINS, 1972: 171. — CHAN & YU, 1987: 184. — HOLTHUIS, 1991: 79, figs 154-155. — GRIFFIN & STODDART, 1995: 232

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Tanimbar Islands*: stn CP 62, 09°01'S, 132°42'E, 246-253 m, 1.11.1991: 9 ♀ 24.0-43.6 mm (MNHN). — Stn CP 78, 09°06'S, 131°24'E, 295-284 m, 3.11.1991: 4 ♂ 34.7-54.4 mm, 1 ovig. ♀ 37.2 mm, 3 ♀ 18.6-45.8 mm, 2 juv. 13.3-13.8 mm (MNHN). — Stn CP 79, 09°16'S, 131°22'E, 250-239 m, 3.11.1991: 3 ♂ 20.5-49.9 mm, 5 ♀ 15.9-33.4 mm (MNHN). — Stn CP 83, 09°23'S, 131°E, 285-297 m, 4.11.1991: 4 ♂ 18.2-42 mm, 1 ♀ 33.8 mm (POLIPI).

REMARKS. — *M. sibogae* is very similar to *M. boschmai* (Holthuis, 1964) but is generally considered to differ in the inner margin of the merus of the large cheliped lacking large spines (HOLTHUIS, 1964, 1991; CHAN & YU, 1987). However, 1-3 large spines are found on the merus of the large cheliped in 23 of the 32 specimens collected by the KARUBAR cruise. Therefore, the use of the spinulation on the large chelipeds to separate these two species is not at all satisfactory. Nevertheless, a direct comparison of some *M. boschmai* specimens from western Australia (NTOU and 6 paratypes at RMNH) shows that several constant differences can be found between the two species (see also GRIFFIN & STODDART, 1995).

The posterior margin of the hepatic groove always bears 4-6 spinules in *M. boschmai*, while these spinules are lacking in all the *M. sibogae* specimens examined. Furthermore, there are 1-5 additional spinules present around the dorsal postorbital spines in *M. boschmai* and these spinules are usually absent in *M. sibogae* (only two specimens have an additional spinule on one side of the carapace). The paired spines on the dorsal post-cervical ridge are well-separated in *M. boschmai*, but abutting in *M. sibogae*. The median ridge of abdominal tergite VI is generally armed with a pair of submedian spines in *M. boschmai*, but only a single median spine in *M. sibogae*. Very rarely (2/32) an additional pair of posterior submedian spinules may be present in *M. sibogae* (as shown in DE MAN, 1916: pl. 6-fig. 18) though these are always smaller than the median spine. On the other hand, the median ridge of abdominal tergite VI may occasionally lack distinct spines in both species. As mentioned by HOLTHUIS (1946) the distal segment of maxilliped III is more oval in *M. boschmai* (1.8-2.04 times as long as broad in *M. boschmai* and 2.6-3.2 times as long as broad in *M. sibogae*). The shape of the scaphocerite, however, is not very different between the two species as described by HOLTHUIS (1964). The large chela is weakly ridged and granular (sometimes rather sharp) in adults of *M. sibogae*, but always rounded and very finely granular in *M. boschmai*. Other than inhabiting different regions (i.e. *M. sibogae* occurs from southern Indonesia to northern Australia at depths of 246-320 m, while *M. boschmai* is restricted to western Australia at similar depths), the two species have very different coloration (see WADLEY & EVANS, 1991). *M. sibogae* is rather uniformly orange-pink. The colour of *M. boschmai* is much attractive: Its body is also orange-pink but the posterior margins of each abdominal tergite and tailfan are whitish, while the large chela has the fixed finger red, but the movable finger whitish. Furthermore, the postorbital margin is deep red in some small specimens of *M. boschmai*.

The abdomen is generally smooth in the present species. However, sometimes rudimentary, transverse, as well as longitudinal, grooves, or rows of shallow pits, may be present on the abdomen (also present in *M. boschmai*, but usually even less distinct).

Metanephrops velutinus Chan & Yu, 1991

Fig. 3, 4 b, 5 a

Metanephrops velutinus Chan & Yu, 1991: 35, pls 2b, 4b, 6c, 8a, c-d (type-locality: the Philippines). — HOLTHUIS, 1991: 82, figs 160-161. — GRIFFIN & STODDART, 1995: 233.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn CC 10, 05°21'S, 132°30'E, 329-389 m, 23.10.199: 2 ♂ 35.7-48.6 mm, 1 ovig. ♀ 51.9 mm, 1 ♀ 37.2 mm (MNHN). — Stn CP 12, 05°23'S, 132°37'E, 436-413 m, 23.10.1991, 1 ♂ 44.8 mm (MNHN). — Stn CP 34, 06°09'S, 132°41'E, 435-445 m, 27.10.199: 4 ♂ 26.7-49.1 mm, 1 ovig. ♀ 47.9 mm, 2 ♀ 32.5-56.4 mm (MNHN).

Tanimbar Islands: stn CC 40, 07°46'S, 132°31'E, 443-468 m, 28.10.1991: 2 ♂ 43.7-56.4 mm (POLIPI). — Stn CC 41, 07°45'S, 132°42'E, 401-393 m, 28.10.1991: 5 ♂ 18.1-55.3 mm, 1 ovig. ♀ 47.5 mm, 1 ♀ 55.1 mm (MNHN). — Stn CC 42, 07°53'S, 132°42'E, 354-350 m, 28.10.1991: 3 ♂ 36.0-40.8 mm, 2 ovig. ♀ 49.1-50.8 mm, 2 ♀ 39.4-55.3 mm (MNHN). — Stn 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♂ 41.9 mm (POLIPI). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 3 ♂ 35.5-46.5 mm, 2 ♀ 38.6-39.9 mm (POLIPI).

REMARKS. — The present species was only recently described by CHAN and YU (1991) from the Philippines and western Australia, where it was previously mistaken for *M. andamanicus* (Wood-Mason, 1891). The 34 specimens collected by the KARUBAR cruise in southeastern Indonesia all have the raised parts of the abdomen coarse and pubescent. The record of *M. andamanicus* by DE MAN (1916) from the other side of Indonesia was suspected to represent the present species (CHAN & YU, 1991). However, a re-examination of DE MAN's (1916) specimen [*"Siboga"*: stn 12, Java Sea, 07°15'S, 115°15.6'E, 289 m, 14.3.1899: 1 ♂ 44.9 mm (ZMA)] revealed that the raised parts of its abdomen are naked and smooth. The *Metanephrops* collection of the USNM also contains two *M. andamanicus* specimens from the Java Sea [Cruise 684, Java Sea, 08°34'S, 114°36'E, 322 m, 22.6.1981: 1 ♂ 34.0 mm, 1 ♀ 50.0 mm (USNM 456448)]. Thus, it is possible that *M. andamanicus* has a distribution from the Indian Ocean to the western part of Indonesia, while *M. velutinus* occurs from the Philippines down to the eastern part of Indonesia and western Australia (at depths of 238-702 m). Material from intermediate localities, such as the Flores and Banda Seas, will probably provide more insights to the exact distribution of these two, closely related species. This species was found recently in the Torres Strait.

NOTES ON THE RELATIONSHIPS OF THE SPECIES OF *METANEPHROPS*

The discovery that the poorly known species *M. arafurensis* is very similar to the single fossil species of the genus, *M. motunauensis*, along with improved knowledge of the species of *Metanephrops* in recent years (CHAN & YU, 1987, 1991, MACPHERSON, 1990), allow a brief revision of the relationships between the species of this genus.

The number of species (including the fossil species) of *Metanephrops* has been increased from 14 to 18 since its erection in 1972. Generally, members of this genus are divided into four groups (DE MAN, 1916; YALDWYN, 1954; JENKINS, 1972; CHAN & YU, 1987; HOLTHUIS, 1991). The *"japonicus"* group has the carapace smooth, abdomen conspicuously sculptured and the large chela bearing prominent, spinulated ridges. The *"binghami"* group has the carapace finely granulate, abdomen smooth but the large chela with prominent spinulate ridges. The *"arafurensis"* group has the carapace spinulose, abdomen with conspicuous furrows and the large chela variably ridged. The *"thomsoni"* group has the carapace smooth, abdomen weakly sculptured or smooth, and the large chela also weakly ridged to smooth.

The division of the genus into these four groups appears to be valid for the 18 species known at present:

The *"japonicus"* group. — *M. japonicus* (Tapparone-Canefri, 1873), *M. andamanicus* (Wood-Mason, 1891), *M. sagamiensis* (Parisi, 1917), *M. formosanus* Chan & Yu, 1987, *M. mozambicus* Macpherson, 1990, *M. armatus* Chan & Yu, 1991, and *M. velutinus* Chan & Yu, 1991.

The *"binghami"* group. — *M. rubellus* (Moreira, 1903) and *M. binghami* (Boone, 1927).

The *"arafurensis"* group. — *M. arafurensis* (de Man, 1905), *M. neptunus* (Bruce, 1965), *M. australiensis* (Bruce, 1966) and *M. motunauensis* Jenkins, 1972.

The *"thomsoni"* group. — *M. thomsoni* (Bate, 1888), *M. challengeri* (Balss, 1914), *M. sibogae* (de Man, 1916), *M. boschmai* (Holthuis, 1964) and *M. sinensis* (Bruce, 1966).

However, the spines and ridges on the large chela are rather small and weak in some species of the *"japonicus"* group, such as *M. velutinus* and *M. formosanus*. The abdomens of *M. mozambicus* and *M. formosanus* lack a distinct dorsal carina and have the sculpture rather simple (CHAN & YU, 1987, 1991). On the other hand, the large chela in some species of the *"thomsoni"* group is somewhat granulate-ridged (e.g. *M. sibogae*) or has large spines (e.g. *M. thomsoni*). Moreover, distinct transverse furrows are present on the abdomen of *M. sinensis* and *M. thomsoni*. Within the *"arafurensis"* group, the abdominal sculpture can be very complicated (e.g. *M. neptunus* and *M. arafurensis*) or rather simple (e.g. *M. australiensis*) while the large chela may be heavily spinulose (e.g. *M. neptunus*) or nearly smooth (e.g. *M. australiensis*).

The spinulation of the carapace, however, appears to be quite constant in separating the species groups of *Metanephrops*. The *"arafurensis"* group has the carapace uniformly spinulose. The *"binghami"* group has the carapace rather smooth but the entire posterior margins of both the hepatic and cervical grooves are spinulose. The carapaces of the *"japonicus"* and" *thomsoni*" groups are smooth, with the posterior margins of the cervical grooves not serrated. Moreover, the ridging of the large chela appears to have two, somewhat different, forms regardless of the degree of development of spines on it. In the *"japonicus"* and *"binghami"* groups, both the dorsolateral and ventrolateral margins of the large chela are strongly ridged, making the outer border of the chela a flat surface (that of the *"japonicus"* group also has a longitudinal, medial depression). On the other hand, the outer border of the large chela in the *"arafurensis"* and *"thomsoni"* groups is always angular. Although there are large differences in the complexity of the abdominal sculpture amongst the species of the *"japonicus"* and *"arafurensis"* groups, the furrows on the abdomen are always distinctive in these two groups. Moreover, distinct longitudinal furrows are present in the *"japonicus"* group, while the *"arafurensis"* group usually has some large pits on the abdomen (not clear in the fossils of *M. motunauensis*). The abdomens of some species of the *"thomsoni"* group are sculptured, but only narrow transverse furrows are present, without large pits on tergites. It should also be noted that the uropods of the *"arafurensis"* group are unique in being spinulose. Thus, the definitions of the four species groups are modified as follows:

***"Arafurensis"* group**. — Carapace uniformly spinulose. Large chela moderately to weakly ridged and from spinulose to finely granulate, outer border always angular. Abdomen conspicuously sculptured, with or without deep longitudinal furrows but always bearing some large pits at least in adults (not clear in the fossil species *M. motunauensis*). Dorsal surface of uropods spinulose.

***"Japonicus"* group**. — Carapace generally smooth, only bearing some spines on anterior and dorsal parts, posterior margin of cervical groove not serrated. Large chela ridged and sharply tuberculate to spinulose, outer border somewhat flat, with a longitudinal medial depression. Abdomen conspicuously sculptured and with deep longitudinal furrows. Uropods unarmed dorsally.

***"Binghami"* group**. — Carapace generally smooth, but entire posterior margins of hepatic and cervical grooves spinulose. Large chela ridged and spinulose, with outer border flat. Abdomen not sculptured and uropods unarmed dorsally.

***"Thomsoni"* group**. — Carapace generally smooth except for some spines on anterior and dorsal parts. Large chela smooth to weakly ridged, bearing a few large spines; outer border always angular. Abdomen smooth or bearing only narrow, transverse furrows. Uropods unarmed dorsally.

Since the distinguishing characters previously used for some species are also found to be unsatisfactory (e.g. *M. sibogae* vs. *M. boschmai* and *M. thomsoni* vs. *M. sinensis*, etc.), a revised key to the species of *Metanephrops* is provided:

1. Carapace rather uniformly spinulose; dorsal surface of uropods covered with spinules .... **2** (*"arafurensis"* group)
— Carapace smooth between ridges and large spines; uropods unarmed dorsally **5**

2. Region between post-rostral carinae heavily spinulose; abdominal tergites II to V each with two transverse furrows; large chelae with fingers distinctly longer than palm .... *M. neptunus*
— Region between post-rostral carinae only bearing some spinules on posterior part; abdominal tergites II to V each with one transverse furrow; large chelae with fingers shorter than palm **3**

3. Abdomen lacking deep longitudinal furrows; large chelae finely granular or nearly smooth. .... *M. australiensis*
— Abdomen with deep longitudinal furrows; large chelae sharply tuberculate **4**

4. Posterior margin of cervical groove not serrated; transverse furrows on abdominal tergites more or less as wide as main facades .... *M. arafurensis*
— Posterior margin of cervical groove entirely spinulose; transverse furrows on abdominal tergites much narrower than main facades .... *M. motunauensis* (fossil species)

5. Posterior margin of cervical groove entirely spinulose .... **6** (*"binghami"* group)
— Posterior margin of cervical groove not serrated **7**

6. Spinules present between post-rostral carinae; abdominal tergites III to V bearing distinct lateral spines; dorsolateral post-cervical ridge nearly smooth .... *M. rubellus*
— Spinules absent between post-rostral carinae; abdominal tergites III to V without lateral spines; dorsolateral post-cervical ridge spinulose .... *M. binghami*

7. Abdomen bearing distinct transverse and longitudinal furrows; large chelae distinctly ridged, with outer borders flat .... **8** (*"japonicus"* group)
— Abdomen smooth or having only narrow transverse furrows; large chelae smooth or weakly ridged, with outer border angular .... **14** (*"thomsoni"* group)

8. Abdominal tergite V bearing distinct lateral spines; median ridge of tergite VI dorsally armed with paired spines **9**
— Abdominal tergite V without distinct lateral spines; median ridge of tergite VI unarmed dorsally **10**

9. Raised parts of abdomen subdivided; abdominal tergite I bearing well-developed dorsal carina .... *M. japonicus*
— Raised parts of abdomen smooth; abdominal tergite I lacking distinct dorsal carina .... *M. armatus*

10. Large spines present on large chela; abdomen without dorsal carina .... *M. formosanus*
— Large spines absent on large chela; abdomen bearing dorsal carina **11**

11. Post-rostral carinae usually with at least one side having 4-5 teeth; spine on lateral lobe of abdominal tergite VI long and nearly reaching posterolateral groove .... *M. sagamiensis*
— Post-rostral carinae never bearing more than 3 teeth; spine on lateral lobe of abdominal tergite VI short and with tip far from posterolateral groove **12**

12. Raised parts of abdomen coarse and pubescent .... *M. velutinus*
— Raised parts of abdomen smooth and naked **13**

13. Abdomen with dorsal carina well-developed; main facades of abdominal tergites IV and V well-separated from dorsal carina, those of tergites II and III bearing posterior submedian notches .... *M. andamanicus*
— Abdomen with dorsal carina almost leveled; main facades of abdominal tergites IV and V more or less fused with dorsal carina, those of tergites II and III with posterior submedian notches minute or absent .... *M. mozambicus*

14. Abdomen bearing transverse furrows **15**
— Abdomen smooth **16**

15. Three postorbital spines present; large chela without large spines along inner margin but lateral margin of movable finger bearing bush of setae; abdominal tergite I usually having short, lateral, transverse furrows .... *M. sinensis*
— 2 postorbital spines present; large chela generally bearing some large spines along inner margin, lateral margin of movable fingers naked; abdominal tergite I generally lacking distinct transverse furrows .... *M. thomsoni*

16. Dorsal post-cervical ridge unarmed, except at anterior end .... *M. challengeri*
— Dorsal post-cervical ridge spinulose **17**

17. Posterior margin of hepatic groove armed with spinules; large chela rounded; median ridge of abdominal tergite VI generally bearing a pair of submedian spines ... *M. boschmai*
— Posterior margin of hepatic groove devoid of spinules; large chela weakly ridged; median ridge of abdominal tergite VI generally bearing a median spine .... *M. sibogae*

DEPTH AND GEOGRAPHICAL DISTRIBUTIONS OF THE SPECIES OF *METANEPHROPS*

Figures 3 and 4 show the known vertical and geographical distributions for the species of *Metanephrops*. Members of the *"japonicus"* group have the widest distribution in the Indo-West-Pacific. The *"binghami"* group is restricted to the western Atlantic. Species of the "*thomsoni*" group mainly occur along the western periphery of the Pacific, from Japan to New Zealand. The *"arafurensis"* group has a similar, but more restricted, distribution in the Philippine-Australian region (with only the fossil species found in New Zealand). Since most of the species (11 out of 18) are present in the Indo-Malay region, the genus probably originated there. JENKINS (1972) is likely right in suggesting that the "*binghami*" group originated from the Indo-Malay region and migrated to the Atlantic through the Tethys, instead of reaching the Atlantic via southern Africa.

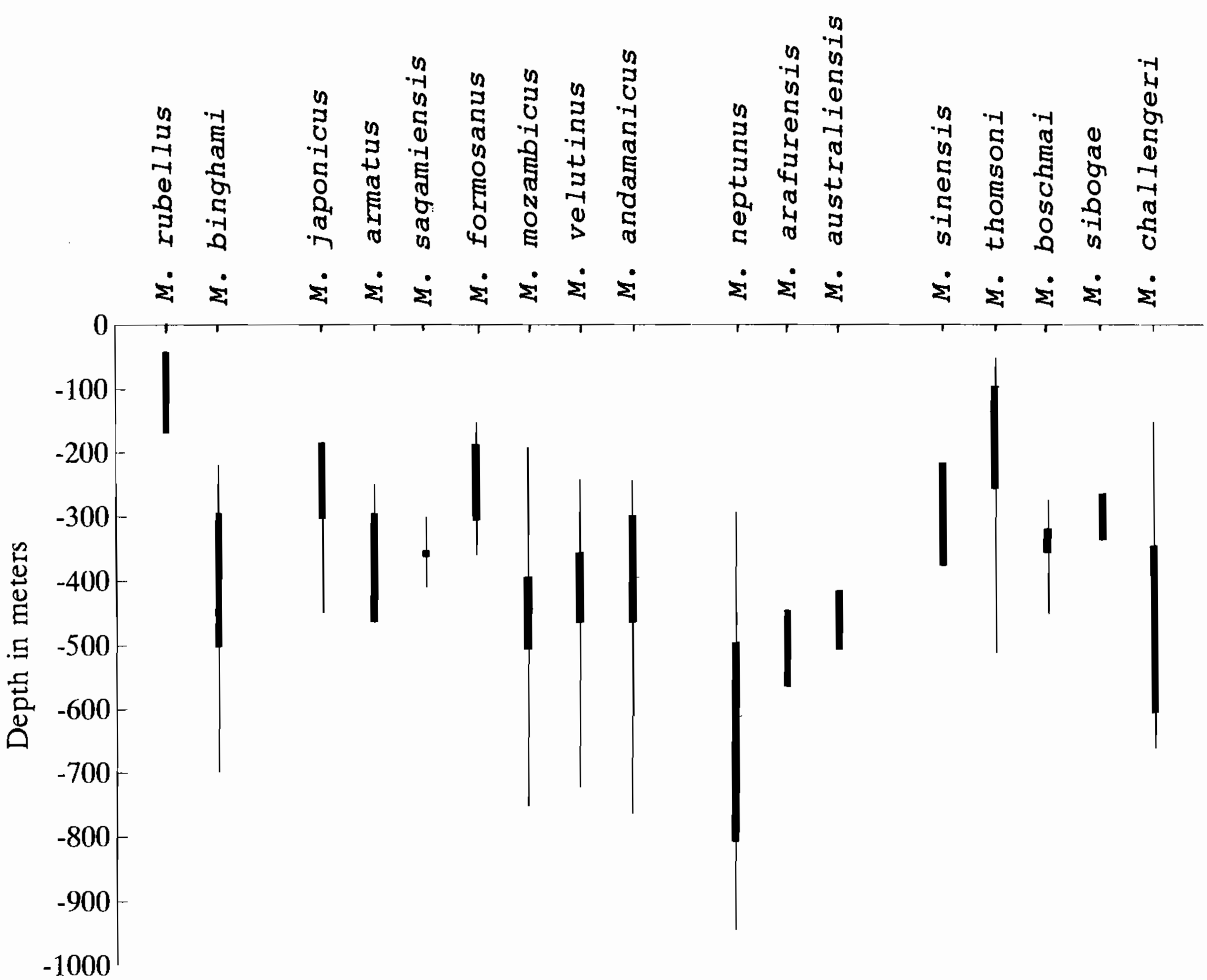

FIG. 3. — Vertical distribution of the extant species of *Metanephrops*. Thick bars represent main distribution of the species.

Amongst the four species groups, the *"japonicus"* group seems to be the most successful in terms of having the most species and spread to the other parts of the Indo-West-Pacific. As suggested by JENKINS (1972), the "*thomsoni*" group is probably the youngest, and therefore still has a limited distribution. However, I disagree with JENKINS (1972) when he suggests that members of the "*thomsoni*" group, by being rather abundant, are actively displacing species of the other groups north- and southwardly. It is now known that species of different groups are often found in the same region, and *M. australiensis*, as well as all the members of the *"japonicus"* group, also occur in large numbers, being exploited commercially (CHAN & YU, 1987, 1991; WADLEY & EVANS, 1991; HOLTHUIS, 1991). On the other hand, species of *Metanephrops* have rather clear vertical zonations. In the same region, members of the *"thomsoni"* group are usually found in shallower waters and those of the *"arafurensis"* group in deeper waters, while species of the *"japonicus"* group occur in between the two (CARTER *et al.*, 1983; Anon., 1984; CHAN & YU, 1987, 1993; WALLNER & PHILLIPS, 1988).

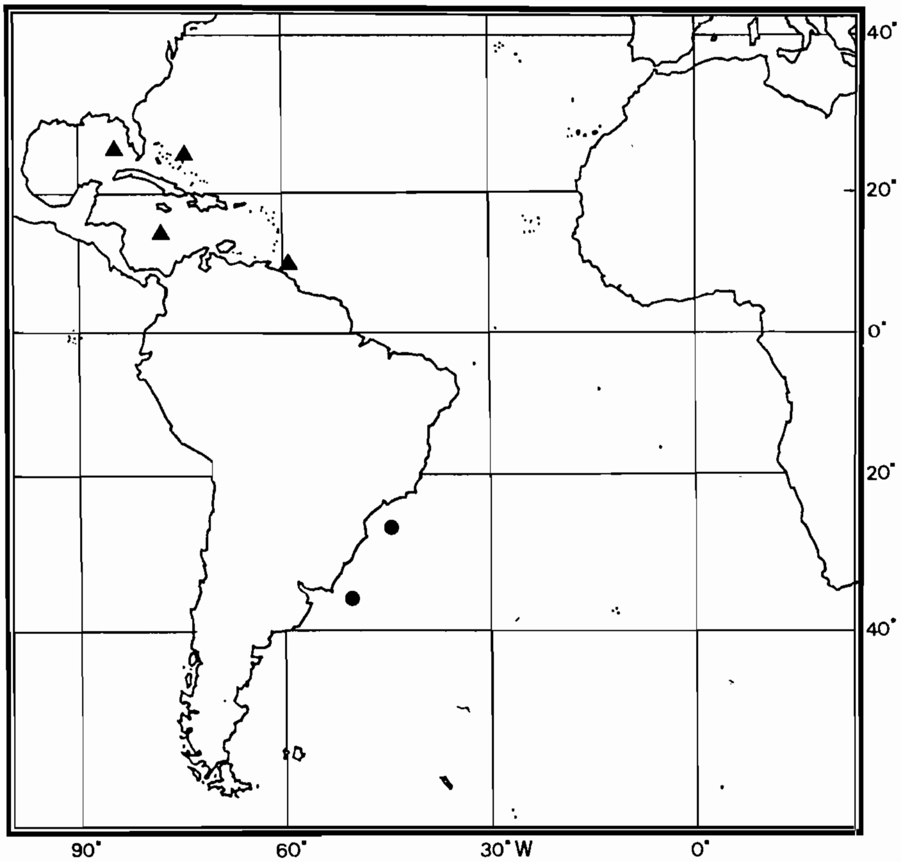

FIG. 4 a. — Geographical distribution of the species of *Metanephrops* of the *"binghami"* group:▲: *M. binghami*; ●: *M. rubellus*,

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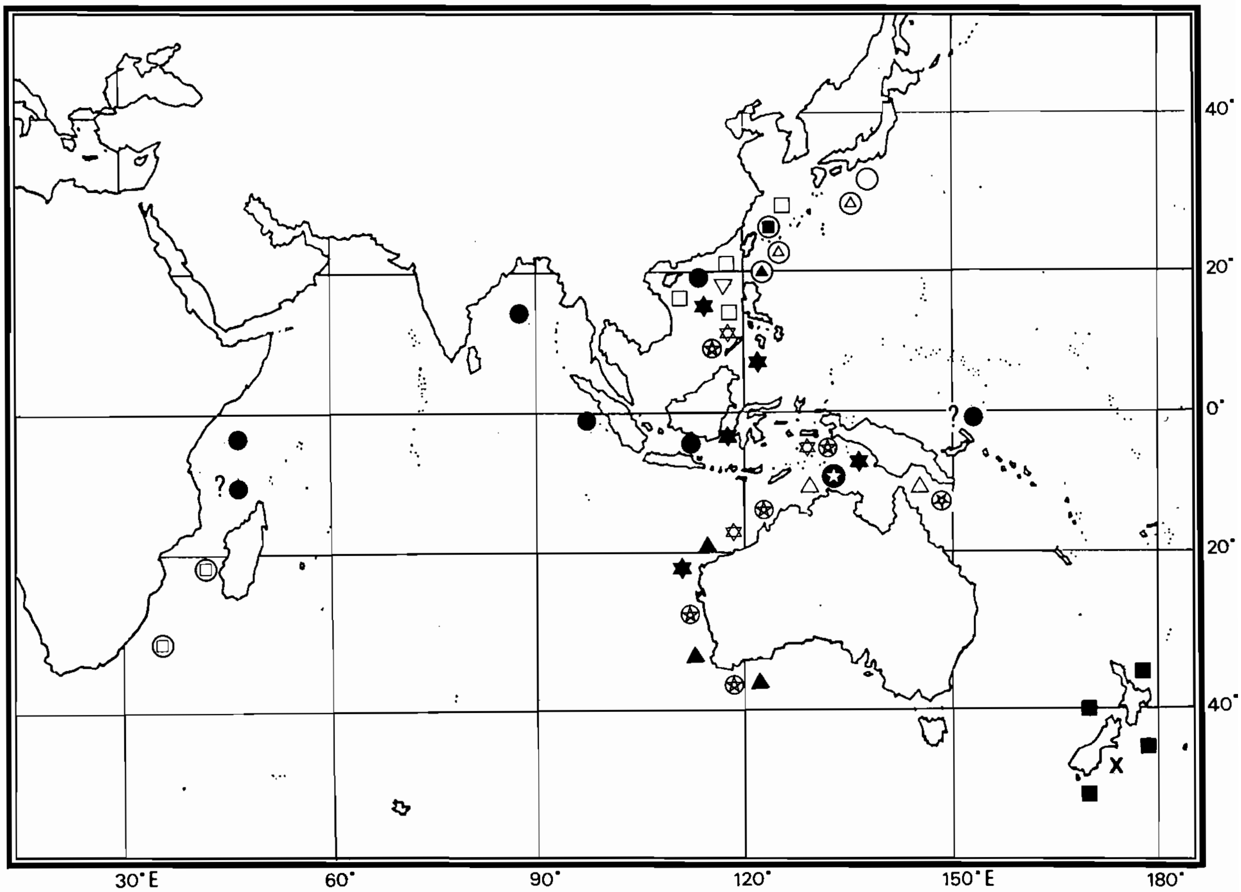

FIG. 4 b. — Geographical distribution of the species of *Metanephrops*

The *"japonicus group"* : ○: *M. japonicus*, ●: *M. andamanicus*, ⓐ: *M. sagamiensis*, ▲(circled): *M. formosanus*, ▢(circled): *M. mozambicus*, ■(circled): *M. armatus*, ⊛: *M. velutinus*.
The *"arafurensis"* group : ✪: *M. arafurensis*, ✱: *M. neptunus*, ✡: *M. australiensis*, **x** : *M. motunauensis*.
The *"thompsoni"* group : □: *M. thomsoni*, ■: *M. challengeri*, △: *M. sibogae*, ▲: *M. boschmai*, ▽: *M. sinensis*.

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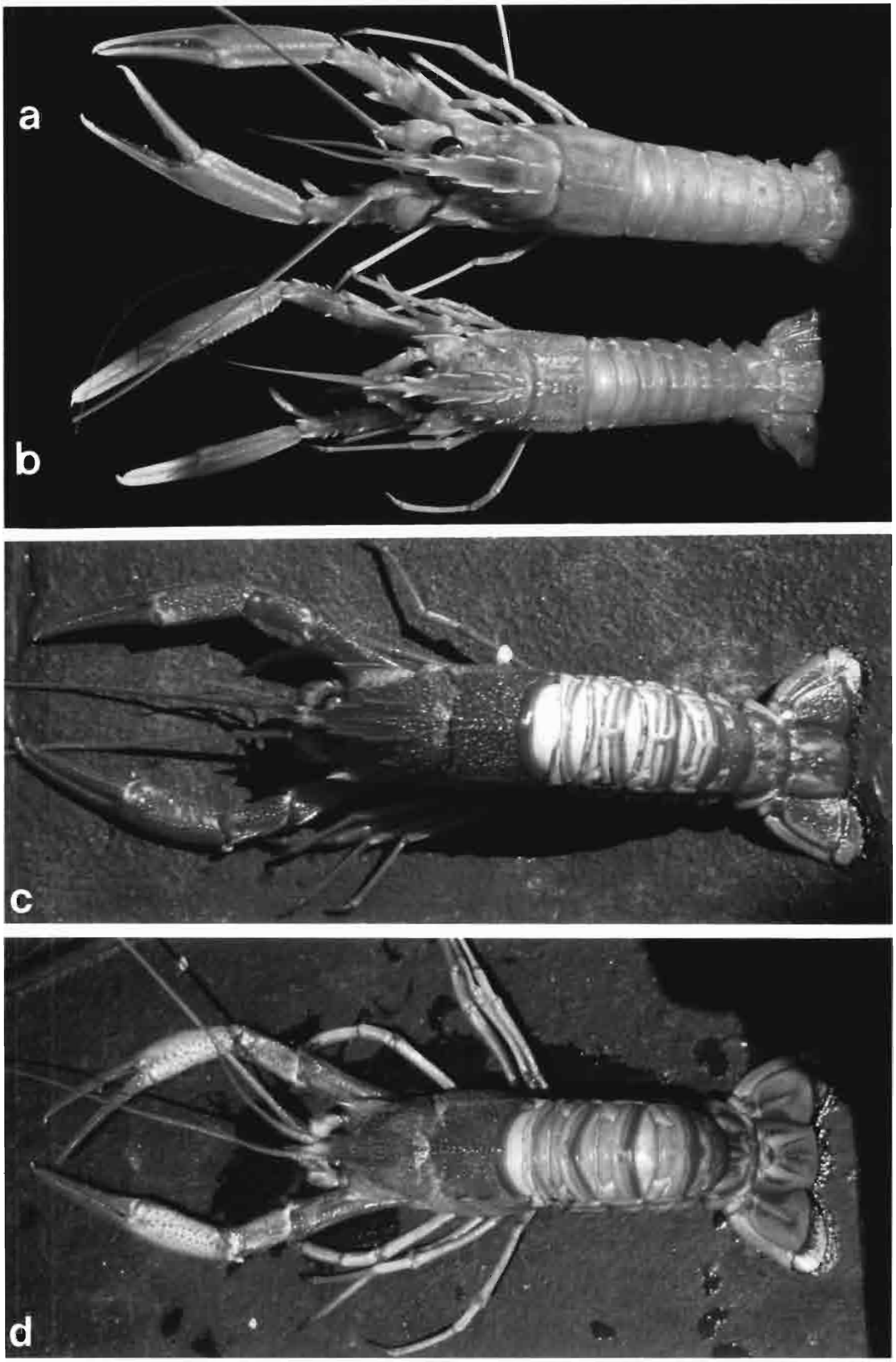
FIG. 5 a. — *Metanephrops velutinus* Chan & Yu, 1991. Indonesia, Tanimbar Islands, 7°46'S, 132°31'E, 443-468 m, ♂ (POLIPI).

FIG. 5 b. — *Metanephrops arafurensis* (de Man, 1905). Indonesia, Tanimbar Islands, 7°46'S, 132°31'E, 443-468 m, ♂ 50.7 mm (MNHN).

FIG. 5 c-d. — *Metanephrops neptunus* (Bruce, 1965): **c**, Indonesia. Kai or Tanimbar Islands, 1 ♀ 79.2 mm (POLIPI). — **d**, Indonesia. Kai Islands, 05°15'S, 132°59'E, 769-809 m, ♂ 87.1 mm (MNHN).


a
b
c
d

10

Crustacea Decapoda: Hermit crabs of the family Paguridae from the KARUBAR Cruise in Indonesia

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ABSTRACT

The French-Indonesian 1991 campagne to the islands of Kai, Aru, and Tanimbar, part of the Maluku region of Indonesia, revealed an unexpected wealth of hermit crabs of the family Paguridae. Although only 295 specimens were collected in depths ranging from 85 to 1024 meters, an incredible 19 genera and 36 species are represented, of which seven genera and 26 species are described for the first time. Included are the monotypic *Alainopaguroides* gen. nov., *Enneopagurus* gen. nov., *Enneophyllus* gen. nov., *Icelopagurus* gen. nov., and *Tarrasopagurus* gen. nov., and their respective new species. The genus *Michelopagurus*, gen. nov., is established for "*Pagurodes*" *limatulus* Henderson, 1888, and one additional new species, and the genus *Pseudopagurus* is created for "*Pagurodes*" *piliferus* Henderson, 1888, the last of the original trio of species initially assigned to the heterogeneous *Pagurodes*. A lectotype for *Pagurodes inarmatus* Henderson, 1888, the type species of the now monotypic *Pagurodes*, is also designated. The genus *Turleania* is proposed as a replacement name for *Laurentia* McLaughlin & Haig.

Of the new genera, three are particularly noteworthy. Not only are *Enneopagurus* and *Enneophyllus* just the second and third genera of the Paguridae to be characterized, in part, by the absence of gills on the third maxillipeds, the latter genus is unique, at least for the present. Its type species, *E. spinirostris* sp. nov., is the first pagurid known to have a well developed epi-rostral spine. *Alainopaguroides* joins that very specialized group of genera distinguished by marked reduction in the abdomen, accompanied by total loss of male pleopods and reduction in the number of female pleopods. Two additional genera of this group, *Solitariopagurus* and *Porcellanopagurus*, are also represented in the KARUBAR collection, each by a new species.

In addition to the new genera, new species are described in several of the less commonly reported genera, e.g., *Catapaguroides*, *Decaphyllus*, *Catapagurus*, and *Tomopaguropsis*. Although *Pagurus* is widely represented in the colder waters, particularly of the northern hemisphere, the discovery of three new species from the restricted geographic region of the KARUBAR campagne was unexpected. A third species has been added to, and extends the distributional range of, the recently described *Bathypaguropsis* from Australian and New Zealand waters. A new species described in *Australeremus* has provided continuity to the heretofore disjunct distribution of this genus. Only one genus, *Pylopaguropsis*, was represented entirely by known species.

McLAUGHLIN, P. A., 1997. — Crustacea Decapoda: Hermits crabs of the family Paguridae from the KARUBAR Cruise in Indonesia. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 433-572. Paris ISBN 2-85653-506-2.

The KARUBAR collection is also significant for its number of highly evolved genera. Specifically, development of the male sexual tube(s) is uncommonly prevalent. In the 19 genera included in the collection, males of 13 develop a sexual tube on one or both coxae of the fifth pereopods, or nearly two-thirds of the total genera.

All species are fully illustrated and detailed descriptions or diagnoses provided. Keys are provided for the regional genera and species, including those reported from the Maluku area, but not included in the KARUBAR collection.

RÉSUMÉ

Crustacea Decapoda : Pagures de la famille des Paguridae récoltés lors de la campagne KARUBAR en Indonésie.

La campagne franco-indonésienne KARUBAR faite aux Moluques, en 1991, dans la région des îles Kai, Aru et Tanimbar a révélé une richesse inattendue en bernard-l'ermite de la famille des Paguridae. Bien que 295 spécimens seulement de cette famille aient été récoltés à des profondeurs comprises entre 85 et 1024 mètres, ils forment un ensemble incroyable de 19 genres et 36 espèces, parmi lesquels sept genres et 26 espèces sont nouveaux. On y trouve les genres monotypiques *Alainopagurus* gen. nov., *Enneopagurus* gen. nov., *Enneophyllus* gen. nov., *Icelopagurus* gen. nov. et *Tarrasopagurus* gen. nov. et les espèces nouvelles qui leur correspondent. Le genre *Michelopagurus*, gen. nov., est établi pour *"Pagurodes" limatulus* Henderson, 1888, et une espèce nouvelle additionnelle, tandis que le genre *Pseudopagurus* est créé pour *"Pagurodes" piliferus* Henderson, 1888, la dernière des trois espèces assignées, à l'origine, au genre hétérogène *Pagurodes*. Un lectotype pour *Pagurodes inarmatus* Henderson, 1888, l'espèce type du genre *Pagurodes*, maintenant monotypique, est désigné. Le genre *Turleania* est proposé en remplacement de *Laurentia* McLaughlin & Haig, préemployé.

Parmi les nouveaux genres, trois sont particulièrement intéressants. Non seulement *Enneopagurus* et *Enneophyllus* sont les second et troisième genres de Paguridae à être caractérisés, en partie, par l'absence de branchies sur les troisièmes maxillipèdes, mais en outre, le dernier cité est unique, au moins pour le moment, son espèce type, *E. spinirostris*, étant le premier paguride connu à posséder une épine épirostrale bien développée. *Alainopagurus* fait partie du groupe très spécialisé de genres se distinguant par une réduction marquée de l'abdomen, accompagnée par la perte totale des pléopodes mâles et la réduction en nombre des pléopodes femelles. Deux genres appartenant à ce groupe, *Solitariopagurus* et *Porcellanopagurus*, sont également représentés dans les récoltes de KARUBAR, chacun par une espèce nouvelle.

Des espèces nouvelles sont également décrites dans plusieurs autres genres peu communs, à savoir *Catapaguroides*, *Decaphyllus*, *Catapagurus* et *Tomopaguropsis*. Bien que *Pagurus* soit largement représenté dans les eaux froides, en particulier de l'hémisphère nord, la découverte de trois nouvelles espèces appartenant à ce genre dans la région restreinte prospectée par la campagne KARUBAR était inattendue. Une troisième espèce a été ajoutée au genre *Bathypaguropsis*, récemment décrit des eaux australiennes et néo-zélandaises. La description d'une nouvelle espèce dans le genre *Australeremus* permet de rendre cohérente la distribution de ce genre jusqu'à présent discontinue. Seul un genre, *Pylopaguropsis*, était représenté dans la collection par des espèces toutes connues.

La collection KARUBAR est également significative par le nombre de genres très évolués qu'elle renferme. En particulier, le développement des tubes sexuels mâles est anormalement prédominant. Parmi les 19 genres représentés dans la collection, 13, soit environ les deux tiers, ont des mâles avec un tube sexuel développé sur l'une ou les deux coxae des cinquièmes péréiopodes.

Toutes les espèces sont figurées et décrites en détail ou des diagnoses sont fournies. Des clés d'identification regroupant les genres ou les espèces récoltés lors de KARUBAR et ceux et celles déjà signalés de la région étudiée sont proposées.

INTRODUCTION

Prior to the 1991 French-Indonesian campaign, KARUBAR (named for the islands of Kai, Aru and Tanimbar), the regional marine hermit crab fauna of the Maluku (formerly Moluccas) region of Indonesia was known primarily from the expeditions of the "*Alert*" (MIERS, 1884), "*Challenger*" (HENDERSON, 1888), "*Siboga*" (DE SAINT LAURENT, 1968a, b; MCLAUGHLIN & HAIG, 1996), "*Snellius*" (BUITENDIJK, 1937) and "*Alpha Helix*" (HUMES, 1981; FOREST, 1984; HAIG & BALL, 1988), and the shallow water collections of the Indonesian Institute of Sciences (RAHAYU & FOREST, 1993, 1995). Eight species were reported in the combined collections of the "*Alert*" and "*Challenger*" and one from the "*Snellius*". Five species from the "*Siboga*" collections were described by DE SAINT LAURENT (1968a, b); however, in subsequent publications FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a, b) indicated that numerous species from that expedition remained to be described. MCLAUGHLIN and HAIG (1996) have just recently described three of those. RAHAYU and FOREST (1993, 1995) reported on 14 species of the diogenid genus *Diogenes* and 20 species of *Clibanarius* from Indonesian waters, although not all were represented in the Maluku region. Isolated species reports have also come from several sources, particularly those concerning associations with rhizocephalans, e.g., the "*Siboga*" (VAN KAMPEN & BOSCHMA, 1925; BOSCHMA, 1931b); MORTENSEN's Pacific Expedition (BOSCHMA, 1931a), and the Danish Expedition to the Kei Islands (VAN BAAL, 1937), as well as museum collections (DE MAN, 1881; LEWINSOHN, 1969); however, the most comprehensive report is that of HAIG and BALL (1988) from the "*Alpha Helix*" expedition. These authors documented the occurrence of 46 marine species (including four new and four left undescribed); however, most were collected at depths of 20 meters or less; seven genera of the Paguridae were represented.

It has long been postulated that the most diverse marine faunas are to be found in the tropical oceans, especially the Indo-West Pacific, but at depths generally less than 200 meters (e.g., EKMAN, 1953; BRIGGS, 1974). Within the Paguridea (sensu FOREST, 1987), most hermit crabs inhabiting these tropical environs were thought to belong to the family Diogenidae. The hermit crabs of the family Paguridae that were collected during the KARUBAR expedition consisted of 295 specimens, all coming exclusively from depths ranging from 85 to 1024 meters. The assemblage includes an astonishing 19 genera, of which seven are proposed herein, and 36 species, 29 of which are reported for the first time. More than 65 percent of the species covered by this report were collected from depths in excess of 200 meters, whereas only four species appeared restricted to more shallow depths.

Of the new genera, *Michelopagurus* gen. nov., with type species *Pagurodes limatulus* Henderson, 1888, has been erected for one of two species originally described in the heterogeneous genus *Pagurodes* Henderson, 1888, but subsequently restricted from that genus by designation of *P. inarmatus* Henderson, 1888, as the type species (DE SAINT LAURENT, 1969). Although the second species, *Pagurodes piliferus* Henderson, 1888, is not present in the KARUBAR collection, it is in the interest of stability in nomenclature that a new genus, *Pseudopagurodes* gen. nov., also be established for it.

The general terminology used in the species descriptions is that of MCLAUGHLIN (1974), with exception of the fourth pereopods. A distinction is made herein between **subchelate** fourth pereopods, in which the pereopod is developed as a prehensile structure by the folding back of the dactyl against the propodus, and **semichelate** fourth pereopods, where the ventral margin of the propodus is produced beneath the dactyl to such an extent that flexion of the dactyl becomes much more akin to the action of a dactyl against a fixed finger of a chelate appendage. Terms pertaining to regions of the carapace follow those proposed by PILGRIM (1973) and MORGAN and FOREST (1991). Gill structure, i.e., trichobranchiate, intermediate, or phyllobranchiate follow the definitions provided by LEMAITRE (1989). The lists of specimens examined follow the station data provided by CROSNIER *et al.* (1997). The station abbreviations DW, CP, and CC refer to Warén dredge, beam trawl, and shrimp trawl respectively. Shield lengths (to the nearest 0.1 mm) of the specimens examined are indicated in parentheses, and measured from the tip or midpoint of the rostrum to the midpoint of the posterior margin of the shield. In keys provided for the Maluku regional taxa, those not encountered during the KARUBAR expedition are indicated by an asterisk (*). The majority of the specimens reported herein are shared between the Muséum national d'Histoire naturelle, Paris (MNHN) and the Puslitbang Oseanologi - LIPI, Jakarta (POLIPI). Supplemental materiels of selected species are deposited in the National Museum of Natural History, Smithsonian Institution, Washington, D.C. (USNM) and the Swedish Natural History Museum, Stockholm (SNHM). Comparative materials used in the study have come from the Muséum national d'Histoire naturelle (MNHN), Museums and Art Galleries of the Northern Territory, Darwin, Australia (MNT), National Museum of Natural History, (USNM), Natural History Museum, London (NHM), Natural History Museum and Institute, Chiba, Japan (CBM-ZC), Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (UMML), and the author's personal collection. Photographs were taken with a Nikon 35 mm camera and a professional camera 4 x 5 inches.

LIST OF GENERA AND SPECIES

Genus ***ALAINOPAGUROIDES*** gen. nov.
A. lemaitrei sp. nov.

Genus ***ANAPAGRIDES*** de Saint Laurent-Dechancé, 1966.
? *Anapagrides* sp.

Genus ***ANAPAGURUS*** Henderson, 1886 (key).

Genus ***AUSTRALEREMUS*** McLaughlin, 1981.
A. indonesiensis sp. nov.
A. triserratus (Ortmann, 1892).

Genus ***BATHYPAGUROPSIS*** McLaughlin, 1994.
B. rahayuae sp. nov.

Genus ***CATAPAGUROIDES*** A. Milne Edwards & Bouvier, 1892.
C. cristimanus de Saint Laurent, 1968 (key).
C. declivis sp. nov.
C. inermis de Saint Laurent, 1968 (key).
C. karubar sp. nov.
C. melini de Saint Laurent, 1968 (key).
C. mortenseni de Saint Laurent, 1968 (key).
C. spinulimanus de Saint Laurent, 1968 (key).

Genus ***CATAPAGURUS*** A. Milne Edwards, 1880.
C. ensifer Henderson, 1893 (key).
C. holthuisi sp. nov.
C. oculocrassus sp. nov.
Catapagurus sp. of HAIG & BALL, 1988 (key).
C. tanimbarensis sp. nov.

Genus ***DECAPHYLLUS*** de Saint Laurent, 1968.
D. barunajaya sp. nov.
D. junquai de Saint Laurent, 1968 (key).
D. maci sp. nov.
D. similis de Saint Laurent, 1968 (key).

Genus ***ENNEOPAGURUS*** gen. nov.
E. garciagomezi sp. nov.

Genus ***ENNEOPHYLLUS*** gen. nov.
E. spinirostris sp. nov.

Genus ***ICELOPAGURUS*** gen. nov.
I. crosnieri sp. nov.

Genus ***MICHELOPAGURUS*** gen. nov.
M. chacei sp. nov.
M. limatulus (Henderson, 1888).

Genus ***MICROPAGURUS*** McLaughlin, 1986 (key).

Genus ***NEMATOPAGURUS*** A. Milne Edwards & Bouvier, 1892.
N. alcocki sp. nov.
N. australis (Henderson, 1888) (key).
N. cf. *indicus* Alcock, 1905.
N. ostlingochirus sp. nov.
N. scutelliformis sp. nov.
Nematopagurus sp.
N. spinulosensoris McLaughlin & Brock, 1974.

Genus ***PAGURODES*** Henderson, 1888.
P. inarmatus Henderson, 1888 (photos).

Genus ***PAGURUS*** Fabricius, 1775.
P. capsularis sp. nov.

P. compressipes (Miers, 1884) (key, photos).
P. haigae sp. nov.
P. hedleyi Grant & McCulloch, 1906 (key).
P. hirtimanus (Miers, 1880) (key).
P. kaiensis sp. nov.
P. moluccensis Haig & Ball, 1988 (key).
P. pergranulatus (Henderson, 1896) (key).
?*Pagurus* sp.

Genus ***PORCELLANOPAGURUS*** Filhol, 1885.
P. jacquesi sp. nov.

Genus ***PSEUDOPAGURODES*** gen. nov.
P. piliferus (Henderson, 1888) (photos).

Genus ***PYLOPAGUROPSIS*** Alcock, 1905.
P. fimbriata McLaughlin & Haig, 1989 (key).
P. laevispinosa McLaughlin & Haig, 1989.
P. lewinsohni McLaughlin & Haig, 1989 (key).
P. zebra (Henderson, 1893).

Genus ***SOLITARIOPAGURUS*** Türkay, 1986.
S. tuerkayi sp. nov.

Genus ***SPIROPAGURUS*** Stimpson, 1858 (key).

Genus ***TARRASOPAGURUS*** gen. nov.
T. rostrodenticulatus sp. nov.

Genus ***TOMOPAGUROPSIS*** Alcock, 1905.
T. crinita sp. nov.
T. miyakei sp. nov.

Genus ***TURLEANIA*** nom. nov.
T. albatrossae (McLaughlin & Haig, 1996) (key).
T. balli (McLaughlin & Haig, 1996) (key).
T. multispina sp. nov.
T. senticosa (McLaughlin & Haig, 1996).
T. sibogae (McLaughlin & Haig, 1996) (key).

SYSTEMATIC ACCOUNT

Family PAGURIDAE Latreille, 1803

Key to the genera of the Maluku Paguridae

1. Crista dentata of third maxilliped with accessory tooth **6**
— Crista dentata of third maxilliped without accessory tooth **2**

2. Rostrum strongly deflected downward over ocular lobes; with epi-rostral spine .... ***Enneophyllus*** gen. nov.
— Rostrum not strongly deflected downward over ocular lobes; without epi-rostral spine ... **3**

3. Pleurobranch present above fourth pereopod; males with elongate left sexual tube; females with paired gonopores **4**
— Pleurobranch absent above fourth pereopod; males with elongate right sexual tube; females with single left gonopore **5**

4. Male sexual tube with terminal tuft of sparse setae; paired arthrobranchs on third maxillipeds .... ***Turleania*** nom. nov.
— Male sexual tube with terminal fringe of dense stiff setae; no paired arthrobranchs on third maxillipeds .... ***Enneopagurus*** gen. nov.

5. Males with 3 unpaired left pleopods; fourth pereopod semichelate .... ***Catapaguroides***
— Males with 4 unpaired left pleopods; fourth pereopod simple, not semichelate .... ***Decaphyllus***

6. Males with sexual tube developed on one or both coxae of fifth pereopods **7**
— Males without sexual tube developed on one or both coxae of fifth pereopods **17**

7. Abdomen well developed; males with 2 to 4 unpaired left pleopods **9**
— Abdomen reduced; males without unpaired left pleopods **8**

8. Pleurobranch present above fourth pereopod; lateral margins of shield rounded .... ***Alainopaguroides*** gen. nov.
— Pleurobranch absent above fourth pereopod; lateral margins of shield drawn out into spinose projections .... ***Solitariopagurus***

9. Females with paired first pleopods modified as gonopods **10**
— Females without paired first pleopods modified as gonopods **12**

10. Chelipeds subequal; rostrum smoothly rounded; males with very short to very long sexual tube on coxa of right fifth pereopod; left sometimes also with very short sexual tube . **11**
— Chelipeds markedly unequal; rostrum denticulate; males with moderately short sexual tube on coxa of left fifth pereopod, right sometimes also with short tube .... ***Tarrasopagurus*** gen. nov.

11. Males with elongate right sexual tube; ocular acicles very broadly separated; gills phyllobranchiate .... ***Nematopagurus***
— Males with very short right sexual tube; ocular acicles separated by approximately basal width of 1 acicle; gills trichobranchiate .... ***Michelopagurus*** gen. nov.

12. Males with well developed right sexual tube **13**
— Males with well developed left sexual tube **15**

13. Right sexual tube elongate, curving up over dorsal surface of body from right to left; telson subtriangular .... ***Catapagurus***
— Right sexual tube short, not curving up over dorsal surface of body; telson not subtriangular **14**

14. Ocular acicles elongate; chelipeds subequal; fourth pereopods with prominent tubular preungual process at base of claw .... ***Icelopagurus*** gen. nov.
— Ocular acicles short; chelipeds markedly unequal; fourth pereopods without prominent preungual process .... ***Anapagrides***

15. Telson with median cleft; ocular acicles simple **16**
— Telson without median cleft; ocular acicles multifid .... ***Micropagurus****

16. Chelipeds grossly unequal .... ***Anapagurus****
— Chelipeds subequal .... ***Spiropagurus****

17. Pleurobranchs above second, third and fourth pereopods **20**
— Pleurobranchs above fourth pereopod only **18**

18. Abdomen reduced; lateral margins of shield drawn out into strongly calcified projections; males without unpaired left pleopods .... ***Porcellanopagurus***

— Abdomen not reduced; lateral margins of shield not drawn out into strongly calcified projections; males with some unpaired left pleopods **19**

19. Females with first pleopods paired and modified as gonopods; right chela circumscribed by row of spines .... ***Australeremus***

— Females without first pleopods paired and modified as gonopods; right chela not circumscribed by row of spines .... ***Pagurus***

20. Chelipeds subequal .... ***Tomopaguropsis***

— Chelipeds grossly unequal, right markedly larger than left **21**

21. Females with first pleopods paired and modified as gonopods; males with 3 unpaired left pleopods .... ***Pylopaguropsis***

— Females without first pleopods paired and modified as gonopods; males with four unpaired left pleopods .... ***Bathypaguropsis***

Genus *ENNEOPHYLLUS* nov.

DIAGNOSIS. — Nine pairs of phyllobranchiate gills; arthrobranchs absent from third maxillipeds. Rostrum well developed, strongly depressed. Ocular acicles simple. Antennal peduncle with supernumerary segmentation not clearly evident. Third maxilliped with 1 spine on basis; ischium with crista dentata somewhat reduced, without accessory tooth (Fig. 1a). Sternite of third maxillipeds unarmed. Chelipeds unequal, right appreciably larger. Dactyls of ambulatory legs with spinose ventral margins. Sternite of third pereopods with small anterior lobe. Fourth pereopods semichelate, with single row of scales in propodal rasp. Fifth pereopods weakly semichelate. Sternite of fifth pereopods developed as single small lobe.

Coxa of left fifth pereopod in males with elongate, basally stout sexual tube directed exteriorly and curved dorsally across abdomen from left to right, with few terminal setae; right fifth coxa with gonopore, no apparent sexual tube; 3 unequally biramous unpaired left pleopods. Females not known.

Abdomen straight; uropods (Fig. 1k) only slightly asymmetrical. Telson with transverse suture very weakly indicated; terminal margins oblique.

TYPE SPECIES. — *Enneophyllus spinirostris* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ennea* meaning nine, and *phyllon* meaning leaf, and referring to the nine pairs of phyllobranchiate gills in this genus.

AFFINITIES. — *Enneophyllus* very closely resembles the other two genera of pagurids now recognized that have only nine pairs of gills, *Enneobranchus* García-Gómez, 1988, and *Enneopagurus* gen. nov. All three are characterized by the absence of an accessory tooth on the crista dentata of the third maxilliped, an elongate left male sexual tube, and a subtriangular telson that has the transverse suture faintly, if at all, indicated. However, the three genera differ fundamentally in gill structure: phyllobranchiate in *Enneophyllus*, intermediate in *Enneobranchus*, and trichobranchiate in *Enneopagurus*. Additional characters that distinguish the three taxa include: 1) the termination of the left sexual tube - apparently lacking any terminal setae in *Enneobranchus* (cf. GARCÍA-GÓMEZ, 1988), with a dense fringe of setae in *Enneopagurus*, but only a very few setae in *Enneophyllus*; 2) a distinctive preungual process at the base of the dactylar claw on the fourth pereopod in *Enneobranchus*, but lacking in both *Enneopagurus* and *Enneophyllus*; and 3) subequal chelipeds in both *Enneobranchus* and *Enneopagurus*, but conspicuously unequal in *Enneophyllus*.

REMARKS. — *Enneophyllus* at present is known only from a single representative of the type species, *E. spinirostris* sp. nov. For this reason, no attempt has been made at this time to determine the precise structure of the mouthparts in this genus; however, a flagellum on the first maxilliped can be observed without dissection. The supernumerary segment of the antennal peduncle that is usually calcified and readily apparent is, in this specimen, represented only as a chitinous area between the third and fourth segments. A character that sets *Enneophyllus* apart, not only from *Enneobranchus* and *Enneopagurus*, but all other pagurids, is its remarkable rostral structure. The rostrum is exceptionally well developed, lobe-like, and bent downward over the ocular plate between the ocular acicles (Fig. 1b-c). At least in *E. spinirostris* a prominent epi-rostral spine is developed.

Enneophyllus spinirostris sp. nov.

Figs 1a-k, 33a-b

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5250).

TYPES. — The unique specimen is the holotype.

DESCRIPTION. — Shield (Fig. 1b) considerably longer than broad, but with lateral portions distinctly rounded; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; dorsal surface glabrous, but with small areas of decalcification anterolaterally. Rostrum strongly produced as rounded lobe, deflected downward over ocular lobes, and provided with extremely prominent epi-rostral spine (Fig. 1b-c). Lateral projections well developed, acutely triangular, with marginal or submarginal spine.

Ocular peduncles (including corneae) approximately 0.60 shield length; peduncles appearing somewhat laterally compressed; corneae slightly dilated. Ocular acicles moderately small, roundly triangular, with submarginal spine; separated basally by width of rostrum or equivalent to basal width of 1 acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by 0.80 length of ultimate segment. Ultimate segment with 1 long seta dorsodistally. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally, with small spine on dorsolateral margin distally.

Antennal peduncles overreaching ocular peduncles by approximately half length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple spine and with slightly smaller spine on mesial margin; dorsomesial distal angle with prominent acute spine. First segment with spine at dorsolateral distal angle; 1 small spine on ventrolateral margin distally. Antennal acicle reaching to proximal margin of fifth peduncular segment; straight, terminating in acute spine and with few very short setae. Antennal flagellum short, not reaching tip of dactyl of left cheliped, with 1 or 2 short (1 or 2 article length) setae on each article. Crista dentata with 7 relatively evenly-sized teeth (Fig. 1a).

Chelipeds unequal; right appreciably larger. Right cheliped (Fig. 1d) moderately elongate, chela (Fig. 33a) operculate; propodal-carpal articulation perpendicular. Dactyl 0.80 length of palm, broad; cutting edge with 2 distinct calcareous teeth; terminating in small calcareous claw; slightly overlapped by fixed finger; dorsal surface flattened, smooth, dorsomesial margin drawn out into subacute obliquely elevated unarmed ridge; mesial and ventral surfaces with few scattered setae. Palm approximately equaling length of carpus; dorsomesial margin rounded proximally, strongly elevated into prominent acute crest in distal half, with 1 spinule basally on distal margin; dorsal surface weakly convex on palm, but weakly concave on fixed finger, dorsolateral margin not delimited in proximal third of palm, but produced as obliquely elevated crest distally and extending length of fixed finger; mesial face of palm and ventral surfaces of palm and fixed finger with scattered setae; cutting edge of fixed finger with 2 prominent calcareous teeth, terminating in calcareous claw. Carpus slightly shorter than merus; dorsomesial distal angle with small subacute spine, dorsomesial margin with few low protuberances and long setae, all surfaces with sparse tufts of setae, most numerous and longest on mesial and ventral surfaces. Merus subtriangular; dorsodistal margin with small spine; dorsal surface with row of very small protuberances and few setae; ventromesial margin with prominent spine at distal angle and 1 smaller spine in distal third; ventrolateral margin with 1 spinule at distal angle. Ischium with row of minute spinules and few setae on ventromesial margin.

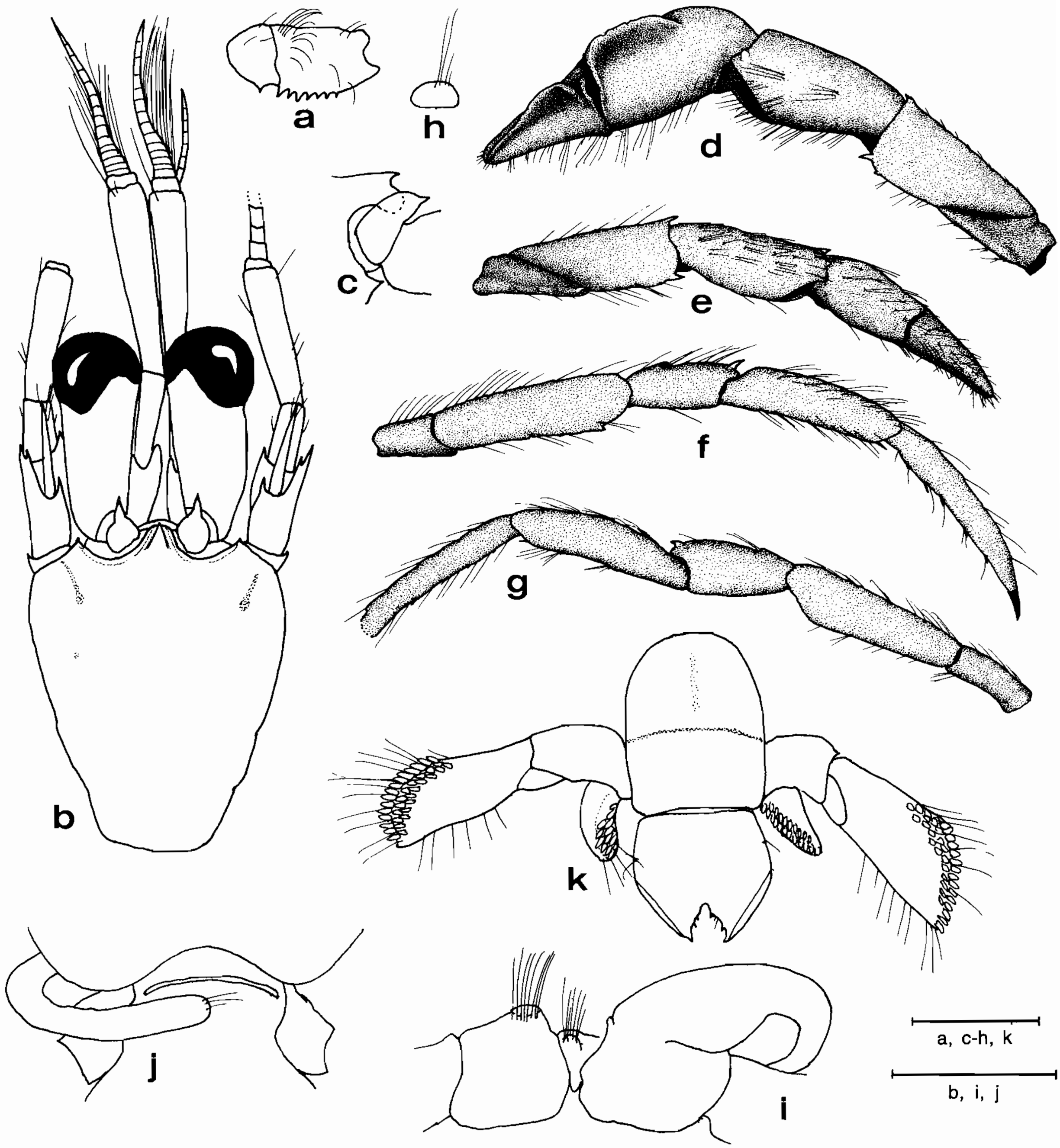

FIG. 1. — *Enneophyllus spinirostris* sp. nov., holotype ♂ (1.5 mm) from KARUBAR Stn DW 49: **a**, basis and ischium of left third maxilliped; **b**, shield and cephalic appendages; **c**, rostrum and right ocular acicle (lateral view); **d**, right cheliped (mesial view); **e**, left cheliped (mesial view); **f**, right second pereopod (lateral view); **g**, left third pereopod (lateral view); **h**, anterior lobe of sternite of third pereopods; **i**, coxae and sternite of fifth pereopods; **j**, left sexual tube (dorsal view); **k**, uropods and telson. Scales equal 0.5 mm (a, c, h, k) and 1.0 mm (b, d-g, i-j).

Left cheliped (Figs 1e, 33b) with propodal-carpal articulation nearly perpendicular; chela somewhat dorsoventrally flattened. Dactyl only slightly longer than palm, unarmed but with scattered setae, longer and more numerous ventrally; cutting edge with row of small corneous teeth, terminating in small corneous claw. Palm approximately 0.65 length of carpus; row of few low protuberances and tufts of long setae on rounded dorsomesial margin, dorsal surface of palm and fixed finger smooth, with few scattered short setae, dorsolateral margin rounded on palm, minutely spinulose on fixed finger; cutting edge of fixed finger with jagged row of very small calcareous teeth, terminating in very small corneous claw. Carpus approximately equal to length of merus, dorsal surface broadened distally; dorsomesial distal angle with small spine, dorsomesial margin with row of spinulose protuberances and tufts of long setae, dorsal midline with spine at distal margin and longitudinal row of minute protuberances and sparse tufts of setae, dorsolateral margin only weakly delimited by few minute protuberances and few setae. Merus subtriangular; dorsal margin with row of low spinulose protuberances and setae, 1 spine at distal margin; ventrolateral margin with 1 very small spine at distal angle; ventromesial margin with 1 prominent spine at distal margin. Ischium with row of small spines on ventromesial margin.

Second and third pereopods (Figs 1f-g) moderately short, not overreaching outstretched right cheliped; generally similar from left to right. Dactyls approximately 0.25 longer than propodi (left second and third broken in holotype); in dorsal view, generally straight; in lateral view slightly curved ventrally; terminating in slender corneous claws; dorsal margins each with row of widely-spaced long moderately stiff setae; ventral, lateral and mesial faces with few scattered setae; ventral margins with 5 or 6 corneous spines. Propodi with 1 corneous spine on ventrolateral distal margin, dorsal and ventral surfaces each with row of widely-spaced low protuberances and long moderately stiff setae. Carpi each with 1 spine at dorsodistal angle, row of low protuberances and long moderately stiff setae on dorsal surface and 1 additional small spine. Meri each with low protuberances and sparse tufts of setae dorsally and ventrally; ventrodistal margins each with small spine (second) or unarmed (third). Ischia unarmed, but with sparse tufts of setae dorsally and ventrally. Fourth pereopod with small spine at dorsodistal margin of carpus. Sternite of third pereopod with roundly rectangular anterior lobe (Fig. 1h), unarmed but with few long setae. Sternite of fifth pereopods (Fig. 1i) narrow, with few distal setae.

Left male sexual tube (Figs 1i-j) very stout basally; right gonopore almost completely obscured by circle of short setae. Abdomen elongate, nearly twice length of cephalothorax, straight; membraneous, with no indication of segmentation of somites 2-5; tergite of somite 6 well calcified. Telson (Fig. 1k) with posterior lobes nearly symmetrical, each with prominent spine at outer angle and 1 or 2 tiny corneous spinules on oblique terminal margins, median cleft moderately deep; lateral margins each with chitinous plate.

COLOR (in preservative). — Calcified integument somewhat iridescent; tint of orange on chelae and proximal portions of fixed fingers and dactyls, distal portions white; ambulatory legs with tint of orange on dactyls and distal halves of propodi.

HABITAT. — Scaphopod shell.

DISTRIBUTION. — Known only from the type locality in the Tanimbar Islands, Indonesia; 206-210 m.

ETYMOLOGY. — From the Latin *spina*, meaning spine and *rostrum*, and indicating the presence of the unusual epi-rostral spine.

AFFINITIES. — While clearly not closely related to any known pagurid taxa, *Enneophyllus spinirostris* does possess a number of convergent characters. The shared generic characters have already been discussed. At the specific level, the operculate right chela is reminiscent of species of *Catapaguroides* A. Milne Edwards & Bouvier, 1892 and *Pylopagurus* A. Milne Edwards & Bouvier, 1891. The use of a scaphopod microhabitat is also seen in some species of *Pylopagurus*, *Orthopagurus* Stevens, 1927, occasionally *Pagurus* species (cf. MCLAUGHLIN & KONISHI, 1994), and the parapagurid genus *Tsunogaipagurus* Osawa, 1995. The left sexual tube curving over the abdomen is suggestive of species of *Catapagurus* A. Milne Edwards, 1880.

REMARKS. — The phylogenetic position of this extraordinary taxon cannot be even speculated upon until the morphology of the female is known, and until sufficient specimens become available to permit a more detailed study of the mouthparts and "skeletal" anatomy. Nonetheless, in having both reduced gill number and well developed sexual tube, it can be hypothesized that the rostral development reflects yet another apomorphic character.

Genus *ENNEOPAGURUS* nov.

DIAGNOSIS. — Nine pairs of trichobranchiate gills; arthrobranchs absent from third maxillipeds. Rostrum moderately well developed, triangular, not deflected. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 2a) with external lobe of endopod somewhat produced, not recurved, but provided with 2 or 3 moderately long setae. Third maxilliped with at least 1 prominent spine on basis; ischium with crista dentata moderately well developed but without accessory tooth (Fig. 2b). Chelipeds subequal, right more robust. Dactyls of ambulatory legs with unarmed or very weakly spinulose ventral margins. Sternite of third pereopods with subquadrate anterior lobe. Fourth pereopods semichelate; with single row of scales in propodal rasp. Fifth pereopods semichelate. Sternite of fifth pereopods developed as single small subovate or subcircular lobe.

Coxa of left fifth pereopod in males with well developed, rather stout sexual tube (Figs 3a-b) directed exteriorly and upward, terminally somewhat spatulate and with fringe of dense curved setae; right fifth coxa with gonopore and occasionally vas deferens slightly protruded; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 5.

Uropods asymmetrical. Telson with transverse suture weakly indicated; terminal margins oblique.

TYPE SPECIES. — *Enneopagurus garciagomezi* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ennea* meaning nine, and *pagouros* meaning crab, and referring to the presence on only nine pairs of gills in this genus.

AFFINITIES. — As previously noted, *Enneopagurus*, *Enneophyllus* gen. nov. and the Atlantic genus *Enneobranchus* share several generic characters, however, none are mutually exclusive. Despite our limited knowledge of its morphology, *Enneophyllus* is so markedly different from the other two genera that its shared characters must be considered convergent.

Differences in gill morphology, terminal setation of the male sexual tube, and the absence of a distinctive preungual process at the base of the dactyl are sufficient to distinguish *Enneopagurus* from *Enneobranchus*; however, their overall morphological similarities suggest a generally close relationship. Nevertheless, if gill number is not considered, *Enneopagurus* appears even more closely allied to the Indo-Pacific genus, *Turleania* nom. nov. Species of both of these genera have trichobranchiate gills, lack an accessory tooth on the crista dentata of the third maxilliped, and have the well developed male left sexual tube terminating in a tuft of setae (Figs 3a-d). The two genera are separated, not only by the presence of arthrobranchs on the third maxilliped in *Turleania* nom. nov., but by differences in the armature of the dactyls of the ambulatory legs and in setal development of the male sexual tube. In all known species of *Turleania* nom. nov. the ventral margins of the dactyls of the ambulatory legs are each provided with a row of well developed spines; the sexual tube is an elongate, usually somewhat spiraled structure with rounded tip and sparse terminal tuft of straight setae. The dactyls of the ambulatory legs in *Enneopagurus*, however, are either unarmed or have only a very few tiny corneous spinules; the left sexual tube is moderately short, curved toward the exterior, with a broad, spatulate tip practically obscured by a dense fringe of curved setae.

REMARKS. — Despite their differences, *Enneopagurus* and the Atlantic *Enneobranchus* might be considered analog genera, set apart from most other pagurid genera chiefly by the absence of gills on the third maxillipeds. Two additional characters shared by these genera, i.e., lack of an accessory tooth on the crista dentata, and left male sexual tube closely align them with a second analog pair of Indo-Pacific/Atlantic genera, *Turleania* nom. nov. and *Iridopagurus* de Saint Laurent-Dechancé, 1966a.

GARCÍA-GÓMEZ (1988) related *Enneobranchus* to *Anapagrides* de Saint Laurent-Dechancé, 1966b (sensu lato) and *Iridopagurus* de Saint Laurent-Dechancé, 1966a, noting that all three genera shared the diagnostic characters of 1) a long left sexual tube and, 2) absence of an accessory tooth on the crista dentata. He also believed that they all possessed "intermediate" type branchiae, defining his term "intermediate" by reference to LEMAITRE's subsequently published PhD dissertation (LEMAITRE, 1989, Fig. 2I-K). Recently MCLAUGHLIN and SANDBERG (1995) showed that DE SAINT LAURENT-DECHANCÉ's (1966b) *Anapagrides*, as defined by its type species, *A. facetus* (Melin, 1939), did not correspond to the diagnosis given by its author, nor by DE SAINT LAURENT (1968b), and emended *Anapagrides* to reflect the characters of *A. facetus*. Subsequently, McLAUGHLIN and HAIG (1996) proposed the genus *Laurentia,* a name now found to be a junior homonym (see, p. 477) for DE SAINT LAURENT-DECHANCÉ's (1966b) taxon. GARCÍA-GÓMEZ's (1988) remarks now apply to *Turleania* nom. nov.

Enneopagurus, *Turleania* nom. nov., *Enneobranchus*, and *Iridopagurus* appear to form a very cohesive phylogenetic unit in being four of only five taxa presently known that have a left male sexual tube, but lack an accessory tooth on the crista dentata. Additionally, species of all four share, albeit not exclusively, elongate ambulatory dactyls, propodal rasps of the fourth pereopods which consist of a single row of scales, and generally subtriangular telsons. However, some interesting divergent pathways, both morphological and geographic, should be noted: 1) gills in species of *Turleania* nom. nov. are trichobranchiate, as are those of *Enneopagurus*;, species of the Atlantic *Iridopagurus* and *Enneobranchus* have intermediate gills; 2) the external lobe of the endopod of the maxillule is well developed, but not recurved, in species of *Enneopagurus* and *Turleania* nom. nov., but obsolete in *Enneobranchus* (cf. GARCÍA-GÓMEZ, 1988) and *Iridopagurus* (cf. GARCÍA-GÓMEZ, 1983); 3) the rostrum is triangular and well developed in *Enneopagurus* and *Turleania* species, in contrast to the reduced and broadly rounded rostra of species of both Atlantic genera; 4) the transverse suture dividing the telson into anterior and posterior lobes is weakly indicated in the Indo-Pacific genera, but apparently absent in *Enneobranchus* and *Iridopagurus*. Although there is a suggested trend toward simplification in morphological structure from Indo-Pacific to Atlantic in these analog genera, all are still highly complex taxa about which we still have only fragmented knowledge.

Enneopagurus garciagomezi sp. nov.

Figs 2a-j, 3a-b, 33 c-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 39, 07°47'S, 132°26'E, 466-477 m, 28.10.1991: 4 ♂, 1 ov. ♀ (2.4-3.1 mm) (POLIPI).

Tanimbar Islands: stn CP 56, 08°16'S, 131°59'E, 552-548 m, 31.10.1991: 3 ♂, 2 ♀, 1 ov. ♀ (2.4-3.3 mm) (USNM 276005). — Stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 2 ♂, 2 ♀ (2.7-3.3 mm) (SNHM 4808). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♂ (3.3 mm) (MNHN-Pg 5251). — Stn CP 71, 08°38'S, 131°44'E, 447-480 m, 2.11.1991: 11 ♂, 18 ♀, 6 ov. ♀ (1.8-3.6 mm) (MNHN-Pg 5252). — Stn CP 70. 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 7 ♂, 5 ♀ (2.2-3.3 mm) (MNHN-Pg 5253); 1 ♀ (2.8 mm) (POLIPI). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 7 ♂, 12 ♀, 1 ov. ♀ (2.3-3.6 mm) (MNHN-Pg 5254). — Stn CP 75, 08°46'S, 131°36'E, 452-451 m, 3.11.1991: 1 ♂, 3 ♀ (2.5-2.9 mm) (POLIPI). — Stn CP 77, 08°57'S, 131°27'E, 352-346 m, 3.11.1991: 6 ♀ (1.8-3.3 mm) (USNM 276020).

TYPES. — The male (3.3 mm, MNHN-Pg 5251) collected at the station 70 of KARUBAR cruise is the holotype. All the other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 2c) slightly broader than long or length approximately equal to width; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping or terraced; posterior margin truncate; dorsal surface with several tufts of setae. Rostrum triangular, well developed, reaching beyond bases of ocular acicles, terminating subacutely and with tiny spinule. Lateral projections well developed, acutely or obtusely triangular, with submarginal spine.

Ocular peduncles (including corneae) approximately 0.75 shield length; corneae strongly dilated. Ocular acicles narrowly triangular, with submarginal spine; separated basally by less than 0.50 to 0.75 basal width of 1 acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by 0.75 to nearly entire length of ultimate segment. Ultimate segment with 5 to 8 long setae forming arc on dorsodistal margin and irregular row of long setae on dorsal surface. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally and dorsoventrally flattened, with small spine near dorsolateral margin in distal half.

Antennal peduncles overreaching ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered long setae. Third segment unarmed or with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple or more frequently bifid spine; dorsomesial distal angle with prominent acute spine. First segment with small spine at dorsolateral distal angle; 1 or 2 very small spines on ventrolateral margin distally. Antennal acicle frequently reaching to distal margin of cornea or beyond; terminating in acute spine and with long setae on mesial margin. Antennal flagellum long, overreaching outstretched chelipeds, with 1 to 3 long and sometimes 1 or 2 shorter setae every 1 to 3 articles, at least in proximal third. Crista dentata with 7 to 14 regularly or irregularly-sized teeth, decreasing in size distally.

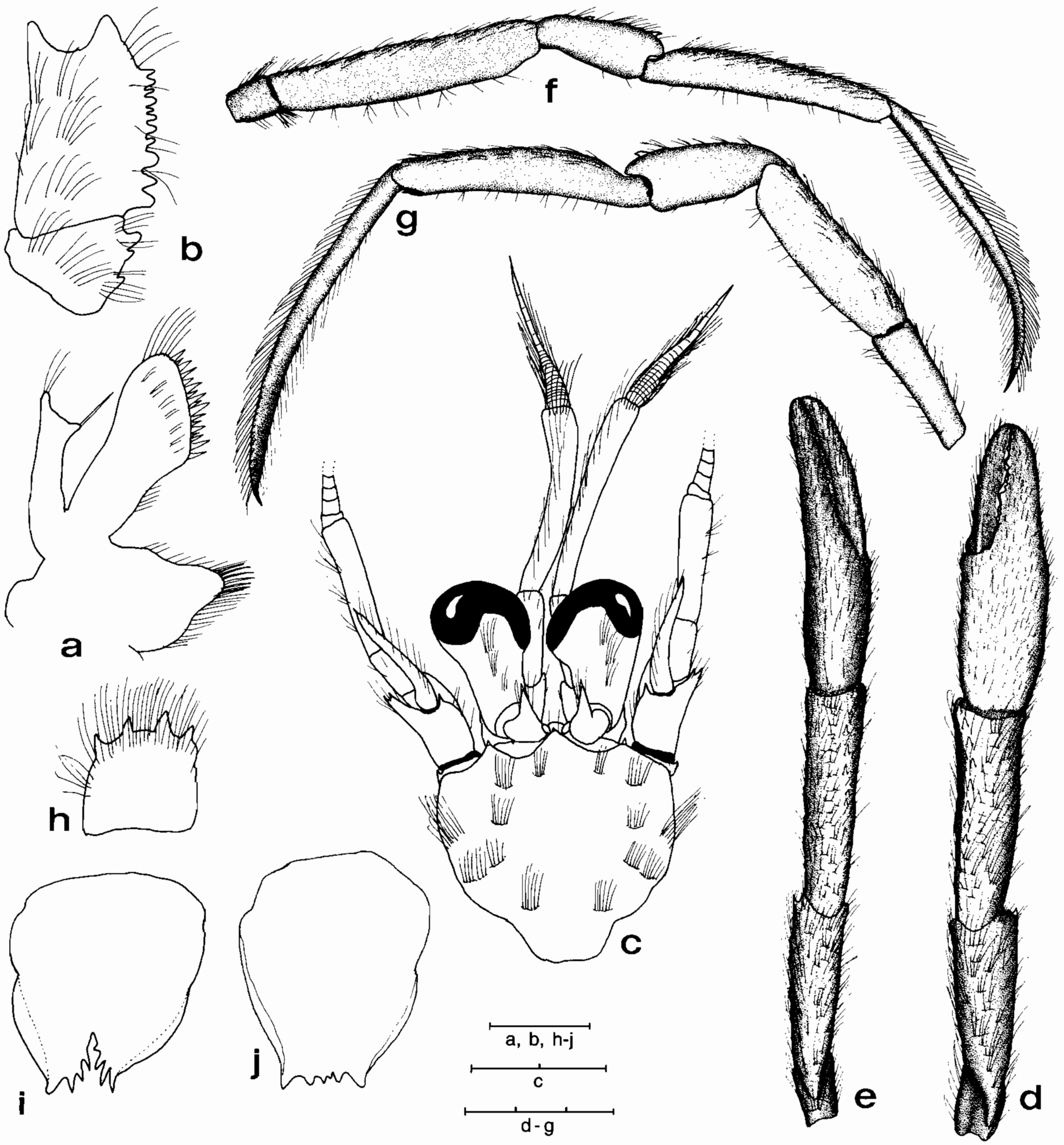

FIG. 2. — *Enneopagurus garciagomezi* sp. nov., a-b, paratype ♀ (3.6 mm) from KARUBAR Stn CP 69; c-i, holotype ♂ (3.3 mm) from Stn DW 70; j, paratype (2.9 mm) from Stn CP 39: **a**, left maxillule; **b**, basis and ischium of left third maxilliped; **c**, shield and cephalic appendages; **d**, right cheliped (dorsal view); **e**, left cheliped (dorsal view); **f**, right second pereopod (lateral view); **g**, left third pereopod (lateral view); **h**, anterior lobe of sternite of third pereopods; **i-j**, telson. Scales equal 0.5 mm (a-b, h-j), 2.0 mm (c), and 3.0 mm (d-g).

Chelipeds subequal; left frequently longer, but not as robust. Right cheliped (Figs 2d, 33c, e) elongate, quite slender. Dactyl slightly shorter to approximately as long as palm; cutting edge with blunt or sometimes denticulate calcareous margin and 2 or 3 more prominent calcareous teeth; terminating in very small corneous claw; dorsomesial margin not delimited; dorsal surface convex, elevated proximally into slender ridge, all surfaces unarmed but with numerous fine setae. Palm 0.60 to 0.80 length of carpus; dorsomesial and dorsolateral margins not delimited, dorsal surface convex, surfaces of palm and fixed finger unarmed, but with many fine setae; cutting edge of fixed finger with several small and 2 or 3 somewhat larger calcareous teeth proximally and row of tiny calcareous teeth distally, terminating in very small corneous claw. Carpus slightly longer than merus; dorsomesial margin sometimes with row of small spines, or more often only 1 to 3 spines and several low tubercles; all surfaces with very short transverse rows of moderate to long setae; ventrolateral distal margin frequently with small spine. Merus with short transverse rows of setae on all surfaces; ventrolateral margin with 1 prominent spine at ventrodistal angle, ventromesial margin with somewhat smaller spine at distal angle. Ischium with dorsal and ventral rows of setae. Coxa with prominent spine on ventrolateral distal angle and smaller spine on ventromesial distal angle.

Left cheliped (Figs 2e, 33d, f) slender, rarely shorter than right and frequently overreaching right by distal third of chela; fingers in males usually obliquely curved ventrolaterally. Dactyl 1.25 to 1.50 length of palm; cutting edge with row of very small corneous teeth, terminating in corneous claw; surfaces unarmed, but with numerous short setae. Palm 0.60 to 0.75 length of carpus, dorsomesial and dorsolateral margins not delimited, all surfaces of palm and fixed finger unarmed, but with numerous short to moderately long setae; cutting edge of fixed finger with row of very small widely-spaced calcareous teeth interspersed with minute calcareous or corneous teeth, terminating in tiny corneous claw. Carpus slightly longer than merus; dorsomesial margin with 1 or 2 distal spines and row of spinulose protuberances, sometimes, at least partial row of small spines, dorsolateral margin not delimited; all surfaces with numerous very short transverse rows of long setae; ventrolateral distal angle usually with small spine. Merus with very short transverse rows of long setae on all surfaces; ventrolateral margin with 1 prominent acute spine at distal angle; ventromesial margin with 1 smaller spine at distal angle. Ischium with long setae dorsally and ventrally. Coxa with acute spine at each ventrodistal angle.

Second and third pereopods (Figs 2f-g) very long, overreaching outstretched chelipeds at least 0.25 length of dactyls; generally similar from left to right. Dactyls long and slender, usually at least half again length of propodi; in dorsal view, twisted in distal half; in lateral view, curved ventrally; terminating in slender corneous claws; dorsal margins each with row of very long stiff setae, ventral, lateral and mesial faces with few scattered setae, ventromesial margins with row of long, fine setae, at least in distal half, ventral margins each usually also with 1 to 5 tiny corneous spines. Propodi often with 1 corneous spine on ventrolateral distal margin, few low protuberances and numerous setae dorsally; few scattered setae ventrally. Carpi each with 1 spine on dorsally adjacent to dorsodistal angle and row of low protuberances on dorsal surface; second pereopods, and rarely third, also with 1 additional small spine or spinulose protuberance on dorsal surface proximally. Meri and ischia unarmed, but with tufts of setae dorsally and ventrally. Sternite of third pereopod with subquadrate anterior lobe (Fig. 2h) armed marginally with 2 to 6 small spines and numerous long setae.

Telson (Figs 2i-j) with posterior lobes slightly asymmetrical, each usually with prominent spine at outer angle and 2 to 4 additional spines on oblique terminal margin, occasionally margins nearly straight, median cleft obsolete; lateral margins each with corneous plate.

COLOR (in preservative). — Calcified integument somewhat iridescent.

HABITAT. — Variety of gastropod shells.

DISTRIBUTION. — Kai and Tanimbar Islands; 356-552 m.

ETYMOLOGY. — The species is named for Dr Julio GARCÍA-GÓMEZ, Miami-Dade Community College, Miami, Florida, not only a friend and colleague, but the first carcinologist to document gill loss on the third maxillipeds in pagurids.

AFFINITIES. — Among KARUBAR species, *Enneopagurus garciagomezi* bears considerable resemblance to species of *Turleania* nom. nov. However, in addition to the characters separating the two genera, *E. garciagomezi* is characterized by setose, but unarmed chelae, and ambulatory legs that have little or no armature on the ventral margins of the dactyls.

REMARKS. — The sexual tube in males of this species (Figs 3a-b) tends to be moderately short to moderately long, thick, curved outwardly and directed dorsally; the tip is spatulate and provided with a dense fringe of curved setae. Males obviously infected with rhizocephalans still exhibit a well developed sexual tube.

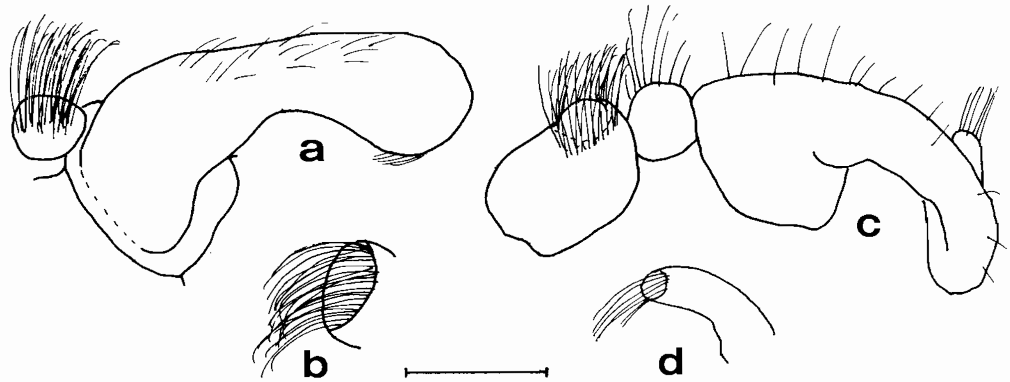

FIG. 3. — Male secondary sexual characters of *Enneopagurus* and *Turleania* nom. nov. a-b, *Enneopagurus garciagomezi* sp nov., paratype ♂ (3.2 mm) from KARUBAR Stn CP 69. — c-d, *Turleania multispina* sp. nov., paratype ♂ (1.9 mm) from Stn DW 03: **a**, **c**, sternite and coxa of left fifth pereopods (ventral view); **b**, **d**, terminal portion of left sexual tube. Scale equals 0.5 mm (c, d) and 1.0 mm (a, b).

Sexual dimorphism is seen in the left cheliped and in the setation of the sternite of the fifth pereopods. Although the dactyl and fixed finger of the left chela are long, slender, and ventrally curved in both sexes, the curvature is usually more pronounced in males where there is also a tendency for the chela to become laterally twisted. Females have a considerably greater amount of setae on the sternite and coxae of the fifth pereopods.

Genus *DECAPHYLLUS* de Saint Laurent, 1968

Decaphyllus de Saint Laurent, 1968a: 925; 1968b: 1100.

EMENDED DIAGNOSIS. — Shield well calcified or with varying amount of decalcification particularly medially, lateral margins strongly convex, well calcified. Posterior carapace weakly calcified or entirely membraneous. Eight to 10 pairs of phyllobranchiate gills (no pleurobranchs; arthrobranchs of third maxilliped small, vestigial or absent). Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule with external endopodal lobe obsolete or absent. Third maxilliped with crista dentata of ischium reduced, no accessory tooth; merus with very strong dorsodistal spine. Sternite of third maxillipeds unarmed. Fourth pereopods simple, neither semi- nor subchelate; without propodal rasp. Sternite of fifth pereopods entire, not divided into 2 lobes by median groove.

Males with very long sexual tube developed on coxa of right fifth pereopod, directed from right to left across ventral body surface and curved anteriorly. Coxa of left fifth pereopod with short or moderately short sexual tube directed from left to right. Females with single gonopore on coxa of left third pereopod.

Abdomen with unpaired pleopods on somites 2 to 5 in both sexes, uniramous or very unequally biramous in males. Telson without transverse suture; terminal margin entire or with minute median cleft; posterior lobes strongly asymmetrical, each with 2 to 4 spines.

REMARKS. — In her revision of the genera *Catapaguroides* A. Milne Edwards & Bouvier, 1892 and *Cestopagurus* Bouvier, 1897, DE SAINT LAURENT (1968a) established the genus *Decaphyllus* for three previously unknown species. In that publication, DE SAINT LAURENT presented only a brief generic diagnosis and a slightly more detailed diagnosis of its type species, *D. spinicornis* de Saint Laurent. In a subsequent paper she (DE SAINT LAURENT, 1968b) provided a detailed description of the general characters of *Decaphyllus*, gave full descriptions of the three species, *D. spinicornis*, *D. similis* de Saint Laurent and *D. junquai* de Saint Laurent, and compared this rather distinctive genus with its closest cohort, *Catapaguroides*. *Decaphyllus spinicornis* is known only from Japan, whereas *D. similis* and *D. junquai* are reported from New Guinea and Indonesia.

Two additional species have been discovered during the course of this study, *D. barunajaya* sp. nov. and *D. maci* sp. nov. Both of these species differ from DE SAINT LAURENT's (1968a, b) taxa in having a very prominent spine on the ventral margin of the first antennal segment. *Decaphyllus barunajaya* sp. nov. also differs more notably in lacking arthrobranchs on the third maxillipeds. Gill loss in the Paguridea typically is manifest by loss of pleurobranchs, from four being present in the Pylochelidae and some diogenids to none in some genera of the Paguridae. *Decaphyllus* is only one of four pagurid genera where this total loss of pleurobranchs has been observed. The tendency toward reduction and/or disappearance in the paired arthrobranchs of the third maxilliped, without complete pleurobranch loss, has been reported in coenobitids and some pylochelids, but until this present report was known in the Paguridae, only in *Enneobranchus*.

Although other characters can be enlisted to justify the establishment of the genera *Enneobranchus*, *Enneophyllus*, and *Enneopagurus*, loss of arthrobranchs on the third maxilliped is the fundamental character. That rationale might similarly suggest that a distinct genus be established for *D. barunajaya* sp. nov., were it not for the overwhelming number of supplemental characters it shares with the other four species of *Decaphyllus*. These include the broadly rounded rostrum; characteristic shape of the ocular acicles; lower ramus of antennular flagellum with only three segments; distinctive profile of the coxal endite of the maxillule; reduced and irregular dentition of the crista dentata; absence of an accessory tooth on the crista dentata; loss of the pleurobranch above the fourth pereopod; uniform armature of the dorsal margins of the carpi of the second pereopods; very specialized development of the dactyl and propodus of the fourth pereopod; length and orientation of both the right and left sexual tubes; male pleopod development; single female left gonopore; and unusual telson shape and armature. In view of all these shared characters, clearly a simple emendation of *Decaphyllus* to accommodate *D. barunajaya* is the appropriate action.

Key to the Indonesian species of *Decaphyllus*

1. Gill lamellae of third maxillipeds vestigial or absent; dactyl of right cheliped unarmed .... ***D. barunajaya*** sp. nov.
— Gill lamellae of third maxillipeds normally developed; dactyl of right cheliped armed at least with few spinules **2**

2. Dactyl of right cheliped with numerous spines or spinules on dorsal surface; telson with nearly symmetrical posterior lobes, each with 2 small spines .... ***D. similis****
— Dactyl of right cheliped with only 1 or 2 spines or spinules on dorsal surface; telson with asymmetrical posterior lobes, terminal margins each with 2 to 4 spines **3**

3. Palm of right cheliped with prominent median longitudinal row of spines on dorsal surface; telson with 3 or 4 spines on each terminal margin .... ***Decaphyllus maci*** sp. nov.
— Palm of right cheliped without prominent median longitudinal row of spines on dorsal surface; telson with 2 spines on each terminal margin .... ***Decaphyllus junquai****

Decaphyllus barunajaya sp. nov.

Figs 4a-l

MATERIAL EXAMINED. — **Indonesia**. KARUBAR. *Kai Islands*: stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26. 10. 1991: 1 ♂ (1.8 mm) (MNHN-Pg 5255).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29. 10. 1991: 1 ov. ♀ (1.9 mm) (MNHN-Pg 5256).

TYPES. — The ovigerous female (MNHN-Pg 5256) from the KARUBAR station DW 50 is the holotype. The other specimen is a paratype.

DESCRIPTION. — Shield (Fig. 4a) longer than broad; anterior margin between rostral region and lateral projections very weakly concave; anterolateral margins sloping; posterior margin roundly truncate; surface with median regions poorly calcified. Rostrum very broadly rounded or nearly obsolete. Lateral projections well developed, with terminal spine or spinule.

Ocular peduncles approximately equaling length of shield, dorsal surface with row of tufts of fine setae; corneae very slightly dilated. Ocular acicles drawn out distally into acute spine, mesial margin with several long setae; separated basally by slightly more than half basal width of 1 acicle.

Antennular peduncles overreaching ocular peduncles by 0.20 to 0.50 length of ultimate segment. Basal segment with prominent spine on dorsolateral margin medially. Penultimate and ultimate segments unarmed.

Antennal peduncle reaching nearly to base of cornea. Fifth and fourth segment with few scattered setae. Third segment with acute spine on ventrodistal margin. Second segment with dorsolateral distal angle strongly produced, terminating in bifid spine, dorsomesial distal angle with small spine. First segment with strong spine on ventrodistal margin. Antennal acicle long, usually reaching to distal margin of ultimate peduncular segment or slightly beyond; terminating in small spine; mesial surface with numerous long setae. Antennal flagellum with 2 to 4 short setae every 1 or 2 articles.

Crista dentata of third maxilliped with 5 or 6 irregularly-spaced and sized teeth; merus with very strong spine on dorsodistal angle. Arthrobranchs of third maxillipeds vestigial or absent.

Chelipeds subequal in length, right only slightly longer, but appreciably stronger. Right cheliped (Fig. 4b) with dactyl set at slightly oblique angle to palm; cutting edges of dactyl and fixed finger each with row of small calcareous teeth. Dactyl slightly shorter than palm; unarmed, but with moderately dense long setae dorsally and ventrally. Palm slightly shorter than carpus; dorsomesial margin with row of small spines not reaching to distal margin, dorsal midline with row of small spines not extending onto fixed finger, dorsolateral margin row of small spines and dorsal surface laterad of midline with numerous small spines, lateral face with faint transverse striations, some minutely spinulose and long setae; fixed finger unarmed but with moderately dense long setae particularly dorsally and ventrally. Carpus slightly longer than merus; dorsomesial margin with row of spines, smallest proximally and distally, dorsolateral surface with row of small spines, surfaces all with long setae. Merus with 1 acute spine on dorsodistal margin laterally; dorsal surface with transverse rows of long setae; ventromesial and ventrolateral margins each with small spine distally, partially obscured by long setae, ventrolateral margin with additional small spine in proximal half. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and long setae on ventral margin.

Left cheliped (Figs 4c-d) with longitudinal hiatus between dactyl and fixed finger; cutting edges each with row of small calcareous teeth. Dactyl slightly to considerably longer than palm, unarmed but with long setae particularly mesially and ventrally. Palm 0.50 to 0.70 length of carpus; dorsal surface with 2 rows of small spines, dorsolateral margin with irregular single or double row of small spines, not extending on to fixed finger; latter unarmed but with long moderately dense setae particularly laterally and ventrally; surfaces of palm also with scattered long setae. Carpus with row of 4 to 6 spines on dorsomesial margin and 2 to 4 spines on dorsolateral margin; all surfaces with scattered setae. Merus with transverse rows of setae on dorsal surface, 1 prominent spine on dorsodistal margin mesially; ventrolateral margin with 2 rather widely-spaced spines, ventromesial margin with 3 spines; ventral surface with scattered long setae. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and scattered setae.

Ambulatory legs (Figs 4e-f) overreaching tip of right cheliped. Dactyls 1.50 to nearly twice length of propodi; slightly curved ventrally; all surfaces unarmed, but with numerous setae, particularly longer and stronger on dorsal margins. Propodi slightly longer than carpi, unarmed but with numerous moderately long setae, particularly dorsally and ventrally. Carpi each with dorsodistal spine and 2 (second) or 1 (third) additional spines on dorsal margin in proximal half. Meri each with 1 spine in proximal half of dorsal margin, also usually 1 spine proximally in distal half, at least on second pereopods; ventral margins with numerous setae. Ischia unarmed but with numerous long setae. Fourth pereopods with claw of dactyl (Figs 4g-h) almost entirely masked by tufts of dense, pectinate setae. Fifth pereopods semichelate. Anterior lobe of sternite (Fig. 4i) of third pereopods subsemicircular, with long marginal setae.

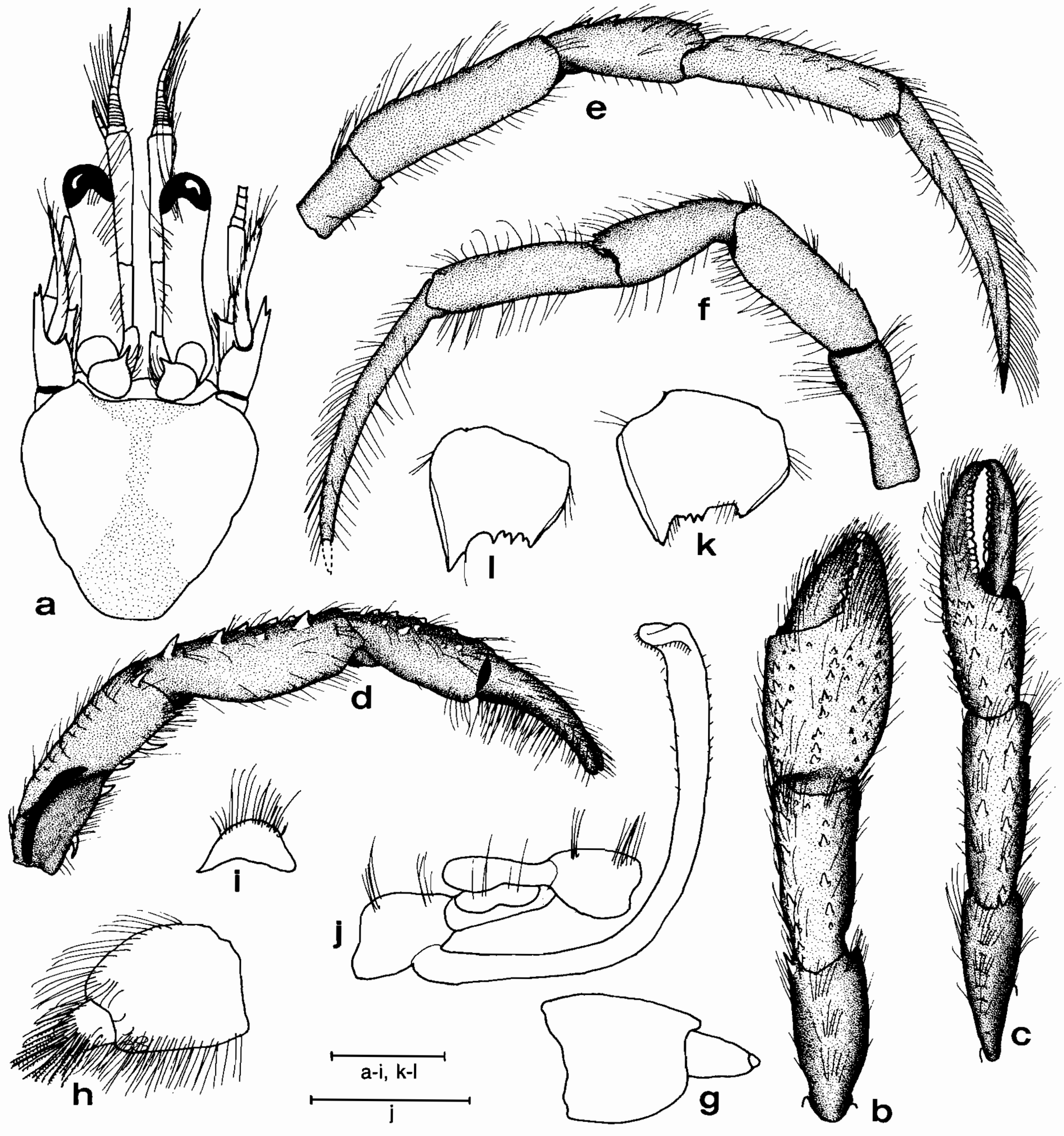

FIG. 4. — *Decaphyllus barunajaya* sp. nov., a-c, e-i, k, holotype ♀ (1.9 mm), from KARUBAR Stn DW 50; d, j, l, paratype ♂ (1.8 mm) from Stn DW 31: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, left cheliped (dorsal view); **d**, left cheliped (mesial view); **e**, right second pereopod (lateral view); **f**, left third pereopod (lateral view); **g**, dactyl and propodus of right fourth pereopod (lateral view; setae omitted); **h**, dactyl and propodus of left fourth pereopod (lateral view); **i**, anterior lobe of sternite of third pereopods; **j**, coxae and sternite of fifth pereopods; **k-l**, telson. Scales equal 0.5 mm (g, h, i, k, l) and 1.0 mm (a-f, j).

Male with unequally biramous pleopod on abdominal somite 2, pleopods 3 to 5 uniramous. Right sexual tube (Fig. 4j) reaching to level of coxa of left third pereopod; left sexual tube reaching to base of coxa of right fifth.

Telson (Figs 4k-l) with median cleft not apparent; terminal margin with prominently produced left exterior angle separated by irregularly-spaced series of 3 or 4 spines from weakly developed right exterior angle; lateral margins each with narrow chitinous plate.

COLOR (in preservative). — Shield and cephalic appendages with faint orange hue. Chelipeds and ambulatory legs mottled orange with white distally on most segments. Calcified integument somewhat iridescent.

HABITAT. — Unknown.

DISTRIBUTION. — Tanimbar and Kai Islands, Indonesia; 184 to 289 m.

ETYMOLOGY. — The species is named for the vessel "*Baruna Jaya 1*", from which the specimens were collected.

AFFINITIES. — *Decaphyllus barunajaya* differs from the other species of the genus in the absence of arthrobranchs on the third maxillipeds, in having an unarmed dactyl of the right cheliped, two proximal spines on the dorsal surfaces of the carpi of the second pereopods, and shorter right sexual tube. The slightly dilated corneae, unarmed ventral margin of the carpus of the right cheliped, and distinctly different telson armature are additional characters that set *D. barunajaya* apart from *D. spinicornis*. Among Indonesian species, it resembles *D. similis* in having moderately long ocular peduncles with slightly dilated corneae, but differs in having shorter antennular peduncles, a bifid dorsolateral distal angle of the second antennal segment, and two rows of spines on the carpus of the left cheliped. *Decaphyllus barunajaya* is also readily distinguished from *D. junquai* by its longer ocular, but shorter antennular peduncles and armature of the right cheliped. Additional characters that serve to distinguish *Decaphyllus barunajaya* from *D. maci* sp. nov. include the anterior lobe of the sternite of the third pereopods, which is subsemicircular in the former species, but subtriangular in the latter. The carpus of the left cheliped has only two to four spines on the dorsolateral margin in *D. barunajaya*, but five or six in *D. maci*, and the left chela exhibits a pronounced hiatus between the dactyl and fixed finger in the former species that is lacking in the latter.

Decaphyllus maci sp. nov.

Figs 5a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 30, 05°39'S, 132°56'E, 118-111 m, 26.10.1991: 1 ♂ (1.8 mm) (MNHN-Pg 5257), 1 ov. ♀ (1.8 mm) (MNHN-Pg 5258).

TYPES. — The ovigerous female (MNHN-Pg 5258) from KARUBAR station DW 30 is the holotype. The male is a paratype.

DESCRIPTION. — Shield (Fig. 5a) longer than broad; anterior margin between rostral region and lateral projections very weakly concave; anterolateral margins sloping; posterior margin roundly truncate; surface with median regions poorly calcified proximally and distally. Rostrum very broadly rounded or nearly obsolete. Lateral projections well developed, with terminal spine.

Ocular peduncles approximately equaling length of shield, dorsal surface with row of tufts of long setae; corneae not dilated. Ocular acicles each drawn out distally into long, acute spine, mesial margin with several long setae; separated basally by approximately 0.75 basal width of an acicle.

Antennular peduncles overreaching ocular peduncles by 0.50 to 0.80 length of ultimate segment. Basal segment with prominent spine on dorsolateral margin medially. Penultimate and ultimate segments unarmed.

Antennal peduncle reaching to distal half of ocular peduncle but not to base of cornea. Fifth and fourth segment with few scattered setae. Third segment with acute spine on ventrodistal margin. Second segment with dorsolateral distal angle strongly produced, terminating in unequally bifid spine; dorsomesial distal angle with prominent spine. First segment with strong spine on ventrodistal margin. Antennal acicle longer than peduncle, usually reaching to base of cornea; terminating in small spine; mesial surface with numerous long setae. Antennal flagellum with 2 to 4 short and 1 or 2 somewhat longer setae every 1 or 2 articles.

Crista dentata of ischium of third maxilliped with 3 to 5 irregularly-spaced and sized teeth; merus with very strong spine on dorsodistal angle. Arthrobranchs of third maxillipeds normally developed.

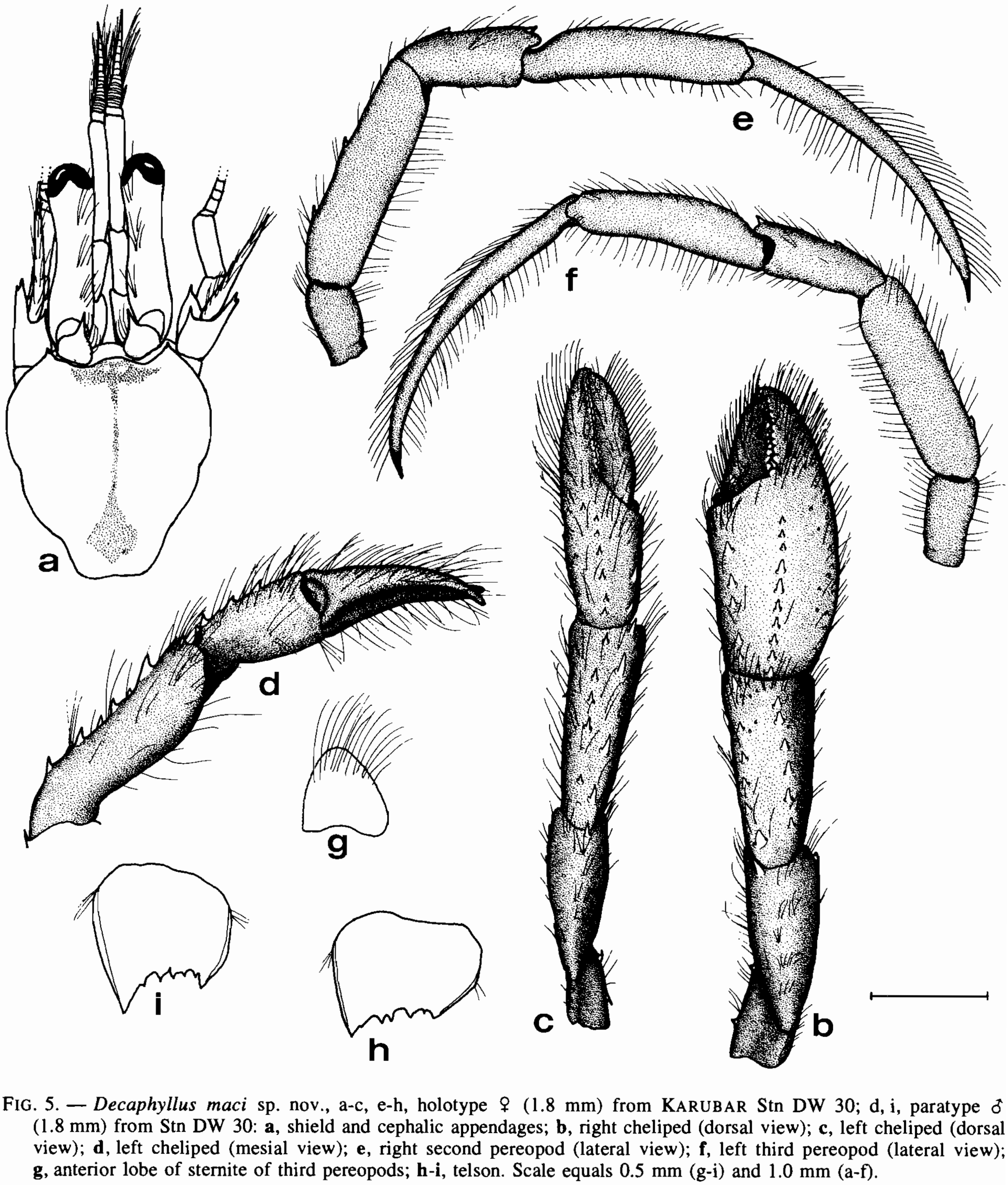

FIG. 5. — *Decaphyllus maci* sp. nov., a-c, e-h, holotype ♀ (1.8 mm) from KARUBAR Stn DW 30; d, i, paratype ♂ (1.8 mm) from Stn DW 30: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, left cheliped (dorsal view); **d**, left cheliped (mesial view); **e**, right second pereopod (lateral view); **f**, left third pereopod (lateral view); **g**, anterior lobe of sternite of third pereopods; **h-i**, telson. Scale equals 0.5 mm (g-i) and 1.0 mm (a-f).

Chelipeds subequal in length, right only slightly longer, but appreciably stronger. Right cheliped (Fig. 5b) with dactyl generally straight; cutting edges of dactyl and fixed finger each with row of small calcareous teeth. Dactyl approximately 0.80 length of palm; with 1 spine on dorsal surface proximally and relatively dense long setae, particularly laterally and ventrally. Palm approximately equal to length of carpus; dorsomesial margin with row of spines not reaching to distal angle, dorsal midline with row of small spines not extending full length of palm, dorsolateral margin with row of moderately widely-spaced small spines, few additional spinules on dorsal surface laterad of midline; lateral and mesial faces with scattered long setae; fixed finger unarmed but with relatively dense long setae particularly laterally and ventrally. Carpus slightly longer than merus; dorsomesial margin with row of moderately small spines, largest proximally, dorsolateral margin with row of slightly larger spines; surfaces all with scattered long setae. Merus with 1 acute spine on dorsodistal margin laterally; dorsal surface with transverse rows of long setae; ventromesial and ventrolateral margins each with small distal and proximal spine and scattered long setae, ventral surface with median spinule. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and long setae on ventromesial margin, ventrolateral distal angle with minute spinule.

Left cheliped (Figs 5c-d) without longitudinal hiatus between dactyl and fixed finger but tips crossing; cutting edge of dactyl with row of sharp spine-like teeth, cutting edge of fixed finger with row of small, blunt calcareous teeth. Dactyl approximately equal to length of palm, unarmed but with long setae particularly mesially and ventrally. Palm 0.60 to 0.80 length of palm; dorsal surface with row of small spines in midline not extending onto fixed finger and 1 or 2 small spines dorsolaterally, dorsolateral margin with row of small spines, extending only slightly, if at all, onto fixed finger; dorsomesial margin with 2 or 3 acute spines; fixed finger unarmed but with long moderately dense setae particularly laterally and ventrally; surfaces of palm also with scattered long setae. Carpus with row of 4 or 5 spines on dorsomesial margin and 5 or 6 spines on dorsolateral margin; ventrolateral distal angle with small acute spine; all surfaces with scattered setae. Merus with transverse rows of setae on dorsal surface, 1 acute spine on dorsodistal margin; ventrolateral margin with 2 or 3 rather widely-spaced spines, ventromesial margin with 3 spines, ventral surface with 1 or 2 acute spines and scattered long setae. Ischium with 1 anteriorly directed and 1 posteriorly directed spine and scattered setae on ventromesial margin.

Ambulatory legs (Figs 5e-f) overreaching tip of right cheliped. Dactyls 1.50 to nearly twice length of propodi; slightly curved ventrally; all surfaces unarmed but with numerous setae, particularly longer and stronger on dorsal margins. Propodi 0.25 to 0.40 longer than carpi, unarmed but with numerous moderately long setae, particularly dorsally and ventrally. Carpi each with dorsodistal spine and 1 additional spine on dorsal margin in proximal half. Meri each with 1 spine on dorsal surface at mid-length and 1 additional spine in proximal half; ventral margins with numerous setae. Ischia unarmed but with numerous long setae. Fourth pereopods with claw of dactyl almost entirely masked by tufts of dense, pectinate setae. Fifth pereopods semichelate. Anterior lobe of sternite (Fig. 5g) of third pereopods bluntly subtriangular, with long submarginal setae.

Male with uniramous pleopods on abdominal somites 2, 4 and 5, pleopod of somite 3 unequally biramous. Right sexual tube reaching to level of coxa of left cheliped; left sexual tube not quite reaching to base of coxa of right fifth.

Telson (Figs 5h-i) sometimes with very small median cleft; terminal margin with prominently produced left exterior angle separated by irregularly-spaced series of 5 or 6 spines from more weakly developed right exterior angle; lateral margins each with narrow chitinous plate.

COLOR (in preservative). — Shield and cephalic appendages with faint orange hue. Chelipeds and ambulatory legs also with faint orange hue, appearing as indistinct bands on most segments. Calcified integument somewhat iridescent.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 111-118 m.

ETYMOLOGY. — This species is named for the late E.J. "Mac" MCGEORGE, whose photographs have enhanced many pagurid reports.

AFFINITIES. — As previously indicated, all known species of *Decaphyllus* share a considerable number of morphological characters. In proportions and armature of the cephalic appendages, and armature of the right cheliped, *D. maci* most closely resembles *D. spinicornis*. Both species have relatively long ocular peduncles with corneae showing no dilation; bifid termination of the dorsolateral distal angles of the second segments of the antennal peduncles; and antennular peduncles that overreach the ocular peduncles by 0.50 to 0.80 length of the ultimate segment. Similarly, the right chelipeds of both species have a single small spine on the dorsoproximal surface of the dactyl and both dorsomesial and median longitudinal rows of spines. However, *D. maci* also has a row of small spines on the clearly delimited dorsolateral margin, whereas *D. spinicornis* is described as having the dorsolateral margin only weakly delimited and with few scattered spinules. Although both species also have two rows of spines on the dorsal surface of the carpus, the ventrolateral margin is armed with a few spines in *D. spinicornis*, but unarmed in *D. maci*. Differences are also found in the development of the telson. In *D. maci* a small median cleft is sometimes apparent, but even when obscured, there is a distinct separation of right and left lobes, each terminal margin armed with two or occasionally three small spines in addition to the spine of the external angle. By contrast, *D. spinicornis* has only two spines on the terminal margin between the spinose external angles.

From the remaining species of *Decaphyllus*, all occurring in Indonesian waters, *D. maci* is best distinguished from *D. similis* by its shorter antennular peduncles, dactyl of the right cheliped having only a single spine on the dorsal surface, and by having two rows of spines on the dorsal surface of the carpus of the left cheliped. From *D. junquai*, this new species is also readily separated by the relative shortness of its antennular peduncles, less strongly armed right chela, and more strongly armed telson. Like *D. spinicornis*, the telsons of both *D. similis* and *D. junquai* have only two spines on the terminal margin between the spinose external angles. *Decaphyllus maci* bears a superficial resemblance to *D. barunajaya* sp. nov. in having relatively long ocular and short antennular peduncles; bifid termination of the dorsolateral distal angles of the second segments of the antennal peduncles; strong spine on the ventrodistal margin of the first segment of the antennal peduncle; and weak median calcification of the shield. However, the two species are easily distinguished by the armature of the chelipeds and the carpi of the second pereopods.

Genus ***CATAPAGUROIDES*** A. Milne Edwards & Bouvier, 1892

Catapaguroides A. Milne Edwards & Bouvier, 1892: 211 (in part). — BOUVIER, 1922: 26 (in part). — DE SAINT LAURENT, 1968a: 927.

DIAGNOSIS. — Ten pairs of phyllobranchiate gills (no pleurobranch above arthrobranchs of fourth pereopod). Antennal peduncle with supernumerary segmentation. Ischium of third maxilliped with crista dentata more or less reduced, without accessory tooth. Chelipeds unequal, right appreciably stronger. Carpi of ambulatory legs with dorsodistal spine. Fourth pereopods semichelate; propodal rasp with single row of corneous scales.

Males with sexual tube developed on coxa of right fifth pereopod, directed from right to left under thorax and recurved anteriorly. Short tube developed on coxa of left fifth pereopod and concealed between 2 thick tufts of setae on sternite; unpaired biramous left third to fifth pleopods. Females with single gonopore on coxa of left third pereopod. No paired pleopods and 4 unpaired, left second to fifth biramous pleopods.

Telson with transverse suture only weakly delineated; posterior lobes not markedly asymmetrical.

REMARKS. — Prior to the revisionary work of DE SAINT LAURENT-DECHANCÉ (1966b) and DE SAINT LAURENT (1968a), the position of the male sexual tube was often the only criterion used in generic assignments. Use of the collective possession of a right sexual tube had resulted a heterogeneous conglomerate of taxa assigned to the genera *Catapaguroides*, *Cestopagurus*, and *Catapagurus* that otherwise shared few characters of phylogenetic significance. With her redefinition of *Catapaguroides* (DE SAINT LAURENT, 1968a), the genus was left with only three of its formerly assigned taxa, all with Atlantic distributions. She reassigned three Indo-Pacific species, two previously included in *Cestopagurus* and one in *Catapagurus* to *Catapaguroides* and described six new species. Five of these, *C. inermis* de Saint Laurent, 1968a; *C. cristimanus* de Saint Laurent, 1968a; *C. mortenseni* de Saint Laurent, 1968a; *C. melini* de Saint Laurent, 1968a; and *C. spinulimanus* de Saint Laurent, 1968a, occur in Indonesian waters, although none were collected during the KARUBAR expedition.

Key to the Indonesian species of *Catapaguroides*

1. Right cheliped with subcircular chela and subtriangular carpus (dorsal view) **2**
— Right cheliped with subrectangular or subovate chela and subrectangular carpus (dorsal view) **3**

2. Right cheliped with row of spines on dorsomesial margin of palm, carpus with row of spines in dorsal midline; palm of left chela with 2 spinulose tubercles .... *C. cristimanus**
— Right cheliped with 1 prominent spine on dorsomesial margin of palm; carpus few spines on dorsomesial margin and 2 spines in dorsal midline distally; palm of left chela unarmed. .... *C. karubar* sp. nov.

3. Palm of right cheliped armed with numerous spines, at least on dorsomesial margin **4**
— Palm of right cheliped unarmed or with only 1 small tubercle at dorsomesial distal angle **6**

4. Dorsal surface of palm of right cheliped with 3 irregular rows of fine spines or spinules ... . *C. spinulimanus**
— Dorsal surface right cheliped unarmed or with only 1 spine or tubercle proximally, dorsomesial margin with row of spines **5**

5. Carpus of right cheliped distinctly shorter than palm; dactyl with convex dorsal surface .... *C. melini**
— Carpus of right cheliped distinctly longer than palm; dactyl with median ridge or crest in distal half .... *C. declivis* sp. nov.

6. Antennular peduncles overreaching distal margins of corneae by nearly half length of penultimate segment; ocular peduncles moderately slender .... *C. inermis**
— Antennular peduncles overreaching distal margins of corneae by length of ultimate segment; ocular peduncles moderately short and stout .... *C. mortenseni**

Catapaguroides declivis sp. nov.

Figs 6a-j, 33g

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5259); 1 ov. ♀ (1.1 mm) (MNHN-Pg 5260); 1 ♂ (0.9 mm) (POLIPI). — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ov. ♀ (1.2 mm) (USNM 276009).

TYPES. — The male (MNHN-Pg 5259) from the KARUBAR station DW 49 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 6a) longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins sloping, posterior margin truncate, but with shallow median concavity; dorsal surface with few setae. Rostrum broadly rounded. Lateral projections triangular, produced little if at all beyond level of rostrum; with small marginal spinule.

Ocular peduncles moderately long and moderately stout, 0.70 to 0.80 shield length; dorsomesial margins each with row of sparse tufts of long setae; corneae slightly dilated. Ocular acicles narrowly triangular, with few marginal setae and submarginal distal spine.

Antennular peduncles overreaching ocular peduncles by at least full length of ultimate peduncular segment. Basal segment elongate, with statocyst lobe produced laterally and with acute spine on distolateral margin, distal margin with several long setae. Penultimate segment with few scattered short setae. Ultimate segment with 1 or 2 very long, distally plumose setae.

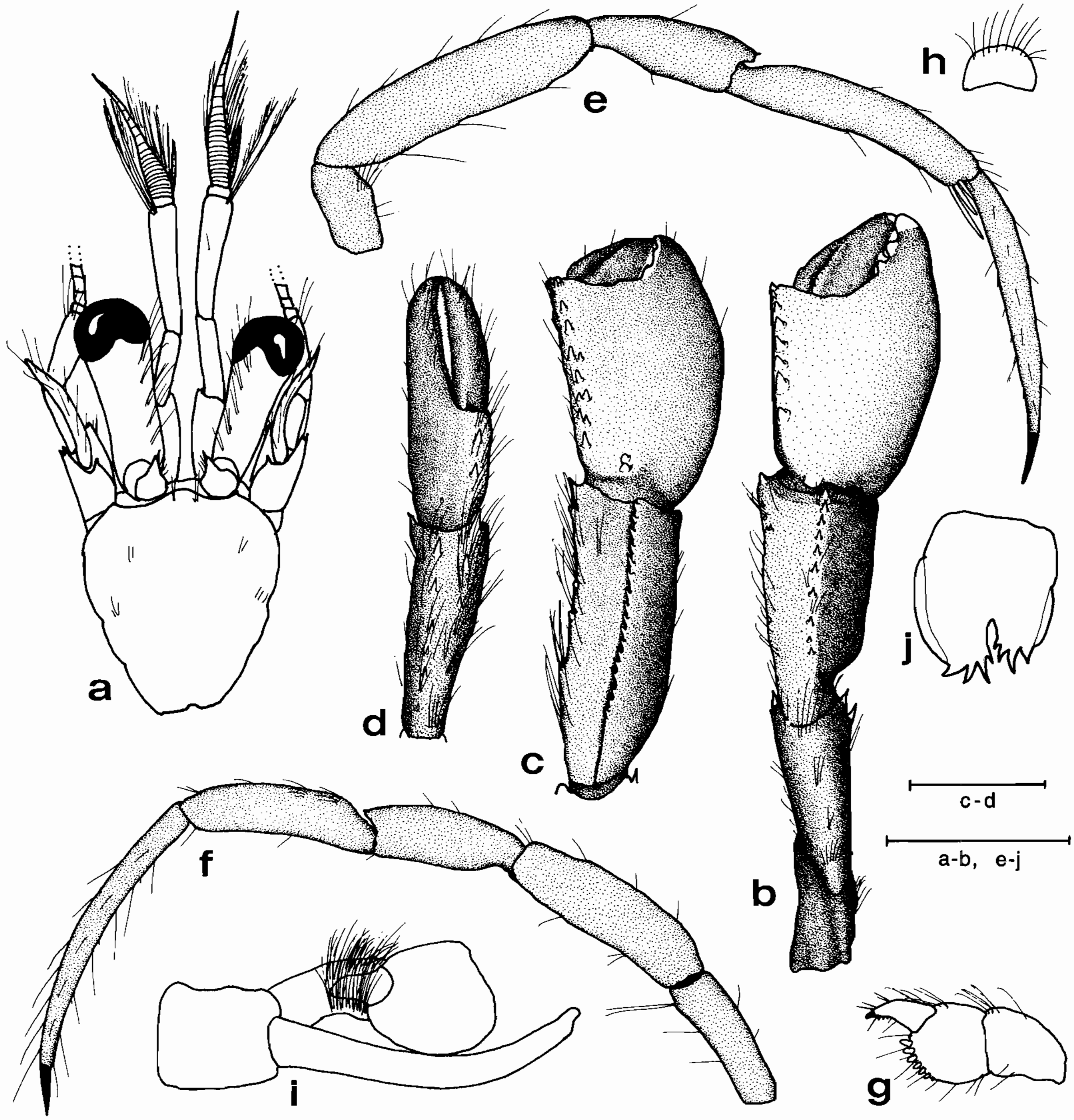

FIG. 6. — *Catapaguroides declivis* sp. nov., a-b, e-j, paratype ♂ (1.1 mm) from KARUBAR Stn DW 49; c-d, holotype ♂ (1.5 mm) from Stn DW 49: **a**, shield and cephalic appendages; **b**, right cheliped; **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped; **e**, right second pereopod (lateral view); **f**, left third pereopod (lateral view); **g**, dactyl, propodus and carpus of left fourth pereopod (lateral view); **h**, anterior lobe of sternite of third pereopods; **i**, coxae and sternite of fifth pereopods; **j**, telson. Scales equal 0.5 mm (g-j) and 1.0 mm (a-f).

Antennal peduncle moderately short, reaching to distal margin of cornea or slightly beyond. Fifth segment with few scattered setae and 2 or 3 longer at distal margin. Fourth segment glabrous. Third segment with few setae and acute spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong simple or bifid spine; dorsomesial distal angle with small spine. First segment with small spine on ventrolateral margin. Antennal acicle slender, arcuate, reaching approxigmately to middle of ultimate peduncular segment; terminating in small spine and with several marginal long setae. Antennal flagella (missing in holotype) overreaching right cheliped; with 1 or 2 moderately long and also 1 or 2 very short setae every 1 or 2 articles proximally, only very short setae distally.

Right cheliped (Figs 6b-c, 33g) with dactyl articulating obliquely with palm; propodal-carpal articulation rotated clockwise 15° to 45° from perpendicular. Dactyl 0.70 to approximately equaling length of palm; cutting edge with 2 prominent calcareous teeth; terminating in small calcareous claw and slightly overlapped by fixed finger; dorsal surface with distinct but very faintly granular or smooth crest in proximal half, dorsomesial margin drawn out into very weak subacute ridge, armed proximally with 2 to several very small spinulose tubercles; mesial and ventral surfaces with few scattered moderately long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial margin with single or irregularly double row of 5 to 11 small to moderately strong acute or subacute spines, 1 or 2 well-developed tubercles at dorsoproximal margin in mesial half, dorsal surface of palm and fixed finger convex, dorsolateral margin not delimited; mesial face and ventral surface of palm and fixed finger with scattered setae; cutting edge of fixed finger with 2 prominent calcareous teeth, terminating in corneous or calcareous claw. Carpus 1.25 to 1.50 times longer than merus; dorsomesial distal angle with acute spine, usually also with row of 3 to several small spinules on dorsomesial margin, long setae along entire dorsomesial margin and on mesial face; dorsal surface laterad of midline with row of 5 to 18 spines, dorsolateral surface strongly sloping ventrally; lateral and ventral surfaces with scattered long setae, most numerous ventrally, ventrolateral distal angle with acute spine. Merus subtriangular; dorsodistal margin with small spine or spinule; dorsal surface somewhat flattened but with double row of long setae sometimes arising from low protuberances; ventromesial margin with 2 to 4 prominent spines distally and row of long setae; ventrolateral margin with 1 or 2 prominent spines near distal angle and row of long setae. Ischium with long setae dorsally and ventrally.

Left cheliped (Fig. 6d) (missing in male paratype) not reaching to proximal margin of dactyl of right; with propodal-carpal articulation twisted 30° to 45° counterclockwise from perpendicular; dactyl and fixed finger curved ventrally and with slender hiatus. Dactyl 1.25 to 1.50 longer than palm, unarmed but with scattered setae; cutting edge with row of small corneous teeth. Palm approximately 0.60 length of carpus; dorsomesial margin with 2 or 3 spines and sparse tufts of long setae, dorsal surface of palm unarmed or with 1 minute spinule proximally in midline, fixed finger unarmed; both with few long setae, particularly on dorsomesial margin of palm; dorsolateral margin not delimited. Carpus approximately 1.25 length of merus; dorsomesial distal angle with strong slender spine, margin with 2 or 3 spines and numerous long setae; dorsolateral distal angle with 1 or 2 tiny spinules, dorsolateral margin with 3 to 6 spines; ventrolateral distal angle with prominent spine; mesial and ventral surfaces with few scattered long setae. Merus with tufts of setae on dorsal margin; ventrolateral margin with 2 slender spines in distal half; ventromesial margin with 1 or 2 spines in distal half. Ischium with small spine at ventromesial distal angle. Coxa with acute spine at distolateral angle.

Ambulatory legs (Figs 6e-f) elongate, overreaching right cheliped by nearly entire length of dactyls; terminating in long, slender claws. Dactyls of right pereopods slightly longer than propodi; dactyls of left second (regenerating in holotype) from 1.25 to 1.50 and dactyls of left third from 1.50 to nearly twice length of propodi; slightly curved and twisted distally, surfaces with few long and short setae most numerous dorsally; ventral margins with 2 or 3 short, fine corneous spinules. Propodi of second pereopods each with single long and 1 or 2 pairs of short or moderately short stiff articulated bristles at ventrodistal margin (males) or unarmed (females); propodi of third with ventrodistal margins unarmed or with 1 short corneous spinule; dorsal and ventral surfaces all with sparse tufts of setae most numerous on third. Carpi each with spinule at dorsodistal angle and few setae dorsally. Meri and ischia each with few setae. Fourth pereopods with 3 or 4 denticles on ventral margin of dactyl; propodal rasp consisting of 6 to 8 corneous scales (Fig. 6g). Fifth pereopod semichelate. Sternite of third pereopods with roundly rectangular anterior lobe (Fig. 6h).

Male with long sexual tube developed on coxa of right fifth pereopod (Fig. 6i), directed from right to left and reaching beyond coxa of left fifth pereopod; coxa of left with short sexual tube directed from left to right and partially obscured by setae arising from sternal surface.

Telson (Fig. 6j) with asymmetrical posterior lobes separated by deep median cleft; terminal margins each with 3 or 4 very strong and often 1 smaller acute spines; lateral margins each delimited by chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the Tanimbar Islands, Indonesia; 206-209 m.

ETYMOLOGY. — From the Latin *declivis* meaning downhill or sloping, referring to the strongly sloping dorsolateral face of the carpus of the right cheliped.

AFFINITIES. — *Catapaguroides declivis* bears some resemblance to both *C. melini* and *C. cristimanus*. From *C. melini*, *C. declivis* differs in having shorter ocular peduncles with more dilated corneae; shorter antennal peduncles; distinctly different armature of the right cheliped; shorter male right sexual tube; and more strongly armed telson. *Catapaguroides declivis* is readily distinguished from *C. cristimanus* by the longer, more slender shield of the former species and most specifically, by its narrower and differently armed right chela, which has one or two dorsoproximal tubercles on the palm and lacks sharply crested dorsomesial and dorsolateral margins. *Catapaguroides declivis* is immediately distinguished from the second species of *Catapaguroides* found during the KARUBAR expedition by shape and armature of the carpus of the right cheliped.

REMARKS. — The spines on the dorsomesial margin of the palm of the right chela are stronger, but fewer in number in the very small, but mature, female (0.92 mm) than in either of the larger males. In the holotype, the right chela is more strongly twisted, and the row of spines on the dorsal surface of the carpus is composed of numerous, but irregular, more serrate appearing spines. The characteristic proximomedial tuberculation of the right chela is a single tubercle in both male and female paratypes, and double in the holotype.

Catapaguroides karubar sp. nov.

Figs 7a-h

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°17'49"S, 133°00'51"E, 205-212 m, 24.10.1991: 1 ♀ (1.1 mm) (MNHN-Pg 5261).

TYPES. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 7a) approximately as long as broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins sloping, posterior margin truncate. Rostrum broadly rounded. Lateral projections triangular, produced only slightly beyond level of rostrum, with small marginal spine.

Ocular peduncles moderately long and moderately stout, approximately 0.80 shield length; corneae approximately 0.30 length of peduncle, not dilated. Ocular acicles triangular, with small distal spine; separated basally by basal width of an acicle.

Antennular peduncles when extended overreaching ocular peduncles by slightly less than length of ultimate peduncular segment. Basal segment elongate, with statocyst lobe produced laterally and with acute spine on dorsolateral margin. Penultimate segment with few scattered short setae. Ultimate segment with 2 or 3 long, distally plumose setae.

Antennal peduncle moderately short, reaching to proximal margin of cornea. Fifth segment with 1 or 2 long setae at distal margin. Fourth segment glabrous. Third segment with very prominent acute spine at ventrodistal margin. Second segment with dorsolateral distal angle strongly produced as elongate spine, with accessory spinule on mesial margin; dorsomesial distal angle with prominent spine. First segment with acute spine on ventrolateral margin. Antennal acicle slender, arcuate, reaching distal margin of ultimate peduncular segment; terminating in small spine, and with few setae distally. Antennal flagella short; each article with 2 or 3 moderately short and 1 or 2 somewhat longer setae. Crista dentata with 5 or 6 irregularly-spaced and sized teeth on ischium; basis unarmed. Right cheliped (Fig. 7b) with operculate chela. Dactyl articulating somewhat obliquely with palm; approximately 1.30 times length of palm; cutting edge with 3 widely separated calcareous teeth; terminating in

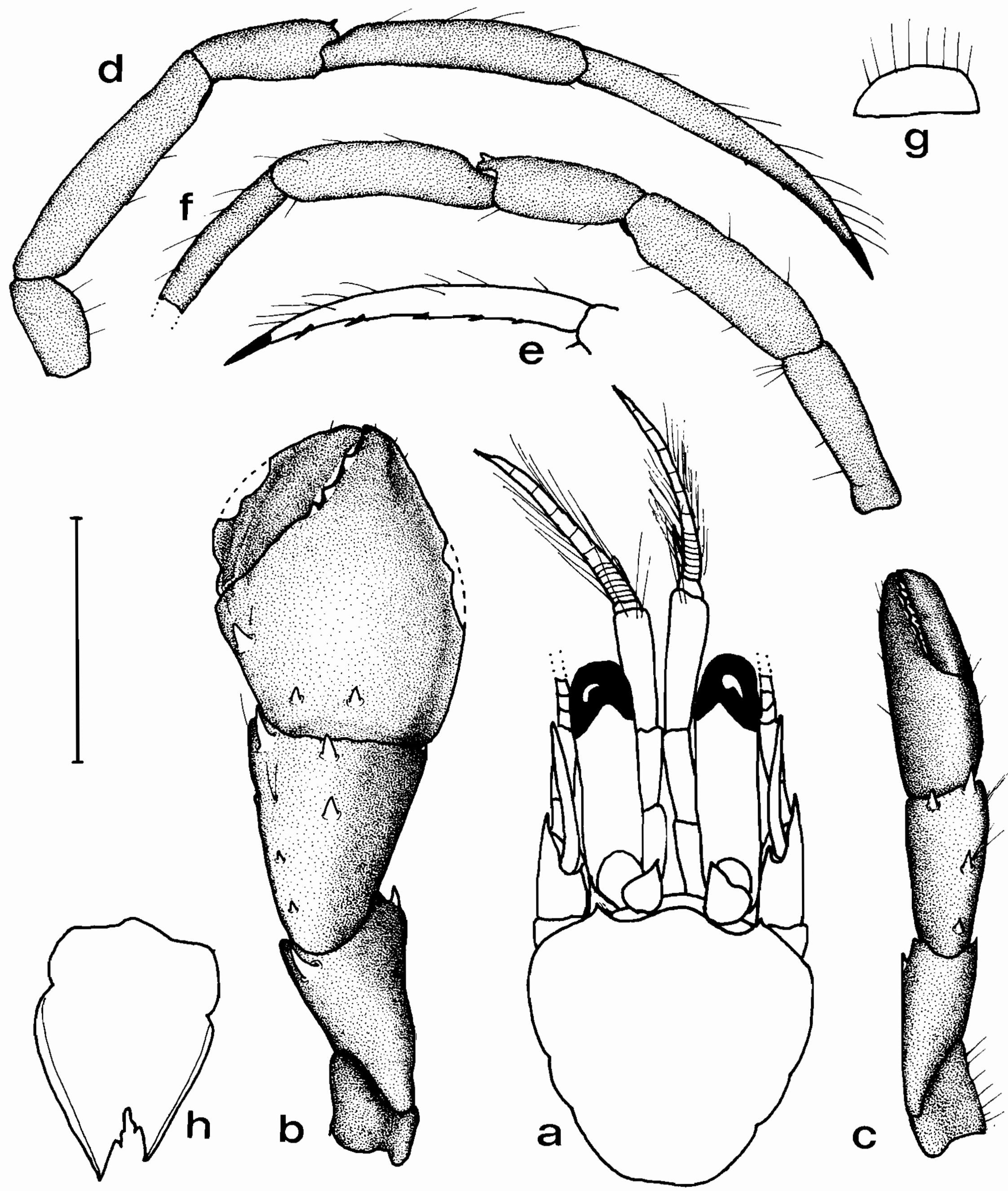

FIG. 7. — *Catapaguroides karubar* sp. nov., holotype ♀ (1.1 mm) from KARUBAR Stn DW 18: **a**, shield and cephalic appendages; **b**, right cheliped; **c**, left cheliped; **d**, right second pereopod (lateral view); **e**, dactyl of right second pereopod (mesial view); **f**, left third pereopod (lateral view); **g**, anterior lobe of sternite of third pereopods; **h**, telson. Scale equals 0.5 mm (g, h) and 1.0 mm (a-f).

small corneous claw, slightly overlapped by fixed finger; dorsal surface convex, with weak ridge in proximal half, dorsomesial margin distinctly lamellar; ventral surface with distinct median ridge. Palm approximately 0.65 length of carpus; dorsomesial margin not delimited, but with 1 well-developed spine in distal third, dorsal surface convex, with 2 small spines adjacent to proximal margin; fixed finger convex, but with distinct depression laterally, dorsolateral margin lamellar; ventral surface of palm and fixed finger with scattered short setae; cutting edge of fixed finger with 3 widely-spaced calcareous teeth, terminating in corneous claw. Carpus only slightly longer than merus; dorsomesial distal angle with prominent acute spine and 2 small spinules near rounded dorsomesial margin proximally; dorsal midline with 2 spines in distal half, dorsolateral surface strongly sloping ventrally, dorsolateral margin not delimited; lateral and ventral surfaces with few fine setae. Merus subtriangular; dorsal surface somewhat rounded, distal margin with strong spine mesially; ventromesial margin with 1 prominent spine distally; ventrolateral margin with 1 prominent and 1 smaller spine near distal angle. Ischium unarmed.

Left cheliped (Fig. 7c) shorter and appreciably less robust than right. Dactyl longer than palm, unarmed but with few setae of moderate length; cutting edge with row of corneous teeth, terminating in small corneous claw. Propodal-carpal articulation rotated counterclockwise approximately 75°; palm and fixed finger unarmed and with only few scattered setae; cutting edge of fixed finger with row of very small calcareous teeth, terminating in small corneous claw. Carpus approximately 1.40 times longer than palm but shorter than merus; dorsomesial margin with row of 3 widely-spaced spines, 1 spine distally on strongly sloping dorsolateral margin. Merus roundly triangular; ventromesial margin with strong spine distally; ventrolateral margin with 2 spines in distal half. Ischium unarmed, but with few fine setae on ventromesial margin.

Ambulatory legs (Figs 7d-f) elongate, overreaching right cheliped; terminating in long, slender claws. Dactyls 1.25 to 1.35 times longer than propodi, slightly curved and twisted distally, dorsal surfaces each with row of stiff setae; ventromesial margins each with row of 5 or 6 long corneous spines. Propodi each with row of widely-spaced, sparse tufts of setae on dorsal margins, ventrodistal angles with 2 or 3 stiff setae. Carpi each with spinule at dorsodistal angle and few setae dorsally. Meri and ischia each with few setae. Fourth pereopods with 4 denticles on ventral margin of dactyl; propodal rasp consisting of 5 corneous scales. Fifth pereopods semichelate. Sternite of third pereopods with roundly rectangular anterior lobe (Fig. 7g).

Male unknown.

Uropods strongly asymmetrical. Telson (Fig. 7h) with weakly delimited transverse suture; slightly asymmetrical posterior lobes separated by deep median cleft; terminal margins strongly oblique, each with 1 small acute spine at midlength and spinose outer angle; lateral margins each delimited by chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands, Indonesia; 205-212 m.

ETYMOLOGY. — The acronym for the 1991 French-Indonesian expedition to Indonesia.

AFFINITIES. — The operculate shape of the right cheliped of *C. karubar* suggests a close relationship with *C. cristimanus*, another species known only from the Kai Islands region of Indonesia; however the quite different armature of both chelipeds will immediately separate to two species, as will the armature of the telsons. *Catapaguroides cristimanus* has been described as having a longitudinal row of spine on the dorsal midline of the palm of the right cheliped and two tubercles on the dorsomesial margin of the palm of the left. The right chela of *C. karubar* has only two proximal spines and one mesial marginal spine on the dorsal surface; the left chela is entirely unarmed. The telson of *C. cristimanus* is reported to have three long spines on each terminal telsonal margin, whereas, *C. karubar* has a single small spine on each margin. As previously noted, the shape and armature of the carpi of the right chelipeds will immediately separate *C. karubar* from *C. declivis*. In the former, the carpus is subtriangular and armed with very few spines, whereas in the latter species, the carpus is subrectangular and armed with a complete row of spines on the dorsolateral margin.

REMARKS. — Although this species is known from a single female, its assignment to *Catapaguroides* is reasonably certain. It shares with other members of the genus, 10 pairs of phyllobranchiate gills, reduced crista dentata lacking an accessory tooth, and single female left gonopore.

Genus *SOLITARIOPAGURUS* Türkay, 1986

Solitariopagurus Türkay, 1986: 139.

DIAGNOSIS. — Ten pairs of phyllobranchiate gills. Anterior carapace vaulted and strongly calcified; lateral margins of shield developed into blunt or spiniform projections. Rostrum and lateral projections widely separated. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod obsolete or absent. Ischium of third maxilliped with well developed crista dentata and one accessory tooth. Sternite of third pereopods with moderately slender transverse anterior lobe and nearly perpendicular posterior plate. Sternite of fifth pereopods widely separated from preceding sternal plates. Fourth and fifth pereopods subchelate.

Males with stout, moderately long, unequal sexual tubes on coxae of both fifth pereopods, right approximately twice length of left; each with long setae terminally; no paired or unpaired pleopods. Female with single gonopore opening posteriorly on coxa of left third pereopod; no paired pleopods; unpaired left uniramous pleopods on abdominal somites 2 to 4.

Abdomen reduced; tergal plate of first somite chitinous or very faintly calcified; tergal plate of second only weakly delineated; tergal plates of somites 3 to 5 clearly defined, chitinous or very weakly calcified; tergite of sixth somite weakly calcified. Uropods symmetrical; protopods each with very prominent, posteriorly directed spine. Telson with transverse suture at least indicated; terminal margin entire.

REMARKS. — *Solitariopagurus* was initially thought to be another of the rather exceptional genera of deep water pagurids. The type species, *S. profundus* Türkay, 1986, was described from depths between 1300 and 2000 meters in the Red Sea. However, both the recently described, *S. triprobolus* Poupin & McLaughlin, 1996, and *S. tuerkayi* sp. nov. have been collected in relatively shallow depths between 111 and 400 meters.

Solitariopagurus tuerkayi sp. nov.

Figs 8a-n, 34a

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands:* stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (2.9 mm) (MNHN-Pg 5262); 2 ♀ (2.9, 3.0 mm) (MNHN-Pg 5263). — Stn DW 30, 05°39'S, 132°56'E, 118-111 m, 26.10.1991: 1 ♂ (3.0 mm) (USNM 276002).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂ (3.3 mm) (POLIPI).

TYPES. — The male (2.9 mm) (MNHN-Pg 5262) from the KARUBAR station DW 18 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Anterior carapace (Figs 8a, 34a) strongly vaulted; shield length consistently shorter than breadth, total carapace length usually slightly longer; anterior margin between rostrum and lateral projections straight or very slightly concave; lateral margins each with relatively short, but prominent spine at anterolateral angle, broad and usually weakly bilobed subacute spine at midlength, and strong broad or moderately slender spine adjacent to cervical groove; dorsal surface strongly calcified, with transverse row of 4 prominent, narrow to broad tubercles proximal to anterior margin, sometimes with few scattered very small spinulose tubercles laterally; posterolateral region weakly delineated and usually somewhat globular; posterior margin broadly rounded. Linea transversalis present as well calcified, broad rod. Rostrum elongate, usually reaching to proximal half of ocular peduncles; broad, slightly to strongly upturned, triangular, with elevated lateral margins and median keel; usually terminating bluntly. Lateral projections triangular; elongate, as long or slightly longer than rostrum. Posterior carapace with anterolateral regions developed distolaterally as pair of unarmed calcified plates, sometimes projecting laterally as short blunt or spinose process; posterolateral regions distomesially and posteromedian plate distally with very weakly calcified transverse rod-like area; remainder of posterior carapace membraneous (damaged in illustrated male paratype).

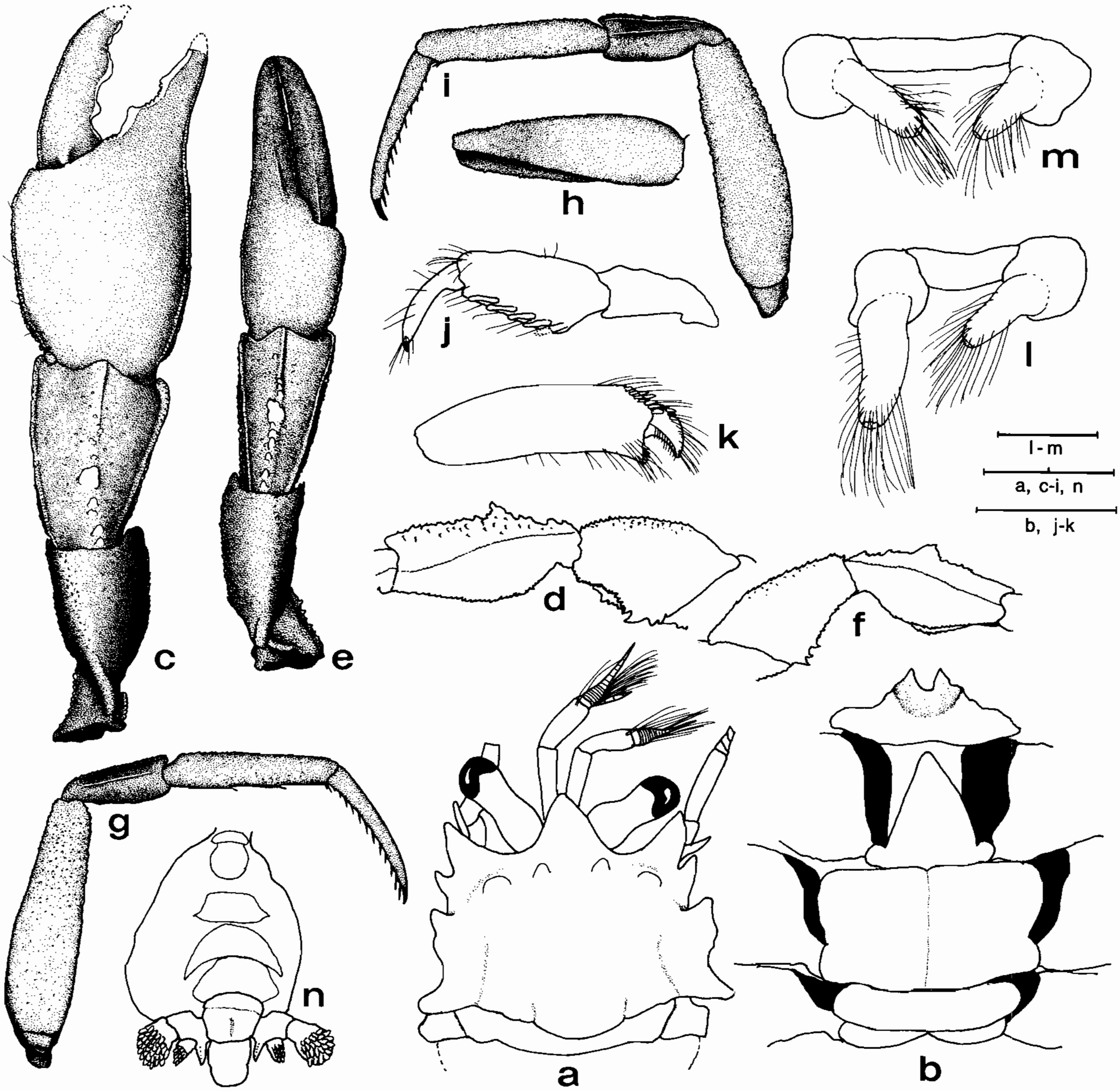

FIG. 8. — *Solitariopagurus tuerkayi* sp. nov., a-k, m-n, paratype ♂ (3.3 mm) from KARUBAR Stn DW 50; l, holotype ♂ (2.9 mm) from Stn DW 18: **a**, shield and cephalic appendages; **b**, thoracic sternites; **c**, right cheliped (dorsal view); **d**, carpus and merus of right cheliped (mesial view); **e**, left cheliped (dorsal view); **f**, carpus and merus of left cheliped (mesial view); **g**, right second pereopod (lateral view); **h**, merus of second right pereopod (mesial view); **i**, left third pereopod (lateral view); **j**, dactyl, propodus and carpus of left fourth pereopod (lateral view); **k**, propodus and dactyl of right fifth pereopod (lateral view); **l-m**, sternite and coxae of fifth pereopods; **n**, abdomen, uropods and telson (dorsal view). Scales equal 0.5 mm (l, m), 1.0 mm (b, j, k), 2.0 mm (a, c-i, n).

Ocular peduncles short, slightly less than half length of shield, with prominent ventral swelling proximally and slight submedian constriction; cornea somewhat dilated, diameter 0.25 to 0.35 length of peduncle. Ocular acicles small, acutely triangular, obscured from dorsal view by base of rostrum; separated basally by more than basal width of one acicle.

Antennular peduncles elongate, overreaching ocular peduncles by full length of ultimate segment or slightly more. Ultimate segment with 2 or 3 long plumose setae on dorsodistal margin. Penultimate segment with few scattered short setae. Basal segment with small spinule on distolateral margin. Epistomial plate well calcified, broad.

Antennal peduncles overreaching ocular peduncles by 0.33 to 0.50 length of ultimate segment, but appreciably shorter than antennular peduncles. Fifth and fourth segments with few scattered, very short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating subacutely; dorsomesial distal angle rounded. First segment with row of small or very small tubercles on ventrolateral margin. Antennal acicle moderately short, not reaching distal margin of fourth peduncular segment, subtriangular and terminating subacutely, with 2 or 3 minute spinules on lateral margin. Antennal flagellum long, overreaching outstretched chelipeds; every 1 to 4 articles with 1 or 2 very short setae.

Sternite of third maxillipeds (Fig. 8b) produced into blunt or acute spinose process on either side of midline. Sternite of chelipeds (Fig. 8b) moderately broad, elongate and subtriangular with surface concave, apex blunt or with shallow median groove. Sternite of second pereopods (Fig. 8b) broad, plate-like, with median longitudinal groove. Sternite of third pereopods with narrowly subrectangular anterior lobe.

Right cheliped (Figs 8c-d, 34a) elongate; considerably stronger than left; propodal-carpal articulation perpendicular. Dactyl equal to or slightly longer than palm; articulating obliquely; cutting edge smooth or serrate and with 2 prominent calcareous teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, smooth or minutely granular, dorsomesial margin minutely serrate; ventral surface smooth or microscopically granular. Palm equal to or slightly longer than carpus; somewhat dorsoventrally compressed; dorsal surface convex, smooth or minutely granular; spinulose or serrate dorsomesial and dorsolateral margins slightly elevated; fixed finger also with smooth or minutely granular dorsal surface; cutting edge smooth or serrate, with large teeth; ventral surface of fixed finger with obliquely longitudinal and microscopically tuberculate ridge extending onto palm in distal half. Carpus equal to or slightly longer than merus; trapezoidal (in dorsal view), spinulose dorsomesial and dorsolateral margins slightly elevated; dorsal surface with scattered small tubercles or spinules, also with longitudinal median ridge or crest, most distinct distally and armed with spinules or tuberculate spines, one strongest in proximal half; mesial and lateral faces minutely granular or spinulose; ventral surface "hourglass" in shape, ventromesial and ventrolateral margins each with row of very small tubercles or blunted spines. Merus broadly subtriangular; dorsal margin spinose or spinulose; lateral and mesial faces spinulose or granular; ventrolateral margin with row of small spines, strongest proximally; ventromesial margin with row of small spines distally, 3 or 4 very prominent spines proximally. Ischium with row of small tubercles or spinules on ventromesial margin.

Left cheliped (Figs 8e-f, 34a) dorsoventrally compressed; not reaching to base of dactyl of right; dactyl and fixed finger curved ventrally. Dactyl 1.50 to twice length of palm; cutting edge with row of corneous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal and ventral surfaces unarmed; dorsomesial margin serrate, at least in proximal half; mesial face with few scattered very short setae. Palm 0.60 to 0.75 length of carpus; dorsal surface smooth or minutely granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface granular or minutely tuberculate, with short distal longitudinal row of small tubercles extending onto proximal half of fixed finger; cutting edge of fixed finger with row of small calcareous teeth interspersed with corneous teeth; terminating in corneous claw. Carpus slightly shorter to slightly longer than merus; dorsal surface trapezoidal (dorsal view), with few scattered very small tubercles or spinules; dorsomesial and dorsolateral margins raised and serrate, midline elevated into prominent crest armed with row of simple or multidenticulate spinulose tubercles or small spines, strongest proximally, and with 1 very prominent tuberculate spine at midlength; mesial, lateral, and ventral surfaces spinulose or tuberculate, ventrodistal margin with row of tubercles. Merus broadly subtriangular; dorsal surface spinose or spinulose, mesial and lateral faces spinulose or tuberculate particularly near ventral margins; ventromesial margin with row of small spinules and 3 strong spines proximally; ventrolateral margin minutely spinulose distally becoming row of stronger spines in proximal half. Ischium with row of small tubercles or spines on ventromesial margin.

Ambulatory legs (Figs 8g-i) moderately long and slender, but not overreaching extended right cheliped; generally similar. Dactyls approximately equal to length of propodi; laterally compressed, slightly curved ventrally; dorsal margins with few scattered short setae; ventral margins each with row of 9 to 12 corneous spines. Propodi 1.75 to nearly twice length of carpi; dorsal margins serrate; mesial and lateral faces minutely spinulose, particularly ventrally; ventral margins each with 1 or 2 corneous spines at distal angle and 2 additional widely-spaced corneous spines. Carpi approximately half or slightly less than half length of meri; dorsal margins minutely serrate, no distinct spine at distal angle; lateral faces each with dorsal and median longitudinal ridges separated by concavity, most distinct on third, and with numerous microscopic spinules in ventral halves. Meri with serrate or spinulose dorsal margins; ventral surfaces oblique (Fig. 8h), ventromesial and ventrolateral margins spinulose. Fourth pereopods strongly subchelate; propodal rasp (Fig. 8j) consisting of single row of often distally bulbous corneous scales. Fifth pereopods weakly subchelate; dactyl and propodus (Fig. 8k) each with small rasp of corneous scales dorsally.

Males with subequal or markedly unequal sexual tubes on coxae of fifth pereopods (Figs 8l-m); each with subterminal and terminal long setae. Females with uniramous, unpaired left pleopods on somites 2 to 4.

Abdomen (Fig. 8n) markedly reduced, segmentation clearly delineated dorsally. Tergite of first abdominal somite usually chitinous, rod-shaped. Tergites of somites 2 to 5 moderately broad, weakly chitinous plates, occasionally showing slight tendency toward calcification. Tergite of sixth somite with moderately well calcified anterior rod-like and posterior paired rectangular plates. Uropods symmetrical; protopods each with very strong, posteriorly directed subacute spine armed dorsally with longitudinal row of 5 or 6 small spinules; exopods subcircular, each with large circular rasp of corneous scales; endopods appreciably smaller, ovate, each with small oval rasp. Telson elongate; transverse suture clearly delineated; terminal margin entire, with rounded external angles.

COLOR (in preservative). — After four years in alcohol only faint orange tint remains on chelae and dactyls of ambulatory legs; propodi of ambulatory legs with one or two very faint bands.

HABITAT. — Unknown.

DISTRIBUTION. — Presently known only from the Kai and Tanimbar Islands, Indonesia; 111-212 m.

ETYMOLOGY. — This species is named for Dr Michael TÜRKAY, Forschungsinstitut Senckenberg, who first recognized the distinctiveness of this genus.

AFFINITIES. — *Solitariopagurus tuerkayi* bears a strong resemblance to *S. triprobolus* from French Polynesia, in the elongation of the rostrum and lateral projections and development of the lateral carapace spines, as well as the structure of the abdomen, uropods and telson. However, the lateral projections of *S. tuerkayi* are generally shorter and stouter than in *S. triprobolus*; the antennular peduncles of the former species are appreciably shorter. The first of the lateral carapace projections also are much smaller in *S. tuerkayi* than those of *S. triprobolus*. There are clear similarities in the shape of the chelipeds of the two species; however, the dorsodistal angles of the carpi are not developed into wing-like projections in *S. tuerkayi* as they are in *S. triprobolus*. The dorsal surfaces of these segments in *S. tuerkayi* each have a raised median crest armed with a row of spines or tubercles set off by one particularly prominent, tuberculate spine in midlength, whereas the median elevations of these surfaces in *S. triprobolus* are slight and very weakly armed. The dactyls and propodi of the ambulatory legs of *S. tuerkayi* are approximately equal in length, in contrast to the much longer propodi of *S. triprobolus*.

Genus *PORCELLANOPAGURUS* Filhol, 1885

Porcellanopagurus Filhol, 1885a: 47; 1885b: 23; 1885c: 410, pl. 49, figs 2-4. — BORRADAILE, 1916: 111. — BENNETT, 1932: 520. — FOREST, 1951a: 82; 1951b: 182. — WOLFF, 1961: 28. — MIYAKE, 1978: 117. — TÜRKAY, 1986: 140.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Anterior carapace vaulted and well calcified; lateral margins of shield developed into blunt or spiniform projections. Rostrum and lateral projections widely separated. Posterolateral plates calcified anteriorly and usually drawn out into projecting lobes; remainder of posterior carapace membraneous or with areas of slight calcification. Ocular acicles reduced, simple. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod slightly produced, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth.

Chelipeds unequal. Ambulatory legs generally similar. Fourth pereopods usually semichelate. Fifth pereopods chelate.

Males without sexual tube on coxa of one or both fifth pereopods; without paired or unpaired pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 4.

Abdomen reduced, usually globular, membraneous, but with tergites at least faintly delineated. Uropods symmetrical or slightly asymmetrical.

REMARKS. — In the original description of *Porcellanopagurus tridentatus* Whitelegge, 1900, the author overlooked the first segment of the antennal peduncle, i.e., the segment upon which the antennal gland opens, and attributed the armature of the second peduncular segment to the first. TAKEDA (1981, 1985) and SUZUKI and TAKEDA (1987) may, in part, have followed WHITELEGGE's (1900) interpretation of the first segment in their inaccurate descriptions of the segmentation and armature of the antenna of their *Porcellanopagurus* species. These authors described the basal segment as having a spinule at its outer distal angle and its inner angle developed forward as a long lobe to grasp the inner margin of second segment, when in fact it is the second segment that is so armed, and the third segment that is produced. In *P. belauensis* Suzuki & Takeda, 1987, the authors further described the "third segment twice as long as the antennal acicula." Neither the true third nor fourth segments are illustrated as longer than the acicle (SUZUKI & TAKEDA, 1987, figs 2b-c); only the fifth (ultimate) segment agrees with that description.

POUPIN and MCLAUGHLIN (1996) noted that, among other characters, the subchelate fourth pereopods found in species of *Solitariopagurus* suggested a closer relationship with *Alainopagurus* Lemaitre & McLaughlin, 1995, than with *Porcellanopagurus*, in which the fourth pereopods are semichelate. The fourth pereopods of *P. truncatifrons* Takeda, 1981, were described by the author as having "propodus widened and spatulated; its lower border fringed with a row of horny curved spines, its distal end being prolonged only slight beyond articulation with dactylus which is talon-like and curved dorsally." From his figure [TAKEDA, 1981, fig. 3 (3)], it would appear that this appendage is inverted, thereby giving the impression of a dorsally directed dactyl; however, the appendage appears distinctly subchelate.

Reference to the telson has been intentionally omitted in the generic diagnosis of *Porcellanopagurus* given here. In most species, a typical pagurid-like telson is developed. However, in two recently described Japanese species, *P. truncatifrons* and *P. nihonkaiensis* Takeda, 1985, telsons apparently are lacking. For *P. truncatifrons*, TAKEDA (1981: 12) commented "It is remarkable that I failed to find the telson, but the presence of marginal hairs along the posterior border of the penultimate segment may justify the absence of the telson." TAKEDA (1985) illustrated only the sixth abdominal somite and uropods, but made no comment about the missing telson in *P. nihonkaiensis*. Both of these species are known only from their respective holotypes; therefore, it is not clear whether this ostensible telson loss reflects evolutionary change or simply injury.

Porcellanopagurus jacquesi sp. nov.

Figs 9a-l, 34b

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (2.8 mm) (MNHN-Pg 5264); 1 ♂ (3.2 mm) (MNHN-Pg 5265).

TYPES. — The male (2.8 mm) (MNHN-Pg 5264) from the KARUBAR station DW 18 is the holotype. The other male is a paratype.

DESCRIPTION. — Anterior carapace (Figs 9a, 34b) vaulted; shield length slightly shorter than maximum breadth, total carapace length usually slightly longer; anterior margin between rostrum and lateral projections

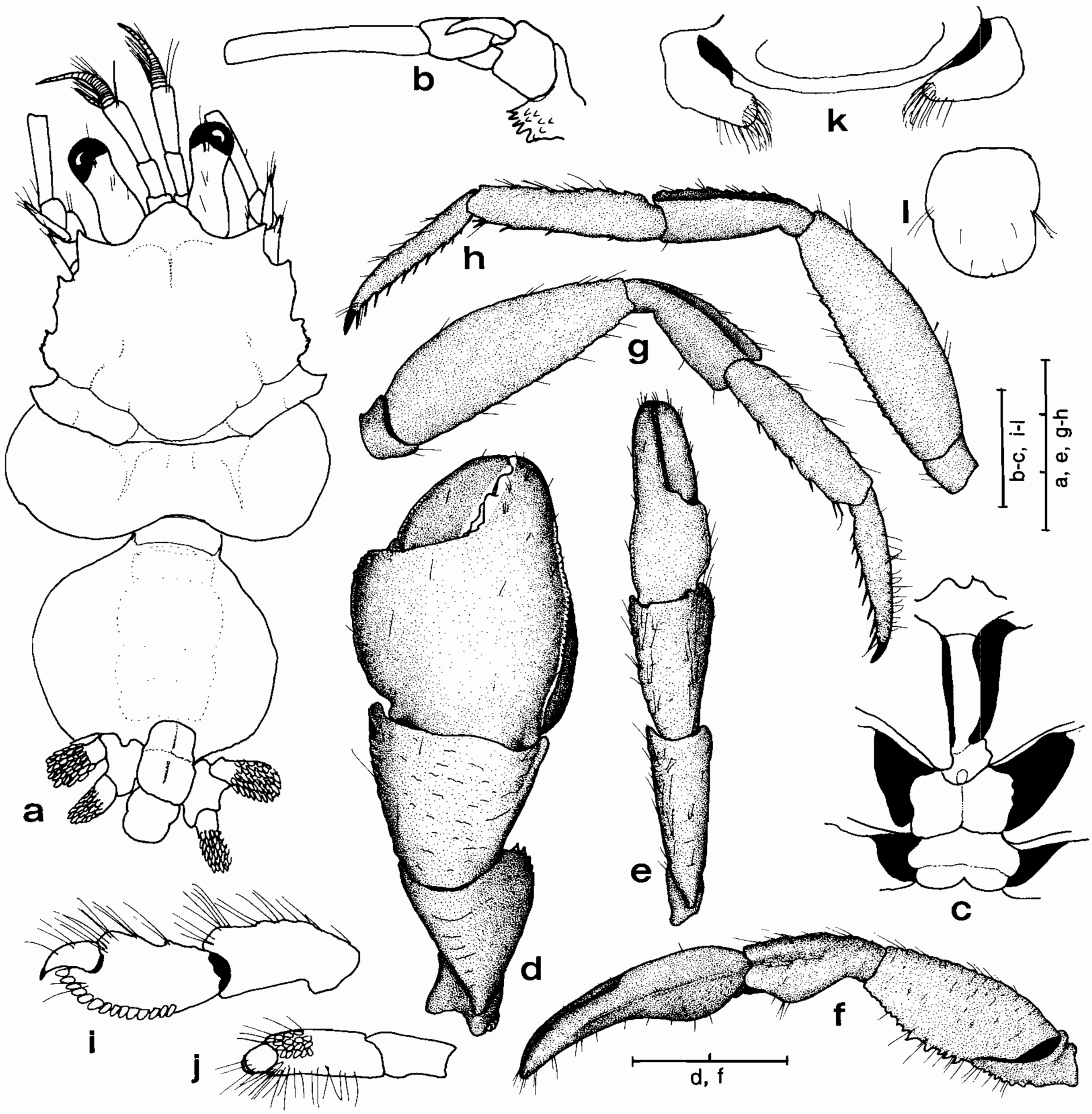

FIG. 9. — *Porcellanopagurus jacquesi* sp. nov., a-b, e, g-l, paratype ♂ (3.2 mm) from KARUBAR Stn DW 18; c-d, f, holotype ♂ (2.8 mm) from Stn DW 18: **a**, cephalothorax with cephalic appendages and abdomen; **b**, left antennal peduncle (lateral view); **c**, thoracic sternites; **d**, right cheliped; **e**, left cheliped (dorsal view); **f**, left cheliped (mesial view); **g**, right second pereopod (lateral view); **h**, left third pereopod (lateral view); **i**, dactyl, propodus and carpus of left fourth pereopod (lateral view); **j**, carpus, propodus and dactyl of left fifth pereopod (lateral view); **k**, sternite and coxae of fifth pereopods; **l**, telson. Scales equal 1.0 mm (b-c, i-l), 2.0 mm (d, f), and 3.0 mm (a, e, g-h).

straight or very slightly concave; lateral margins each with short acute spine at basally broadened anterolateral angle, broad multispinose process at midlength, and strong broad or moderately slender spinose process posterior to cervical groove; dorsal surface strongly calcified, with faintly marked postrostral furrows and weakly delineated, usually somewhat globular posterolateral regions; posterior margin roundly truncate. Cardiac sulci and posteromedian plate chitinous or weakly calcified. Rostrum broadly triangular, usually reaching to proximal fourth of ocular peduncles; terminating subacutely or bluntly. Lateral projections triangular; produced, but not in advance of rostrum.

Ocular peduncles short, slightly less than half length of shield, with distinct submedian constriction; cornea slightly dilated, diameter approximately 0.33 length of peduncle. Ocular acicles small, acutely triangular, obscured from dorsal view by base of rostrum.

Antennular peduncles moderately short, but overreaching ocular peduncles by nearly full length of ultimate segment. Ultimate segment with 2 or 3 long plumose setae on dorsodistal margin. Penultimate and basal segments unarmed.

Antennal peduncles (Fig. 9b) overreaching ocular peduncles by 0.25 to 0.50 length of ultimate segment. Fifth and fourth segments with few scattered, very short setae. Third segment unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine; dorsomesial distal angle rounded. First segment with cluster of spines on lateral surface ventrally. Antennal acicle moderately short, but sometimes reaching beyond distal margin of fourth peduncular segment, terminating acutely. Antennal flagellum long, slightly overreaching outstretched chelipeds; every 1 to 4 articles with 1 or 2 very short setae, at least in proximal half.

Sternite of third maxillipeds (Fig. 9c) produced into rounded or acute spinose process on either side of midline. Sternite of chelipeds (Fig. 9c) slender, elongate with asymmetrical posterior lobe. Sternite of second pereopods (Fig. 9c) broad, plate-like, with median longitudinal groove. Sternite of third pereopods with roundly subrectangular anterior lobe.

Right cheliped (Figs 9d, 34b) (missing in paratype) stout; not much longer, but considerably stronger than left; propodal-carpal articulation twisted clockwise approximately 45° from perpendicular. Dactyl slightly longer than palm; articulating obliquely; cutting edge with 4 prominent teeth; terminating in small calcareous claw, slightly overlapped by fixed finger; dorsal surface convex, armed with few tiny spinules, dorsomesial margin minutely serrate; ventral surface with few widely-spaced tufts of setae. Palm approximately equal to length of carpus; somewhat swollen dorsoventrally; dorsal surface convex, dorsomesial and dorsolateral margins slightly elevated, tuberculate or spinulose; fixed finger with few tufts of short setae on dorsal surface; cutting edge with 2 large teeth; ventral surface of palm and fixed finger microscopically spinulose and with scattered tufts of setae. Carpus slightly longer than merus; trapezoidal (in dorsal view), dorsomesial and dorsolateral margins also slightly elevated, at least distally, crenulate and with few low transverse ridges; all surfaces with scattered short low transverse ridges providing rough-textured appearance. Merus broadly subtriangular; dorsal margin with several transverse ridges and few fine setae; lateral and mesial faces minutely granular in ventral halves; ventromesial margin with row of small spines; ventrolateral margin with row of somewhat stronger spines distally and few widely-spaced spinules proximally. Ischium with row of small spinules on ventromesial margin.

Left cheliped (Figs 9e-f, 34b) with dactyl and fixed finger curved ventrally. Dactyl approximately 1.25 length of palm; cutting edge with row of corneous teeth; terminating in corneous claw and very slightly overlapped by fixed finger; dorsal surface unarmed, dorsomesial margin not delimited; mesial and ventral surfaces with scattered setae. Palm nearly 0.75 length of carpus; dorsal surface smooth or microscopically granular, dorsomesial and dorsolateral margins serrate and slightly elevated; ventral surface weakly granular; cutting edge of fixed finger with row of small calcareous teeth, terminating in corneous claw. Carpus 0.65 to 0.75 length of merus; with low transverse ridges mesially and laterally; dorsolateral margin raised proximally and distally; mesial, lateral and ventral surfaces each with few short transverse low ridges and sparse setae. Merus subtriangular; dorsal surface with few short transverse ridges and short setae; lateral face minutely spinulose or tuberculate; ventromesial margin with row of small spines, ventrolateral margin with row of stronger spines. Ischium with row of small tubercles on ventrolateral margin; row of small spines on ventromesial margin.

Ambulatory legs (Figs 9g-h) moderately long and slender, overreaching extended right cheliped; generally similar. Dactyls approximately equal to or slightly shorter than propodi; in dorsal and lateral views, nearly straight; dorsal margins with short setae; mesial and lateral faces with few short setae; ventral margins each with row of 8 to 11 corneous spines. Propodi 1.10 to 1.25 length of carpi; dorsal margins slightly tuberculate; ventral margins each with 1 or 2 corneous spines at distal angle and 2 to 6 additional widely-spaced corneous spines. Carpi approximately half or slightly more than half length of meri; dorsal margins slightly spinulose, no distinct spine at distal angle; lateral faces each with longitudinal ridge separated by concavity from dorsal margin. Meri with minutely protuberant or serrate dorsal margins; ventral surfaces oblique (mesial view), ventromesial and ventrolateral margins spinulose. Fourth pereopods strongly semichelate; propodal rasp (Fig. 9i) consisting of single row of corneous scales. Propodus of fifth pereopods with small rasp of corneous scales (Fig. 9j).

Males with coxae of fifth pereopods (Fig. 9k) drawn out posteromedially, gonopores each masked by long setae. Females unknown.

Abdomen (Fig. 9a) somewhat reduced, globular. Tergite of first abdominal somite rod-shaped, membraneous and only faintly delineated. Tergites of somites 2 to 5 also membraneous, moderately broad, weakly indicated. Tergite of sixth somite moderately well calcified, divided into anterior and posterior lobes by transverse suture, each with median furrow. Uropods symmetrical; protopods with weak posteriorly directed subacute protuberance on right side only. Telson (Fig. 9l) (missing in holotype) with transverse suture weakly delineated; posterior lobes separated by very small median cleft, terminal margins rounded, unarmed.

COLOR (in preservative). — Both specimens, after four years in alcohol, showed faint light orange banding at proximal margins of dactyls and medianly on propodi of ambulatory legs; carpi each with nearly imperceptible longitudinal stripe on lateral ridge.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands, Indonesia; 205-212 m.

ETYMOLOGY. — This species is named for Professor Jacques FOREST of the Muséum national d'Histoire Naturelle, Paris, in recognition, not only of his landmark studies of *Porcellanopagurus*, but his many contributions to hermit crab systematics.

AFFINITIES. — *Porcellanopagurus jacquesi* most closely resembles *P. japonicus* Balss, 1913, *P. nihonkaiensis* Takeda, 1985, and *P. belauensis* Suzuki & Takeda, 1987, in having a broadly triangular rostrum, somewhat broad and spinulose or denticulate lateral carapace lobes, and additionally with the latter two species, the laterally ridged carpi of the ambulatory legs. *Porcellanopagurus jacquesi* shares with *P. japonicus* a small, spiniform posterior carapace lobe; in both *P. nihonkaiensis* and *P. belauensis* this lobe is quite blunt. Like *P. jacquesi*, a postrostral furrow is present in both *P. japonicus* and *P. belauensis* that is lacking in the only known specimen of *P. nihonkaiensis*. The presence of a strongly acute, spiniform rostrum and absence of laterally ridged carpi of the ambulatory legs immediately distinguishes *P. japonicus* from the other three species. The development, in *P. nihonkaiensis* and *P. belauensis*, of a triangular distal lobe on the rostrum also sets these species apart from *P. jacquesi*, where the rostrum terminally is subacute or rounded and slightly depressed. The width of the shield is appreciably greater in *P. belauensis* than in the other three species.

In *P. nihonkaiensis* the ventral margins of the propodi of the ambulatory legs are described as having five corneous spines, the dactyls seven; *P. belauensis* is reported to have three corneous spines on the ventrodistal angle and a row of seven additional spines on the ventral margins of the propodi of the second pereopods, while the spines on the third pereopods number two distally and five marginally. The dactyls of the second pereopods have nine spines, the third, 11 in this species. *Porcellanopagurus jacquesi* is intermediate in having one or two corneous spines on the ventrodistal angles of the propodi and three to six on the ventral margins; the ventral spines of the dactyls range from eight to 11.

TAKEDA (1985, figs 1A-C) illustrated, but did not discuss the tergites of the sixth abdominal somite and uropods in *P. japonicus*, *P. nihonkaiensis* and *P. truncatifrons*. For *P. japonicus* the sixth tergite is represented by a rounded anterior lobe with shallow, incomplete median furrow and rectangular posterior lobe with deeper but still incomplete median furrow. This tergite in *P. nihonkaiensis* and *P. truncatifrons* is illustrated as having a triangular anterior lobe with central median depression; the rectangular posterior lobe has a well developed and nearly complete longitudinal groove. As described above and illustrated in Fig. 9a, *P. jacquesi* has two subequal rectangular lobes, each with a longitudinal median furrow, incomplete only on the posterior lobe. Like *P. jacquesi*, the uropods of *P. japonicus* show only a small protuberance posteriorly from the protopod of the right uropod. In *P. nihonkaiensis* the protopods of both uropods show a well developed posterior protuberance, and in

P. truncatifrons an even more prominent spiniform protuberance. Depicted by SUZUKI and TAKEDA (1987, fig. 3p), but not described is a similar strong spine on the protopod of each uropod of *P. belauensis*; the sixth abdominal tergite in this species is clearly divided into four distinct, well separated lobes.

BALSS (1913) did not describe the telson of *P. japonicus* but his figure (fig. 40) shows a reduced and subtriangular structure. As previously mentioned, TAKEDA (1985, fig. 1B-C) illustrates *P. nihonkaiensis* and *P. truncatifrons* without telsons. His specimen of *P. japonicus* is depicted with an elongate telson, lacking both transverse suture and median cleft. The telson of *P. belauensis*, as illustrated by SUZUKI and TAKEDA (1987), has the anterior and posterior lobes divided by a complete transverse suture, and the posterior lobes by a longitudinal median groove over their entire length. *Porcellanopagurus jacquesi* has a well developed telson with transverse suture weakly marked and with a small median cleft separating the posterior lobes.

Rather abundant setation was illustrated by BALSS (1913, fig. 40) for *P. japonicus*. Both in the description and figures (SUZUKI & TAKEDA, 1987) *P. belauensis* is characterized as having abundant setation on the carapace and all appendages. In contrast, setation was described by TAKEDA (1985) as being sparse in *P. nihonkaiensis*. Very sparse setation is also characteristic of *P. jacquesi*.

REMARKS. — Although the specimen selected as the holotype is the smaller of the two, it is the only specimen with all appendages still attached. The carapaces of both specimens were damaged in collection; however, that of the paratype had been severed in such a way that it has been possible to reconstruct it accurately (Fig. 9a). The abdomen of this specimen is in excellent condition, whereas that of the holotype is badly shriveled and the telson is missing.

WHITELEGGE (1900), in his original description of *Porcellanopagurus tridentatus*, described the coxae of the fifth pereopods as having a "tubular prolongation, directed inwards and downwards, and their margins are fringed with long setae". His statement could apply equally well to the coxae of *P. jacquesi*, although there is no doubt that the two are distinct taxa. When discussing the relationship of *Solitariopagurus* with *Porcellanopagurus*, TÜRKAY (1986), called attention to WHITELEGGE's (1900) report, but commented that he could detect no sexual tubes in the male syntype of this species that he examined. Close inspection of the coxae of both males of *P. jacquesi* similarly does not support the supposition that these elongations represent sexual tubes.

Genus *ALAINOPAGUROIDES* nov.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Anterior carapace vaulted and generally well calcified, with anterolateral regions slightly depressed. Linea transversalis as calcified rod, posterior carapace membraneous or with slight calcification. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule with external endopodal lobe obsolete or absent. Third maxilliped with crista dentata of ischium (Fig. 10a) somewhat reduced, but with 1 accessory tooth. Sternite of third maxillipeds with anterior margin rounded on either side of median concavity. Sternite of second pereopods subdivided into broad lateral lobes by deep longitudinal median groove. Sternite of third pereopods (Fig. 10b) with narrow, transverse anterior lobe and broad posterior lobe divided by deep median groove. Fourth pereopods weakly semichelate, propodal rasp rudimentary; with prominent tubular preungual process (Fig. 10c) at base of claw.

Abdomen reduced; tergal plate of first somite chitinous; tergal plates of second through fifth somites sometimes very faintly delineated; tergite of sixth somite (Fig. 10d) weakly calcified, subdivided into narrow to moderately broad anterior lobe, and posterior pair of broad plates separated by distinct median groove. Uropods generally symmetrical. Telson with transverse suture; posterior lobes usually separated by shallow median cleft.

Males with moderately long and stout sexual tube on coxa of right fifth pereopod (Fig. 10e), left often with very short tube; no paired or unpaired pleopods. Female with paired gonopores; no paired pleopods; unpaired left biramous pleopods on abdominal somites 2 to 4 (Fig. 10f).

TYPE SPECIES. — *Alainopaguroides lemaitrei*, sp. nov. Gender masculine.

ETYMOLOGY. — This genus is named for Alain CROSNIER, marine biologist of ORSTOM, in recognition of his many contributions to our knowledge of the decapod fauna of the Indo-Pacific.

AFFINITIES. — Although *Alainopaguroides* shares a number of important characters with several other genera, no precise phylogenetic relationships can yet be determined. In reduction of the abdomen, total absence of paired or unpaired pleopods in males and lack of the left fifth pleopod in females, *Alainopaguroides*, *Porcellanopagurus*, *Ostraconotus* A. Milne Edwards, 1880, *Solitariopagurus*, and *Alainopagurus* conceivably might all be considered sister taxa. However, 11 pairs of phyllobranchiate gills are common to species of *Porcellanopagurus*, *Alainopagurus* and *Alainopaguroides*, while *Ostraconotus* and *Solitariopagurus* species have only 10. The rostrum is very strongly produced and broadly triangular in species of *Solitariopagurus* and some species of *Porcellanopagurus*, developed as a prominent slender spiniform projection in *Alainopagurus*, but broad and bluntly truncated in other species of *Porcellanopagurus* or upturned in *Ostraconotus* and *Alainopaguroides*. The lateral regions of the anterior carapace are drawn out into spinose lobes in *Porcellanopagurus* and *Solitariopagurus*, or simply globular in *Alainopagurus*, whereas only spinulose margins are seen in *Ostraconotus*, and simply rounded margins in *Alainopaguroides*. Varying areas of weak calcification are observed on the posterior carapaces of species of four of the genera; yet, only in *Ostraconotus* is there nearly complete calcification of the posterior carapace. The second through fifth abdominal tergites of *Solitariopagurus* and *Alainopagurus* are chitinized or calcified to some extent, while those of the other three genera are only faintly indicated.

Quite different specializations in the fourth pereopods are seen among the five genera. With the one exception previously mentioned, in *Porcellanopagurus* species the fourth pereopod is semichelate; the propodal rasp consists of a single row of very small spinules. The semichelae of *Alainopagurus* and *Alainopaguroides* are similar in having the ventrodistal portion of the propodus very weakly produced; the propodal rasp consists of a single row of small spines in *Alainopagurus*, but only two or three distal scales or corneous spines in *Alainopaguroides*. The fourth pereopods of *Solitariopagurus* species are distinctly subchelate, allowing the dactyl to articulate against the ventral margin of the propodus; the propodal rasp consists of a row of bulbous scales. Major structural differences and sexual dimorphism are seen in the fourth pereopods of *Ostraconotus*. Females of the only known species, *Ostraconotus spatulipes* A. Milne Edwards, 1880, have an extremely paddle-shaped propodus and simple articulating dactyl; the propodus of the male is approximately half the breadth of the female, but the dactyl is similar. Rather typical pagurid type, minutely chelate, fifth pereopods are found in *Ostraconotus*, *Porcellanopagurus* and *Alainopaguroides*, but subchelate in *Solitariopagurus* and in *Alainopagurus*. Species of *Porcellanopagurus*, *Alainopagurus* and one species of *Solitariopagurus* are known to utilize bivalve shells as their microhabitat; nothing is known for the others.

Extensions of the vas deferens as sexual tubes are present in all of the aforementioned genera except *Porcellanopagurus*. Species of this latter genus occasionally show a posterior elongation of one or both coxae, but no tubular structure arises from a gonopore. In contrast, males of *Alainopagurus* and *Solitariopagurus* have short, equal or unequal sexual tubes produced from the gonopores of both fifth pereopods. Males of *Ostraconotus* have a single right sexual tube, whereas *Alainopaguroides* has an elongate right sexual tube and usually a very short left, although it may only resemble a small protuberance in smaller specimens. While females of all five genera have no paired pleopods and only left unpaired egg-bearing pleopods (left second through fourth), paired gonopores occur in *Porcellanopagurus*, *Ostraconotus*, and *Alainopaguroides*, but only single left gonopores are found in females of *Solitariopagurus* and *Alainopagurus*.

Until TÜRKAY's (1986) account of *Solitariopagurus*, *Ostraconotus* and *Porcellanopagurus* had been considered the prime examples of carcinization in the Paguridae (e.g., BORRADAILE, 1916; WOLFF, 1961). The recent discovery of *Alainopagurus*, and now *Alainopaguroides*, brings to five the candidates for this distinction. As may be seen from the foregoing brief review of major characters in these genera, no clearly defined evolutionary pathway can yet be observed.

Alainopaguroides lemaitrei sp. nov.

Figs 10a-m, 34c-e, 35a

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands:* stn DW 13, 05°26'S, 132°38'E, 417-415 m, 24.10.1991: 1 ♂, 4 ♀ (1.3-2.6 mm) (MNHN-Pg 5266). — Stn DW 31, 05° 40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♂ (2.1 mm) (POLIPI). — Stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ov. ♀

(4.9 mm) (MNHN-Pg 5267). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♂, 1 ♀ (2.6, 3.6 mm) (USNM 276007).

Tanimbar Islands: stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♂ (6.2 mm) (MNHN-Pg 5268 A), 3 ♀, 2 ov. ♀ (4.7-5.2 mm) (MNHN-Pg 5268 B); 1 ♂, 2 ♀, 1 ov. ♀ (4.5-5.6 mm) (USNM 276006). — Stn CP 62, 09°01'S, 132°42'E, 246-253 m, 1.11.1991: 1 ♂ (5.4 mm) (SMNH 4813). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♂ (3.9 mm) (POLIPI).

TYPES. — The male (6.2 mm) (MNHN-Pg 5268 A) from KARUBAR station CP 59 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 10f, 34c, 35a) usually considerably broader than long, dorsal surface swollen, anterolateral region somewhat depressed; anterior margin between rostrum and lateral projections slightly concave; posterior margin roundly truncate; dorsal surface with light covering of short to moderately long setae, longest and most abundant laterally; frequently with moderately deep transverse postrostral depression. Rostrum broad, blunt or rarely subacute, unarmed, upturned. Lateral projections broadly rounded or obtusely triangular, with small marginal or submarginal spine or spinule.

Ocular peduncles (including corneae) very short, slightly more than half shield length, slender basally but enlarged distally; with corneae strongly dilated. Ocular acicles moderately short to moderately long, 0.35 to 0.50 length of peduncle (excluding cornea), slender, triangular; terminating acutely and with dorsal surface longitudinally grooved; mesial margins each with row of moderately long setae and few additional setae laterally; separated basally by more than basal width of one acicle.

Antennular peduncles (left broken in holotype) overreach ocular peduncles by approximately half length of penultimate segment. Ultimate segment with 2 widely separated rows of long setae on dorsal surface. Penultimate segment with few setae. Basal segment unarmed, but with statocyst enlarged.

Antennal peduncles overreaching ocular peduncles (including corneae) by 0.25 to 0.50 length of ultimate segment. Ultimate and penultimate segments with few to several moderately long setae. Third segment with small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in slender spine and frequently with accessory spine on lateral margin, with long setae dorsally, mesially and laterally; dorsal surface with numerous long setae and prominent longitudinal furrow, mesial and lateral margins with low, spinulose protuberances and long setae; dorsomesial distal angle with small spine. First segment with strong spine on laterodistal margin; ventrally produced and with 1 small spine distolaterally. Antennal acicle reaching nearly to distal margin of ultimate peduncular segment; terminating in small spine; mesial, lateral and dorsal surfaces all with long setae, margins sometimes also with spinulose protuberances. Antennal flagellum longer than outstretched ambulatory legs; each article naked or proximal articles with 1 or 2 minute bristles.

Right cheliped (Figs 10g, 34d) stronger; frequently but not always, shorter than left in large males; palm, fixed finger and dactyl somewhat dorsoventrally compressed. Dactyl 0.65 to 0.75 length of palm; cutting edge with 2 broad calcareous teeth and often numerous small calcareous denticles; terminating in small corneous claw, slightly overlapped by fixed finger; dorsomesial margin not delimited, dorsal surface with few tufts of short setae; mesial and ventral surfaces with moderate to dense long setae. Palm 1.35 to 1.50 length of carpus; dorsal surface very slightly convex, unarmed; dorsomesial and dorsolateral margins not delimited, mesial and lateral faces spinulose, sometimes almost imperceptibly so; fixed finger with scattered short and long setae on weakly convex dorsal surface; cutting edge with 1 broad sometimes denticulate calcareous tooth, few to many much smaller calcareous teeth proximally and distally, terminating in small corneous claw; ventral surfaces of palm and fixed finger with moderate to dense long setae. Carpus 0.65 to 0.75 length of merus; dorsomesial and dorsolateral margins each with row of irregularly-sized slender spines, strongest distally, dorsal surface with scattered spinules; lateral, mesial and ventral surfaces also spinose, ventromesial and ventrolateral margins with slightly stronger serrations; all surfaces with scattered fine setae. Merus subtriangular; dorsodistal margin with 1 strong sometimes nearly erect spine; slightly flattened dorsal margin with very short transverse rows of spines or spinules; lateral face spinulose, ventrolateral margin with irregular single or double row of small spines, 1 more prominent spine at distal angle; mesial and ventral surfaces spinulose, ventromesial margin spinulose or with distinct row of small spines, 1 stronger spine at distal angle. Ischium with row of fine setae on ventral margin.

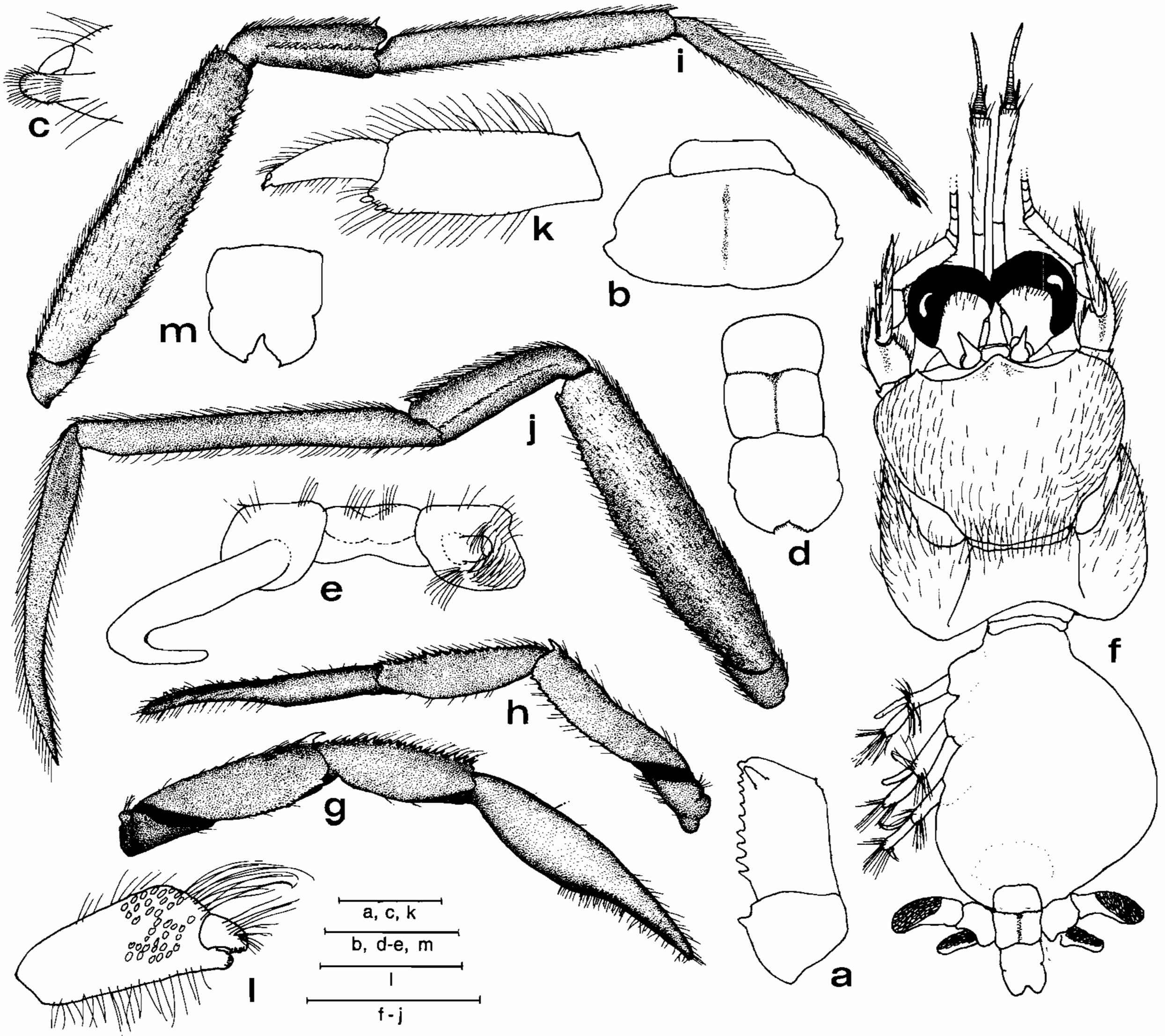

FIG. 10. — *Alainopaguroides lemaitrei* sp. nov., a, c-d, g-l, paratype ♀ (5.6 mm) from KARUBAR Stn CP 59; b, e, m, holotype ♂ (6.2 mm) from Stn CP 59: **a**, basis and ischium of left third maxilliped with crista dentata and accessory tooth; **b**, sternite of third pereopods; **c**, tip of dactyl and preungual process of left fourth pereopod; **d**, sixth abdominal somite and telson (dorsal view); **e**, sternite and coxae of fifth pereopods; **f**, cephalothorax with cephalic appendages and abdomen; **g**, right cheliped (lateral view); **h**, left cheliped (lateral view); **i**, right second pereopod (lateral view); **j**, left third pereopod (lateral view); **k**, dactyl and propodus left fourth pereopod (lateral view); **l**, propodus and dactyl of right fifth pereopod (lateral view); **m**, telson. Scales equal 0.1 mm (c), 1.0 mm (a, k-l), 2.0 mm (b, d, e, m) and 5.0 mm (f-j).

Left cheliped (Figs 10h, 34e) in large males sometimes overreaching right cheliped by as much as half length of dactyl; chela dorsoventrally compressed; dactyl and fixed finger slightly arched. Dactyl long, approximately twice length of palm; dorsomesial margin microscopically serrate, at least proximally; dorsal and ventral surfaces with scattered long and short setae; cutting edge with row of tiny corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger. Palm 0.50 to 0.65 length of carpus; with nearly flat dorsal surface, dorsomesial and dorsolateral margins usually minutely serrate, latter also often with row of widely-spaced tiny bristles extending almost entire length of fixed finger; mesial, lateral and ventral surfaces with scattered usually short setae; cutting edge of fixed finger with few widely-spaced very small calcareous teeth, interspaces occupied by short rows of corneous teeth, terminating in small simple or bifid claw; dorsal and ventral surfaces with scattered long setae. Carpus about 0.65 length of merus, subrectangular; dorsomesial and dorsolateral margins weakly elevated, each with row of small slender spines, strongest at distal angles, dorsal surface slightly concave, unarmed; mesial and lateral faces nearly perpendicular, unarmed; ventromesial margin with row of widely-spaced short setae, ventrolateral margin with row of very small spines. Merus subtriangular; dorsodistal margin with spine, slightly flattened dorsal margin with small spinules and moderately short setae; lateral face spinulose, ventrolateral margin with row of small spines; ventromesial margin with row of spinules, ventral surface with scattered small spines and spinules. Ischium with row of fine setae on ventromesial margin.

Ambulatory legs (Figs 10i-j) overreaching right cheliped by full length of dactyls; generally similar. Dactyls slightly blade-shaped, particularly third, usually somewhat shorter than propodi; laterally compressed; in dorsal view, slightly twisted in distal half; in lateral view, curved ventrally; terminating in small corneous claws; dorsal surfaces each with row of regularly-spaced stiff long setae; lateral faces each with faint broad longitudinal sulcus proximally, mesial faces glabrous; ventral margins each with row of shorter and finer but also regularly-spaced setae. Propodi 1.75 to twice length of carpi, somewhat laterally compressed; dorsal and ventral surfaces each with row of long setae; mesial and lateral faces unarmed. Carpi 0.45 to 0.65 length of meri; dorsal surfaces each with row of tiny spinules, 1 stronger spine at distal margin; lateral faces each with median longitudinal row of short fine setae sometimes accompanied by tiny spinules; mesial and ventral surfaces unarmed. Meri each usually with small spine at dorsodistal margin, at least on second, dorsal surfaces often spinulose or spinose and with abundant short fine setae; mesial faces glabrous; lateral faces minutely spinulose, each also with irregular rows of short fine setae; ventromesial margins unarmed or with few minute spinules proximally, ventrolateral margins, and occasionally also broadened ventral surfaces, each with irregularly double or triple rows of spinules or small spines, 1 slightly larger spine at distal angle. Ischia unarmed. Fourth pereopods each with 2 or 3 ovate corneous scales or spines at ventrodistal angle of propodus (Fig. 10k), lateral face often abundantly setose; dactyl with prominent preungual process at base of claw (Fig. 10d). Fifth pereopods chelate; propodus with diffuse rasp (Fig. 10l).

Uropods (Fig. 10f) with elongate moderately narrow rasps of corneous scales on both exopods and endopods; protopods not produced posteriorly. Telson (Figs 10d, m) with roundly subtriangular posterior lobes usually separated by small median cleft, sometimes cleft nearly obsolete; narrowly or broadly oblique terminal margins each usually with 1 or 2 spinules and very short bristles.

COLOR. — Unknown.

HABITAT. — One specimen found occupying gastropod shell well covered by anemone.

DISTRIBUTION. — Presently known only from the Kai and Tanimbar Islands, Indonesia; 210 - 502 m.

ETYMOLOGY. — This species is named for Dr. Rafael LEMAITRE, National Museum of Natural History, Smithsonian Institution in recognition of his continuing contributions to pagurid systematics.

AFFINITIES. — The generic discussion previously presented pertains directly to *A. lemaitrei* as it is the only known representative of the genus. However, the elongation of the right sexual tube and its right-to-left direction over the dorsal part of the abdomen in this genus is more reminiscent of sexual tube development in *Catapagurus* than in any of the other previously discussed genera. *Alainopaguroides* also shares with *Catapagurus* such characters as short and stout ocular peduncles with dilated corneae and moderate to long ocular acicles, although these are also seen in *Ostraconotus spatulipes*. The general structure and armature of the chelipeds and ambulatory legs, as well as the specialized preungual process on the fourth pereopod, also resemble those of *Catapagurus* species.

REMARKS. — Contrary to the typical relationship of shield length to animal size in the majority of pagurids, this is not the case in *A. lemaitrei*. In this species, there is a marked increase in shield breadth in proportion to length with increased animal size. However, as width increases, so does the general convexity of the shield, making accurate linear width measurements impossible.

As indicated in the description, there is a tendency in some males for the length of the left cheliped to noticeably exceed that of the right; however, this phenomenon does not appear to necessarily be a function of size. In the holotype, which was the largest male examined, the left cheliped was shorter than the right, as it was in all females. In two of the slightly smaller males, the left cheliped overreached the right by a quarter to a half the length of the left dactyl.

Genus *ANAPAGRIDES* de Saint Laurent-Dechancé, 1966

Anapagrides de Saint Laurent-Dechancé, 1966b: 262 (in part). — MIYAKE, 1978: 141 (in part). — MCLAUGHLIN & SANDBERG, 1995: 580.
Nanopagurus McLaughlin, 1986: 797.
Not *Anapagrides* - DE SAINT LAURENT, 1968b: 1115. — HAIG & BALL, 1988: 177 (= *Turleania* nom. nov.).

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Third maxilliped with well developed crista dentata and 1 accessory tooth. Chelipeds unequal, right appreciably larger. Ambulatory legs similar from left to right; carpi with or without dorsodistal spinule. Fourth pereopod semichelate; with single row of corneous scales in propodal rasp.

Males with coxae of fifth pereopods slightly asymmetrical; right larger and with short sexual tube directed posteriorly. No paired pleopods, 3 unpaired left pleopods. Females with single gonopore on coxa of third left pereopod. No paired pleopods, 4 unpaired pleopods; second to fourth with both rami well developed, fifth reduced.

Telson with transverse suture; posterior lobes separated by median cleft; terminal margins with few small spines.

REMARKS. — The inclusion of *Anapagrides* in the KARUBAR material is based upon a single ovigerous female of uncertain specific identity, and must therefore be considered tentative.

?*Anapagrides* sp.

Figs 11a-g

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands:* stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10. 1991: 1 ov. ♀ (1.1 mm) (MNHN-Pg 5269).

DIAGNOSIS. — Shield (Fig. 11a) slightly longer than broad. Rostrum broadly triangular, not produced in advance of lateral projections. Lateral projections triangular, with small marginal or submarginal spine. Ocular peduncles moderately short and stout, much shorter than antennular peduncles. Ocular acicles narrowly triangular, with submarginal spine. Antennal peduncles reaching slightly beyond distal margin of corneae; shorter than antennular peduncles.

Right cheliped (Fig. 11b) with moderately long fine setae particularly laterally on carpus and ventrally on merus. Dorsal surface of dactyl elevated in midline and armed with row of tiny spinules, dorsomesial margin with row of very small spines. Palm with row of small spines on dorsomesial and dorsolateral margins and slightly shorter row adjacent to dorsomesial margin, dorsal surface of palm and fixed finger with scattered spinules. Carpus with row of spines on dorsomesial margin, 1 spine on dorsodistal margin and row of slightly smaller spines on dorsal surface mesially; dorsolateral margin not distinctly delimited, but with row of tiny spinules; ventrolateral margin with row of minute tubercles. Merus with row of spines on ventrolateral margin.

Left cheliped (Fig. 11c) with long fine setae, particularly mesially on carpus and ventrally on merus. Dorsal surface of dactyl with few tiny spinulose protuberances. Palm strongly elevated in midline and armed with row of small spines extending to distal half of fixed finger. Carpus with short row of spines on dorsolateral margin, dorsomesial margin with 1 small spine distally and row of minutely spinulose protuberances; distal margin with 1 spine dorsally and 2 laterally. Merus with 2 strong spines on ventrolateral margin distally.

Ambulatory legs (Figs 11d-e) similar. Dactyls each with row of 7 or 8 corneous spines on ventral margins; mesial faces of third pereopods each with row of widely-spaced corneous spines dorsally. Propodi with 1 or

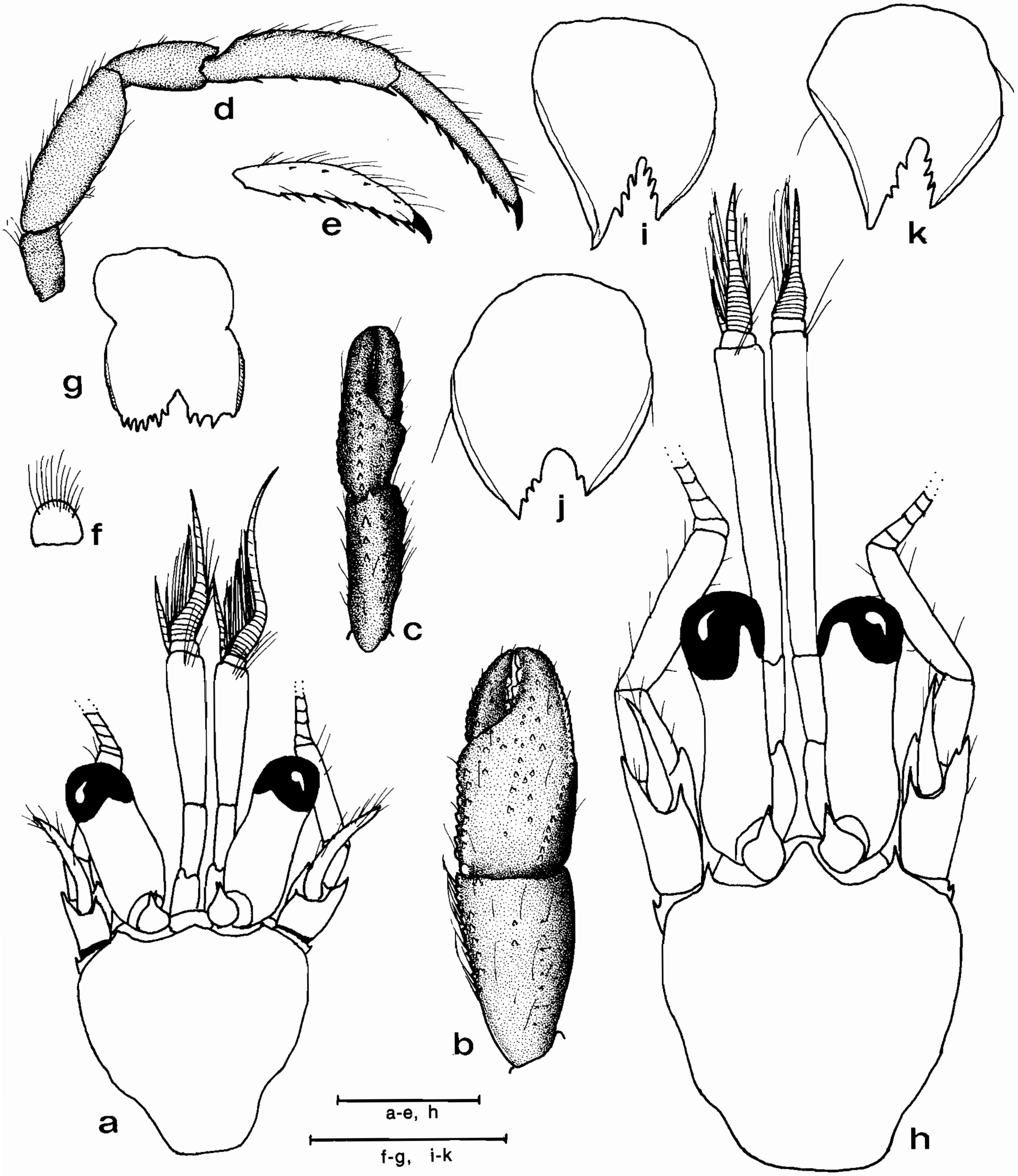

FIG. 11. — ?*Anapagrides* sp., a-g, ov. ♀ (1.1 mm) from KARUBAR Stn DW 18. — *Turleania senticosa* McLaughlin & Haig, 1996, h, ♂ (2.1 mm) from Stn DW 22; i, ♂ (2.3 mm) from Stn DW 22; j, ♂ (1.6 mm) from Stn DW 50; k, ♀ (1.6 mm) from Stn DW 50: **a**, **h**, shield and cephalic appendages; **b**, chela and carpus of right cheliped (dorsal view); **c**, chela and carpus of left cheliped (dorsal view); **d**, right second pereopod (lateral view); **e**, dactyl of left third pereopod (mesial view); **f**, anterior lobe of sternite of third pereopods; **g**, **i-k**, telson. Scales equal 0.5 mm (f-g, i-k) and 1.0 mm (a-e, h).

2 spines on ventrodistal margins and 2 or 3 widely-spaced and smaller spinules on ventral surface. Carpi each with minute spinule on dorsodistal margin. Sternite of third pereopods with subsemicircular unarmed anterior lobe (Fig. 11f).

Telson (Fig. 11g) with terminal margins of posterior lobes horizontal to slightly oblique, armed with 4 and 7 small spines, lateral margins with serrate marginal plate.

COLOR (in preservative). — Only remaining color: left cheliped faint orange with tips of dactyl and fixed finger white, distal margin of carpus darker orange and light orange band distally on merus.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from one locality in the Kai Islands, Indonesia; 205-212 m.

REMARKS. — This specimen has been referred to *Anapagrides* because of its considerable similarity to *A. reesei* (McLaughlin, 1986), a species known only from subtidal *Pocillopora* rubble at Kahe Point, Oahu, in the Hawaiian Islands. *Anapagrides reesei*, like the KARUBAR specimen, is very small, with females ovigerous in very much the same size range (1.2-1.4 mm). The armature of the left cheliped is nearly identical in the two species, as is that of the right chela. Like *A. reesei*, the anterior lobe of the sternite of the KARUBAR specimen is subsemicircular; the terminal margins of the telsons of both taxa are slightly oblique and armed with a few spines, the lateral margins carry a serrate chitinous plate. The latter species differs from the Hawaiian taxon in having slightly longer antennal peduncles, a row of tiny spines on the dorsolateral margin of the carpus of the right cheliped, and minute spinules on the dorsodistal margins of each of the ambulatory legs.

There is also an affinity, albeit less striking, between the KARUBAR specimen and *A. facetus* (Melin, 1939), particularly in the relative proportions of the cephalic appendages; however the rostrum of *A. facetus* is stronger than the lateral projections. In *A. facetus* at least the dactyl of the third left pereopod has a row of corneous spines on the mesial face (cf. MCLAUGHLIN & SANDBERG, 1995). Similar armature of the mesial faces of the dactyls of the third pereopods can be observed in the KARUBAR specimen. Differences in the female of *A. facetus* include having a pair of strong spines on the dorsal surface of the carpus of the right cheliped, whereas the KARUBAR specimen has a lateral row of small spines. The anterior lobe of the telson of *A. facetus* is subrectangular.

In the absence of male characters, a female specimen having a single left gonopore and no paired first pleopods modified as gonopods also conceivably might represent a species of *Trichopagurus* de Saint Laurent, 1970b or *Pagurixus*. However, the gills are intermediate in the monotypic *Trichopagurus*, but unquestionably phyllobranch in the KARUBAR specimen. The occurrence of an unpaired left gonopore in species of *Pagurixus* is variable; but in all species, the rostrum is usually well developed and the lateral projections weak or obsolete. A reversed condition is seen in the KARUBAR specimen. Additionally, all of the 13 species of *Pagurixus* now recognized (cf. MORGAN, 1993; KOMAI & ASAKURA, 1995) are described as having a subrectangular or subquadrate anterior lobe developed on the sternite of the third pereopods.

Tarrasopagurus rostrodenticulatus gen. nov., sp. nov., and ?*Anapagrides* sp. also share common characters such as the armature of the chelipeds and spination of the ambulatory legs. Females of the two taxa are readily distinguished, *T. rostrodenticulatus* by the presence of paired gonopores and first pleopods, ?*Anapagrides* sp. by a single left gonopore and the absence of paired first pleopods. If assignment of the KARUBAR specimen to *Anapagrides* is correct, males would correspondingly be easily distinguished by sexual tube development, i.e., left in *T. rostrodenticulatus*, right in *Anapagrides* sp. Although these two taxa occurred sympatrically at Stn DW 18, the intermediate type gills of the two presumably juvenile male specimens assigned to *T. rostrodenticulatus* immediately distinguished them from ?*Anapagrides* sp., despite their lack of sexual tubes and denticulate rostra.

Genus *TURLEANIA* nom. nov.

Anapagrides de Saint Laurent-Dechancé, 1966b: 262 (in part). — MIYAKE, 1978: 142 (in part).
Anapagrides, DE SAINT LAURENT, 1968b: 1115. — HAIG & BALL, 1988: 177; not *Anapagrides* de Saint Laurent-Dechancé, 1966b.
Laurentia McLaughlin & Haig, 1996: 76; not *Laurentia* Ragonot, 1888: 49.

DIAGNOSIS. — Eleven pairs of trichobranchiate gills. Rostrum narrowly triangular. Ocular acicles simple or multifid. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod somewhat produced, not recurved. Crista dentata of ischium of third maxilliped without accessory tooth. Dactyls of ambulatory legs with armed ventral margins. Chelipeds unequal or subequal, right appreciably stouter. Fourth pereopods semichelate; with single row of scales in propodal rasp. Sternite of fifth pereopods developed as single small subovate or subquadrate lobe.

Coxa of left fifth pereopod in males (Fig. 3c) with moderately long or long, often weakly spiraled, sexual tube provided with sparse terminal tuft of stiff setae (Fig. 3d); right fifth coxa with gonopore, occasionally vas deferens slightly produced, but not developed as distinct sexual tube; 3 uniramous or unequally biramous unpaired left pleopods. Females with paired gonopores; no paired pleopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture only weakly indicated; terminal margins oblique.

REMARKS. — *Laurentia* McLaughlin & Haig, 1996 has proved to be a junior homonym of *Laurentia* Ragonot, 1888, a lepidopteran genus (cf. FLETCHER & NYE, 1984: 80), and as such must be replaced. MCLAUGHLIN and HAIG chose the name *Laurentia* in recognition of the work of M. DE SAINT LAURENT. In proposing the replacement name *Turleania*, an anagram (from *Laurentia*), the dedication remains unchanged; gender feminine.

All four originally described species, type species *T. albatrossae* McLaughlin & Haig, 1966, *T. balli* McLaughlin & Haig, 1996, *T. sibogae* McLaughlin & Haig, 1996, and *T. senticosa* McLaughlin & Haig, 1996, were collected in Indonesian waters; however, only *T. senticosa* is represented in the KARUBAR material. The generic diagnosis has been broadened to include a fifth species. *Turleania multispina* sp. nov. is the first species in the genus with multifid ocular acicles.

Key to the species of *Turleania*

1. Ocular acicles simple 2
— Ocular acicles multifid .... ***T. multispina*** sp. nov.

2. Right chela with dorsal surface unarmed or with only few scattered spinules 3
— Right chela with dorsal surface armed with numerous spines or spinules 4

3. Dactyl of right cheliped with row of spines on dorsomesial margin, dorsodistal margin of carpus with median spine; an-terior lobe of sternite of third pereopod with 4 marginal spines .... ***T. balli****
— Dactyl of right cheliped with only few low protuberances on dorsomesial margin, dorsodistal margin of carpus unarmed; anterior lobe of sternite of third pereopod with 1 marginal spine .... ***T. sibogae****

4. Dorsomesial margin of right chela with row of strong spines; telson with asymmetrical posterior lobes, each with strong spine at outer angle and 1 or 2 spines on terminal margins .... ***T. albatrossae****
— Dorsomesial margin of right chela with spinules or irregular rows of small spines; telson with only slightly asymmetrical posterior lobes, each with acute outer angle and 1 or 2 low protuberances and sparse tufts of setae on terminal margins .... ***T. senticosa***

Turleania senticosa (McLaughlin & Haig, 1996)

Figs 11h-k

Laurentia senticosa McLaughlin & Haig, 1996: 87, figs 3E, 6

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ov. ♀ (1.5 mm) (POLIPI). — Stn DW 22, 05°22'S, 133°01'E, 85-124 m, 25.10.1991: 2 ♂ (2.1, 2.3 mm) (MNHN-Pg 5270).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂, 2 ♀, 1 ov. ♀ (1.6-1.8 mm) (USNM 275999, 276000).

DIAGNOSIS. — Shield (Fig. 11h) slightly to considerably longer than broad. Rostrum triangular, terminating bluntly or subacutely. Lateral projections well developed, triangular, with strong marginal or submarginal spine. Ocular peduncles subcylindrical, 0.65 to 0.80 shield length; overreached by both antennular and antennal peduncles; corneae dilated. Ocular acicles subtriangular, with small submarginal spine.

Second segment of antennal peduncle with dorsolateral distal angle produced, terminating in acute spine and sometimes with accessory spine; dorsomesial distal angle with very prominent spine. Antennal acicle reaching to base of cornea or slightly beyond; terminating in acute spine and with long setae mesially and terminally. Antennal flagellum moderately short, with 1 or 2 short or long setae every 1 to 4 articles.

Right cheliped moderately long and stout; sometimes with hiatus between dactyl and fixed finger. Dactyl 0.60 to 0.90 length of palm; dorsomesial margin and dorsal midline each with row(s) of very small spines or spinules and long setae. Palm with dorsomesial margin not clearly delimited, but with irregular rows of spinules or small spines; dorsal surface convex, armed with small spines or spinules particularly in lateral half and on fixed finger; surfaces all with long, but not particularly dense setae. Carpus with row of moderately slender, acute spines on dorsomesial margin, dorsal surface with 1 row of slightly smaller spines laterad of midline and scattered small spines or spinules laterally, dorsolateral margin not delimited; surfaces all with long setae. Merus with 1 or 2 prominent spines on ventrolateral margin distally, ventromesial margin with 1 prominent spine at distal angle, sometimes also 1 additional spine at midlength, and occasionally smaller spine proximally.

Left cheliped not appreciably shorter than right but much less robust. Dactyl unarmed or with few spinules and tufts of long setae in dorsal midline, low occasionally spinulose protuberances and long setae on dorsomesial margin. Palm with convex dorsal surface armed with tiny spines or spinules, particularly laterally, and long setae. Carpus with row of slender spines on dorsolateral and dorsomesial margins, both rows partially obscured by long setae; ventrolateral margin with acute spine distally. Merus with long setae on all surfaces; ventrolateral margin with 1 or 2 prominent acute spines distally, and frequently irregular row of smaller spinules on lateral face ventrally; ventromesial margin with 1 spine near distal angle.

Ambulatory legs similar from left to right. Dactyls slightly to considerably longer than propodi, slender; dorsal and ventral margins each with row of stiff setae, latter also with 5-8 long corneous spines. Carpi each with 1 spine on dorsal surface adjacent to dorsodistal angle, 1 additional spine on dorsal surface proximally (second). Meri each with 1 spine on ventral margin in distal third (second) or unarmed (third). Sternite of third pereopods with small, subovate or subtriangular anterior lobe usually with 1 to 4 marginal spines and row of long setae.

Telson (Figs 11i-k) with posterior lobes slightly asymmetrical, each outer angle acutely produced or with terminal spine, 0 to 3 spines on oblique terminal margins.

COLOR (in preservative). — Ocular acicles retain faint orange tint. Chelipeds with some iridescence. Right cheliped with faint spot of orange near the tip of fixed finger and larger patch proximally. Left cheliped with band of light orange proximally on dorsal surfaces of dactyl and fixed finger. Band of light orange present distally on dactyls of ambulatory legs.

HABITAT. — Unknown.

DISTRIBUTION. — Seram, Kai and Tanimbar Islands, Indonesia; 85-186 m.

AFFINITIES. — MCLAUGHLIN and HAIG (1996), discussed the similarities between *T. senticosa* and *T. albatrossae*. *Turleania multispina* similarly resembles *T. senticosa* in having the dorsal surfaces of the chelae armed with small spines or spinules. The other species, *T. balli* and *T. sibogae* both have unarmed chelae. The specimens of *T. senticosa* collected during the KARUBAR expedition all have the spines of the dorsomesial region of the palm of the right cheliped more strongly developed than in the type series. With that exception, two males from the Kai Islands agree exceptionally well with the holotype; the specimens from Tanimbar Islands do not exhibit the hiatus between the dactyl and fixed finger.

REMARKS. — Antennal flagella were missing from the type specimens described by MCLAUGHLIN and HAIG (1996). They have been included in the diagnosis presented based upon the present material. The KARUBAR specimens of *T. senticosa*, while agreeing with the type material from Seram Island in most characters, do exhibit some variations not noted by MCLAUGHLIN and HAIG. As previously indicated not all of the present specimens have a hiatus between the dactyl and fixed finger of the right cheliped; in one specimen, the spine on the ventromesial distal angle of the merus is absent. Similarly, the left cheliped of one specimen has one rather than two spines on the ventrolateral distal angle. The most noteworthy variation is seen in the telson. In all of present specimens the posterior lobes are clearly asymmetrical; the oblique margins are armed with two or three spines (Figs 11b-d).

Turleania multispina sp. nov.

Figs 12a-j

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 02, 05°47'S, 132°13'E, 209-240 m, 22.10.1991: 1 ov. ♀ (2.1 mm) (USNM 276003). — Stn DW 03, 05°48'S, 132°13'E, 278-301 m, 22.10.1991: 1 ♂ (1.8 mm) (MNHN-Pg 5271) ; 1 ♀ (1.9 mm) (POLIPI). — Stn DW 31, 05° 40'S, 132°51'E, 288-289 m, 26.10.1991 : 1 ov. ♀ (2.1 mm) (MNHN-Pg 5272). — Stn CP 35, 06°08'S, 132°45'E, 390-508 m, 27.10.1991: 1 ov. ♀ (2.3 mm) (MNHN-Pg 5273).

TYPES. — The ovigerous female (2.3 mm) (MNHN-Pg 5273) from KARUBAR station CP 35 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 12a) longer than broad; anterior margin between rostrum and lateral projections somewhat concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few tufts of setae. Rostrum triangular, well developed, reaching beyond bases of ocular acicles, terminating acutely. Lateral projections well developed, acutely or obtusely triangular, with submarginal spine.

Ocular peduncles (including corneae) approximately 0.80 shield length; corneae dilated. Ocular acicles subrectangular, with 3 to 6 terminal spines; separated basally by approximately half basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by 0.75 to nearly entire length of ultimate segment. Ultimate segment with 2 to 6 long setae on dorsodistal margin and scattered shorter setae on dorsal and ventral surfaces. Penultimate segment with few short setae. Basal segment with statocyst region expanded laterally and dorsoventrally flattened; with 0-3 small spines on protuberances of dorsodistal margin mesially and 1 stronger spine dorsodistal margin laterally.

Antennal peduncles overreaching ocular peduncles by 0.35 to 0.50 length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment unarmed or with small ventrodistal spinule. Second segment with dorsolateral distal angle produced, terminating in acute simple or bifid spine; dorsomesial distal angle with prominent acute spine. First segment often with small spine at dorsolateral distal angle; 1 to 3 small spines on ventrolateral distal margin. Antennal acicle reaching beyond base of cornea, but not to distal margin; terminating in acute spine and with long setae on mesial margin. Antennal flagellum long, overreaching outstretched chelipeds; with 2 to 4 short (≤ 2 articles length) setae every 1 to 3 articles in proximal half, fewer longer and irregularly-spaced setae in distal half.

Right cheliped (Fig. 12b) moderately long and stout. Dactyl slightly less than length of palm; cutting edge with 2 large calcareous teeth in proximal half, row of very small calcareous teeth distally; terminating in small corneous claw; dorsomesial margin not delimited, dorsal surface convex, with long setae and scattered small spines or spinules in proximal third; ventral and mesial surfaces also with scattered long setae. Palm 0.60 to 0.75 length of carpus; dorsomesial margin not delimited, but sometimes with prominent tubercle at proximal angle; dorsal surface convex, with scattered small spines and spinules, not extending onto dorsolateral surface or fixed finger, armature partially to entirely obscured by long simple or plumose setae; dorsal surface of fixed finger also with numerous long setae; cutting edge with 2 large rather sharp and several small calcareous teeth, terminating in small corneous claw. Carpus slightly longer than merus; dorsomesial distal angle with acute spine and usually 1 or 2 smaller spines on dorsomesial margin, dorsal surface with short transverse rows of long setae,

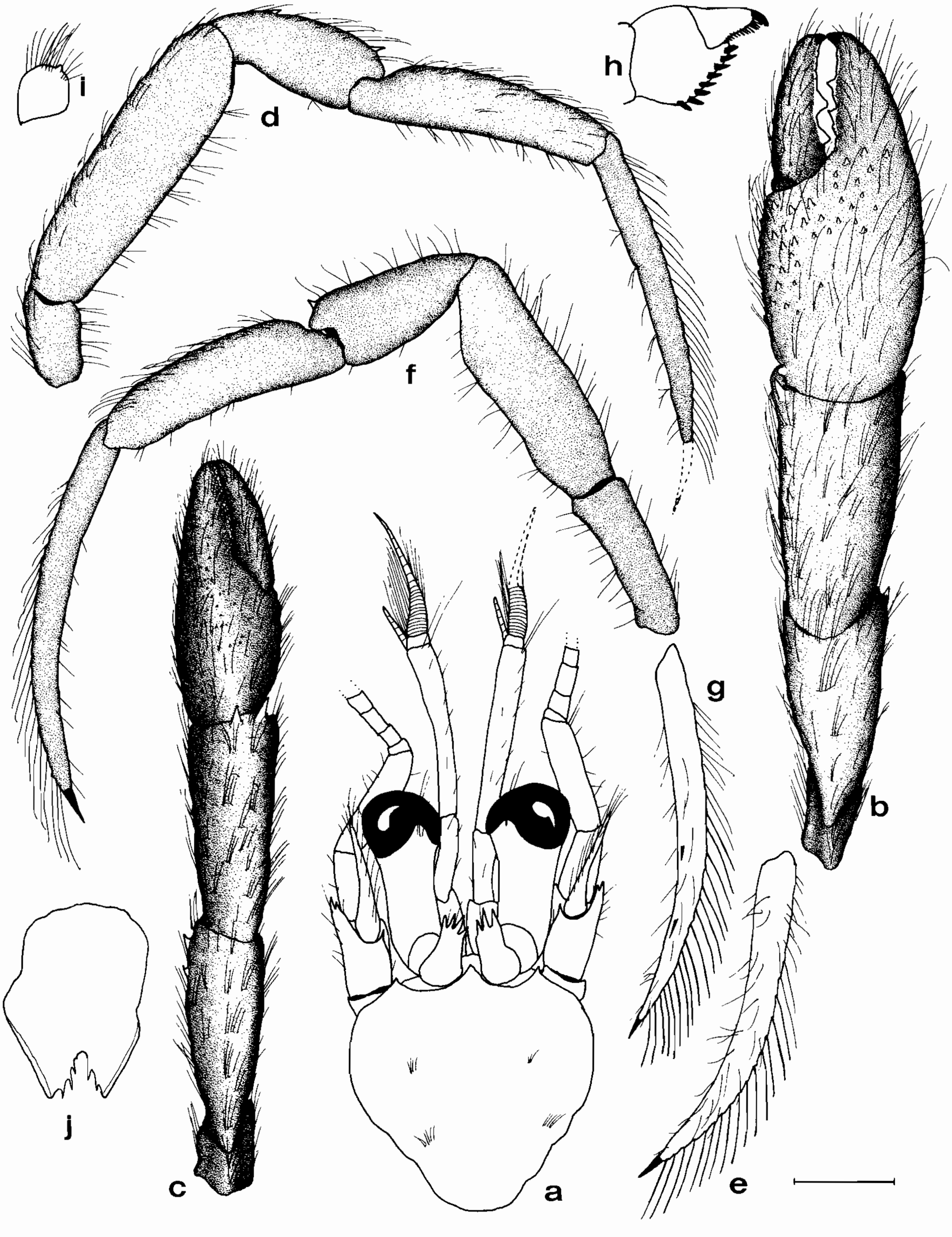

FIG. 12. — *Turleania multispina* sp. nov., holotype ♀ (2.3 mm) from KARUBAR Stn CP 35: **a**, shield and cephalic appendages; **b**, right cheliped; **c**, left cheliped; **d**, right second pereopod (lateral view); **e**, dactyl of left second pereopod (mesial view); **f**, left third pereopod (lateral view); **g**, dactyl of left third pereopod (mesial view); **h**, dactyl and propodus of right fourth pereopod (lateral view); **i**, anterior lobe of sternite of third pereopods; **j**, telson. Scale equals 0.5 mm (h-j) and 1.0 mm (a-g).

dorsolateral margin not delimited; mesial, lateral and ventral surfaces also with scattered long setae. Merus with numerous long setae on dorsal margin and mesial and lateral faces; ventrolateral and ventromesial distal angles each with 1 acute spine, or occasionally only blunt protuberance at ventromesial angle. Ischium with setae mesially and ventrally. Coxa with spine at ventrolateral distal angle.

Left cheliped (Fig. 12c) slender; usually equaling right in length but less robust. Dactyl approximately equal to or slightly longer than palm; cutting edge with row of very small corneous teeth, terminating in corneous claw; dorsal surface convex, unarmed but with numerous long setae. Palm 0.50 to 0.60 length of carpus; dorsal surface convex, armed with scattered small spines and spinules laterally and on proximal half of fixed finger, both with numerous long setae; cutting edge of fixed finger with row of small calcareous teeth, terminating in small corneous claw; ventral surfaces also with numerous long setae. Carpus approximately as long as merus; dorsodistal margin with 1 mesial acute spine and second in midline, dorsolateral and dorsomesial margins unarmed but with tufts of long setae; mesial, lateral and ventral faces also with long setae. Merus with long setae on dorsal, lateral and ventral surfaces; ventrolateral margin with 2 acute spines distally, ventromesial margin with 1 spine near distal angle. Ischium with long setae on ventral margin. Coxa with spine at ventrolateral distal angle.

Ambulatory legs (Figs 12d-g) similar from left to right. Dactyls 1.20 to 1.50 length of propodi, slender; in dorsal view, straight; in lateral view, curved ventrally; terminating in long, slender corneous claws; dorsal margins each with row of long stiff setae, mesial faces with scattered long setae and 1 to 3 widely-spaced corneous spines near ventral margin. Propodi with long setae dorsally and ventrally, often arising from low protuberances, particularly on dorsal surfaces. Carpi each with 1 spine on dorsal surface adjacent to dorsodistal angle, often 1 additional spine on dorsal surface proximally (second). Meri unarmed but with several tufts of moderately long setae on dorsal and ventral margins. Ischia unarmed. Sternite of third pereopods with small, subquadrate or subcircular anterior lobe (Fig. 12i) unarmed or with 1 or 2 marginal spinules. Fourth pereopod with 8 or 9 clearly separated, sharp corneous scales in propodal rasp (Fig. 12h). Fifth pereopods semichelate.

Telson (Fig. 12j) with posterior lobes only slightly asymmetrical, each outer angle prominent, blunt or subacute; terminal margins oblique and armed with 2 to 4 acute spines.

COLOR (in preservative). — Calcified integument somewhat iridescent. Ventral surfaces of carpi of chelipeds retaining faint orange tint.

HABITAT. — Two of the specimens were inhabiting shells covered by an unidentified bryozoan.

DISTRIBUTION. — Kai Islands, Indonesia; 209-502 m.

ETYMOLOGY. — From the Latin *spina* meaning spined, and refers to the multispined ocular acicles of this species.

AFFINITIES. — In having the dorsal surfaces of the chelae armed with small spines or spinules, *T. multispina* resembles both *T. albatrossae* and *T. senticosa*; however, this new species is immediately distinguished from all known species of the genus by its multispined ocular acicles.

Genus *MICHELOPAGURUS* nov.

Pagurodes Henderson, 1888: 94 (in part). — ALCOCK, 1901: 224; 1905b: 106 (in part). — GORDAN, 1956: 324 (in part; lit.). — DE SAINT LAURENT, 1969: 740 (in part).
?*Pagurodes* - BOUVIER, 1922: 22. — INGLE, 1993: 102; not *Pagurodes* Henderson, 1888.

DIAGNOSIS. — Eleven pairs of trichobranchiate gills. Rostrum broadly rounded or obtusely and bluntly triangular. Ocular acicles simple. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 13a) with external lobe of endopod well developed, not recurved. Ischium of third maxilliped with accessory tooth on crista dentata. Chelipeds elongate, subequal, right appreciably stouter. Fourth pereopods semichelate; with single row of scales or rarely incomplete double row in propodal rasp; no distinctive preungual process.

Coxae of fifth pereopods in males (Fig. 13b) symmetrical; right, left, or both with short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; posterior lobes separated by distinct median cleft; terminal margins rounded; lateral margins, at least left, with corneous plate.

ETYMOLOGY. — The genus is named for Michèle DE SAINT LAURENT, who first recognized that HENDERSON's (1888) *Pagurodes* consisted of three distinct taxa.

TYPE SPECIES. — *Pagurodes limatulus* Henderson, 1888. Gender masculine.

REMARKS. — HENDERSON (1888) described the genus *Pagurodes* for three superficially similar Indo-Pacific species collected during the "*Challenger*" expedition. *Pagurodes inarmatus* was based upon eight syntypes; *P. piliferus* and *P. limatulus* were each represented by single specimens, although a second small, poorly preserved specimen was "doubtfully" referred to *P. piliferus*. HENDERSON indicated that while the trichobranchiate gills, presumably, possessed by all three species suggested a relationship with *Parapagurus* Smith, 1879, *Pagurodes* was distinct because males had sexual tubes rather than paired first and second pleopods, modified as gonopods.

When DE SAINT LAURENT (1969) erected the genus *Acanthopagurus* de Saint Laurent, she expressed her belief that HENDERSON's (1888) species of *Pagurodes* actually represented three distinct genera. She designated *Pagurodes inarmatus* as the type species of HENDERSON's taxon, thus restricting *Pagurodes*, and indicated that *P. piliferus* and *P. limatulus* would be separated in a later publication. That separation was never formalized. Having now reexamined five of HENDERSON's syntypes of *P. inarmatus*, including the male specimen from "*Challenger*" station 168 upon which he based his description, as well as all "syntypes" of the two other species, it is clear that DE SAINT LAURENT (1969) was correct in her evaluation. *Pagurodes*, as defined by the characters of the examined syntypes of *P. inarmatus*, is a plainly identifiable taxon. Although *P. inarmatus* is not represented in the KARUBAR material, it is in the interest of stability in nomenclature that HENDERSON's (1888) described male (NHM 88.33) (Figs 15d, 35b-e) be designated as the lectotype of *P. inarmatus*.

ALCOCK (1905b) redescribed *P. limatulus*, pointing out that his female specimen(s) possessed paired first pleopods modified as gonopods; however, he did not propose a distinct genus for this species. Instead he simply noted in his generic description that paired first pleopods were present in females of at least one species. When BOUVIER (1922) assigned two new abyssal Atlantic species to *Pagurodes* sensu lato, he remarked that since his species were both represented by only single specimens, he could not be sure that all characters of the genus were present. As previously indicated, DE SAINT LAURENT (1969) noted that neither *P. limatulus* nor *P. piliferus* were congeners of *P. inarmatus*. Of *P. limatulus* she commented that this species would be assigned to a new taxon, together with BOUVIER's (1922) species, *Pagurodes richardi* Bouvier and *Pagurodes atlanticus* Bouvier. That publication was never completed. In his comprehensive treatment of Atlantic pagurids, INGLE (1993) retained *P. richardi* and *P. atlanticus* in *Pagurodes* (sensu BOUVIER, 1922), noting that until DE SAINT LAURENT's (1969) opinions could be reevaluated through a thorough study of HENDERSON's (1888) Indo-Pacific species, the generic placement of the Atlantic species was uncertain.

MCLAUGHLIN (1988) considered the possible relationship of *"Pagurodes" limatulus* with the Atlantic *"Pagurus" piercei* Wass, 1963, unlikely, when she proposed the genus *Goreopagurus* for the latter taxon. The recent discovery of a second species of *Goreopagurus* from the eastern Pacific (MCLAUGHLIN & HAIG, 1995) confirms the distinctive characters of this genus that set it apart from HENDERSON's (1888) species. *Pagurodes limatulus* is herein reassigned to *Michelopagurus* gen. nov. as its type species; *Pagurodes richardi* and *Pagurodes atlanticus* are also, provisionally, reassigned to this genus.

Michelopagurus limatulus (Henderson, 1888) new combination

Figs 13a-d, 36a-f

Pagurodes limatulus Henderson, 1888: 97, pl. 10, fig. 6. — ALCOCK, 1905b: 107, pl. 12, fig. 6. — ESTAMPADOR, 1937: 507 (list). — GORDAN, 1956: 325 (lit.). — DE SAINT LAURENT, 1969: 740. — MCLAUGHLIN, 1988: 262.

Pagurodes sp. ?*limatulus*: ALCOCK, 1901: 225.

MATERIAL EXAMINED. — **South of Philippines**. "*Challenger*", Stn 214, 1414 m: 1 ♂ holotype (3.5 mm) (NHM 88.33).

Indonesia. KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 25.10.1991: 5 ♂, 11 ♀, 3 ov. ♀ (2.1-3.6 mm) (MNHN-Pg 5274). — Stn CC 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 5 ♂, 6 ♀ (1.9-3.6 mm) (USNM 276001). — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 2 ♂, 3 ♀ (2.1-4.0 mm) (MNHN-Pg 5275); 2 ♀ (USNM 275997); 1 ♀ (1.7) (POLIPI); 1 ♂, 1 ♀ (2.9-3.2) (SNHM 4809). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ♀ (2.4 mm) (POLIPI).

DIAGNOSIS. — Shield (Figs 13c, 36a, d) broader than long. Rostrum produced beyond level of lateral projections, broadly rounded. Lateral projections somewhat produced, broadly rounded. Ocular peduncles (including corneae) very short and stout, less than half length of shield; corneae 0.25 to 0.33 length of peduncles, dilated little if at all. Ocular acicles triangular, with submarginal spine.

Antennular peduncle with very prominent spine on dorsolateral margin of basal segment. Third segment of antennal peduncle with very strong spine at ventrodistal angle; second segment with dorsolateral distal angle strongly produced, terminating in simple or bifid spine and frequently with small secondary spine on mesial margin, dorsomesial distal angle with acute spine. Sternite of third maxillipeds with prominent spine on either side of midline.

Right cheliped (Figs 36b, e) moderately elongate. Dactyl slightly shorter than palm; surface with scattered setae, occasionally unarmed but more frequently with row of tubercles on dorsomesial margin. Palm narrow, somewhat compressed dorsoventrally; dorsomesial margin tuberculate and with 2 or 3 prominent spines at proximal margin, convex dorsal surface with short transverse sometimes tuberculate ridges and rows of setae, usually 1 spine or tubercle in midline at proximal margin. Carpus with row spines on dorsomesial margin, dorsal surface often with short transverse rows of tubercles and slightly oblique row of small spines, dorsolateral margin with irregular row of small spines not extending to proximal or distal margins. Merus with irregular single or double row of spines or spinulose protuberances on ventrolateral margin, most distal usually strongest; ventromesial margin with row of small spines.

Left cheliped (Figs 36c, f) with elongate slender unarmed or weakly tuberculate dactyl and fixed finger, tending to curve ventrally. Palm with midline elevated and armed 1 or 2 double rows of small spinules or tubercles, dorsal surface spinulose or tuberculate. Carpus with row of spines on both dorsolateral and dorsomesial margins; ventrolateral margin with row of tuberculate spines or spinules. Merus with small spines on distal half of ventromesial margin; 1 to 3 spines distally and transverse rows of spinules or tubercles in proximal half of ventrolateral margin.

Second and third pereopods similar from left to right. Dactyls 1.20 to 1.35 length of propodi; dorsal margins each with row of stiff setae, mesial and lateral faces each with longitudinal sulcus, flanked above on mesial faces by 1 or 2 rows of corneous spinules; ventral margins each with row of 11 to 19 corneous spines. Propodi with low protuberances and tufts of setae on dorsal surfaces, 1 or 2 corneous spinules at ventrodistal margins. Carpi each with dorsodistal spine and row of low protuberances with tufts of setae on dorsal surface. Meri each with 1 to 3 spines at ventrolateral distal angle and row, sometimes double, of spinules or tubercles on ventral surface (second) or unarmed (third). Fifth pereopods weakly semichelate. Anterior lobe of sternite of third pereopods subrectangular, subdivided by median longitudinal groove into two sub-lobes, each with tuft of setae.

Males usually with vas deferens produced as short, almost transparent, sexual tube from both right and left coxa of fifth pereopods, sometimes from only one, and occasionally hardly produced at all.

Telson (Fig. 13d) with prominent median cleft separating slightly asymmetrical posterior lobes; rounded terminal margins each with 3 to 7 prominent spines often interspersed with smaller spines.

COLOR (in preservative). — Overall reddish orange.

HABITAT. — Gastropod shells sometimes encased in bryozoan.

DISTRIBUTION. — South of Philippine Islands, Indonesia; ?Travancore coast of India; 620 - 1414 m.

AFFINITIES. — *Michelopagurus limatulus* shows greater affinity to *M. chacei* sp. nov. than to either of its Atlantic congeners, particularly in the armature of the telson and lack of armature of the anterior lobe of the sternite of the third pereopods. The two Indo-Pacific species are separated by the shorter and more stout ocular peduncles of *M. limatulus* and its more elongate and slender chelipeds.

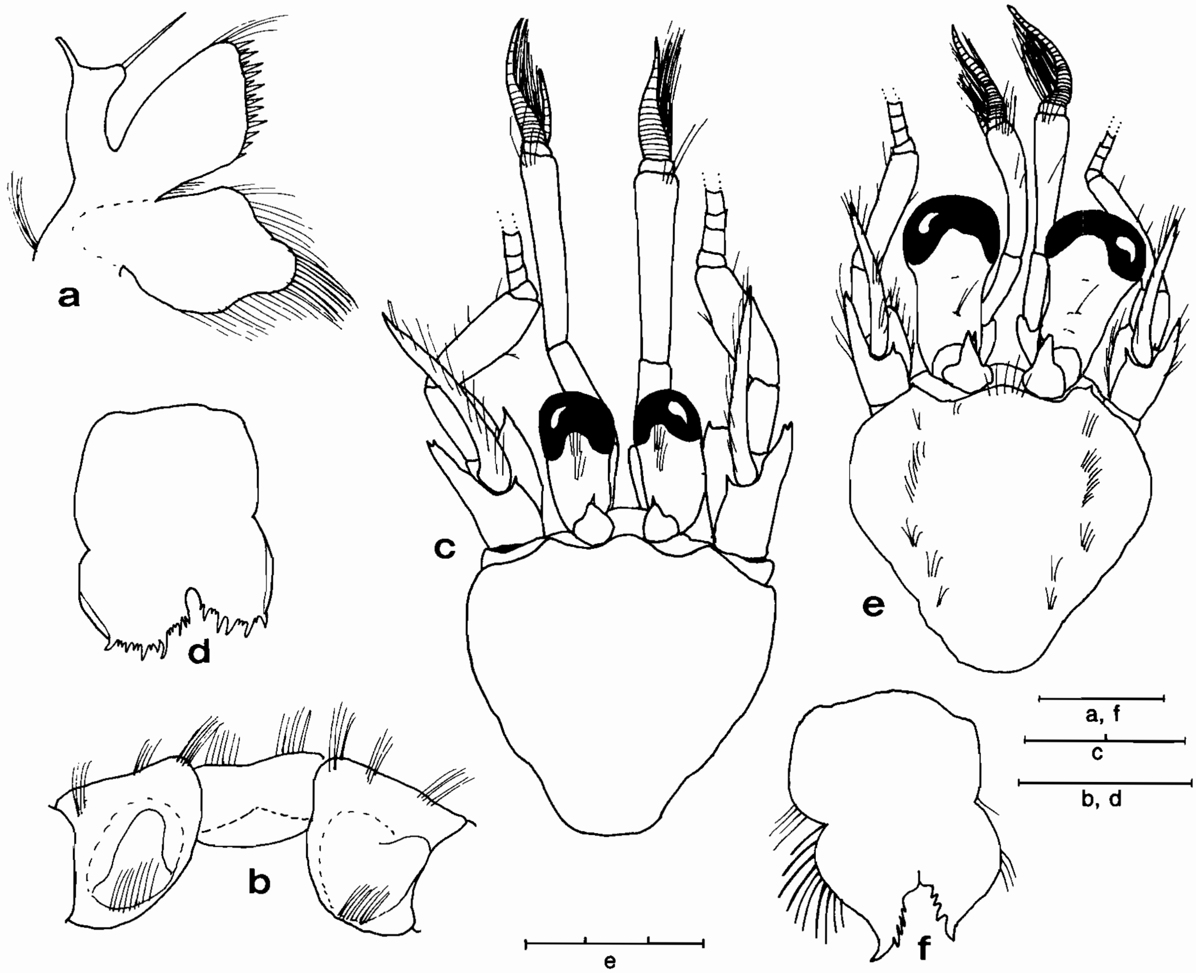

FIG. 13. — *Michelopagurus limatulus* (Henderson, 1888), new combination, a-d, ♂ (2.8 mm) from KARUBAR Stn CP 38. — *Pseudopagurodes piliferus* (Henderson, 1888), new combination, e-f, holotype ♀ (4.5 mm) from *"Challenger"* Stn Tablas Islands (NHM 88.33): **a**, left maxillule; **b**, sternite and coxae of fifth pereopods; **c-e**, shield and cephalic appendages; **d-f**, telson. Scales equal 0.5 mm (a), 1.0 mm (b, d, f), 2.0 mm (c), and 3.0 mm (e).

REMARKS. — In addition to the species of HENDERSON (1888) and BOUVIER (1922) now assigned to *Michelopagurus*, DE SAINT LAURENT (1969) indicated that she had seen three undescribed species among the *"Albatross"* and *"Siboga"* collections. As indicated above, one additional species assignable to this genus is present in the KARUBAR material, but it is unknown whether it is one of the three seen by DE SAINT LAURENT.

Michelopagurus chacei sp. nov.

Figs 14a-h, 37c-e

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 13, 05°26'S, 132°38'E, 417-425 m, 24.10.1991: 1 ov. ♀ (2.5 mm) (MNHN-Pg 5276). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ (2.1 mm) (MNHN-Pg 5277).

TYPES. — The ovigerous female (2.5 mm) (MNHN-Pg 5276) from KARUBAR station DW 13 is the holotype. The other specimen is a paratype.

DESCRIPTION. — Shield (Fig. 14a, 37c) as broad or slightly broader than long; anterolateral margins slightly terraced; posterior margin truncate; dorsal surface with scattered tufts of setae. Rostrum broadly rounded, reaching approximately to level of lateral projections. Lateral projections strongly produced, obtusely triangular, unarmed.

Ocular peduncles short and stout, dorsal surface with tufts of setae; corneae large, occupying 0.25 to 0.33 length of peduncle, but only weakly dilated. Ocular acicles triangular, terminating subacutely and with strong submarginal spine; separated basally by approximately 0.75 basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by 0.25 to 0.50 length of ultimate peduncular segment. Ultimate segment with prominent tuft of long setae on dorsal surface distally and with row of short setae at least in distal half. Penultimate segment glabrous. Basal segment with acute spine on dorsolateral margin.

Antennal peduncle overreaching ocular peduncles by nearly full length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong simple or bifid spine and sometimes with small accessory spine on mesial margin; dorsomesial distal angle with prominent spine. First segment with spine at laterodistal margin and 1 spine on ventrodistal margin. Antennal acicle quite long, reaching to distal half of fifth peduncular segment; terminating in acute spine and tuft of setae; mesial margin with few setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs; with 1 or 2 very few short setae every 2 to 4 articles.

Chelipeds subequal; right usually slightly longer and stouter. Right cheliped (Figs 14b, 37d) elongate, moderately slender. Dactyl 1.10 to 1.20 length of palm; dorsomesial margin with row of very small spines, dorsal surface unarmed but with few scattered setae; mesial and ventral surfaces with scattered of setae; cutting edge with 2 widely-spaced calcareous teeth in proximal half, row of corneous teeth distally. Palm slightly compressed dorsoventrally; 0.75 length of carpus; dorsomesial margin with irregular row of small spines, decreasing in size distally, dorsolateral margin not delimited; dorsal, mesial and lateral surfaces unarmed but with scattered short setae; fixed finger unarmed; cutting edge with 2 large and distal row of small calcareous teeth. Carpus slightly broadened distally; dorsomesial margin with row of prominent spines, dorsolateral margin distinct proximally and armed with irregular row of very small spinulose tubercles; dorsal surface with double longitudinal row of very small spines laterad of midline and numerous very small spines forming short quasi-transverse rows in proximal half; mesial and lateral faces with sparse tufts of setae; ventrolateral distal angle with small spine. Merus with transverse rows of setae dorsally; ventromesial distal angle with 1 spine and few marginal spinules; ventrolateral margin with 2 spines distally and spinules proximally. Ischium with ventromesial margin spinulose proximally.

Left cheliped (Figs 14c, 37e) only slightly shorter than right. Dactyl and fixed finger long and slender, somewhat dorsoventrally compressed, with tips deflected ventrally; margins of dactyl and fixed finger not delimited, rounded surfaces smooth. Palm markedly shorter than both dactyl and carpus; dorsal surface elevated in midline and armed with row of small spines not extending onto fixed finger, dorsomesial margin with row of small spines on spinulose tubercles; dorsolateral margin not delimited, lateral surface with few small spinules dorsally. Carpus with dorsolateral and dorsomesial margins each with row of spines, 1 spine on dorsodistal margin; ventrolateral distal angle with 1 or 2 small spines, ventral surface spinulose. Merus with transverse rows of setae on dorsal margin; ventrolateral margin with row of spines, ventromesial margin with row of very small spines or spinules. Ischium unarmed.

Ambulatory legs (Figs 14d-e) similar from left to right; moderately long and slender; overreaching outstretched chelipeds by nearly entire length of dactyls. Dactyls relatively long, 1.10 to 1.25 length of propodi; nearly straight; dorsal surfaces each with row of stiff setae; mesial and lateral faces with few setae; ventral margins each with 9 to 11 corneous spines. Propodi each with irregular row of setae on dorsal surface; mesial and lateral faces unarmed; ventral surfaces with few setae and 1 or 2 corneous spines at distal angle. Carpi each with small dorsodistal spine and dorsal row of sparse tufts of setae. Meri usually with 1 or 2 spinules distally on ventral margins of second, third unarmed but with few dorsal and ventral setae. Ischia unarmed. Sternite of third pereopods

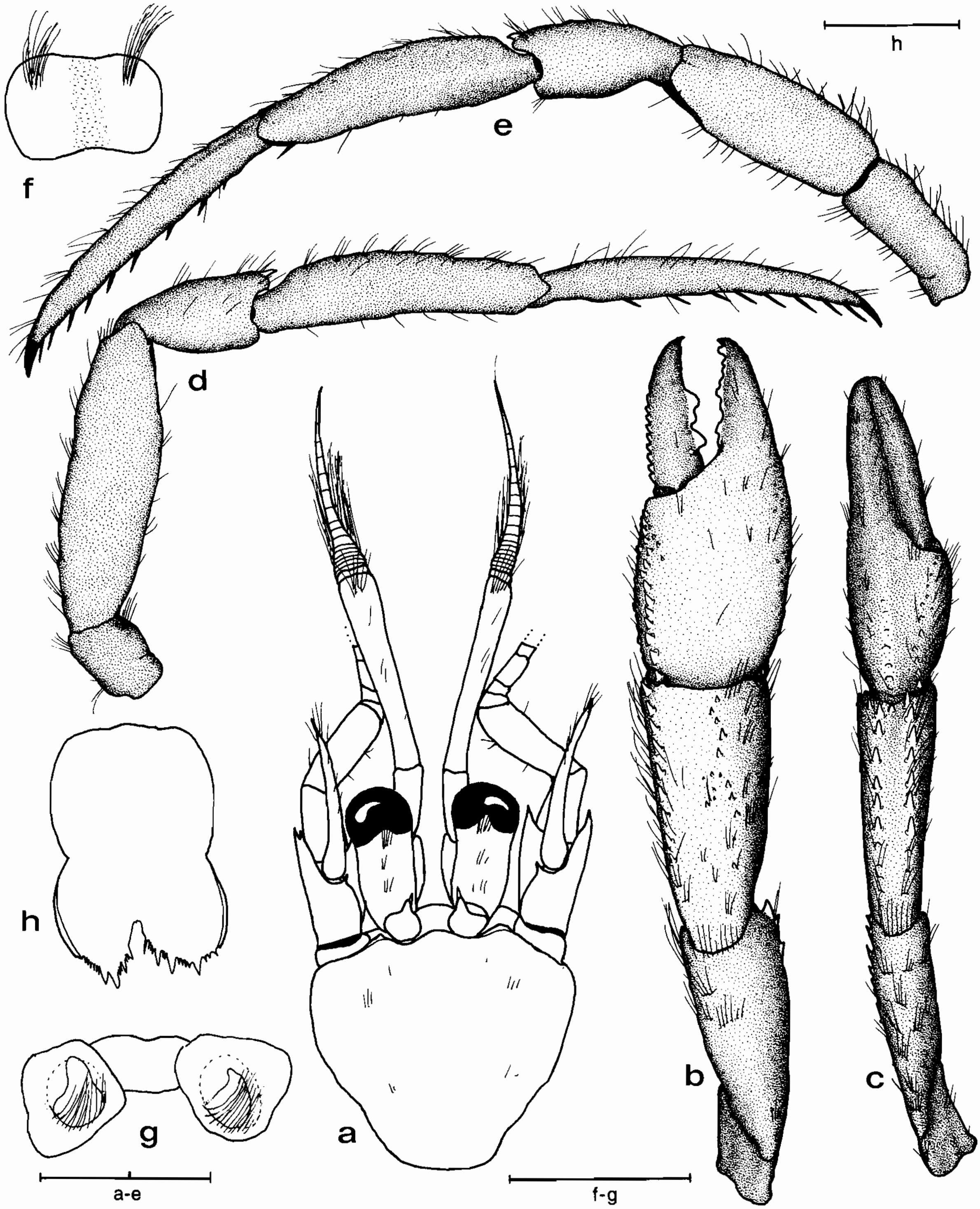

FIG. 14. — *Michelopagurus chacei* sp. nov. a, f, h, holotype ♂ (2.5 mm) from KARUBAR Stn DW 13; b-e, g, paratype ♂ (2.1 mm) from Stn CP 26: **a**, shield and cephalic appendages; **b**, right cheliped; **c**, left cheliped; **d**, second right pereopod (lateral view); **e**, third left pereopod (lateral view); **f**, anterior lobe of sternite of third pereopods; **g**, coxae and sternite of fifth pereopods; **h**, telson. Scales equal 0.5 mm (f, h), 1.0 mm (g), and 2.0 (a-e).

with anterior lobe (Fig. 14f) broadly subrectangular, concave as result of median depression, unarmed but with submarginal tuft of setae adjacent to each lateral angle. Fifth pereopods chelate.

Coxae of fifth pereopods in males (Fig. 14g) with short right sexual tube and even shorter left.

Telson (Fig. 14h) with well defined transverse suture; posterior lobes subcircular to subtriangular, median cleft prominent; terminal margins slightly oblique or rounded, armed with 3 to 5 spines interspersed with much smaller slender spines or spinules.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 264-425 m.

ETYMOLOGY. — Dedicated to Dr Fenner A. CHACE, Zoologist Emeritus of the Division of Crustacea, National Museum of Natural History, Smithsonian Institution, who, during a continuing long and active career has contributed so much to decapod systematics.

AFFINITIES. — As previously noted, *Michelopagurus chacei* bears a considerable resemblance to *M. limatulus*, particularly in the structure of the anterior lobe of the sternite of the third pereopods and development of the telson armature. In addition to the distinguishing characters of *M. limatulus* mentioned above, the shield of *M. chacei* tends to be slightly broader and the antennular flagella longer than seen in *M. limatulus*; however, these characters may well be subject to intraspecific variation when large samples are available for examination. The ambulatory legs appear to provide the best characters for separating the two species. A row of spinules or tubercles is present on the ventral margins of the meri of the second pereopods of *M. limatulus*, and the ventral margins of the dactyls are provided with 11 to 19 corneous spines. In *M. chacei*, the meri of the second pereopods have only one or two distal spinules on the ventral margins; the ventral margins of the dactyls are armed with nine to 11 corneous spines.

Genus ***PSEUDOPAGURODES*** nov.

Pagurodes Henderson, 1888: 94 (in part). — ALCOCK, 1901: 224; 1905b: 106 (in part). — GORDAN, 1956: 324 (in part; lit.). — DE SAINT LAURENT, 1969: 740 (in part).

DIAGNOSIS. — Eleven pairs of intermediate type gills. Rostrum reduced and rounded. Ocular acicles small, widely separated. Maxillule with external lobe of endopod well developed, not recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth. Chelipeds subequal. Dactyls of ambulatory legs without corneous spinules on ventral margins. Fourth pereopods semichelate; propodal rasp with single row of scales; no preungual process at base of dactylar claw. Fifth pereopods chelate.

Male unknown. Female with paired gonopores, no paired pleopods on first abdominal somite, and 4 unequally biramous left pleopods on somites 2 to 5.

Asymmetrical uropods. Telson with transverse suture, subtriangular posterior lobes separated by median cleft.

ETYMOLOGY. — From the Greek *pseudes* meaning false, and *pagouros* meaning crab, reflecting the deceptive similarities between this genus and *Pagurodes* sensu stricto.

TYPE SPECIES. — *Pagurodes piliferus* Henderson, 1888. Gender masculine.

REMARKS. — With the restriction of *Pagurodes* to taxa exhibiting the characters manifest by *P. inarmatus* and the establishment of *Michelopagurus* gen. nov. for *P. limatulus*, *Pagurodes piliferus* is left in a systematic limbo. The damaged male specimen from the Arafura Sea that HENDERSON (1888) doubtfully assigned to *P. piliferus* was subsequently redetermined to be *Pagurus compressipes* Miers, 1884, by M. DE SAINT LAURENT (unpublished). I concur with her identification. The remaining, and true type specimen of *Pagurodes piliferus* (NHM 88.33) is a female (Figs 13e-f, 37a-b) with intermediate gills, thus clearly not allied to *Pagurodes* sensu stricto, nor to

Michelopagurus gen. nov. In gill structure *Pseudopagurodes* approaches *Tarrasopagurus* gen. nov., but differs from that genus in having subequal, elongate chelipeds and ambulatory legs, while lacking paired first pleopods. No specimens of *Pseudopagurodes* were found during the KARUBAR expedition.

Genus *ICELOPAGURUS* nov.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Rostrum triangular. Ocular acicles triangular, elongate. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 15a) with external lobe of endopod rudimentary or vestigial. Crista dentata of third maxilliped somewhat reduced, but with accessory tooth. Chelipeds elongate, subequal, right stouter. Sternal plate of third pereopods broad, with weak longitudinal groove. Fourth pereopods semichelate; with single row of spiniform scales in propodal rasp; dactyl with tubular preungual process (Fig. 15b).

Coxae of fifth pereopods in males (Fig. 15c) symmetrical, right with stout, relatively short sexual tube directed posteriorly and externally, left usually with very short sexual tube; 3 unequally biramous unpaired left pleopods. Females with paired gonopores; without paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; rounded posterior lobes separated by distinct median cleft with nearly perpendicular margins, terminal margins armed; lateral margins with very narrow chitinous plate.

TYPE SPECIES. — *Icelopagurus crosnieri* sp. nov. Gender masculine.

ETYMOLOGY. — From the Greek *ikelos* meaning like or resembling, and *pagouros* meaning crab, and referring to the similarities shared with another pagurid genus, namely, *Catapagurus*.

REMARKS. — As indicated in the derivation of its name, *Icelopagurus* is superficially very similar to *Catapagurus*. Both genera are characterized by unusually elongate ocular acicles, rudimentary or vestigial external endopodal lobe on the maxillule, more or less reduced crista dentata with one accessory tooth, distinctive tubular preungual process on the dactyl of the fourth pereopod, well developed right male sexual tube, and females lacking specialized secondary sexual characters. However, *Icelopagurus* is readily separated from *Catapagurus* by the shortness of the male sexual tube that does not curve up over the dorsal surface of the body and by the very distinctive development of the telson.

Icelopagurus is also ostensibly quite similar to *Pagurodes* sensu stricto. As presently known, both taxa are monotypic, and their type species share such immediately observable characters as elongate chelipeds and ambulatory legs, well calcified shields that tend to be somewhat vaulted, long antennal acicles, triangular rostra, very short, stout ocular peduncles provided with low protuberances and tufts of setae, and males with a short sexual tube arising from the coxa of the right fifth pereopod and an even shorter tube from the left (Figs 15c-d). However, upon closer inspection, the ocular acicles of *Pagurodes inarmatus* (Fig. 35b) are short, reaching only to the basal portion of the peduncles; the external lobe of the maxillulary endopod is completely absent; the gills are trichobranchiate; the dactyl of the fourth pereopod lacks a preungual process; and the posterior lobes of the telson are acutely subtriangular with strongly oblique terminal margins armed with 3 or 4 small spines. In contrast, *I. crosnieri* sp. nov. has very long ocular acicles (fig. 38b), reaching to or beyond the bases of the corneae; the external lobe of the maxillulary endopod is vestigial; the gills are phyllobranchiate; the dactyl of the fourth pereopod is provided with a large tubular preungual process; and the posterior lobes of the telson are broadly rounded, with convex terminal margins armed with 4 or 5 widely-spaced long corneous spines.

Icelopagurus crosnieri sp. nov.

Figs 15a-c, e-j, 38a-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Tanimbar Islands*: stn CP 87, 08°49'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♀ (5.2 mm) (USNM 276004). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ov. ♀ (4.3 mm) (MNHN-Pg 5278) ; 1 ♂, 2 ♀, 1 ov. ♀ (3.1-4.3 mm) (MNHN-Pg 5279); 1 ♀ (3.2 mm) (POLIPI).

TYPES. — The ovigerous female (4.3 mm) (MNHN-Pg 5278) from KARUBAR station CP 91 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 15e; 38a-b) broader than long, well calcified, slightly vaulted; cervical groove deep; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with numerous tufts of setae. Posterior carapace with patches of calcification medianly posterior to cervical groove, remainder membraneous. Rostrum triangular, terminally subacute or acute, usually not reaching level of lateral projections. Lateral projections strongly produced, acutely or obtusely triangular, with prominent terminal marginal or submarginal spine.

Ocular peduncles very short and stout, dorsal surface with tufts of setae; corneae large, occupying 0.25 to 0.33 length of peduncle, but not dilated. Ocular acicles slender, elongate, length variable (extending from 0.25 length of peduncle to nearly base of cornea), terminating acutely or with distinct spine; separated basally by entire to 1.25 basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles by slightly less to slightly more than entire combined lengths of ultimate and penultimate peduncular segments. Ultimate segment with prominent tuft of long setae on dorsal surface distally and with additional row of short setae. Penultimate segment with sparse row of short setae dorsally. Basal segment unarmed.

Antennal peduncle overreaching ocular peduncles by at least 0.25 length of penultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in simple or bifid spine and with small accessory spine on lateral margin; dorsomesial distal angle with small spine. First segment with spine at laterodistal margin and 1 spine on ventrodistal margin. Antennal acicle quite long, reaching to or beyond distal margin of fifth peduncular segment; terminating in acute spine; mesial margin with row of long setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs, naked or with very few short setae on proximal articles. Sternite of third maxillipeds with median concavity, unarmed.

Chelipeds subequal; right usually slightly longer and stouter. Right cheliped (Figs 15f, 38c) with dactyl 0.65 to 0.80 length of palm; dorsomesial margin rounded, unarmed or minutely spinulose, dorsal surface with scattered moderately long setae and row of shorter setae adjacent to cutting edge; ventral surface also with few tufts of setae; cutting edge calcareous, with 2 prominent teeth. Palm somewhat dorsoventrally compressed; slightly shorter to approximately equal to length of carpus; dorsomesial and dorsolateral margins not well defined; dorsal, mesial and lateral surfaces covered with very small spinules or tubercles; fixed finger minutely spinulose on proximal portion of dorsal surface; cutting edge with 2 or 3 large and distal row of small calcareous teeth. Carpus appreciably broadened distally; dorsomesial and dorsolateral margins distinct distally, each armed with irregular double row of small spines or spinulose tubercles; dorsal surface with numerous small spines; mesial and lateral faces with spinules or tubercles dorsally, minutely spinulose or granular ventrally. Merus with all surfaces uniformly spinulose or tuberculate. Ischium with minutely spinulose ventromesial margin.

Left cheliped (Fig. 38d) only slightly shorter than right. Dactyl and fixed finger long and slender, somewhat dorsoventrally compressed, with tips deflected ventrally; margins of neither dactyl nor fixed finger delimited, rounded surfaces smooth or minutely spinulose. Palm markedly shorter than both dactyl and carpus; dorsal surface weakly convex, dorsomesial and dorsolateral margins not delimited; all surfaces spinulose or tuberculate, ventral surface minutely so. Carpus with dorsal surface relatively flat, covered with small spines; mesial, lateral and ventral surfaces spinulose. Merus with dorsal, lateral and ventral surfaces uniformly spinulose; mesial face nearly smooth. Ischium with minutely spinulose ventral margin.

Ambulatory legs (Figs 15g-h) similar from left to right; slender and very long, overreaching outstretched chelipeds by half to entire length of dactyls. Dactyls long, very slender, ventrally curved, and slightly twisted distally; approximately 1.25 length of propodi; dorsal surfaces each with row of low protuberances and long stiff setae; mesial faces each with longitudinal row of shorter setae. Propodi each with irregular double row of small spines and short setae on dorsal surface; mesial, lateral and ventral surfaces usually spinulose. Carpi with single or double row of small spines on dorsal surface; mesial and lateral faces spinulose, at least dorsally. Meri with spinulose dorsal, lateral and ventral surfaces, spinules strongest ventrally; mesial faces smooth or minutely spinulose. Ischia with minutely spinulose ventral margins. Fifth pereopods weakly chelate.

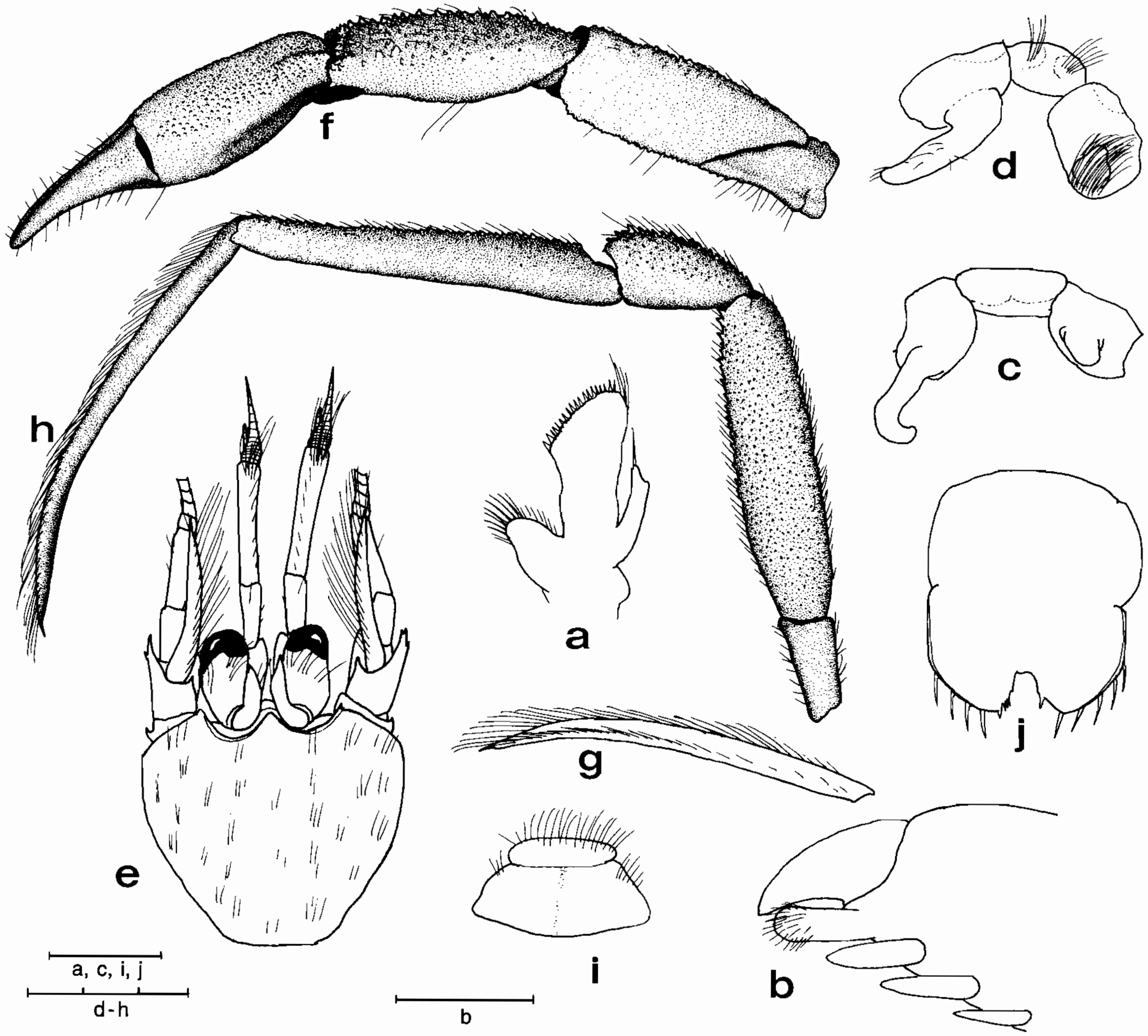

FIG. 15. — *Icelopagurus crosnieri* sp. nov. a, c, g-j, paratype ♂ (3.1 mm) from KARUBAR Stn CP 91; b, paratype ♀ (5.2 mm) from Stn CP 87; e, holotype ♂ (4.3 mm) from Stn CP 91; f, paratype ♀ (4.3 mm) from Stn CP 91. — d, *Pagurodes inarmatus*, lectotype ♂ (7.0 mm) from "Challenger" Stn 168: **a**, maxillule; **b**, distal portion of dactyl of fourth pereopod; **c-d**, sternite and coxae of fifth pereopods; **e**, shield and cephalic appendages; **f**, right cheliped (mesial view); **g**, dactyl of right second pereopod (mesial view); **h**, left third pereopod (lateral view); **i**, sternite of third pereopods; **j**, telson. Scales equal 0.25 mm (b), 0.5 mm (j), 1.0 mm (a, c, i), and 3.0 mm (d-h).

Sternite of third pereopods (Fig. 15i) broad; anterior lobe subrectangular, unarmed but with marginal row of setae.

Coxae of fifth pereopods in males (Fig. 15c) with right sexual tube short and moderately thick basally, curving posteriorly and externally; small protuberance of left vas deferens.

Telson (Fig. 15j) with prominent transverse suture; posterior lobes obliquely rounded and chitinous lateral plate armed with 4 to 6 long corneous spines; median cleft prominent, margins slightly oblique and armed with 0 to 2 small spines and often 1 more prominent at outer angle.

COLOR. — Unknown.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Tanimbar Islands, Indonesia; 884-891 m.

ETYMOLOGY. — Dedicated to Alain CROSNIER, marine biologist of ORSTOM, who made the collection available for study.

AFFINITIES. — *Icelopagurus crosnieri* most closely resembles *Catapagurus oculocrassus* sp. nov. in overall morphology, but is immediately distinguished from that species by the major differences in the telsons of the two species. As noted in the remarks for the genus, *I. crosnieri* also shares several general characters with *Pagurodes inarmatus*, but differs significantly from the latter species in the spination of the chelipeds, as well as in the numerous characters cited above.

Genus ***TARRASOPAGURUS*** nov.

DIAGNOSIS. — Eleven pairs of intermediate gills. Rostrum obtusely triangular or broadly rounded, with 1 or more marginal spinules. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Maxillule (Fig. 16a) with external lobe of endopod moderately well developed, not recurved. Crista dentata well developed, 1 accessory tooth. Chelipeds markedly unequal, right considerably longer and stronger. Fourth pereopods semichelate; with single row of scales in propodal rasp.

Coxae of fifth pereopods in males (Fig. 16b) generally symmetrical, left with short sexual tube directed anteriorly or posteriorly, right sometimes also with short tube developed, sometimes with vas deferens only slightly protruded; 3 unpaired, unequally biramous pleopods. Females with paired gonopores; paired first pleopods modified as gonopods, unpaired left pleopods on somites 2 to 5.

Telson with transverse suture; posterior lobes subequal, terminal margins oblique.

ETYMOLOGY. — From the Greek *tarraso* meaning confused, and *pagouros* meaning crab, and referring to the characters of this genus shared with several other pagurid genera.

TYPE SPECIES. — *Tarrasopagurus rostrodenticulatus* sp. nov. Gender masculine.

REMARKS. — As its etymology indicates, *Tarrasopagurus* shares a number of characters with several other pagurid genera. In having intermediate type gills (Fig. 16c), markedly unequal chelipeds and relatively short ambulatory legs, it agrees with *Cestopagurus* as redefined by DE SAINT LAURENT (1968c). It is distinguished from species of *Cestopagurus* by the presence in the latter genus of an elongate right sexual tube, which is directed from right to left across the ventral part of the body and a very short left sexual tube that may or may not be developed. Intermediate gills are also a character that *Tarrasopagurus* shares with *Pseudopagurodes*, but females of that genus lack the paired first pleopods found in *Tarrasopagurus* species; males of *Pseudopagurus* are not presently known. Short paired male sexual tubes is a character that *Tarrasopagurus* shares with *Parapagurodes* McLaughlin & Haig, 1973; but again, females of this latter genus lack paired first pleopods modified as gonopods. A character that *Tarrasopagurus* shares with *Michelopagurus* nov. gen., in addition to short or very short male sexual tubes, is paired female first pleopods. However, the gills in *Michelopagurus* are clearly trichobranchiate in structure, whereas those of *Tarrasopagurus* are intermediate. The chelipeds in this genus are grossly unequal; the ambulatory legs are relatively short, overreaching the outstretched right cheliped little if at all. In contrast, the chelipeds of *Michelopagurus* species are elongate and subequal; the ambulatory legs are long and slender, and considerably overreach the outstretched chelipeds.

Tarrasopagurus rostrodenticulatus sp. nov.

Figs 16a-l

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 22.10.1991: 1 ♂ (2.7 mm) (MNHN-Pg 5280). — Stn DW 13, 05°26'S, 132°38'E, 417-425 m, 24.10.1991: 4 ♀ (0.9-

1.2 mm) (MNHN-Pg 5281). — Stn DW 18, 05°17'49"S, 133°00'51"E, 205-212 m, 24.10.1991: 4 ♂, 4 ♀ (1.6-1.8 mm) (MNHN-Pg 5282); 1 ♂, 2 ♀ (1.0-1.1 mm) (POLIPI); 2 ♂, 4 ♀, 1 ov. ♀ (1.3-1.7 mm).(USNM 276011). — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♂ (1.6 mm) (MNHN-Pg 5283). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♀ (1.9 mm) (USNM 276010).

TYPES. — The male (2.7 mm) (MNHN-Pg 5280) from KARUBAR station CP 05 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 16d) longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterolateral margins terraced; posterior margin truncate; dorsal surface with few tufts of setae. Rostrum broadly rounded or weakly subtriangular, usually not reaching level of lateral projections, armed with 1 to several small marginal spines or spinules. Lateral projections broadly rounded or obtusely triangular, usually with small terminal marginal or submarginal spine.

Ocular peduncles short and stout; corneae occupying approximately 0.15 to 0.25 length of peduncle, not dilated. Ocular acicles small, triangular, with submarginal spine; separated basally by 0.75 to entire basal width of one acicle.

Antennular peduncles, when fully extended, overreaching ocular peduncles (including corneae) by slightly less to slightly more than entire length of ultimate peduncular segment. Ultimate segment with 1 long seta on dorsal surface in distal third, and with additional row of sparse short setae. Penultimate segment with few short setae dorsally. Basal segment with strong spine on dorsolateral margin.

Antennal peduncle overreaching ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in bi- or trifid spine and usually with 1 or 2 smaller accessory spines on both lateral and mesial margins; dorsomesial distal angle with small spine. First segment with spine at laterodistal margin and 1 or 2 spines on ventrolateral margin. Antennal acicle long, reaching to or beyond distal margin of cornea; terminating in acute spine and tufts of moderately long setae. Antennal flagellum long but usually not overreaching tips of dactyls of outstretched ambulatory legs; with 1-3 moderately long and 1 or 2 very short setae every, or every other, article. Sternite of third maxillipeds with slight median concavity, unarmed.

Chelipeds markedly unequal; right longer and stronger. Right cheliped (Figs 16e-f) with dactyl 0.65 to 0.80 length of palm; armature variable: dorsomesial margin rounded and unarmed, delimited but unarmed, or delimited by row of small spines; dorsal surface convex or with distinct median elevation, unarmed or with scattered small spinules or tubercles; ventral surface with few tufts of setae; cutting edge calcareous, usually with 2 more prominent teeth. Palm somewhat dorsoventrally swollen; slightly to considerably shorter than carpus; dorsomesial and dorsolateral margins frequently not well defined, often armed with 1 or 2 irregular rows of low tubercles, strongest mesially, less commonly with irregular, almost double row of distinct spines on dorsomesial margin and row of blunt spines or spinulose tubercles on dorsolateral margin extending nearly to tip of fixed finger; dorsal surface with few very small tubercles, with scattered small tubercles and spinules, or with numerous small spines; mesial, lateral and ventral surfaces with few scattered setae; fixed finger sometimes with few spinules or low tubercles on dorsal surface; cutting edge calcareous, also usually with 2 or 3 larger teeth. Carpus somewhat longer than merus; with double or triple row of small spines on and/or adjacent to dorsomesial margin; longitudinal row of small spines or spinules on dorsal surface laterad of midline, dorsolateral margin not delimited, but dorsal surface laterally and extending onto lateral faces usually armed with scattered spinules or tubercles; ventrolateral margin usually with few spinules; mesial surface generally glabrous; ventral surface with few long setae. Merus with few very short setae on dorsal surface; ventrolateral margin with row of 4 or 5 slender spines, ventromesial margin with 1 or 2 spines distally. Ischium unarmed.

Left cheliped (Figs 16g-h) reaching to or slightly beyond base of dactyl of right; with or without hiatus between dactyl and fixed finger. Dactyl 0.25 to 0.33 longer than palm; dorsomesial margin not delimited, dorsal, mesial and ventral surfaces with few scattered setae. Palm 0.50 to 0.75 length of carpus; dorsal surface elevated in midline and armed with row of spines usually extending at least to proximal half of fixed finger; dorsomesial surface weakly to strongly sloping, with longitudinal row of spines not clearly marginal; dorsolateral surface very strongly sloping, usually with 1 longitudinal row of small spinules and scattered spinules or tubercles; ventral

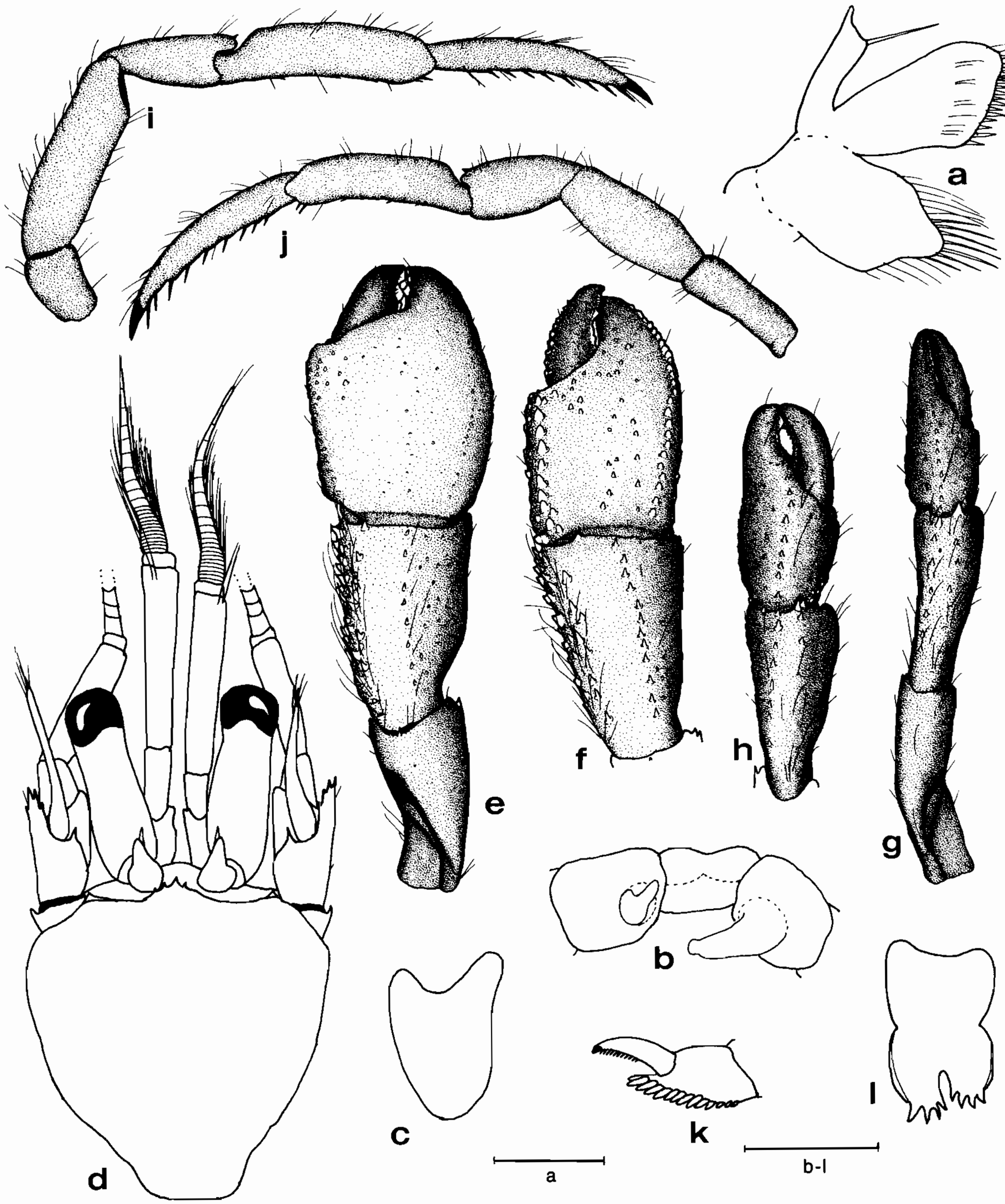

FIG. 16. — *Tarrasopagurus rostrodenticulatus* sp. nov., a, c, f, h, paratype ♂ (1.5 mm) from KARUBAR Stn DW 18; d, holotype ♂ (2.7 mm) from Stn CP 05; b, e, g, i-l, paratype ♂ (1.5 mm) paratype, from Stn DW 18: **a**, right maxillule; **b**, coxae and sternite of fifth pereopods; **c**, intermediate arthrobranchiate gill lamella; **d**, shield and cephalic appendages; **e**, right cheliped (dorsal view); **f**, carpus and chela of right cheliped (dorsal view); **g**, left cheliped (dorsal view); **h**, carpus and chela of left cheliped (dorsal view); **i**, second right pereopod (lateral view); **j**, third left pereopod (lateral view); **k**, propodus and dactyl of left fourth pereopod (lateral view); **l**, telson. Scales equal 0.25 mm (a, c), 0.5 mm (b, k, l), and 1.0 mm (d-j).

surface with scattered setae. Carpus approximately as long as merus; dorsomesial and dorsolateral margins each with row of spines; ventrolateral margin with 2 or 3 spines distally. Merus with row of acute spines on ventrolateral margin, ventromesial margin with 3 or 4 widely-spaced small spines or spinules. Ischium unarmed.

Ambulatory legs (Figs 16i-j) similar from left to right. Dactyls equal to or only very slightly longer than propodi; very slightly curved, not twisted; dorsal surfaces each with row of sparse tufts of setae; ventral margins each with row of 6 to 9 strong corneous spines. Propodi with tufts of short setae on dorsal surfaces; ventrodistal angles each with corneous spine, ventral surfaces each with row of widely-spaced corneous spinules. Carpi each with tiny spinule at dorsodistal angle, dorsal surfaces with few tufts of setae. Meri and ischia unarmed. Sternite of 3rd pereopods with large semicircular anterior lobe, unarmed but with marginal row of setae. Fourth pereopod with moderately elongate dactyl (Fig. 16k). Fifth pereopods chelate.

Coxae of fifth pereopods in males (Fig. 16b) with short left and frequently also short right sexual tube.

Telson (Fig. 16l) with prominent transverse suture; posterior lobes with chitinous lateral margins, median cleft prominent; terminal margins oblique, with 4 or 5 spines, largest usually at outer angle.

COLOR (in preservative). — Ocular peduncles with orange tint, darker basally. Ambulatory legs with distal halves of dactyls and propodi white, proximal halves orange; carpi each with longitudinal orange stripe dorsally and laterally; meri each with faint orange band on lateral face distally.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Kai Islands, Indonesia; 205-425 m.

ETYMOLOGY. — The specific epithet reflects the unusual denticulate rostral margin of this species.

AFFINITIES. — At first glance, the small size and general shape and armature of the chelipeds and ambulatory legs of *Tarrasopagurus rostrodenticulatus* might suggest a relationship with species of *Pagurixus* Melin, 1939. However, where males of *Pagurixus* species have the right gonopore masked by a mesially directed tuft of stiff setae, males of *Tarrasopagurus* have developed sexual tubes, albeit quite short; females possess paired first pleopods modified as gonopods. Females of *Pagurixus* have no special sexual modifications, although not uncommonly only one gonopore develops. The denticulate rostral margin of *T. rostrodenticulatus* immediately sets it apart from all other known species.

REMARKS. — Two very small specimens (0.8, 1.0 mm) (POLIPI) from Stn DW 18, appeared to be juvenile males of this species, but neither had either sexual tube developed, nor could any denticulations be seen on the rounded rostra. Neither are considered paratypes. Within the size range of 1.0 to 1.5 mm (shield length), denticulations on the rostral margin are very tiny and difficult to observe; however, with increased animal size these denticulations become quite obvious.

Genus ***CATAPAGURUS*** A. Milne Edwards, 1880

Catapagurus A. Milne Edwards, 1880: 46. — SMITH, 1882: 14. — HENDERSON, 1888: 75. — A. MILNE EDWARDS & BOUVIER, 1893: 125. — ALCOCK, 1905b: 114. — FOREST & DE SAINT LAURENT, 1968: 151. — DE SAINT LAURENT, 1970a: 1456. — MIYAKE, 1978: 141.
Hemipagurus Smith, 1881: 422.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with rostrum weakly developed. Ocular acicles simple, slender, elongate. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod rudimentary. Ischium of third maxilliped with crista dentata more or less reduced, 1 accessory tooth. Sternite of third maxillipeds unarmed.

Chelipeds long and slender; right stronger. Ambulatory legs very long and slender; dactyls and propodi similar. Fourth pereopods semichelate; propodal rasp consisting of 1 row of scales; distinctive preungual process present.

Males with right sexual tube orientated toward exterior then recurved over anterior part of abdomen; 2 (pleopods 3 and 4) or 3 (pleopods 3-5) unpaired, usually uniramous pleopods. Females with paired gonopores; without paired first pleopods modified as gonopods, with pleopods 2 to 4 biramous, pleopod 5 similarly present or absent.

Telson with transverse suture; posterior lobes subtriangular; terminal margins oblique.

REMARKS. — In her revision of *Catapaguroides* and *Cestopagurus*, DE SAINT LAURENT (1968a) transferred three species from *Catapagurus* to other existing genera, including *C. vallatus* Melin, 1939, to *Nematopagurus*. However, she did not consider *Catapagurus australis* Henderson, 1888. Despite HENDERSON's correct diagnosis of the generic characters of *Catapagurus*, a recent rexamination of the syntypes of *C. australis* (NHM 1888.33) have shown that the structure of the sexual tubes and the weak development of the ocular acicles provide convincing evidence that this species too should have been assigned to *Nematopagurus*.

Even with the transfer of the three species aforementioned from *Catapagurus*, FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a) indicated that the genus still included about ten Indo-Pacific species, of which several remained to be described. It is unfortunate that the revision promised by DE SAINT LAURENT (1970a) was never completed. Not only there are serious inconsistencies in the diagnoses that have been presented by several authors cited in the above synonymy, but major problems in species interpretations prevail as well, which are beyond the scope of the KARUBAR study. HAIG and BALL (1988) reported the occurrence of a species they believed to represent *Catapagurus ensifer* Henderson, 1893, and a second "probably ... undescribed" species from the Maluku area, noting that the lack of an up-to-date revision of the genus made identification difficult. The new species described herein are assigned to *Catapagurus* as defined by FOREST and DE SAINT LAURENT (1968) and DE SAINT LAURENT (1970a), until such time as a thorough review of the genus can be completed.

Key to the Indonesian species of *Catapagurus*

1. Dactyls of ambulatory legs spatulate or blade-shaped **2**
— Dactyls of ambulatory legs not spatulate or blade-shaped **3**

2. Telson with roundly triangular posterior lobes separated by very broad median cleft .... ***C. ensifer****
— Telson with acutely triangular posterior lobes separated by moderately narrow median cleft .... ***Catapagurus*** sp. of Haig & Ball*

3. Telson with broad median cleft, terminal margins of posterior lobes oblique and armed with 1 to 4 small spines; ocular peduncles very short and stout, ocular acicles usually reaching beyond midpoint of peduncle .... ***C. oculocrassus*** sp. nov.
— Telson with narrow median cleft, terminal margins of posterior lobes perpendicular or nearly so, unarmed or with only few very short bristles; ocular peduncles not extremely short, ocular acicles not reaching beyond midpoint of peduncle **4**

4. Mesial faces of dactyls of ambulatory legs each with ventral row of corneous spines .... ***C. tanimbarensis*** sp. nov.
— Mesial faces of dactyls of ambulatory legs without ventral row of corneous spines .... ***C. holthuisi*** sp. nov.

Catapagurus oculocrassus sp. nov.

Figs 17a-k, 39a-b

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 20, 05°15'S, 132°59'E, 769-809 m, 25.10.1991: 2 ♂, 3 ♀, 2 ov. ♀ (2.7-3.7 mm) (MNHN-Pg 5284). — Stn CP 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 2 ♂, 6 ♀, 4 ov. ♀ (1.5-2.7 mm) (MNHN-Pg 5285). — Stn CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 ♂ (3.1 mm) (MNHN-Pg 5286). — Stn CP 39, 07°47'S, 132°26'E, 477-466 m, 28.10.1991: 1 ov. ♀ (2.4 mm) (POLIPI).

Tanimbar Islands: stn CC 56, 08°16'S, 131°59'E, 552-549 m, 31.10.1991: 1 ♂, 1 ♀ (2.1, 2.3 mm) (SNHM 4810). — Stn CC 57, 08°19'S, 131°53'E, 603-620 m, 31.10.1991: 2 ♂, 2 ov. ♀ (1.9-2.2 mm) (MNHN-Pg 5287); 1 ♂ (1.8 mm) (POLIPI); 2 ♂, 2 ♀, 1 ov. ♀ (1.7-2.3 mm) (USNM 276016).

TYPES. — The male (3.1 mm) (MNHN-Pg 5286) from KARUBAR Station CP 38 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 17a-b) usually broader than long, occasionally longer than broad in some females; anterior margin between rostrum and lateral projections slightly concave; anterolateral margins rounded; posterior margin roundly truncate; surface with numerous tufts of setae. Rostrum broadly rounded, produced to or slightly beyond level of lateral projections. Lateral projections very obtusely triangular, subacute or acute, with terminal spine or spinule.

Ocular peduncles very short and stout, dorsal surfaces each with 2 or 3 short transverse rows of setae; corneae usually dilated (not noticeably so in illustrated paratype); equal to slightly less than half length of peduncle. Ocular acicles triangular, moderately to very slender, reaching to or slightly beyond bases of corneae; terminating in acute spine, mesial margins each with row of moderately long setae; separated basally by 1.00 to 1.35 basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by half to entire length of penultimate segment. Ultimate segment with short row of long setae or bristles on dorsal surface mesially and longer row laterally, usually several additional setae at dorsodistal margin. Penultimate and basal segments unarmed, but with few scattered setae.

Antennal peduncles overreach distal margin of cornea by 0.75 to 1.25 length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine or spinule at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine, lateral margin usually with 1 or 2 spinules distally; dorsomesial distal angle with smaller spine, mesial margin with few setae. First segment with small spine on laterodistal margin; ventral margin also with 1 small spine distolaterally. Antennal acicle long, reaching to distal half or third of fifth segment, with small terminal spinule; mesial margin with numerous long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 to 4 articles, at least in proximal third.

Right cheliped (Figs 17c, 39a) long, moderately slender, somewhat dorsoventrally compressed. Dactyl 0.50 to 0.80 length of palm; dorsal surface minutely granular, at least in mesial half and with few scattered setae; rounded dorsomesial margin and mesial face granular or spinulose; cutting edge with 1 or 2 broad calcareous teeth, terminating in small corneous claw. Palm equal to or slightly longer than carpus; dorsomesial margin not delimited, dorsolateral margin weakly indicated by slightly elevated granular or spinulose ridge sometimes extending nearly to tip of fixed finger; dorsal surface smooth, granular or minutely spinulose; mesial and lateral surfaces minutely spinulose or granular; fixed finger with scattered moderately long setae, cutting edge with 1 or 2 distinct teeth, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with scattered long setae. Carpus slightly shorter to slightly longer than merus; dorsomesial margin with irregular sometimes double or triple row of small to very small spines and spinules, dorsal surface spinulose or granular, dorsolateral margin spinulose but not distinctly delimited; lateral mesial and ventral surfaces spinulose or granular. Merus subtriangular; dorsal surface with few short transverse setal ridges at least in distal half, occasionally 1 or 2 small spines at distal margin; mesial, lateral and ventral surfaces granular or spinulose; ventromesial margin sometimes with larger spines in distal half; ventrolateral margin rounded, granular or spinulose. Ischium unarmed or with row of minute spinules on ventromesial margin.

Left cheliped (Figs 17d, 39b) slender, somewhat dorsoventrally compressed; dactyl and fixed finger 1.00 to 1.75 length of palm; in lateral view, straight or ventrally curved; terminating in corneous claws. Dactyl with dorsomesial margin and mesial half of dorsal surface spinulose in proximal half, numerous long setae distally. Palm and proximal half of fixed finger with minutely spinulose dorsal surfaces; rounded dorsomesial margin spinulose, dorsolateral margin with row of very small spines on faintly raised ridge; mesial and lateral faces spinulose; ventral surfaces smooth or microscopically spinulose, distal halves of dactyl and fixed finger with numerous tufts of long setae. Carpus slightly shorter or equal to length of merus; dorsomesial margin with irregular single or nearly double row of small spines; dorsolateral margin also with single or double row of smaller spines; all surfaces at least partially covered with very small spinules and sparse short to moderately long setae, particularly dorsally. Merus with few short occasionally spinulose transverse ridges or low protuberances and tufts of setae; lateral, mesial and ventral surfaces spinulose, slightly stronger spines on ventromesial and ventrolateral margins distally. Ischium unarmed or with microscopically spinulose ventromesial margin.

Ambulatory legs (Figs 17e-f) elongate, overreaching outstretched right cheliped. Dactyls not blade-shaped; in dorsal view, twisted; in lateral view, slightly curved ventrally in distal halves; exceeding length of propodi usually

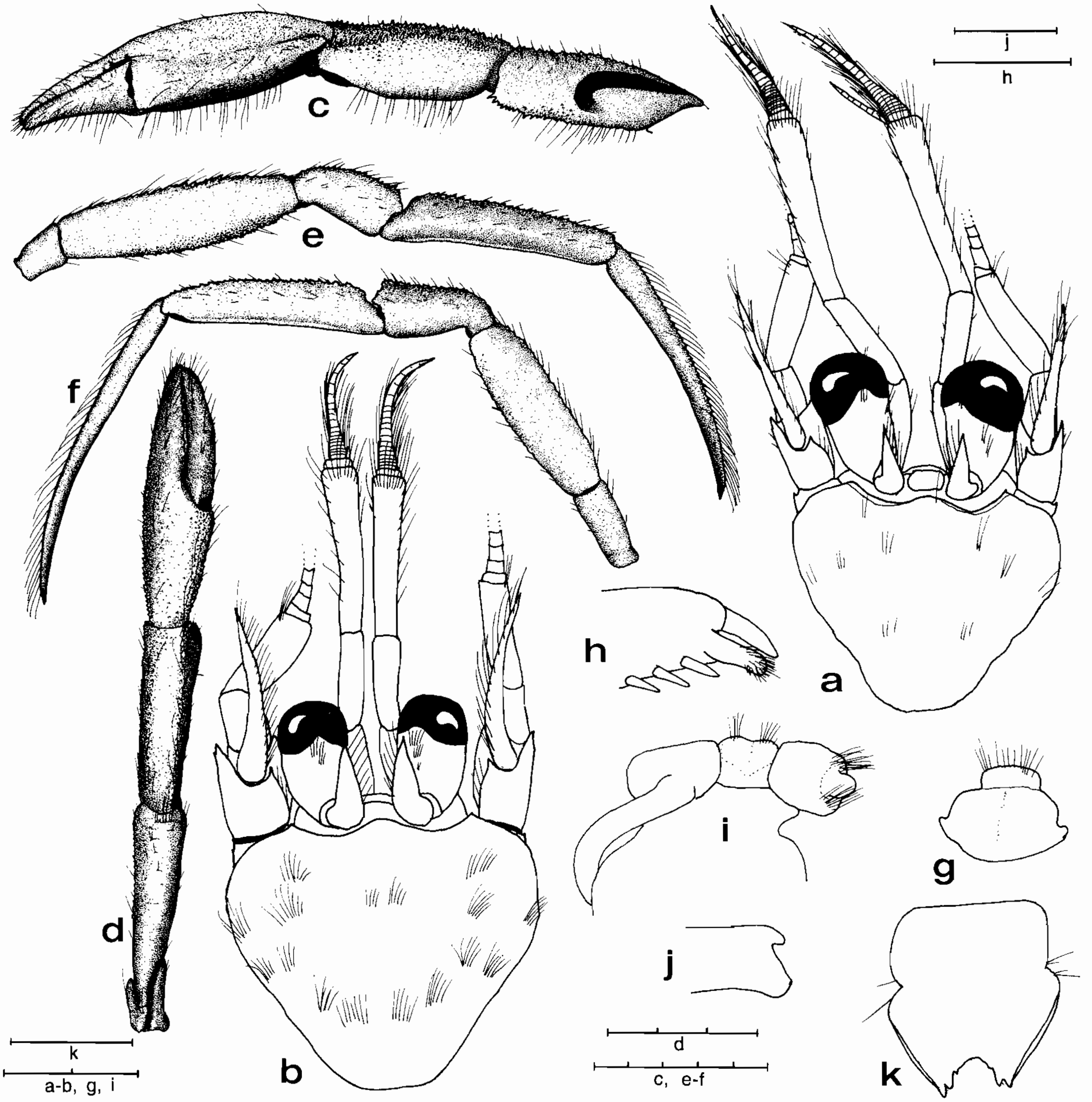

FIG. 17. — *Catapagurus oculocrassus* sp. nov., a, c, g-k, holotype ♂ (3.1 mm) from KARUBAR Stn CP 38; b, e-f, paratype ♂ (3.7 mm) from KARUBAR Stn CP 20; d, paratype ♀ (3.7 mm) from Stn CP 20: **a-b**, shield and cephalic appendages; **c**, right cheliped (mesial view); **d**, left cheliped (dorsal view); **e**, second right pereopod (lateral view); **f**, third left pereopod (lateral view); **g**, sternite of third pereopods; **h**, tip of dactyl and preungual process of left right fourth pereopod (lateral view); **i**, coxae and sternite of fifth pereopods; **j**, tip of right sexual tube; **k**, telson. Scales equal 0.25 mm (h), 0.5 mm (j), 1.0 mm (k), 2.0 mm (a-b, g, i), 3.0 mm (d), and 5.0 mm (c, e-f).

by more than 0.35 own length, third pair usually slightly longer than second; dorsal margins each with row of long rather stiff setae; mesial faces each with ventral row of long fine setae; lateral faces and ventral margins with few setae. Propodi 1.5 to nearly twice length of carpi; dorsal surfaces each with row of small spines interspersed with short often stiff setae; mesial faces and sometimes also lateral faces spinulose, at least in dorsal halves; ventral margins each usually with row of minute setae and 1 stiff bristle at distal angle. Carpi short, frequently less than half length of meri; dorsal surfaces each with sparse setae and numerous small spinules, largest distally; lateral faces, and mesial faces dorsally, also spinulose. Meri with short transverse rows of moderately long setae on dorsal surfaces, tending to be spinulose or spinose in distal third, usually 1 or 2 slightly stronger spines near distal margin; ventromesial and ventrolateral margins delimited only distally, usually unarmed, ventral surfaces spinulose, spinules strongest on second. Ischia with few tufts of setae dorsally and ventrally. Sternite of third pereopods (Fig. 17g) with roundly rectangular anterior lobe. Carpus of fourth pereopods unarmed or with small blunt spine at dorsodistal angle; preungual process of dactyl (Fig. 17h) approximately as long as claw. Fifth pereopods chelate.

Male with moderately long right sexual tube (Figs 17i-j) directed toward exterior and upward over dorsal surface of abdomen. Left coxa with slight protuberance of vas deferens. Pleopods of third and fourth somites very unequally biramous, fifth uniramous. Females also with uniramous fifth pleopod.

Uropods with protopod of right (only) produced posteriorly into small spine. Telson (Fig. 17k) with posterior lobes acutely triangular, terminating in corneous spine; oblique terminal margins each with 1 to 4 small spines; lateral margins each with narrow chitinous marginal plate.

COLOR (in preservative). — Some specimens in alcohol for four years retain an orange tint on chelipeds, particularly carpi and meri.

HABITAT. — Gastropod shells frequently covered by bryozoans.

DISTRIBUTION. — Known only from the Kai and Tanimbar Islands, Indonesia; 466-809 m.

ETYMOLOGY. — From the Latin *oculus* meaning eye, and *crassus* meaning stout, indicating the stout ocular peduncles characteristic of this species.

AFFINITIES. — At first glance, *C. oculocrassus* bears a more striking similarity to *Icelopagurus crosnieri* than to other species of *Catapagurus*. Both *C. oculocrassus* and *I. crosnieri* have noticeably setose shields, very short, stout ocular peduncles, long and moderately broad ocular acicles, elongate antennular peduncles, relatively slender subequal chelipeds, comparable tubular preungual process at the base of the claw of the dactyl of the fourth pereopod, and a right male sexual tube. Differences of cheliped armature are species distinctive, but it is the subtriangular, relatively weakly armed posterior telsonal lobes of *C. oculocrassus* that provides the most convincing generic distinction.

The species of *Catapagurus* described herein are morphologically very closely allied, in that none have the blade-like ambulatory dactyls seen in *Catapagurus ensifer* and the figured, but unnamed species reported by HAIG and BALL (1988) from the Banda and Arafura regions of Indonesia. *Catapagurus oculocrassus* is most reliably distinguished from the following new species by the posterior lobes of the telson which have oblique terminal margins armed with one to four small spines. In all of the other known species, including *C. ensifer* and HAIG and BALL's species, the perpendicular terminal margins are unarmed or provided only with very short stiff bristles; the posterior lobes are separated by a very broad and deep median cleft. Until further study of *Catapagurus* is completed, its actual generic limits remain uncertain.

Catapagurus tanimbarensis sp. nov.

Figs 18a-m, 39c-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ov. ♀ (2.1 mm) (MNHN-Pg 5288); 1 ♂, 1 ov. ♀ (1.9-2.1 mm) (MNHN-Pg 5289).

TYPES. — The ovigerous female (2.1 mm) (MNHN-Pg 5288) is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 18a-b) slightly longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; surface with several tufts of setae. Rostrum broadly rounded, produced to or slightly beyond level of lateral projections. Lateral projections obtusely triangular, with terminal spine.

Ocular peduncles moderately short and stout, approximately 0.75 length of shield, dorsal surfaces with 1 or 2 tufts of setae; corneae strongly dilated. Ocular acicles narrowly triangular, slender, reaching to or slightly beyond mid-length of peduncle; terminating acutely, mesial margins with few moderately short setae; separated basally by nearly entire basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by entire length of ultimate segment. Ultimate segment with short oblique row of long setae at dorsodistal margin, 2 rows of widely-spaced short setae on dorsal surface. Penultimate segment with few setae. Basal segment with spine on produced ventromesial distal angle.

Antennal peduncles overreach distal margin of cornea by half length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine or spinule at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine, lateral margin usually with 1 accessory spinule distally; dorsomesial distal angle with relatively long spine, mesial margin with few setae. First segment with small spine on laterodistal margin, ventral margin also with 1 small spine distolaterally. Antennal acicle moderately long, reaching to proximal third of fifth segment, but not overreaching distal margin of cornea; with small terminal spinule, mesial margin with few long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 or 2 articles.

Right cheliped (Fig. 39c) long, moderately slender, somewhat dorsoventrally compressed. Dactyl approximately equal to length of palm; dorsal surface spinulose, at least in proximal half and with scattered setae; dorsomesial margin with row of spinules, mesial face weakly spinulose; cutting edge with 2 widely-spaced calcareous teeth interspersed with smaller calcareous denticles; terminating in small corneous claw and slightly overlapped by fixed finger. Palm equaling length of carpus; dorsomesial margin weakly delimited by multiple rows of very small spinules, dorsolateral margin with slightly elevated spinulose ridge extending nearly half length of fixed finger; dorsal surface covered by minute spinules except for smooth distal third of fixed finger, mesial and lateral surfaces minutely spinulose or granular; fixed finger with moderately long setae distally; cutting edge with 3 widely-spaced large and few smaller calcareous teeth, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with scattered very short setae. Carpus approximately equal to merus in length; dorsomesial margin with row of small spines becoming double or triple row distally, dorsodistal margin with few small spines, dorsal surface minutely spinulose, dorsolateral margin with double row of spinules; lateral, mesial and ventral surfaces spinulose. Merus subtriangular; dorsodistal margin with 2 or 3 small spines, dorsal surface with few short transverse spinose and setose ridges at least in distal half; mesial, lateral and ventral surfaces microscopically spinulose; ventrolateral margin with 1 spine at distal angle and minute spinules or tubercles proximally; ventromesial margin rounded, granular or spinulose. Ischium with small spine at ventrolateral distal angle.

Left cheliped (Figs 18c, 39d) slender, reaching to base of dactyl of right; somewhat dorsoventrally compressed; dactyl and fixed finger 1.25 to nearly twice length of palm; in lateral view, straight or slightly curved ventrally; terminating in corneous claws. Dactyl with dorsomesial margin faintly serrate in proximal 0.25 to 0.50, several moderately long setae marginally and on dorsal surface. Palm and proximal 0.50 to 0.75 of fixed finger with minutely spinulose dorsal surfaces; rounded dorsomesial margin spinulose, dorsolateral margin faintly marked by row of very small spines forming weak ridge proximally; mesial and lateral faces spinulose; ventral surfaces smooth or microscopically spinulose, distal halves of dactyl and fixed finger with few long setae. Carpus equal to or slightly longer than merus; dorsomesial and dorsolateral margins each with row of small spines; all surfaces with very small spinules and few short to moderately long setae. Merus with short, occasionally spinulose, transverse ridges and stiff setae; lateral and mesial faces minutely spinulose; ventral surface with scattered very small spines or tubercles, ventromesial and ventrolateral margins spinulose, each with 1 stronger spine at distal angle. Ischium unarmed.

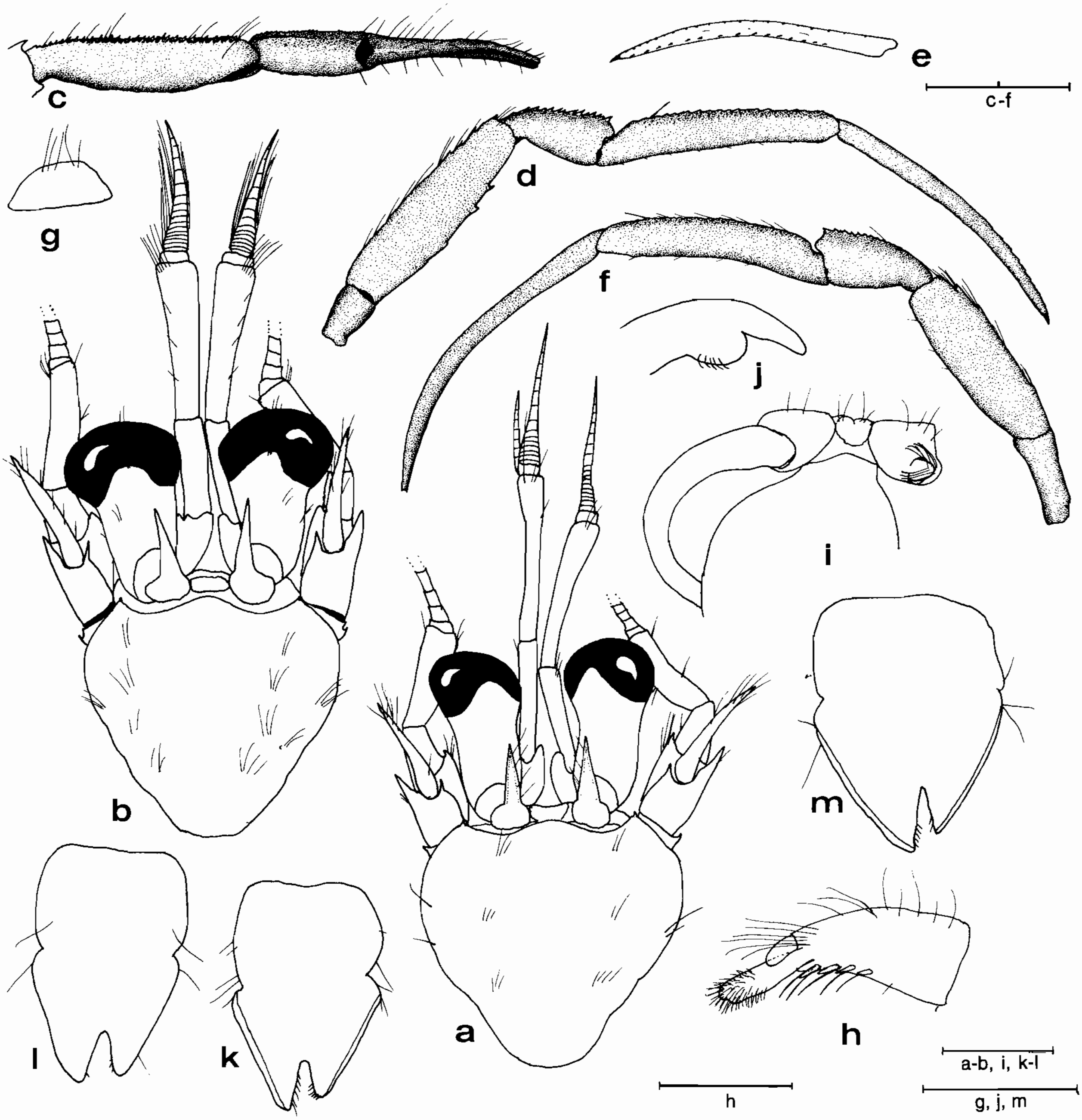

FIG. 18. — *Catapagurus tanimbarensis* sp. nov., a, d-f, k, holotype ov. ♀ (2.1 mm) from KARUBAR Stn DW 49; b-c, g-j, l, paratype ♂ (2.0 mm) from Stn DW 49; m, paratype ♀ (1.9 mm) from Stn DW 49: **a-b** shield and cephalic appendages; **c**, carpus and chela of left cheliped (mesial view); **d** right second pereopod (lateral view); **e**, dactyl of right second pereopod (mesial view); **f**, third left pereopod (lateral view); **g**, anterior lobe of sternite of third pereopods; **h**, tip of dactyl and preungual process of left right fourth pereopod (lateral view); **i**, coxae and sternite of fifth pereopods with sexual tubes; **j**, tip of right sexual tube; **k-m**, telson. Scales equal 0.25 mm (h), 0.5 mm (j-m), 1.0 mm (a-b, g, i), and 2.0 mm (c-f).

Ambulatory legs (Figs 18d-f) elongate, overreaching outstretched right cheliped. Dactyls not blade-shaped; in dorsal view, straight; in lateral view, slightly curved ventrally in distal half; equaling or exceeding length of propodi usually by approximately 0.25 own length, third pair usually slightly longer than second; dorsal margins each with row of setae, longer and more bristle-like distally (most broken off in holotype); mesial faces each with ventral row of 12 to 14 corneous spinules; lateral faces with few setae; ventral margins glabrous. Propodi 1.75 to twice length of carpi; dorsal surfaces each with row of low protuberances and short stiff setae or bristles; mesial and ventral faces unarmed; ventral margins occasionally with few short setae and 1 stiff bristle at distal angle. Carpi short, 0.50 to 0.75 length of meri; dorsal surfaces each with sparse setae and row of small spines, strongest on second pereopods; lateral, mesial and ventral surfaces glabrous. Meri with 4 short transverse ridges dorsally, each usually with 1 small spine and 2 or 3 short bristles; ventromesial and ventrolateral distal angles each with very small spine, ventromesial and ventrolateral margins of second pereopods minutely spinulose or granular, third unarmed. Ischia unarmed. Sternite of third pereopods with narrowly subrectangular anterior lobe (Fig. 18g). Preungual process of fourth pereopods (Fig. 18h) elongate and setose. Fifth pereopods chelate.

Male with moderately long right sexual tube (Figs 18i-j) directed toward exterior and upward over dorsal surface of abdomen. Left coxa with slight protuberance of vas deferens encircled by short stiff setae. Pleopods of third and fourth somites uniramous and rudimentary, fifth uniramous and moderately well developed. Females also with uniramous fifth pleopod.

Uropods with protopod of right (only) produced posteriorly and armed with small spinule. Telson (Figs 18k-m) with posterior lobes separated by moderately deep V-shaped median cleft, triangular; terminating acutely or subacutely and sometimes with small corneous spine at tip; oblique terminal margins each with 2 to several very short stiff bristles and rarely small protuberance or spinule; lateral margins each with narrow chitinous marginal plate.

COLOR. — Unknown.

HABITAT. — One specimen occupied a shell of *Natica* sp.

DISTRIBUTION. — Known from the Kai and Tanimbar Islands, Indonesia; 184-301 m.

ETYMOLOGY. — Named for the Tanimbar Islands of Indonesia.

AFFINITIES. — *Catapagurus tanimbarensis* and the following new species share many general morphological attributes, but can be distinguished by the shapes of their telsons, as is the case of other Indo-Pacific species of the genus (HAIG & BALL, 1988). Additionally, neither of the other new species described herein have the mesial faces of the ambulatory dactyls armed with a ventral row of spines. The shorter antennular peduncles, but longer antennal acicles distinguish *C. tanimbarensis* from *C. holthuisi* sp. nov., while the more strongly dilated corneae and more slender ocular acicles immediately separate *C. tanimbarensis* from *C. oculocrassus*.

REMARKS. — Particularly in the holotype, but also to a lesser extent in both paratypes, the setae on the dorsal margins of the dactyls of the ambulatory legs have been broken off. All that remains to indicate their original presence is a row of distinct sockets (Fig. 18e).

Two additional ovigerous females, both with shield lengths of 1.5 mm, are assigned to *C. tanimbarensis* based on the shape of the telson and armature of the ambulatory dactyls; but because of their conditions, neither are considered paratypes. The specimen from station DW 50 (POLIPI), collected at a depth of 184 to 186 m, is missing both third pereopods and chelipeds; the specimen from station DW 03 (MNHN), collected at a depth of 278-301 m, is missing both chelipeds. However, both are included in the geographical and depth distributions of the species.

Catapagurus holthuisi sp. nov.

Figs 19a-j, 39e-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♂ (1.5 mm) (MNHN-Pg 5290).

Tanimbar Islands: stn CP 77, 08°57'S, 131°27'E, 352-346 m, 03.11.1991: 1 ov. ♀ (2.8 mm) (MNHN-Pg 5291). — Stn DW 84, 09°23'S, 131°09'E, 275-246 m, 04.11.1991: 2 ov. ♀ (1.8-1.8 mm) (USNM 276017). — Stn 86, 09°26'S, 131°13'E, 225-223 m, 04.11.1991: 1 ov. ♀ (1.5 mm) (POLIPI).

TYPES. — The ovigerous female (2.8 mm) (MNHN-Pg 5291) from KARUBAR station CP 77 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Figs 19a-b) slightly to considerably broader than long; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; surface with numerous tufts of setae. Rostrum usually broadly subtriangular, occasionally rounded, not produced to level of lateral projections. Lateral projections triangular, with marginal spine.

Ocular peduncles moderately short and stout, approximately 0.65 length of shield, dorsal surfaces each with 1 or 2 tufts of setae; corneae strongly dilated. Ocular acicles narrowly triangular, slender, reaching beyond mid-length of peduncle; terminating acutely, sometimes with distinct simple or minutely bifid spine, mesial margins each with few moderately short setae; separated basally by more than basal width of one acicle.

Antennular peduncles overreach distal margin of corneae by 0.25 to 0.40 length of penultimate segment. Ultimate segment with 3 or 4 long setae at dorsodistal margin, row of long setae on dorsal surface. Penultimate segment with very few setae. Basal segment unarmed.

Antennal peduncles overreaching distal margin of cornea by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute spine; dorsomesial distal angle with well developed spine, mesial margin with few setae. First segment with small spine on laterodistal margin, ventral margin also with 1 small spine distolaterally. Antennal acicle moderately short, usually reaching little, if any, beyond proximal margin of fifth segment or distal margin of cornea; with small terminal spinule, mesial margin with few long setae. Antennal flagellum long, overreaching outstretched chelipeds; 1 or 2 very short setae every 1 to several articles.

Right cheliped long, moderately slender; chela (Fig. 39e) somewhat dorsoventrally compressed. Dactyl approximately equal to length of palm; dorsal surface minutely spinulose, at least in mesial half, and with scattered setae; dorsomesial margin with row of spinules and sparse long setae, mesial face weakly spinulose; cutting edge with 2 broad calcareous teeth; terminating in small corneous claw and slightly overlapped by fixed finger. Palm equaling length of carpus; dorsomesial margin rounded and armed with multiple rows of very small spinules or tubercles, dorsolateral margin usually with slightly elevated spinulose ridge extending nearly entire length of fixed finger; dorsal surface covered by minute spinules or granules except for smooth distal half of fixed finger; mesial and lateral surfaces minutely spinulose or granular; fixed finger with moderately long setae distally; cutting edge with 1 prominent calcareous tooth proximally and 2 widely-spaced broad smaller teeth and few calcareous denticles distally, terminating in small corneous claw; ventral surfaces smooth or microscopically granular and with sparse setae. Carpus slightly shorter than merus; dorsomesial margin with single or irregularly double row of small spines, extending onto mesiodistal margin dorsally, rounded or very weakly ridged dorsolateral margin armed with multiple rows of spinules or small tubercles; lateral, mesial and ventral surfaces spinulose. Merus subtriangular; dorsodistal margin with 2 or 3 small spines, dorsal surface with few short transverse spinose and setose ridges at least in distal half; mesial, lateral and ventral surfaces microscopically spinulose; ventrolateral margin with 1 spine at distal angle and minute spinules or tubercles proximally; ventromesial margin rounded, granular or spinulose. Ischium with spine at ventrolateral distal angle, ventrolateral and ventromesial margins sometimes spinulose.

Left cheliped (Figs 19c, 39f) slender, reaching well beyond base of dactyl of right; somewhat dorsoventrally compressed; dactyl and fixed finger 1.25 to twice length of palm; in lateral view, straight or very slightly curved ventrally; terminating in corneous claws. Dactyl with row of spinules on dorsomesial margin in proximal half and row of long setae along entire length of margin. Palm 0.65 to 0.75 length of carpus; dorsal surface of palm and fixed finger spinulose and with scattered long setae; rounded dorsomesial margin spinulose, dorsolateral margin with row of very small spines forming weak ridge extending almost entire length of fixed finger; mesial and lateral faces spinulose; ventral surfaces smooth or microscopically spinulose, dactyl and fixed finger with numerous long setae. Carpus equal to length of merus; dorsomesial and dorsolateral margins each with row of small spines;

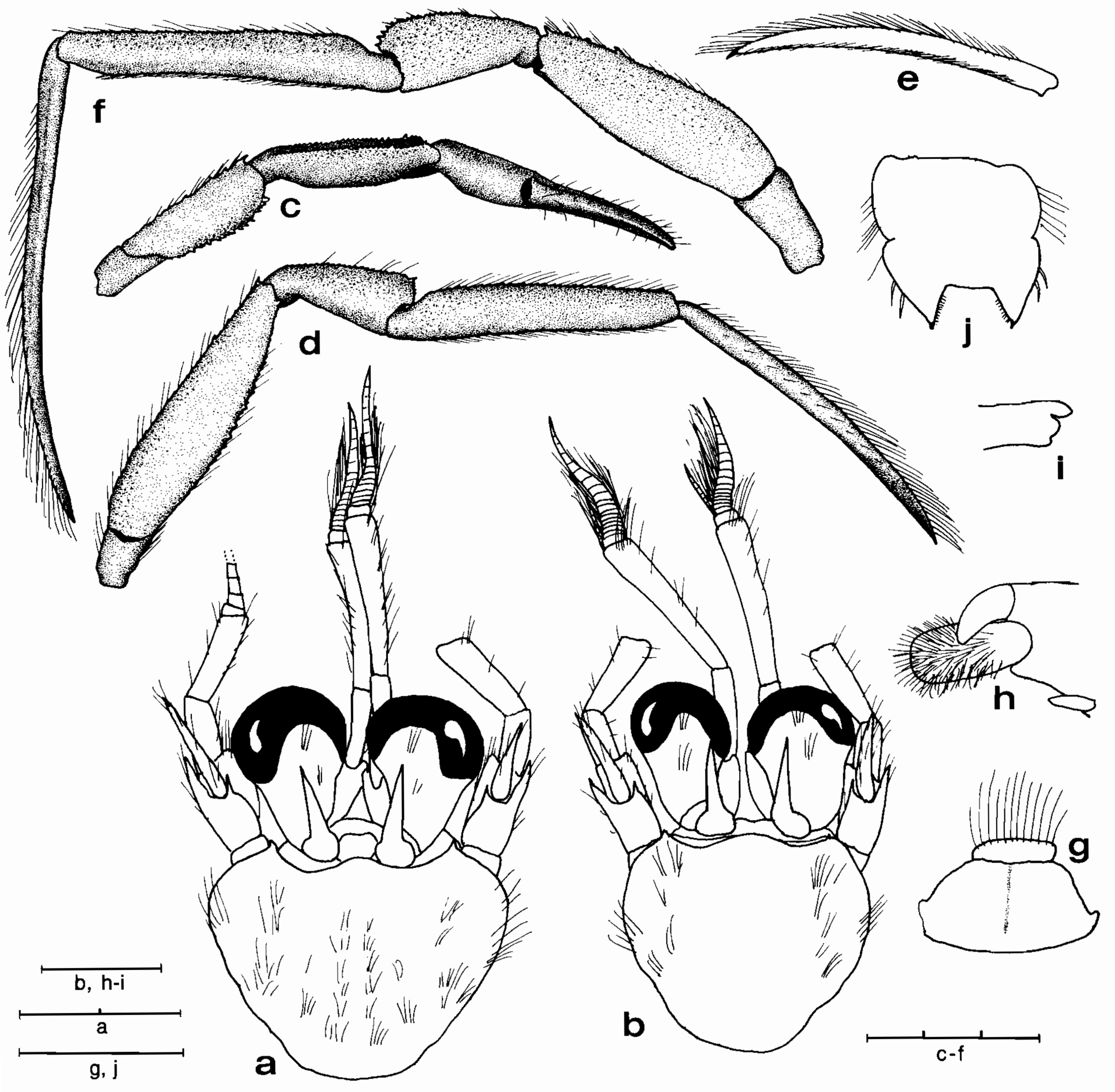

FIG. 19. — *Catapagurus holthuisi* sp. nov., a, d-g, j, holotype ov. ♀ (2.8 mm) from KARUBAR Stn CP 77; b-c, h-i, paratype ♂ (2.0 mm) from Stn DW 27: **a-b** shield and cephalic appendages; **c**, left cheliped (mesial view); **d** right second pereopod (lateral view); **e**, dactyl of right second pereopod (mesial view); **f**, third left pereopod (lateral view); **g**, sternite of third pereopods; **h**, tip of dactyl and preungual process of left right fourth pereopod (lateral view); **i**, tip of right sexual tube; **j**, telson. Scales equal 0.10 mm (h), 0.5 mm (i), 1.0 mm (b, g, j), 2.0 mm (a), and 3.0 mm (c-f).

distomesial and distolateral margins each with 2 or 3 small spines; all surfaces with small spinules or tubercles and few moderately long setae. Merus with spine at dorsodistal margin, 1 or 2 additional spines on dorsal surface in distal half and double row of stiff setae; lateral and mesial faces minutely spinulose at least in ventral halves; ventral surface with scattered small spines or tubercles, ventromesial and ventrolateral margins each with row of small spines, strongest at distal angle. Ischium with spine on ventrolateral margin distally.

Ambulatory legs (Figs 19d-f) elongate, overreaching outstretched right cheliped by more than half length of dactyls. Dactyls not blade-shaped; in dorsal view, straight or slightly twisted; in lateral view, slightly curved ventrally in distal half; equaling or exceeding length of propodi usually by 0.25 to 0.35 own length, third pair commonly slightly longer than second; dorsal margins each with row of long moderately stiff setae; mesial faces each with ventral row of equally long setae; lateral faces occasionally with row of widely-spaced short setae, third often with faint longitudinal sulcus dorsally; ventral margins glabrous. Propodi 1.65 to twice length of carpi; dorsal surfaces minutely spinulose, each also with row of long setae; mesial and lateral faces also minutely spinulose; ventral margins each with few spinules and row of very fine, moderately short setae. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with sparse stiff setae and irregular almost double row of small spines or spinules, strongest on second pereopods; lateral faces minutely spinulose; mesial and ventral surfaces smooth. Meri each with 1 spine at dorsodistal margin, row of low sometimes spinulose protuberances and stiff setae on dorsal surface, first 3 or 4 often also with small spine; ventromesial and ventrolateral margins of second pereopods each with row of small spines, strongest ventrolaterally; third with spine at ventrolateral distal angle, ventrolateral margins usually minutely tuberculate or spinulose. Ischia unarmed. Sternite of third pereopods (Fig. 19g) with narrowly subrectangular anterior lobe and broad posterior lobe subdivided by weak longitudinal furrow. Preungual process of fourth pereopods (Fig. 19h) elongate and setose. Fifth pereopods semichelate.

Males with long right sexual tube directed toward exterior and upward over dorsal surface of abdomen from left to right; with partially protruded tip (Fig. 19i); left coxa with small almost transparent sexual tube partially obscured by circle of short setae; moderately short uniramous left pleopods on abdominal somites three to five. Females with well developed biramous second to fourth pleopods, fifth uniramous.

Uropods with protopods usually not noticeably produced, unarmed. Telson (Fig. 19j) with triangular posterior lobes separated by broad subrectangular or rectangular median cleft, terminating in strong corneous spine; generally perpendicular margins usually with row of very short bristles; lateral margins each with narrow chitinous marginal plate frequently armed with 1 or 2 moderately long stiff bristles.

COLOR. — Unknown.

HABITAT. — One specimen occupied shell of *Natica* sp.

DISTRIBUTION. — Known from the Kai and Tanimbar Islands, Indonesia; 223-352 m.

ETYMOLOGY. — This species is dedicated to Dr Lipke B. HOLTHUIS, Nationaal Natuurhistorisch Museum, Leiden, one of the world's foremost carcinologists and always a willing advisor.

AFFINITIES. — As previously indicated, *C. holthuisi* appears quite closely allied to *C. tanimbarensis* particularly in the shape and armature of the chelipeds. The two species are immediately distinguished by the armature of the ambulatory dactyls; fringed with long setae dorsally and ventromesially in *C. holthuisi*, but provided with a mesioventral row of corneous spines in *C. tanimbarensis*. In the absence of the ambulatory legs, or in instances where the setae have been broken off, the broad subrectangular median cleft and perpendicularly-sided terminal margins of the posterior telsonal lobes of *C. holthuisi* readily separate this species from both *C. tanimbarensis* and *C. oculocrassus* in which the median cleft is V-shaped and the terminal margins oblique.

Genus *NEMATOPAGURUS* A. Milne Edwards & Bouvier, 1892

Nematopagurus A. Milne Edwards & Bouvier, 1892: 209; 1899: 59; 1900: 200. — ALCOCK, 1905b: 108. — MIYAKE, 1978: 128.

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Shield with rostrum weakly and obtusely subtriangular, broadly rounded or obsolete. Ocular peduncles relatively stout; corneae often prominently dilated. Ocular acicles triangular or ovate, with strong submarginal spine. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod usually rudimentary, sometimes somewhat developed, not recurved. Ischium of third maxilliped with crista dentata well developed, 1 accessory tooth.

Chelipeds moderately long and slender; subequal, with right generally slightly longer and/or more robust. Ambulatory legs moderately long; dactyls and propodi usually similar. Fourth pereopods semichelate; propodal rasp with 1 row of scales; dactyls without prominent preungual process.

Males with moderate to long usually filamentous sexual tube emanating from coxa of right fifth pereopod and orientated from left to right across ventral body surface; coxa of left with papilla or short sexual tube; 3 unpaired unequally biramous pleopods. Females with paired gonopores, paired first pleopods modified as gonopods, 4 unpaired pleopods.

Telson with transverse suture; slightly asymmetrical posterior lobes divided by distinct median cleft; terminal margins rounded or somewhat oblique.

REMARKS. — As previously mentioned, personal examination of the type specimens of *Catapagurus australis* Henderson, 1888, has shown that this species correctly belongs in *Nematopagurus* and is herein formally transferred. The specimen upon which HENDERSON (1888) based his description was from "*Challenger*" station 188 in the Arufura Sea. He stated that the abdomen was missing from that particular specimen, but that the carapace measured 4.8 mm and the ocular peduncle 2.5 mm. The second specimen, from the reefs at Levuku, Fiji Islands, was reported to be a "very imperfect specimen". *Catapagurus australis* is represented by two syntypes (NHM 1888.33), a male with a shield length of 1.5 mm and carapace length of 2.8 mm, lacking an attached abdomen, although a somewhat damaged abdomen is present, and a second slightly larger male with attached abdomen, and shield and carapace lengths of 2.1 and 3.5 mm respectively. The ocular peduncles of neither specimen approach the 2.5 mm given by HENDERSON. The smaller specimen, from "*Challenger*" station 188 is better preserved, as HENDERSON noted, and is accompanied by detached right and left chelipeds and right third pereopod. The syntype from the Fiji Islands has only a right cheliped and both third pereopods, all detached and poorly calcified. Since both specimens agree well with HENDERSON's description, there is no need to designate a lectotype at this time.

With the inclusion of HENDERSON's taxon, 12 species are currently assigned to *Nematopagurus*, of which 11 are found in the Indo-Pacific region. Three additional new species are described herein. Two others species are represented in the KARUBAR collection, but their identities both are questionable. One is tentatively assigned to *Nematopagurus indicus* Alcock, 1905b; the other most closely resembles *N. gardineri* Alcock, 1905a, b, but its conspecificity with this taxon is doubtful. When the host of additional new species of this genus awaiting description (J. FOREST, personal communication; personal observations) have been fully studied, *Nematopagurus* will be one of the most speciose genera in the entire region. In the interim, specimen assignments to known taxa, particularly of those species exhibiting a median longitudinal row of spines on the dorsal surface of each chela, must be considered conditional, at best.

Key to the Maluku species of *Nematopagurus*

1. Chelae of chelipeds marked by transverse scutes .... ***N. scutelliformis*** sp. nov.
— Chelae of chelipeds not marked by transverse scutes **2**

2. Chelipeds with dorsal surfaces armed with spines modified by tear-drop shaped sensory structures .... ***N. spinulosensoris***
— Chelipeds without dorsal surfaces armed with spines modified by tear-drop shaped sensory structures **3**

3. Mesial and lateral faces of carpi of chelipeds each with short transverse rows of long stiff iridescent bristle-like setae **4**
— Mesial and lateral faces of carpi of chelipeds without short transverse rows of long stiff iridescent bristle-like setae **5**

4. Dactyls of chelipeds each with dorsomesial row of spines; dorsal surface of fixed finger of right chela spinulose .... ***N. australis****
— Dactyls of chelipeds each without dorsomesial row of spines; dorsal surface of fixed finger of right chela unarmed .... ***N. alcocki*** sp. nov.

5. Telson with subtriangular posterior lobes; terminal margins oblique **6**
— Telson with rounded posterior lobes; terminal margins convex and armed with marginal and submarginal spines .... *N.* cf. ***indicus***

6. Chelae with setae of dorsal surfaces curved or curled; dactyls of ambulatory legs with 5 or fewer corneous spines on ventral margins .... *N.* ***ostlingochirus*** sp. nov.
— Chelae with setae of dorsal surfaces long and straight; dactyls of ambulatory legs with more than 5 corneous spines on ventral margins ....***Nematopagurus*** sp. (? = *N. gardineri* sensu HAIG & BALL, 1988)

Nematopagurus cf. ***indicus*** Alcock, 1905

Figs 20a, e-f, 40a-c

Nematopagurus indicus Alcock, 1905b: 109, pl. 12, fig. 4. — KEMP & SEWELL, 1912: 26. — BALSS, 1912: 110.
Not *Nematopagurus indicus* - MIYAKE, 1961: 12 (list); 1978: 30 (list). — MIYAKE, SAKAI & NISHIKAWA, 1962: 126 (list). = *Nematopagurus vallatus* (Melin, 1939).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-226 m, 29.10.1991: 1 ♂ (5.2 mm) (MNHN-Pg 5292).

DIAGNOSIS. — Shield (Fig. 20a) longer than broad, with tufts of setae anteriorly and laterally. Rostrum broadly rounded, not reaching level of lateral projections. Lateral projections with 1 or 2 marginal spines. Ocular peduncles moderately stout; approximately as long as antennal peduncles but reaching only to middle of ultimate segment of fully extended antennular peduncles and with sparse setae dorsally; corneae dilated. Ocular acicles moderately small, terminating subacutely and with strong submarginal spine. Antennal acicle slightly arcuate; with terminal spine and setose margins, reaching distal half of ultimate peduncular segment. Antennal flagellum long, nude.

Chelipeds similar in form and ornamentation; left slightly shorter; right (Fig. 40a) stouter; copiously setose, but not obscuring surface armature. Palm of right cheliped longer than broad and approximately equal to length of dactyl; dorsomesial margin with row of spines, dorsal surface with median row of spines not extending onto fixed finger; dorsolateral margin with row of spines extending only to proximal half of fixed finger; ventral surfaces of dactyl, palm and fixed finger with few long setae. Carpus about as long as merus and longer than palm; dorsomesial margin with row of spines, dorsal surface with irregular longitudinal row of somewhat smaller spines laterally; 1 spine on dorsodistal margin. Merus with 3 strong spines on ventrolateral margin; ventromesial margin with 1 distal and 1 proximal spine, ventral surface with scattered spines.

Left cheliped (Fig. 40b) with palm slightly shorter than dactyl; similar in armature and setation to that of right. Carpus with dorsomesial and dorsolateral row of spines; 1 spine at dorsodistal margin. Merus with ventromesial and ventrolateral row of spines; ventral surface with few spinulose protuberances.

Ambulatory legs overreaching chelipeds by 0.50 to 0.75 length of dactyls (second shorter). Dactyl of left third straight, almost peg-like (Fig. 40c), with row of 14 corneous spines on ventral margin; second and right third with slight ventral curvature, ventral margins with 8 to 12 corneous spines; all with abundant long setae randomly arranged. Propodi with short transverse rows of setae on dorsal surfaces. Carpi each with spine at dorsodistal angle; second right with 2 and second and third left each with 1 additional spine on dorsal surface posteriorly. Meri of second pereopods each with row of spines on ventral margin; ventral margins of third only with protuberances.

Right sexual tube (Fig. 20e) short, directed from right to left across ventral surface of body, but not reaching coxa of left fifth pereopod. No development of left sexual tube. Telson (Fig. 20f) with asymmetrical posterior lobes separated by prominent median cleft; terminal margins with several strong curved spines and few additional smaller spines on dorsal surface marginally, most numerous on left.

COLOR (in preservative). — Only faint reddish tint on the tips of spines of chelae remains after four years in alcohol.

HABITAT. — Unknown.

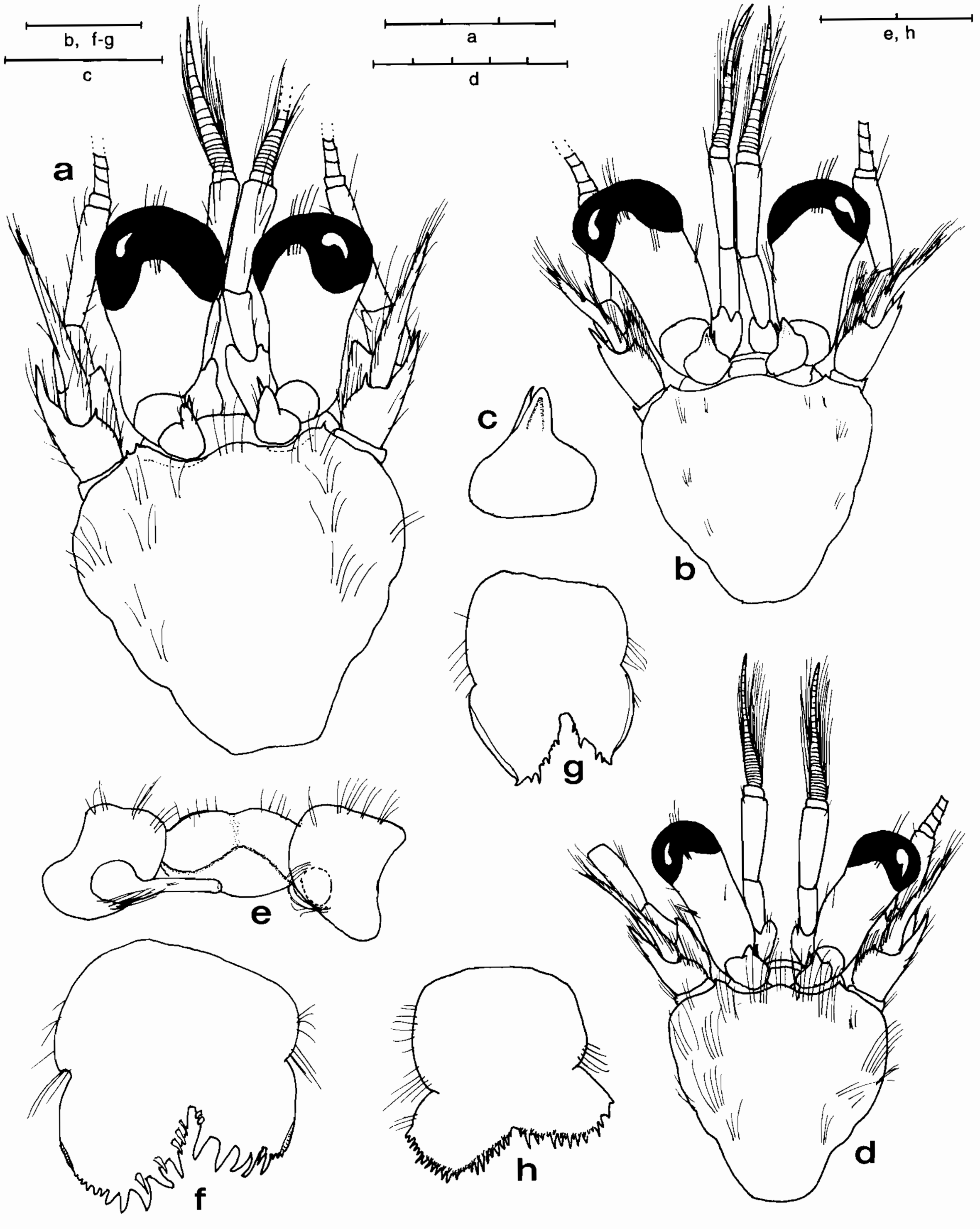

FIG. 20. — *Nematopagurus* cf. *indicus* Alcock, 1905, a, e-f, ♂ (5.2 mm) from KARUBAR Stn DW 49. — *Nematopagurus* sp., b-c, g, ♀ (1.7 mm) from Stn DW 18. — *Nematopagurus spinulosensoris* McLaughlin & Brock, 1974, d, h, ♀ (5.6 mm) from Stn CP 86: **a-b**, **d**, shield and cephalic appendages; **c**, right ocular acicle; **e**, coxae and sternite of fifth pereopods; **f-h**, telson. Scales equal 0.5 mm (c, g), 1.0 mm (b, f), 2.0 mm (e, h), 3.0 mm (a), and 5.0 mm (d).

DISTRIBUTION. — Tanimbar Islands, Indonesia; 210-226 m. ?Off Nicobar Islands and Travancore and Cochin coasts of India; approximately 185-433 m.

REMARKS. — Despite the short right sexual tube and lack of a left, the KARUBAR specimen certainly appears to belong to *Nematopagurus*. Whether it is correctly assigned to *N. indicus* is less certain. At present only *N. indicus* and *N. gardineri* Alcock, 1905a (repeated practically verbatim by ALCOCK, 1905b with the same illustration), have been described with a median longitudinal row of spines on the palms of the chelae; however, one new species reported herein is also similarly armed. Neither of the former species is described in much detail, although ALCOCK (1905a, b) stated that *N. gardineri* was the more pilose of the two. Except for its pilosity and armature of the ambulatory legs, the present KARUBAR specimen agrees more closely with *N. indicus* than with *N. gardineri*. The diagnosis given above is based on the KARUBAR specimen; differences with ALCOCK's description are discussed below.

The only reports of *N. indicus* are those of ALCOCK (1905b), BALSS (1912), and KEMP and SEWELL (1912). ALCOCK (1905b)'s description was rather general, dealing more with length ratios than specific diagnostic characters; his figure, if accurate, provides some additional information. BALSS (1912) gave no information on his specimen other than to note that its capture southwest of Great Nicobar in the Nicobar Islands represented an extension of the range of the species. KEMP and SEWELL (1912) remarked that their male and female specimens agreed with ALCOCK's (1905b) description and type specimens in all characters except the eyes, which were distinctly stouter and reached only to the proximal third of the ultimate peduncular segment of the antennule. In this regard, the KARUBAR specimen agrees more closely with those reported by KEMP and SEWELL (1912).

ALCOCK (1905b) contrasted *N. indicus* with *N. gardineri* by "regularly disposed tufts of setae on the hepatic and gastric regions" of the carapace in the former species and a "smooth carapace" in the latter. In his figure (ALCOCK, 1905b, pl. 12, fig. 4), the carapace setae are shown in two longitudinal rows on the shield. As noted in the diagnosis, tufts of setae in the single KARUBAR specimen occur laterally and anteriorly on the shield. The rostrum of *N. indicus* was described by ALCOCK as being "very broadly triangular"; it is broadly rounded in the present specimen. He specified that the ocular peduncles reached beyond the middle of the ultimate segment of the antennular peduncle. As previously indicated, the ocular peduncles of the KARUBAR specimen reach only to the middle; however, minor variations in this length ratio are to be expected. Similarly, the length of the dactyl of the right cheliped was reported to be shorter than the palm in the Indian specimens, whereas the ratio would be approximately 1:1 if the tip of the dactyl were not broken in the KARUBAR specimen.

ALCOCK (1905b) remarked that the dactyls of the ambulatory legs were stout, compressed and curved, with the third pair slightly longer than the second. In the KARUBAR specimen, the third pereopods also are longer than the second, but whether the peg-like development of the dactyl of the left third (Fig. 40c) is characteristic of the KARUBAR taxon or is attributable to injury cannot be determined from this single specimen. Only a spine at the dorsodistal margin of the carpus of each ambulatory leg was reported in the description, but his figure (ALCOCK, 1905b, pl. 12, fig. 4) shows a proximal spine on the left second. Two proximal spines are present on the second pereopods and one on the third in the KARUBAR specimen, as were illustrated, but not described, by ALCOCK (1905a, pl. 68, fig. 3; 1905b, pl. 12, fig. 2) for *N. gardineri*.

The right sexual tube was described for *N. indicus* as a stout tube ending in a very long, lax, curly filament, the left was short and blunt. In the KARUBAR specimen, the right is not particularly stout, but quite short, not reaching to the coxa of the left fifth pereopod. However, it is possible that the more filamentous terminal portion had been broken off. Variation in the development of the left sexual tube in species of *Nematopagurus* is not uncommon, thus the absence of a left tube in the KARUBAR specimen would not, of itself, exclude the specimen from *N. indicus*.

Nematopagurus sp.

Figs 20b-c, g, 40d-e

?*Nematopagurus gardineri* - HAIG & BALL, 1988: 185; ?not *Nematopagurus gardineri* Alcock, 1905a, b.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♀ (1.7 mm) (MNHN-Pg 5293).

DIAGNOSIS. — Shield (Fig. 20b) approximately as long as broad, smooth, but with few sparse tufts of setae. Rostrum broadly rounded, reaching level of lateral projections. Lateral projections each with marginal spinule. Ocular peduncles moderately stout; slightly longer than antennal peduncles but reaching only to distal 0.75 of ultimate segment of fully extended antennular peduncles, with tuft of stiff setae dorsally at base of dilated corneae. Ocular acicles moderately small, terminating subacutely and with strong laterally produced submarginal spine, giving bifid appearance (Fig. 20c). Antennal acicle somewhat arcuate, with terminal spine and stiff setae mesially, reaching distal half of ultimate peduncular segment; flagellum long, with 1 or 2 short setae every 2 to 4 articles.

Chelipeds similar in form, sculpture and length; right (Fig. 40d) stouter; with numerous long fine setae, particularly dorsally but not obscuring surface armature. Palm of right cheliped longer than broad and approximately equal to length of dactyl; dorsomesial margin with row of spines, dorsal surface with median row of spines not extending onto fixed finger; dorsolateral margin with row of spines extending only to proximal half of fixed finger; ventral surfaces of dactyl, palm and fixed finger with moderately long setae. Carpus about as long as merus and palm; dorsomesial margin with row of spines, dorsal surface with second longitudinal row of somewhat smaller spines laterally; 1 spine on dorsodistal margin. Merus with 1 small spine on each ventral margin distally; ventral surface with scattered low protuberances and few setae.

Left cheliped (Fig. 40e) with palm slightly shorter than dactyl; similar in armature and setation to that of right. Carpus with dorsomesial and dorsolateral row of spines; 1 spine at dorsodistal margin. Merus with 3 widely-spaced spinules on ventromesial margin; ventrolateral margin with 1 small spine distally.

Ambulatory legs with dactyls of second pair shorter than third; each with row of 8 corneous spines on ventral margin; all with sparse tufts of moderately long setae dorsally. Propodi with tufts of long stiff setae on dorsal surfaces. Carpi each with spine at dorsodistal angle and tuft of stiff setae on dorsal surface posteriorly. Meri unarmed, but with widely-spaced tufts of stiff setae dorsally and ventrally.

Telson with slightly asymmetrical posterior lobes separated by prominent median cleft; terminal margins with several small spines, strongest near outer angles.

COLOR (based on *N. gardineri* sensu HAIG & BALL, 1988). — Carapace with scattered red and white chromatophores on semi-transparent background. Antennules light reddish brown distally. Antennae reddish brown. Meri and carpi of chelipeds with large red spots on semi-transparent background. Carpi, propodi and dactyls of ambulatory legs with reddish brown longitudinal stripes on semi-transparent background.

HABITAT. — Questionably, gastropod shells with associated anemones.

DISTRIBUTION. — Kai Islands and ?Arafura Sea, Indonesia; ?58-212 m.

REMARKS. — Although the KARUBAR specimen is a small female, lacking paired first pleopods, it agrees well with the general morphology of species of *Nematopagurus*. The sternal region of the fifth pereopods and anterior portion of the abdomen are damaged; however, upon close inspection, two openings in the ventral integument, corresponding in position to those of first pleopods can be seen. There is little doubt that it is correctly assigned to this genus, and it bears certain similarities to ALCOCK's (1905a, b) *N. gardineri*, particularly in the seemingly bifid structure of the ocular acicles. The acicles are not truly bifid, but the well developed submarginal spine is mesial in position and clearly visible dorsally (Fig. 20b, c) giving the impression of a bifid acicle. Additionally, ALCOCK specified that the ocular peduncles were equal in length to the anterior margin of the carapace, longer than the antennal peduncles and reaching to the distal fourth of the ultimate segment of the antennular peduncles. The KARUBAR specimen agrees in the ratios of ocular peduncle length to anterior shield margin and antennal peduncle, but not antennular. In contrast, ALCOCK described and illustrated the corneae as not dilated. The ocular peduncles of the KARUBAR specimen are much stouter than ALCOCK illustrated for *N. gardineri*, and the corneae are clearly dilated. His description of *N. gardineri* specifies a single spine at the dorsodistal marginal of the carpi of the ambulatory legs, but his figure (ALCOCK, 1905a, pl. 68, fig. 3; 1905b, pl. 12, fig. 2) shows two and one proximal spines on the denuded left second and third pereopods respectively; only a dorsodistal spine is present in the KARUBAR specimen. Although the chelipeds are provided with an abundance of long fine setae in the KARUBAR specimen, this pilosity does not begin to approach the density of the other KARUBAR specimen tentatively assigned to *N. indicus*. This disparity is in marked disagreement with ALCOCK's (1905a, b) observations.

Very few additional accounts of *N. gardineri* have been published. The first appears to have been KENSLEY's (1969) report of the species from the International Indian Ocean Expedition's (IIOE) "*Anton Bruun*" Stn 390 (29°35'S, 31°42'E). KENSLEY gave only a cryptic account of his male specimen, but his figure (KENSLEY, 1969, fig. 6e-h) illustrated a species agreeing, at least in armature of the chelipeds, with ALCOCK's description. However, KENSLEY illustrated a specimen with ocular peduncles broadly expanded distally and with dilated corneae. Although the type locality for *N. gardineri* in the Maldive Islands is in relatively close geographic proximity to KENSLEY's IIOE station, conspecificity of his and ALCOCK's (1905b) specimens can not be confirmed at this point.

MIYAKE (1978) subsequently identified a species from Japanese waters as *N. gardineri*. While his single male specimen from Sagami Bay agreed generally with most of the segmental ratios given by ALCOCK (1905a, b), it apparently differed substantively in having unequal chelipeds. MIYAKE (1978) reported that the right was "vastly larger" than the left. The ambulatory legs of MIYAKE's specimen were reported to have three spines "basally" (presumably intended to mean proximally) on the carpi of the second pair, and 11 or 12 spines on the ventral margins of the dactyls. It is very unlikely that MIYAKE's and ALCOCK's specimens are assignable to the same taxon, nor that either is conspecific with the KARUBAR specimen.

Although HAIG and BALL (1988) indicated that their three specimens, collected in the Arafura Sea during the "*Alpha Helix*" expedition, agreed with the original ALCOCK (1905a, b) descriptions in most characters, they too found exception in the shape of the ocular peduncles. Like the KARUBAR specimen, HAIG and BALL (1988) described their specimens as having peduncles "markedly expanded at the cornea." These authors also commented on MIYAKE's (1978) record, noting that he did not mention the form of the ocular peduncles. Apparently they overlooked his reference to grossly unequal chelipeds. Since HAIG and BALL's (1988) description was limited to notes on living color and the comments on the ocular peduncles referred to previously, it is not possible to ascertain whether or not their specimens and the KARUBAR female belong to the same taxon but, given the close proximity of the collection sites, it is probable. It is doubtful that either are conspecific with ALCOCK's (1905a, b) species.

Nematopagurus spinulosensoris McLaughlin & Brock, 1974

Figs 20d, h, 41a-b

Nematopagurus spinulosensoris McLaughlin & Brock, 1974: 246, figs 1-3. — MCLAUGHLIN & LANE, 1975: 520, pls 1-3.
Nematopagurus spinulosensorius - TÜRKAY, 1986: 139 (misspelling).
Nematopagurus muricatus - THOMPSON, 1943: 424. — MIYAKE, 1978: 129; not *Nematopagurus muricatus* Henderson, 1888.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 45, 07°54'S, 132°47'E, 302-305 m, 29.10.1991: 1 ♀ (5.0 mm) (MNHN-Pg 5294). — Stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (3.0 mm) (POLIPI). — Stn CP 86, 09°26'S, 131°13'E, 225-223 m, 04.11.1991: 1 ♀ (5.6 mm) (MNHN-Pg 5295).

DIAGNOSIS. — Shield (Fig. 20d) longer than broad. Rostrum usually obtusely rounded, occasionally obtusely triangular. Ocular peduncles overreached by both antennular and antennal peduncles; corneae usually strongly dilated. Ocular acicles acutely triangular, moderately slender, with prominent longitudinal furrow and very strong submarginal spine.

Chelipeds subequal, right usually somewhat larger; chelae and carpi of both chelipeds with numerous sensory-modified spines on dorsal surfaces. Right cheliped (Fig. 41a) with dorsal surface of dactyl generally flattened, dorsomesial margin, or dorsal surface mesially, usually with irregular longitudinal row of unmodified small spines or tubercles. Palm with irregular single or double row of usually unmodified moderately strong spines on dorsomesial margin; dorsal surface with several irregular rows of customarily modified spines, extending onto fixed finger proximally; dorsolateral margin with single or double row of moderately strong, usually modified spines, extending onto fixed finger as single row of blunt unmodified spines or tubercles. Carpus with row of strong unmodified spines on dorsomesial margin; dorsal surface with irregular rows of moderately strong, generally modified spines; laterodistal margin with spine. Distal margin of merus usually with 2 or 3 strong spines; ventrolateral margin with row of strong spines mesiodistal margin and ventromesial face distally with few small spines.

Left cheliped (Fig. 41b) with short row of small unmodified spines or spinulose tubercles usually in dorsal midline of dactyl. Palm with single or double row of frequently modified spines on dorsomesial margin; dorsal midline with 2 or 3 irregular rows of usually modified spines extending onto fixed finger; dorsolateral margin with double or triple row of small modified spines proximally becoming single row of small unmodified spines or tubercles on fixed finger. Carpus with row of frequently unmodified spines on dorsomesial margin; dorsal surface with 2 or 3 irregular rows of modified spines proximally, tending to cluster distally, distal margin occasionally with 1 or 2 spines; dorsolateral margin with single or double row of commonly modified spines. Merus with 1-3 spines on distal margin; ventromesial and ventrolateral margins each with row of spines.

Second and third pereopods generally similar. Dactyls long, slender; ventral surfaces each with row of 10 to 13 strong corneous spines. Carpi each with row of strong spines on dorsal surfaces. Sternite of third pereopods with subsemicircular anterior lobe, anterior margin with long stiff setae.

Coxa of left fifth pereopod with vas deferens usually slightly protruded. Telson (Fig. 20h) with posterior lobes subtriangular or subquadrate, left usually slightly larger; separated by very shallow median cleft; terminal and usually also lateral margins weakly calcified, terminal margins rounded or somewhat oblique, each with numerous small calcareous spines marginally and several stronger calcareous acute or blunt spines submarginally; lateral margins unarmed or occasionally each with row of small calcareous spines or spinules.

COLOR. — *In life:* chelipeds and ambulatory legs generally vivid salmon-pink, bordering on iridescent; antennal flagella bright yellow.

In preservative: Shield pale orange or straw-colored; ocular peduncles light orange with dark orange ring proximally. Chelipeds very pale orange with white spines; carpi with darker red-orange proximally and ventrally. Ambulatory legs pale orange with lighter longitudinal stripes on dactyls and propodi; carpi pale orange with darker red-orange proximally; meri pale orange and white (MCLAUGHLIN & BROCK, 1974).

HABITAT. — Unknown.

DISTRIBUTION. — Hawaiian Islands, Japan, Maldives, Indonesia; east coast of South Africa; 180 to 250 m.

AFFINITIES. — In having the dorsal surfaces of the chelae armed with numerous well-developed spines, *N. spinulosensoris* superficially resembles *N. muricatus*. However, neither *N. muricatus* nor any other known species of this genus are provided with the tear-drop sensory structures so characteristic of the spines of *N. spinulosensoris*.

REMARKS. — TÜRKAY (1986) reported that he had examined the specimens identified as *N. muricatus* by THOMPSON (1943) from the "*John Murray*" Expedition and by MIYAKE (1978) from Tosa Bay, Japan, and had found these to actually represent *N. spinulosensoris*. Apparently neither of these latter authors noticed the distinctive spines apparently unique to *N. spinulosensoris*.

Nematopagurus scutelliformis sp. nov.

Figs 21a-h, 41c-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 05, 05°49'S, 132°18'E, 296-299 m, 22.10.1991: 1 ♂ (4.4 mm) (SNHM 4811). — Stn CP 06, 05°49'S, 132°21'E, 298-287 m, 22.10.1991: 1 ♀ (6.1 mm) (MNHN-Pg 5296). — Stn CP 16, 05°17'S, 132°50'E, 315-349 m, 24.10.1991: 1 ♂ (5.1 mm) (MNHN-Pg 5297).

Tanimbar Islands: stn CP 46, 08°01'S, 132°51'E, 271-293 m, 29.10.1991: 1 ♂, 1 ♀ (2.3, 3.3 mm) (MNHN-Pg 5298). — Stn CP 83, 09°23'S, 131°00'E, 285-297 m, 4.11.1991: 1 ov. ♀ (6.9 mm) (USNM 276008). — Stn CP 84, 09°23'S, 131°09'E, 275-296 m, 4.11.1991: 1 ov. ♀ (3.6 mm) (POLIPI).

TYPES. — The male (5.1 mm) (MNHN-Pg 5297) from KARUBAR station CP 16 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 21a) as broad as long or broader; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with few tufts of setae.

Rostrum broadly rounded, not exceeding lateral projections. Lateral projections prominent, roundly triangular or subquadrate, each usually with small submarginal spine laterally.

Ocular peduncles short, 0.75 to 0.80 length of shield; dorsal surfaces each with median tuft of stiff setae at base of cornea, dorsomesial surface with few setae; corneae strongly dilated. Ocular acicles small, triangular; terminating subacutely, with deeply concave dorsal surface and prominent submarginal spine; separated basally by entire basal width of one acicle.

Antennular peduncles moderately short, exceeding distal margin of corneae by 0.25 to 0.75 length of ultimate segment. Ultimate segment with 2 or 3 tufts of setae on dorsolateral surface in distal half. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face.

Antennal peduncles moderately short, overreaching distal margin of cornea by 0.20 to 0.25 length of ultimate segment. Fifth and fourth segments with few tufts of stiff setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in simple spine, lateral and mesial margins with few stiff setae; dorsomesial distal angle with small spine. First segment frequently with tiny spinule on laterodistal margin. Antennal acicle moderately long, reaching to or beyond proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with tufts of long stiff setae. Antennal flagella long, overreaching tip of right cheliped; occasionally few articles each with 1 or 2 very short setae or bristles, at least in proximal half.

Chelipeds subequal; right (Figs 21b, 41c, e) approximately as long, but slightly stronger than left, moderately elongate. Dactyl slightly shorter than palm; cutting edge with 3 strong calcareous teeth proximally, few corneous teeth distally, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with several low transverse scutes mesially and extending onto rounded dorsomesial margin, each with marginal row of short stiff setae, few tufts of longer setae adjacent to cutting edge; mesial face dorsally and ventral surface also with tufts of longer setae. Palm approximately as long as carpus; dorsomesial margin not delimited, but with 1 or 2 spines proximally; dorsal surface with 7 to 9 rows of partially to nearly complete transverse scutes continued onto lateral face proximally, each with marginal row of short stiff setae, 3 distal-most scutes interrupted at dorsolateral margin by distinct calcareous spine; proximal 0.75 to 0.80 of dorsal surface of fixed finger with transverse rows of scutes provided with marginal short stiff setae, each interrupted at dorsolateral margin by strong spine; distal 0.20 to 0.25 of dorsal surface nearly smooth, with only scattered tufts of setae; cutting edge with row of strong calcareous teeth in proximal 0.65, small calcareous teeth interspersed with corneous teeth distally, terminating in small corneous claw; ventral surfaces of palm and fixed finger smooth, with few scattered fine setae. Carpus slightly shorter than merus; dorsodistal margin with 1 small spine and row of uniformly short stiff setae; dorsomesial margin with row of strong spines; dorsal surface with transverse rows, each consisting of 2 or 3 scutes extending onto dorsal half of lateral face, and provided marginally with short stiff setae; dorsolateral margin not delimited; lateral, mesial and ventral surfaces with scattered tufts of setae. Merus subtriangular; dorsal margin with few transverse ridges and long stiff setae; lateral and mesial faces tufts of stiff setae; ventrolateral margin unarmed or with 1 small spine distally, frequently few transverse ridges and stiff setae in proximal 0.65; ventromesial margin 3 or 4 widely-spaced small spines, ventral surface with few low protuberances or ridges and tufts of stiff setae. Ischium with few stiff setae, occasionally also with 1 small spinulose tubercle on ventromesial margin near proximal angle.

Left cheliped (Figs 41d, f) moderately long, usually reaching nearly to tip of dactyl of right; moderately slender. Dactyl slightly longer than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with tufts of long setae adjacent to cutting edge, few marginally setiferous scutes mesially, extending onto rounded dorsomesial margin; mesial face dorsally and ventral surface each with few long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial margin not delimited, but with 1 or 2 spines proximally; dorsal surface, like that of right, with 7 to 9 transverse rows of nearly complete single scutes, each extending onto lateral face and provided with marginal row of short stiff setae, 3 distal-most interrupted at dorsolateral margin by spine; dorsal surface of fixed finger with several transverse scutes, each with marginal fringe of short stiff setae and terminating in spine at dorsolateral margin, distal quarter to third nearly smooth, but with scattered tufts of setae; cutting edge with row of small calcareous teeth interspersed with corneous teeth. Carpus slightly longer than merus; dorsodistal margin with 1 small spine and uniform row of short

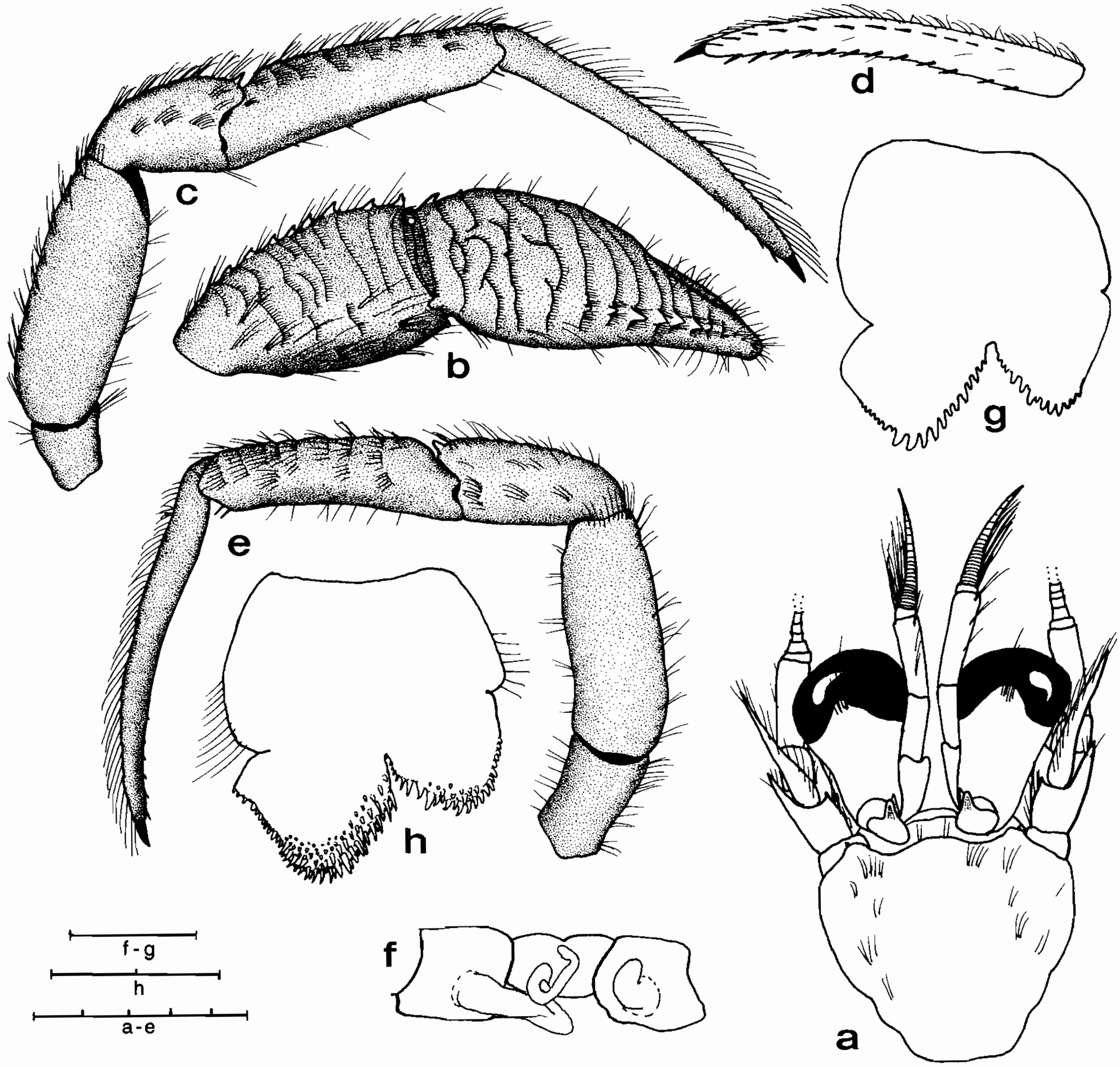

FIG. 21. — *Nematopagurus scutelliformis* sp. nov., a-g, holotype ♂ (5.1 mm) from KARUBAR Stn CP 16; h, paratype ov. ♀ (7.0 mm) from Stn CP 83: **a**, shield and cephalic appendages; **b**, right cheliped (lateral view); **c**, right second pereopod (lateral view); **d**, dactyl of right second pereopod (mesial view); **e**, left third pereopod (lateral view); **f**, coxae and sternite of fifth pereopods; **g-h**, telson. Scale equals 1.0 mm (f-g), 2.0 mm (h) and 5.0 mm (a-e).

stiff setae, dorsomesial margin with row of prominent spines, dorsolateral margin not delimited; dorsal surface with transverse rows each consisting of 2 or 3 individual marginally setiferous scutes and extending onto lateral face; mesial and ventral surfaces with tufts of stiff setae. Merus subtriangular; dorsal surface with transverse ridges and stiff setae, distal margin with row of moderately long stiff setae; lateral and mesial faces with tufts of stiff setae; ventral surface with few low protuberances and tufts of setae; ventromesial margin with row of 4 widely-spaced spines, decreasing in size proximally, ventrolateral margin with 1 small distal spine and few short sometimes spinulose ridges in proximal half. Ischium with scattered tufts of setae, and occasionally 1 spinulose tubercle on ventromesial margin near proximal angle.

Ambulatory legs (Figs 21c-e) overreaching right cheliped by approximately half length of dactyls. Dactyls 0.25 to 0.35 longer than propodi; in lateral view, slightly curved ventrally; in dorsal view, twisted (at least in large specimens); each terminating in strong corneous claw; dorsal surfaces each with 1 or 2 rows of short corneous spines often obscured by 2 or 3 rows of long stiff setae; mesial faces each with row of spiniform bristles or corneous spines; lateral faces each with few scattered setae; ventral surfaces each with row of 9 to 17 strong corneous spines increasing in size distally. Propodi 0.25 to 0.35 longer than carpi; dorsal surfaces each with row of short transverse ridges extending onto lateral faces and set with short to moderately long stiff spiniform bristles; mesial and lateral faces with scattered setae; ventral surfaces usually with 2 or 3 widely-spaced small corneous spinules and fine setae, 1 or 2 corneous spines at ventrodistal angle. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with spine at dorsodistal angle, occasionally 1 additional spine in proximal half at least on right second pereopod, and all with row of tufts of stiff setae; mesial and ventral surfaces each with few scattered tufts of long setae; lateral faces each with 1 to 3 rows of stiff setae, longest medially. Meri laterally compressed; dorsal surfaces each with row of transverse ridges and stiff setae; lateral and mesial faces usually with few tufts of setae; ventral surface usually also with tufts of setae. Ischia each with setae dorsally and ventrally. Anterior lobe of sternite of third pereopods subsemicircular or subrectangular, with long stiff setae medially and/or on anterior margin. Fifth pereopods chelate.

Males with well developed, elongate, filiform sexual tube on coxa of right fifth pereopod (Fig. 21f), left with very short sexual tube; unpaired pleopods 3-5 with exopods well developed, endopods substantially reduced. Telson (Figs 21g-h) with posterior lobes slightly asymmetrical, nearly subsemicircular; separated by deep median cleft; terminal margins rounded, each with 1 or more rows of acute spines; lateral margins oblique, each (or at least left) with row of small subacute spines increasing in size toward outer angle; dorsal surface frequently spinulose near terminal margins.

COLOR (in preservative). — Spines and margins of scutes of chelipeds with faint pinkish orange tint; scutal setae usually weakly iridescent.

HABITAT. — Not known.

DISTRIBUTION. — Kai and Tanimbar Islands, Indonesia; 271-349 m.

ETYMOLOGY. — From the Latin *scutella* meaning small flat dish, and *forma* meaning shape, and referring to the scute-like form of the ornamentation of the chelipeds.

AFFINITIES. — *Nematopagurus scutelliformis* sp. nov. shares several morphological peculiarities with *N. scutellichelis* Alcock, 1905b, most notably in having the chelae and carpi ornamented with broad, flat, imbricating scutes; however, the two species are readily distinguished by the spination of the chelae and ambulatory legs. Each chela of *Nematopagurus scutelliformis* has a row of spines on dorsolateral margin of the palm distally and fixed finger proximally, that is absent in *N. scutellichelis*. Additionally, the dorsal surfaces of the carpi of both ambulatory legs of *N. scutellichelis* are provided with a row of spines; the propodi are "ringed or scutellated, the squames and scutes being nude and polished" (ALCOCK, 1905b: 113). The carpi of these appendages in *N. scutelliformis*, although having numerous tufts of stiff setae, have only a dorsodistal spine and occasionally one proximal spine on the second right pereopod; the propodi have short transverse setiferous ridges dorsally that extend onto the lateral surfaces of the segments only slightly.

REMARKS. — Although *N. scutelliformis* is ostensibly very similar in appearance to *N. scutellichelis*, a species reported only from very deep water (in excess of 1500 m) off the Maldive Islands in the Indian Ocean, there is no doubt that the two taxa are distinct. Despite the fact that in some of the larger KARUBAR specimens, the spines of the right cheliped tend to be obscured by stiff setae, those of the left are very distinct in individuals of any size. It is improbable that ALCOCK (1905b) would have failed to observe such spines on the left chela in his specimen(s), which, from the carapace measurement given, appear to be in the size range of the KARUBAR specimens. However, even if he had, the differences in armature and ornamentation of the ambulatory legs provide additional differentiating characters.

Nematopagurus ostlingochirus sp. nov.

Figs 22a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (1.2 mm) (MNHN-Pg 5299).

TYPE. — The single specimen collected is the holotype.

DESCRIPTION. — Shield (Fig. 22a) slightly longer than broad; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with very sparse setae. Rostrum broadly rounded, not reaching distal margins of lateral projections. Lateral projections prominent, roundly subquadrate, each with small submarginal spine laterally, left with additional accessory spinule.

Ocular peduncles moderately short, but only slightly shorter than length of shield; dorsal surfaces each with median tuft of stiff setae at base of cornea, 1 additional tuft on dorsal surface and second tuft mesially; corneae dilated. Ocular acicles small, triangular; terminating acutely, with concave dorsal surface and prominent simple or bifid submarginal spine; separated basally by slightly less than basal width of one acicle.

Antennular peduncles short, overreaching distal margins of corneae by 0.20 length of ultimate segment or less. Ultimate segment with 1 or 2 fine setae. Penultimate segment with few scattered setae. Basal segment with small spine on dorsolateral distal margin.

Antennal peduncles short, not overreaching distal margins of corneae. Fifth and fourth segments with few setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, lateral margin with 1 or 2 accessory spines; dorsomesial distal angle with small spine. First segment with 1 or 2 small spines on ventrolateral margin distally. Antennal acicle moderately long, reaching proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with few moderately long stiff setae. Antennal flagella slightly longer than outstretched right cheliped; every 1 or 2 articles with 1 or 2 very short setae and occasionally 1 long seta.

Chelipeds subequal; right (Figs 22b-c) slightly longer and stronger. Dactyl slightly shorter than palm; cutting edge with 5 calcareous teeth, terminating in small corneous claw and overlapped by fixed finger; dorsal surface with few spinules proximally and several moderately short, usually plumose and distally curved or curled setae, longer simple setae distally, dorsomesial margin with row of spinules in proximal half; mesial and ventral surfaces with scattered longer setae. Palm slightly longer than carpus; dorsomesial margin with row of small spines; dorsal midline with longitudinal row of spines extending to distal half of fixed finger, dorsal surface covered with moderately short usually plumose curved or curled setae and scattered longer simple setae; dorsolateral margin with row of spines extending approximately half length of fixed finger; dorsal surface of fixed finger with similarly plumose curved or curled setae proximally and scattered longer simple setae distally; cutting edge with 2 large calcareous teeth proximally, 1 large and several small calcareous teeth distally, terminating in small corneous claw; lateral and ventral surfaces of palm and fixed finger with scattered simple setae. Carpus approximately equal to length of merus; dorsodistal margin with 1 small spine, dorsomesial margin with row of spines; dorsal surface with scattered moderately long stiff setae and row of smaller spines approximating dorsolateral margin; lateral and mesial faces with few short transverse rows of stiff setae. Merus subtriangular; dorsodistal margin with row of stiff setae; dorsal margin and mesial and lateral faces with few long stiff setae; ventrolateral margin with 2 small spines distally; ventromesial margin 2 slightly stronger spines in distal half. Ischium with few setae dorsally and ventrally.

Left cheliped (Fig. 22d) long, reaching almost to tip of dactyl of right; moderately slender. Dactyl slightly shorter than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with several small spines and few short plumose and curled setae in proximal half, scattered longer simple setae distally; mesial and ventral surfaces with few moderately long simple setae. Palm approximately 0.65 length of carpus; dorsomesial margin with row of spines; dorsal surface with longitudinal row of small spines in slightly raised midline, extending half length of fixed finger and partially obscured by short plumose curved or curled setae; dorsolateral margin with row of spines, extending to distal half

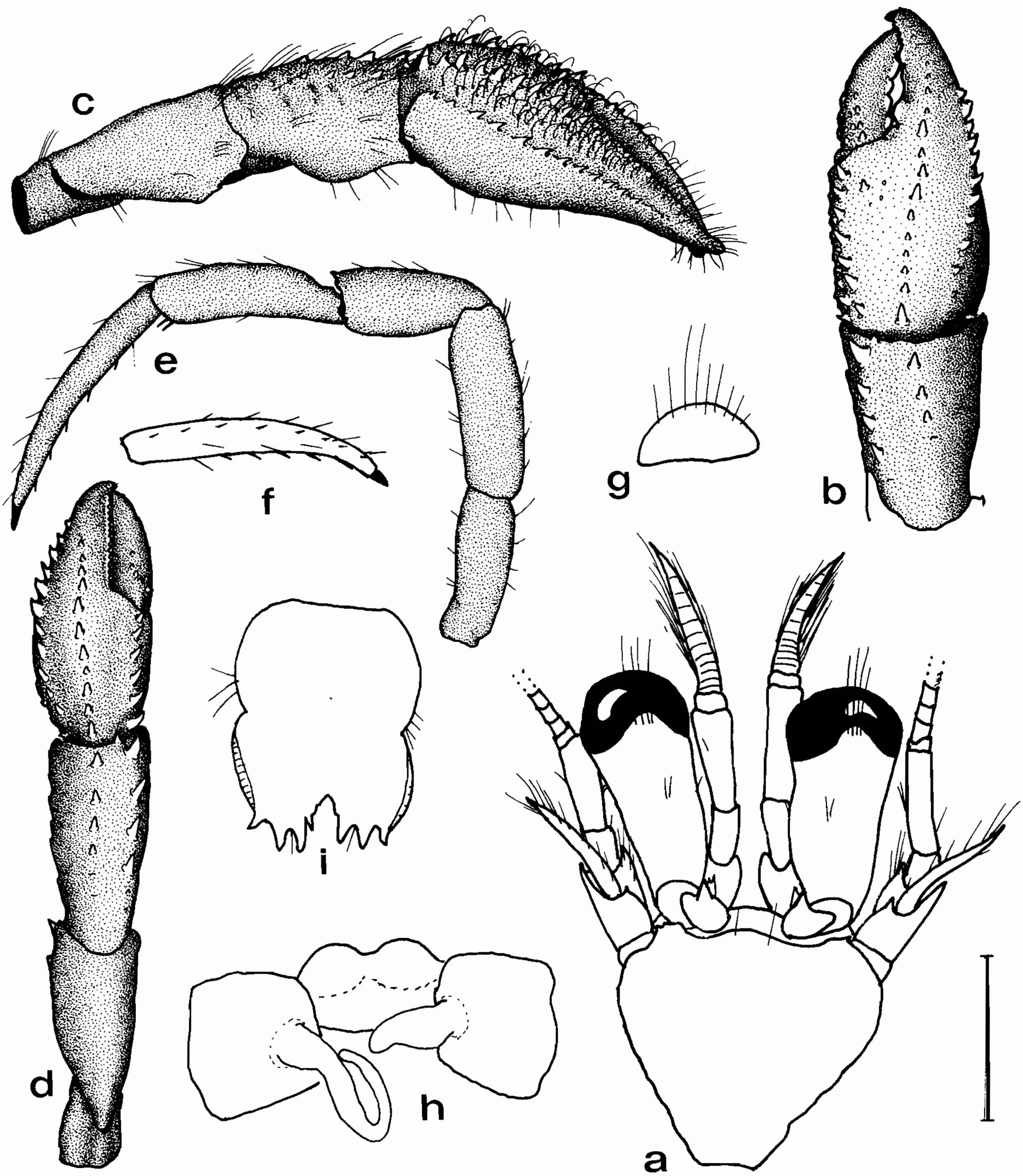

FIG. 22. — *Nematopagurus ostlingochirus* sp. nov., holotype ♂ (1.2 mm) from KARUBAR Stn DW 49: **a**, shield and cephalic appendages; **b**, chela and carpus of right cheliped (dorsal view; setae omitted); **c**, right cheliped (lateral view); **d**, left cheliped (dorsal view; setae omitted); **e**, left third pereopod (lateral view); **f**, dactyl of left third pereopod (mesial view); **g**, anterior lobe of sternite of third pereopods; **h**, coxae and sternite of fifth pereopods; **i**, telson. Scale equals 0.5 mm (g-i) and 1.0 mm (a-f).

of fixed finger and numerous longer but similarly plumose curled setae; cutting edge of fixed finger with row of small calcareous teeth. Carpus slightly longer than merus; dorsodistal margin with 1 small spine; dorsomesial and dorsolateral margins each with row of spines strongest mesially; mesial, lateral and ventral surfaces with few long stiff setae; ventrolateral distal angle with small spine. Merus subtriangular; dorsal surface with few stiff setae, particularly at distal margin; ventromesial and ventrolateral margins each with 2 strong spines in distal half. Ischium with few setae ventrally.

Only detached left third pereopod (Figs 22e-f) remains with holotype. Dactyl approximately 1.25 length of propodus; dorsal surface with few short setae; mesial face with row of 8 corneous spines dorsally; lateral face with few scattered setae; ventral margin with row of 5 corneous spines. Propodus somewhat longer than carpus; surfaces each with few setae; 2 small corneous spinules at ventrodistal angle. Carpus approximately 0.65 length of merus; dorsal and ventral surfaces with few setae, dorsodistal angle with small spine. Merus with few setae dorsally and ventrally. Ischium unarmed. Anterior lobe of sternite of third pereopods (Fig. 22g) narrowly subsemicircular, with few marginal setae. Fifth pereopods chelate.

Male with long right sexual tube (Fig. 22h) not noticeably filamentous terminally; left tube stout, moderately short, directed toward right coxa. Telson (Fig. 22i) with posterior lobes practically symmetrical, nearly subquadrate; separated by moderately deep median cleft; terminal margins straight, both with 3 large spines, left with additional smaller spine; lateral margins rounded, each with distinct chitinous plate.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from type locality in the Tanimbar Islands, Indonesia; 206-210 m.

ETYMOLOGY. — From the Greek *ostlingos* meaning curled hair, and *cheir* meaning hand, denoting the curling setae on the dorsal surfaces of the chelae of this species.

AFFINITIES. — In having a median row of spines on the dorsal surfaces of both chelae, *N. ostlingochirus* bears some similarity to both *N. indicus* and *N. gardineri*; however, the new species is easily distinguished by the distinctive setation of the chelae.

Nematopagurus alcocki sp. nov.

Figs 23a-i

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 124-85 m, 25.10.1991: 1 ♀ (1.3 mm) (MNHN-Pg 5300); 1 ov. ♀ (1.7 mm) (MNHN-Pg 5301).

TYPES. — The ovigerous female (1.7 mm) (MNHN-Pg 5300) from KARUBAR station DW 22 is the holotype. The other female is a paratype.

DESCRIPTION. — Shield (Fig. 23a) as broad as long; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin roundly truncate; dorsal surface with very few tufts of setae. Rostrum broadly rounded, approximately equaling level of lateral projections. Lateral projections prominent, roundly triangular, each with small submarginal spine laterally.

Ocular peduncles moderately short, 0.80 to nearly entire length of shield; dorsal surfaces each usually with median tuft of stiff setae at base of cornea and 1 additional on dorsomesial surface; corneae strongly dilated. Ocular acicles small, triangular; terminating subacutely, with deeply concave dorsal surface and prominent submarginal spine; separated basally by slightly less to slightly more than basal width of one acicle.

Antennular peduncles short, overreaching distal margin of corneae by 0.10 to 0.25 length of ultimate segment. Ultimate segment with 1 or 2 setae on dorsolateral distal margin. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face dorsally.

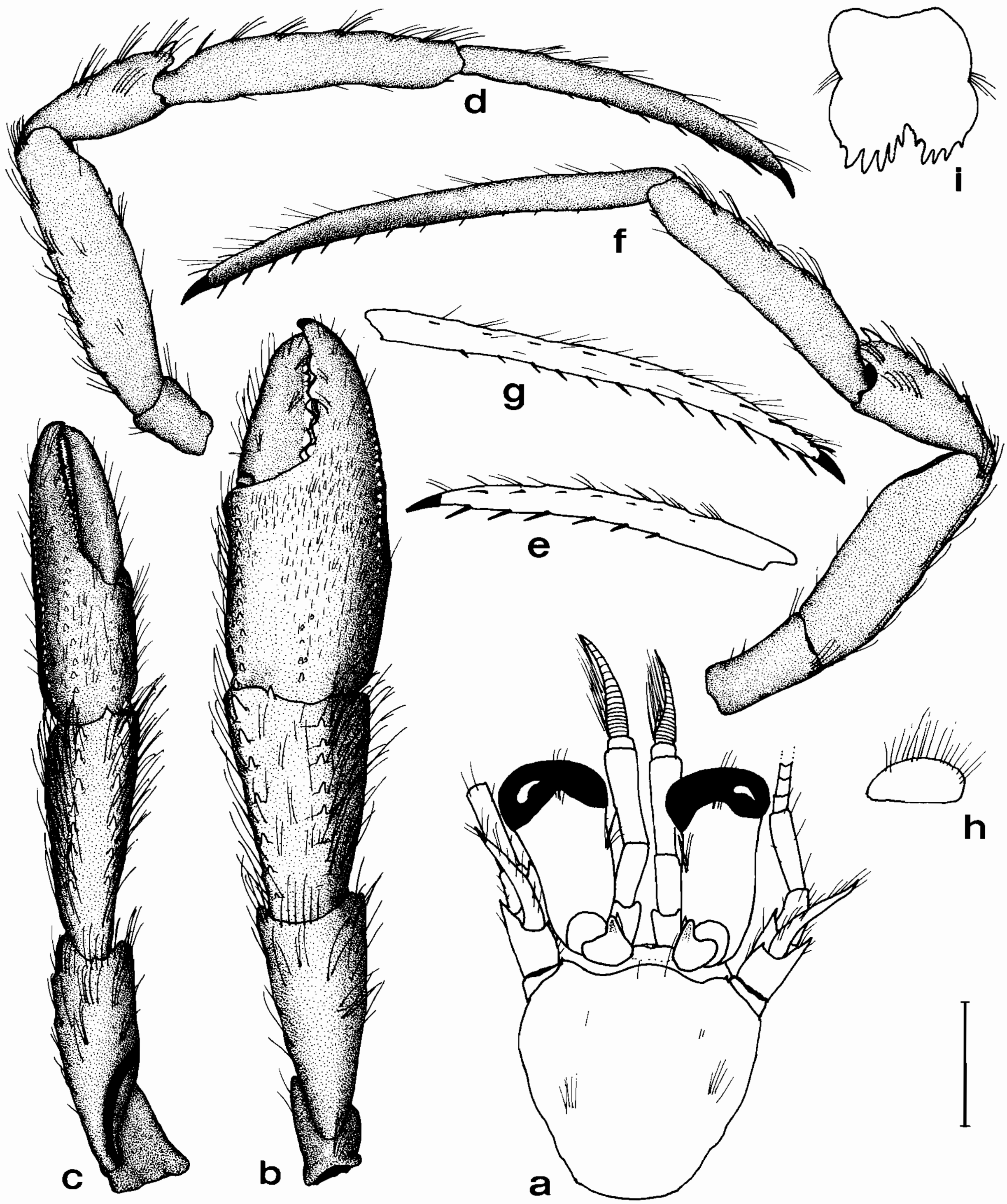

FIG. 23. — *Nematopagurus alcocki* sp. nov., holotype ♀ (1.7 mm) from KARUBAR Stn DW 22: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, left cheliped (dorsal view); **d**, right second pereopod (lateral view); **e**, dactyl of right second pereopod (mesial view); **f**, left third pereopod (lateral view); **g**, dactyl of left third pereopod (mesial view); **h**, anterior lobe of sternite of third pereopods; **i**, telson. Scale equals 0.5 mm (h-i) and 1.0 mm (a-g).

Antennal peduncles short, not overreaching distal margins of corneae. Fifth and fourth segments with few stiff setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in simple spine, lateral and mesial margins with few stiff setae; dorsomesial distal angle with small spine. First segment with 2 small spines on ventrolateral margin distally. Antennal acicle moderately long, reaching beyond proximal half of ultimate peduncular segment; arcuate, terminating in acute spine; mesial margin with moderately long stiff setae. Antennal flagella long; occasionally few articles with 1 or 2 very short setae or bristles, at least in proximal half.

Chelipeds subequal; right (Fig. 23b) slightly longer and stronger. Dactyl somewhat shorter than palm; cutting edge with 3 strong calcareous teeth proximally and few calcareous teeth distally, terminating in small corneous claw and overlapped by fixed finger; dorsal surface with scattered short setae and longer setae on rounded dorsomesial margin, occasionally 1 small spinule proximally; mesial and ventral surfaces also with tufts of longer setae. Palm slightly shorter than carpus; dorsomesial margin with row of small or very small spines; dorsal midline with longitudinal row of small spines in proximal third, sometimes extending distally as row of tiny spinules, dorsal surface with numerous short setae, most abundant distally and laterally, dorsolateral margin with row of very small spines extending approximately half length of fixed finger; dorsal surface of fixed finger with short setae proximally and scattered longer setae distally; cutting edge with row of strong calcareous teeth in proximal 0.75, small calcareous teeth distally, terminating in small corneous claw; lateral and ventral surfaces of palm and fixed finger with scattered setae. Carpus slightly longer than merus; dorsodistal margin with 1 small spine, dorsomesial margin with row of spines; dorsal surface with scattered setae, dorsolateral margin with row of somewhat smaller spines; lateral and mesial faces with long stiff bristle-like and often somewhat iridescent setae. Merus subtriangular; dorsodistal margin with row of bristle-like setae, dorsal margin and mesial and lateral faces with short transverse ridges of long stiff bristle-like setae; ventrolateral margin with 1 small spine and 2 tiny spinules distally, stiff setae in proximal 0.65; ventromesial margin 1 or 2 small spines distally and 1 or 2 tuberculate protuberances proximally, ventral surface with few low protuberances or ridges and stiff setae. Ischium with few stiff setae.

Left cheliped (Fig. 23c) moderately long, but not reaching to tip of dactyl of right; moderately slender. Dactyl slightly longer than palm; cutting edge with row of small corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsal surface with few scattered setae; mesial and ventral surfaces with few long setae. Palm approximately 0.65 length of carpus; dorsomesial margin with 1 spine at proximal angle, few transverse ridges and stiff setae, and adjacent row of tiny spinules; dorsal surface with row of very small spines laterad of midline and extending onto fixed finger proximally and numerous short setae, dorsolateral margin with row of tiny spines, extending to distal half of fixed finger; cutting edge with row of small calcareous teeth. Carpus somewhat longer than merus; dorsodistal margin with 1 small spine, dorsomesial and dorsolateral margins each with row of moderately small spines; mesial and ventral surfaces with numerous short transverse ridges and bristle-like long setae; ventrolateral distal angle with small tubercle, ventral surface with few low tubercles and long setae. Merus subtriangular; dorsal surface with few transverse ridges and bristle-like setae, distal margin with row of moderately long similar setae; lateral and mesial faces with short transverse ridges and bristle-like setae, ventral surface with few low protuberances and tufts of setae; ventromesial and ventrolateral margins each with few small spines distally and low protuberances proximally. Ischium with few tufts of setae.

Ambulatory legs (Figs 23d-g) similar; dactyl of third left (third right missing in holotype) approximately 0.25 longer than dactyls of second; all terminating in small corneous claws; dorsal surfaces each with row of sparse tufts of moderately short setae and few corneous spines; mesial faces each with row of corneous spines dorsally; lateral faces each with few scattered setae; ventral surfaces each with row of 6 to 9 corneous spines increasing in size distally. Propodi 0.30 to 0.45 longer than carpi; dorsal surfaces each with row of tufts of long bristle-like setae and few corneous spinules; mesial and lateral faces with few scattered setae; ventral surfaces with 1 or 2 small corneous spinules at ventrodistal angle. Carpi 0.65 to 0.75 length of meri; dorsal surfaces each with spine at dorsodistal angle and 1 or 2 much smaller spines in proximal half, partially obscured by tuft of stiff bristle-like setae; lateral faces each with 1 or 3 short rows of bristle-like setae. Meri laterally compressed; dorsal surfaces each with row of short transverse ridges and bristle-like setae; lateral and mesial faces with few setae; ventral surfaces each with 1 small spine in distal third (second) or unarmed (third) and tufts of setae. Ischia each with few setae dorsally and ventrally. Anterior lobe of sternite of third pereopods (Fig. 23h) roundly subrectangular, with long marginal setae. Fifth pereopods chelate.

Males unknown. Telson (Fig. 23i) with posterior lobes slightly asymmetrical, nearly subsemicircular; separated by moderately deep median cleft; terminal margins rounded or slightly oblique, each with 2 to 4 large and 2 smaller spines; lateral margins slightly oblique.

COLOR (in preservative). — Segments of chelipeds and few spines retain faint small spots or patches of light orange; bristle-like setae with yellowish tint.

DISTRIBUTION. — Known only from the type locality in Kai Islands, Indonesia; 85-124 m.

ETYMOLOGY. — This species is named for A. ALCOCK, noted carcinologist of the Indian Museum, whose monographic work on Indian Paguridea is still the cornerstone for regional studies.

AFFINITIES. — *Nematopagurus alcocki* appears most closely allied with *N. australis*, particularly in having long, stiff irridescent setae on the mesial and lateral faces of the carpi of both chelae, and a covering of short setae on the dorsal surfaces of the palms and fixed fingers. The ocular peduncles of HENDERSON's (1888) specimen from the Arafura Sea are a little more slender than seen in the specimens of *N. alcocki*, and the corneae only slightly dilated; however the peduncles of syntype from the Fiji Islands more closely approach those of the KARUBAR species. Nonetheless, the two species are immediately distinguished by the dactyls of the chelipeds. The dorsomesial margins of both dactyls are provided with a row of spines in *N. australis*, whereas they are completely unarmed or may have one very small spine proximally in *N. alcocki*. Other differences include the spination of the dorsal surface of the palm of *N. australis* that is lacking in *N. alcocki*, and the longer ocular peduncles of the former species. HENDERSON described the carpi of the ambulatory legs as slightly spinulose. Only a dorsodistal spine is actually present on each of these appendages, whereas the carpi of *N. alcocki* have one or two small spines proximally on the dorsal margins, in addition to the dorsodistal spine.

REMARKS. — Although this species is described from only female specimens, there can be little doubt as to the accuracy of its assignment to *Nematopagurus*. In addition to well developed paired first pleopods modified as gonopods in the holotype, *N. alcocki* has such additional generic characters as the small, deeply grooved ocular acicles, reduced, rounded rostrum and clearly exposed interocular lobes, subequal chelipeds, and elongate ambulatory legs with ventrally armed dactyls.

The paratype is an immature female, as the gonopores are quite small and the gonopods minute; only a rudimentary left second pleopod is apparent. The chelipeds of this specimen have similar patterns of spination to that described for the holotype; however, the spines are appreciably stronger. In contrast, the dorsal surfaces of the chelae are not as abundantly provided with short setae and the characteristic bristle-like longer setae are weaker and more sparse on both the chelipeds and ambulatory legs.

One additional female specimen (1.7 mm) (POLIPI) of *Nematopagurus* was found at stn DW 22, and probably also represents *N. alcocki*; however, it is missing the chelipeds, left ambulatory legs, including the coxa of the third, the coxae and sternite of the fifth pereopods, and the abdomen. This specimen is not considered a paratype, even though the carpi of both right ambulatory legs have a very small proximal spine on the dorsal margin, and the second has a tiny spine on the ventral margin of the merus.

Genus ***AUSTRALEREMUS*** McLaughlin 1981

Pylopagurus - FOREST & DE SAINT LAURENT, 1968: 145 (in part), not *Pylopagurus* A. Milne Edwards & Bouvier, 1891. — MIYAKE, 1978: 119 (in part). — MCLAUGHLIN, 1981a: 2 (in part).
Australeremus McLaughlin, 1981a: 4. — MCLAUGHLIN & GUNN, 1992: 68.

DIAGNOSIS. — Eleven pairs phyllobranchiate gills. Ocular acicles triangular. Basal antennular segment with strong lateral spine; ventrodistal margin produced into elongate lobe. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod well developed, not recurved. Third maxilliped with well developed crista dentata and very strong accessory tooth.

Right cheliped often not appreciably larger than left. Chela of right subrectangular to subtriangular; dorsal surface of palm circumscribed by row of dorsomesial, dorsoproximal and dorsolateral marginal spines; angle of propodal-carpal articulation approximately 15° from horizontal plane. Left chela with variable propodal-carpal angle of articulation; dactyl elongate and considerably narrower than fixed finger; dorsolateral margin of chela elevated, at least proximally, and frequently expanded. Fourth pereopods semichelate; propodal rasp consisting of single row of corneous scales.

Males without paired pleopods or sexual tubes; with 3 unpaired, unequally biramous left pleopods. Females with paired first pleopods modified as gonopods, with 4 unpaired biramous pleopods, second to fourth with both rami well developed, fifth with endopod reduced.

Abdomen frequently straight or only weakly flexed. Uropods symmetrical or asymmetrical. Telson with transverse suture, sometimes only weakly indicated; posterior lobes symmetrical or subequal, terminal margins straight, oblique or rounded, armed; lateral margins each with undifferentiated, usually weakly calcified or chitinous plate.

REMARKS. — MCLAUGHLIN (1981a) chose the generic epithet in the belief that species of the genus all were endemic to the Southern Ocean. In their subsequent review of *Australeremus*, MCLAUGHLIN and GUNN (1992) reassigned *Eupagurus triserratus* Ortmann, 1892, and *Pylopagurus serpulophilus* Miyake, 1978 (as a junior synonym) from Japan to the genus, thus giving it a broad, but disjunct distribution. The discovery, not only of *A. triserratus*, but of an additional new species in the Maluku region of Indonesia suggests that *Australeremus* may be far more ubiquitous than previously believed and simply overlooked by collectors. At least several species occupy habitats not routinely sampled, such as bryozoan and serpulid worm tubes.

Australeremus triserratus (Ortmann, 1892)

Figs 24a, c

Eupagurus triserratus Ortmann, 1892: 308, pl. 12, fig. 15.
?*Eupagurus tricarinatus* - BALSS, 1913: 58 (?not *Eupagurus tricarinatus* Stimpson, 1858).
Eupagurus triserratus (?) - SHIINO, 1936: 184.
Eupagurus (Eupagurus) triserratus - MELIN, 1939: 29, figs 9, 10.
Pagurus triserratus - KIM, 1964: 5, pl. 1, fig. 6; 1970: 8; 1973: 225, 599, fig. 50, pl. 65, fig. 30.
Pylopagurus serpulophilus Miyake, 1978: 120, pl. 4, fig. 4; 1982: 120, pl. 40, fig. 5. — MCLAUGHLIN, 1981a: 3.
Australeremus triserratus - MCLAUGHLIN & GUNN, 1992: 87, fig. 14, pl. 1.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂ (0.9 mm) (MNHN-Pg 5302).

DIAGNOSIS. — Shield (Fig. 24a) slightly to considerably longer than broad. Rostrum acutely triangular. Ocular peduncles slightly shorter than antennular peduncles. Ocular acicles acutely triangular, with strong submarginal spine.

Right cheliped (Fig. 24c) with row of spines on dorsomesial margin of dactyl, dorsal surface with scattered low or spinulose tubercles. Dorsomesial, dorsoproximal and dorsolateral margins of palm each with row of acute spines entirely circumscribing palm and fixed finger; dorsal surface slightly convex and with numerous blunt or spinulose tubercles, midline with single or occasionally double row of larger spines. Carpus often with appreciably concave mesial face; dorsomesial margin with row of spines at least in distal half, second row of smaller spines laterally. Merus with row of spines on ventrolateral margin distally, ventromesial margin with 3 or 4 spines proximally.

Left cheliped (missing in KARUBAR specimen) with propodal-carpal articulation 45° to 50° from horizontal plane. Dactyl dorsoventrally flattened, unarmed. Palm and fixed finger with row of strong spines on dorsolateral margin, dorsal surfaces generally flattened, armed with 2 irregular rows of tubercles or spinules. Carpus with row of acute spines on dorsal margin.

Ambulatory legs generally similar. Dactyls each with 7 to 11 corneous spines on ventral margin; propodi with low protuberances on dorsal surfaces. Carpi each with 1 spine at dorsodistal angle, second often also with 1 additional spine on dorsal surface proximally. Sternite of third pereopods with subsemiovate anterior lobe.

Uropods symmetrical. Telson (Fig. 24g) with terminal margins of posterior lobes straight or slightly oblique, armed with 2 to 4 strong spines and occasionally 1 or 2 small spines; lateral plates reduced.

COLOR (in preservative). — Ground color of body and legs light red-brown. Carapace with pair of dark red-brown spots in front and behind cervical groove. Antennal flagellum with light and dark red-brown segments alternatively. Chela and carpus dark red-brown; merus light red-brown with three dark colored cross-bands. Walking legs light red-brown; meri and dactyls each with two dark colored cross-bands; carpi and propodi each with one dark colored cross-band (after MIYAKE, 1978, pl. 4, fig. 4).

HABITAT. — Serpulid worm tubes, at least in part.

DISTRIBUTION. — Sagami Bay, Tanabe Bay, Amakusa, Japan; East China Sea; Bonin Islands; South China Sea; Tanimbar Islands, Indonesia; 60 - 400 m.

AFFINITIES. — Based upon the armature of the chelipeds and carpi of the ambulatory legs, MCLAUGHLIN and GUNN (1992) suggested a possible relationship among the species, *A. triserratus*, *A. stewarti* (Filhol, 1883), and *A. eltaninae* McLaughlin & Gunn, 1992. However, a much closer kinship now appears to exist with *A. indonesiensis* sp. nov., as is discussed under that taxon.

REMARKS. — The diagnosis given is here for the species in general, not just as characterized by the very small KARUBAR specimen. This report of *A. triserratus* represents a considerable extension of the southern range of this species. MCLAUGHLIN and GUNN (1992) earlier had documented its occurrence only as far south as the South China Sea southwest of Kaohsiuhg, Taiwan. Despite its small size and the absence of the left cheliped, the single specimen in the KARUBAR collection unquestionably represents *A. triserratus*. The right palm has the marginal encirclement of spines characteristic of *Australeremus* and the median row of spines on the dorsal surface indicative of *A. triserratus*.

Australeremus indonesiensis sp. nov.

Figs 24 b, d-f, h, 42a-b

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♀ (1.9 mm) (MNHN-Pg 5303). — Stn DW 31, 05°40'S, 132°51'E, 288-289 m, 26.10.1991: 1 ♀ (2.0 mm) (MNHN-Pg 5304).

TYPES. — The female (1.9 mm) (MNHN-Pg 5303) from KARUBAR station DW 18 is the holotype. The other female is a paratype.

DESCRIPTION. — Shield (Fig. 24b) longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with scattered tufts of moderately long setae. Rostrum triangular, with small terminal spine; reaching beyond bases of ocular acicles. Lateral projections obtusely or acutely triangular, with marginal or submarginal spine. Posterior carapace with few tufts of long setae mesially adjacent to cervical groove.

Ocular peduncles 0.75 to 0.85 length of shield, moderately slender, dorsal surfaces with few sparse tufts of setae; corneae slightly, if at all, dilated. Ocular acicles triangular, terminating subacutely and with strong submarginal spine; separated basally by approximate basal width of one acicle.

Antennular peduncles (when extended) overreaching ocular peduncles by third to half length of ultimate segment. Basal segment with spine at dorsolateral distal margin. Penultimate segment with scattered short setae. Ultimate segment usually with 1 long seta at dorsodistal margin and few much shorter setae on dorsal surface.

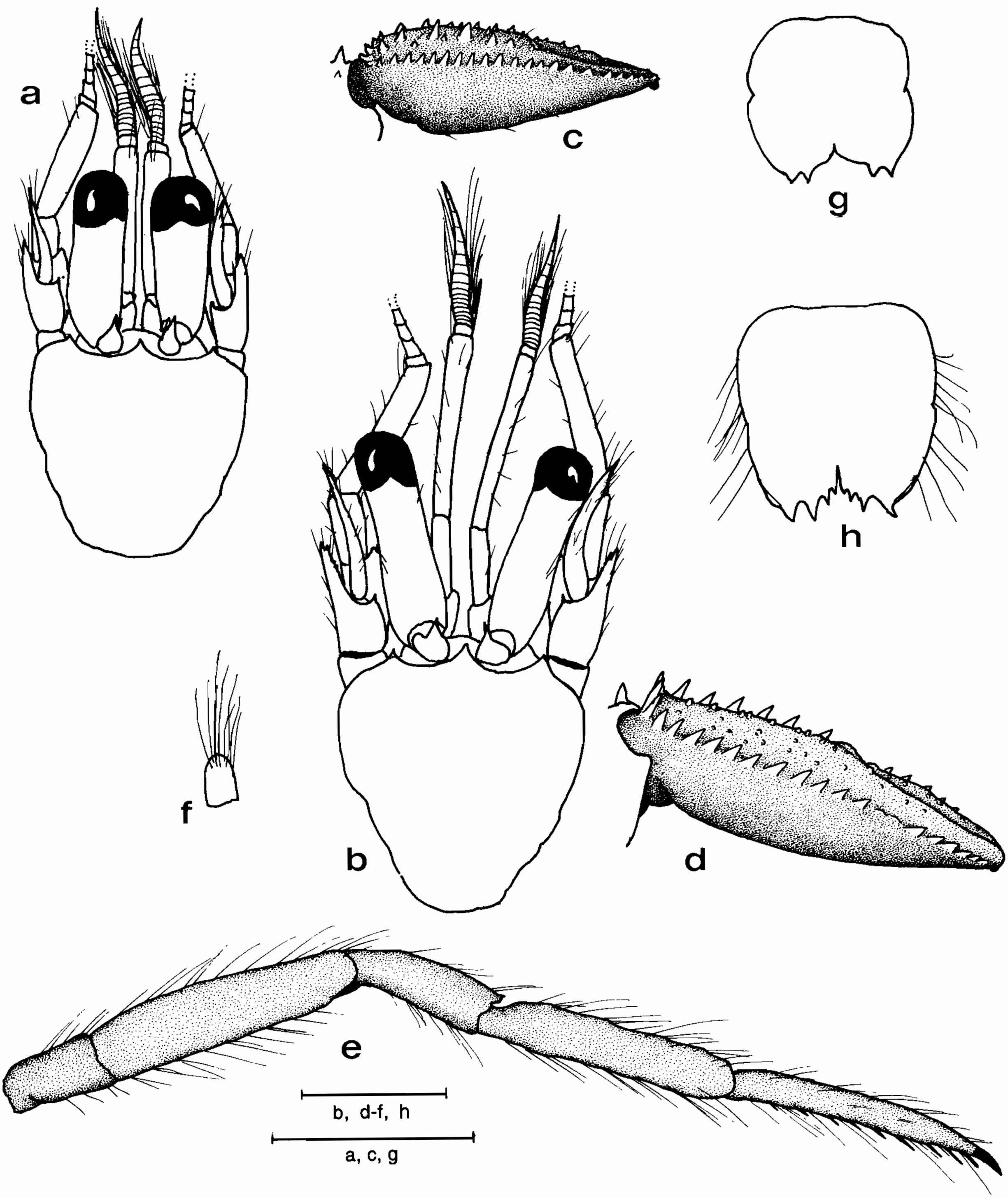

FIG. 24. — *Australeremus triserratus* (Ortmann, 1892), a, c, g, ♂ (0.9 mm) from KARUBAR Stn DW 50. — *Australeremus indonesiensis* sp. nov., b, d-f, h, holotype ♀ (1.9 mm) from Stn DW 18: **a-b**, shield and cephalic appendages; **c-d**, right chela (lateral view); **e**, right second pereopod (lateral view); **f**, anterior lobe of sternite of third pereopods; **g-h**, telson. Scales equal 0.5 mm (f-h) and 1.0 mm (a-e).

Antennal peduncles overreach ocular peduncles by 0.50 to 0.75 length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with unarmed ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in acute bifid spine, mesial and lateral margins each with 1 to 3 accessory spinules; dorsomesial distal angle with acute spine. First segment sometimes with spine at dorsolateral distal angle, 1 spine on ventrolateral margin distally. Antennal acicle reaching to proximal third of ultimate segment, terminating in small spine and with 1 to 4 quite long setae; mesial face with few moderately short setae. Antennal flagellum overreaching right cheliped; every, or every other, article with 1 to 3 long (4-6 article length) and 1 or 4 shorter setae.

Right cheliped (Figs 24d, 42a) with dactyl from slightly shorter to equaling length of palm; cutting edge with 3 or 4 calcareous teeth proximally, short row of corneous teeth in distal third, terminating in corneous claw and slightly overlapped by fixed finger; dorsomesial margin with row of spines, dorsal surface with longitudinal row of spinules or low spinulose tubercles and few setae, 1 or 2 additional spinules or tubercles laterally and adjacent to cutting edge; mesial and ventral surfaces with scattered long setae. Palm 0.65 to 0.80 length of carpus; dorsomesial, dorsoproximal and dorsolateral margins each with row of acute spines entirely circumscribing palm and fixed finger, dorsal surfaces of palm and fixed finger slightly convex and with numerous small spinules, 1 or 2 somewhat stronger adjacent to dorsomesial margin; cutting edge of fixed finger with 1 large calcareous tooth medianly, smaller teeth proximally and distally, terminating in corneous claw; surfaces with few scattered setae. Carpus slightly longer than merus; dorsomesial margin with row of spines at least in distal half, only few setae proximally in paratype, 1 spine at dorsodistal margin and row of spines on dorsolateral margin; all surfaces with scattered long setae. Merus subtriangular; dorsal margin with few setae, particularly distally; ventromesial margin with row of small spines distally, ventrolateral margin with few spinulose protuberances. Ischium unarmed.

Left cheliped (Fig. 42b) with propodal-carpal articulation 35° to 45° clockwise from horizontal plane. Dactyl 1.25 length of palm; cutting edge with row of corneous teeth, terminating in small corneous claw; dorsomesial margin with row of low sometimes spinulose protuberances and few setae, dorsal surface with few scattered setae. Palm half length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surfaces generally flattened, armed with few scattered tiny spinules, dorsomesial margin with few spinulose protuberances and setae. Carpus acutely triangular in cross-section; dorsal margin with row of strong spines, distal margin with 2 smaller spines mesially; 1 or 2 blunt spines on or adjacent to ventromesial margin distally; lateral and ventral surfaces with scattered long setae. Merus slightly shorter than carpus; dorsal margin with few setae; ventromesial margin with row of small spines or protuberances and long setae, ventrolateral margin unarmed or with few low protuberances and long setae. Ischium with few spinules on ventromesial margin.

Ambulatory legs (Fig. 24e) generally similar (third left missing in both holotype and paratype). Dactyls slightly shorter to approximately equaling length of propodi; dorsal margins each with row of sparse tufts of long setae; mesial and lateral faces with scattered shorter setae; ventral margins each with 7 or 8 corneous spines and numerous long setae. Propodi 1.50 to 1.75 length of carpi; dorsal and ventral surfaces with low protuberances and sparse tufts of long setae. Carpi 0.50 to 0.65 length of meri; dorsal margins each with 1 tiny spinule at distal angle, dorsal and particularly ventral surfaces with sparse tufts of long setae, second pereopods also with 1 slightly more prominent protuberance in proximal half. Dorsal and ventral surfaces of meri with low protuberances and sparse tufts of long setae. Ischia unarmed, but with tufts of setae. Sternite of 3rd pereopods with small subsemiovate anterior lobe (Fig. 24h) and tuft of long setae.

Dorsal surface of sixth abdominal somite with several long setae; uropods symmetrical. Telson (Fig. 24h) with transverse suture very faintly indicated; terminal margins of posterior lobes slightly oblique, armed with 2 or 3 spines and 1 or 2 spinules on either side of median cleft, outer angles blunt or with corneous spinule; lateral margins rounded, chitinous plates limited to very small area adjacent to outer angle.

COLOR (in preservative). — Only a general faint orange tint remains on the chelae and ambulatory legs after four years in alcohol.

HABITAT. — Unknown.

DISTRIBUTION. — Presently known only from the Kai Islands, Indonesia; 205-289 m.

ETYMOLOGY. — The specific name, *indonesiensis*, reflects the general geographic environs of this species, only the second to be described from outside the "Southern" Ocean.

AFFINITIES. — As previously indicated, *A. indonesiensis* is morphologically most similar to *A. triserratus*. Both species are characterized by the lack of armature on the dorsal margins of the segments of the ambulatory legs. The lack of a median row of large spines on the dorsal surface of the right chela will immediately distinguish *A. indonesiensis* from *A. triserratus*.

Genus *PAGURUS* Fabricius, 1775

Cancer Linnaeus, 1758: 625 (in part).
Pagurus Fabricius, 1775: 410 (in part).
Eupagurus Brandt, 1851: 105 (in part).
Bernhardus Dana, 1851: 267 (in part).
Not *Pagurus* Berthold, 1827: 255 (nomen nudum).
Not *Pagurus* Fabricius sensu Dana, 1851: 267 (= *Dardanus* Paul'son, 1875).

DIAGNOSIS. — Eleven pairs of phyllobranchiate gills. Rostrum variable. Ocular acicles simple, bifid or multifid. Crista dentata well developed, with 1 or more accessory teeth. Sternite of third maxillipeds unarmed or armed. Chelipeds generally grossly unequal, right usually appreciably larger. Dactyls of ambulatory legs commonly with spinose ventral margins. Sternite of third pereopods variable. Fourth pereopods usually semichelate, with 1 to several rows of scales in propodal rasp. Sternite of fifth pereopods variable.

Coxae of fifth pereopods generally symmetrical in both sexes. Males with paired gonopores; no paired pleopods, usually with 3 or 4 unpaired left pleopods, rarely without unpaired pleopods. Females usually with paired gonopores; no paired pleopods, usually 4 unpaired left pleopods, rarely only 3.

Abdomen usually spirally twisted, rarely straight. Uropods most commonly asymmetrical, occasionally symmetrical. Telson typically with transverse suture; posterior lobes frequently separated by well developed median cleft; terminal margins rounded, straight or oblique.

REMARKS. — *Pagurus* is the "catch-all" genus for any hermit crab having 11 pairs of phyllobranchiate gills, but lacking secondary sexual modifications or similar exclusive characters, and as such is the most specious, albeit heterogeneous, of all pagurid genera. However, despite the widespread occurrence of more than 150 species throughout the world's oceans, fewer than one quarter of those have been reported from the tropical Indo-Pacific.

In addition to the KARUBAR specimens, five species of *Pagurus* are known specifically from the Maluku area. A small male of *Pagurus compressipes* (Miers, 1884) was the specimen from the Arafura Sea that HENDERSON (1888) tentatively assigned to his *"Pagurodes" piliferus*. Although BUITENDIJK (1937) published only on the Diogenidae of the "*Snellius*" expedition, she did identify some of the Paguridae from that collection, among them a specimen of *P. hirtimanus* (Miers, 1880) from Wotap Island ("Tenimber Islands"), now part of the collection of the National Museum of Natural History (USNM 122050). HAIG and BALL (1988) reported *P. hirtimanus* and *P. moluccensis* Haig & Ball, 1988, from the Banda Islands, *P. hedleyi* Grant & McCulloch, 1906, from the Arafura Sea, and *P. pergranulatus* (Henderson, 1896) from Seram.

Key to the Maluku species of *Pagurus*

1. Interocular lobes developed as pair of spinose processes .... ***Pagurus moluccensis****
— Interocular lobes not developed as pair of spinose processes **2**

2. Ventromesial margins of carpus and/or merus of right cheliped strongly produced into ventrally directed "wing-like" lobe **3**
— Ventromesial margins of carpus and/or merus of right cheliped not produced into ventrally directed "wing-like" lobe **4**

3. Dorsomesial distal angle of right chela produced into distinct spinose or tuberculate lobe; dactyls of ambulatory legs longer than propodi; second pereopods each with dorsodistal and dorsoproximal spine .... ***P. pergranulatus****
— Dorsomesial distal angle of right chela not produced into distinct spinose or tuberculate lobe; dactyls of ambulatory legs shorter than propodi; second pereopods each with only dorsodistal spine .... ***P. hedleyi****

4. Dorsal surfaces of chelae armed with numerous very strong spines **5**
— Dorsal surfaces of chela unarmed or armed only with granules, tubercles or small spines.... .... **6**

5. Dactyl of fourth pereopod with multiple rows of corneous scales in propodal rasp; lateral face of propodus of left third pereopod with numerous short transverse rows of setae .... ***P. haigae*** sp. nov.
— Dactyls of fourth pereopods with single row of corneous scales in propodal rasp; lateral face of propodus of left third pereopod without numerous short transverse rows of setae ... . **?*Pagurus* sp.**

6. Right cheliped not appreciably longer than left; dorsomesial and dorsolateral margins of chelae each forming low, but distinct ridge, dorsal surfaces armed with transverse ridges and setae .... ***P. compressipes****
— Right cheliped appreciably longer than left; dorsomesial and dorsolateral margins of chelae not forming low, but distinct ridges, dorsal surfaces not armed with transverse ridges and setae **7**

7. Dorsal surfaces of chelae with covering of dense short setae practically obscuring armature .... ***P. hirtimanus****
— Dorsal surfaces of chelae without covering of dense short setae practically obscuring armature **8**

8. Dorsal surface of right chela smooth, granular, minutely spinulose or with small simple tubercles; dactyls of ambulatory legs nearly twice length of propodi .... ***P. kaiensis*** sp. nov.
— Dorsal surface of right chela with numerous small spines and tubercles, latter usually with central corneous capsule; dactyls of ambulatory legs much less than twice length of propodi .... ***P. capsularis*** sp. nov.

Pagurus kaiensis sp. nov.

Figs 25a-l, 42e-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 14, 05°18'S, 132°38'E, 245-246 m, 24.10.1991: 1 ♂ (2.6 mm) (MNHN-Pg 5305). — Stn DW 15, 05°17'S, 132°41'E, 212-221 m, 24.10.1991: 1 ♀ (2.8 mm) (POLIPI). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (8.4 mm) (MNHN-Pg 5306); 1 ♀ (3.0 mm) (MNHN-Pg 5307). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♀ (3.9 mm) (USNM 276015).

TYPES. — The male (8.4 mm) (MNHN-Pg 5306) from the KARUBAR station DW 18 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 25a) as long as broad or slightly broader; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; surface frequently with few scattered setae. Rostrum broadly triangular, terminating acutely or bluntly and often with terminal spine (but absent in holotype). Lateral projections obtusely triangular, with strong submarginal spine.

Ocular peduncles short, approximately 0.70 to 0.80 length of shield, appreciably broadened distally; corneae dilated. Ocular acicles narrowly triangular, terminating acutely and with very small submarginal spine; separated basally by basal width of one acicle.

Antennular peduncles overreaching corneae by 0.75 to entire length of ultimate segment. Ultimate segment with 1 long and few shorter setae on dorsal surface. Penultimate segment with few short setae ventrally. Basal segment with strong spine on laterodistal margin dorsally.

Antennal peduncle overreaching ocular peduncle (including cornea) by 0.50 to 0.65 length of ultimate segment; with supernumerary segment. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle. Second segment with dorsolateral distal angle very prominently produced, reaching to mid or distal portion of fourth segment and terminating in very strong spine, usually with 1 or 2 accessory spines on both mesial and lateral margins; dorsomesial distal angle with prominent, slender, acute spine. First segment frequently with very small spine on lateral margin distally, ventrolateral margin with 1 prominent spine. Antennal acicle long, reaching to distal half of ultimate peduncular segment, arcuate, terminating in acute spine, mesial margin with sparse row of setae. Antennal flagellum usually slightly shorter than outstretched right cheliped, with 1 to 3 short setae every 2 to 6 articles.

Maxillule with external lobe of endopod moderately well developed, not recurved. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds unarmed or with very small median spinule.

Chelipeds grossly unequal. Right cheliped (Fig. 42e) with dactyl somewhat shorter to approximately equaling length of palm; cutting edge with row of calcareous teeth, terminating in small calcareous claw; dorsal surface angularly convex, with scattered small spinules and few setae, midline with row of very small spines extending nearly to tip; dorsomesial margin with row of small spines; ventral surface with few setae. Palm 0.75 to approximately equaling length of carpus; dorsomesial margin with row of spinules and 1 more prominent tubercle at dorsomesial proximal angle, convex dorsal surface generally smooth, faintly granular, or minutely spinulose, but with weak longitudinal depression setting off distinctly spinulose or tuberculate mesial portion, dorsolateral margin with row of small spines, obsolete in proximal fourth or third but increasing slightly in size distally and extending almost to tip of fixed finger; mesial, lateral and ventral surfaces minutely spinulose or granular; cutting edge of fixed finger with row of small calcareous teeth and 1 more prominent tooth medially, terminating in small calcareous claw. Carpus approximately as long as merus; dorsomesial margin with irregular row of small to moderately strong spines; dorsal surface with 3 irregular rows of smaller spines; dorsolateral margin not delimited, dorsolateral surface with numerous short transverse spinulose ridges; distomesial and distolateral margins each with row of small spines; ventral surface tuberculate. Merus triangular; 1 spine on dorsodistal margin, dorsal surface with rows of short transverse spinulose ridges and short setae; ventromesial and ventrolateral margins each with row of small spines, usually more acute laterally; ventral surface spinulose or tuberculate. Ischium unarmed or with row of widely-spaced very small spinulose protuberances and few moderately long setae on ventral margin.

Left cheliped (Fig. 42f) with dactyl exceeding length of palm by 0.10 to 0.35 own length; cutting edge with row of very fine corneous teeth, terminating in small corneous claw; dorsomesial margin with row of spinules at least in proximal half, dorsal midline usually slightly elevated and often with row of spinules in proximal half; dorsal, mesial and ventral surfaces with scattered moderately long setae, most numerous distally and ventrally. Palm 0.40 to 0.65 length of carpus; triangular in cross-section, dorsal surface elevated in midline, but not forming distinct ridge or crest, with irregular double row of very small spines and tubercles, extending onto proximal half of fixed finger, dorsal surface of fixed finger frequently spinulose or weakly tuberculate; dorsolateral margin with row of small or very small spines, usually not extending to tip of fixed finger; dorsolateral and dorsomesial surfaces spinulose and strongly sloping ventrally, dorsomesial margin with irregular row of spinulose protuberances or small spines. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, laterodistal margin with few spines or spinules dorsally; dorsodistal margin with strong usually double spine, dorsomesial margin with row of smaller spines or spinulose protuberances; dorsal, mesial and lateral faces often tuberculate and with scattered setae; ventromesial margin with row of widely-spaced low blunt or spinulose protuberances, ventrolateral margin with row of very small spinulose tubercles, ventral surface tuberculate. Merus with short transverse rows of setae on dorsal margin; ventromesial margin with row of small blunt spines, ventrolateral margin with row of more acute spines; mesial, lateral and ventral surfaces with scattered setae. Ischium sometimes with row of small spinulose tubercles on ventromesial margin.

Ambulatory legs (Figs 25b-e) similar from left to right. Dactyls 1.65 to 1.85 longer than propodi; in dorsal view, straight or very slightly twisted; in lateral view, slightly arched; terminating in small corneous claws; dorsal

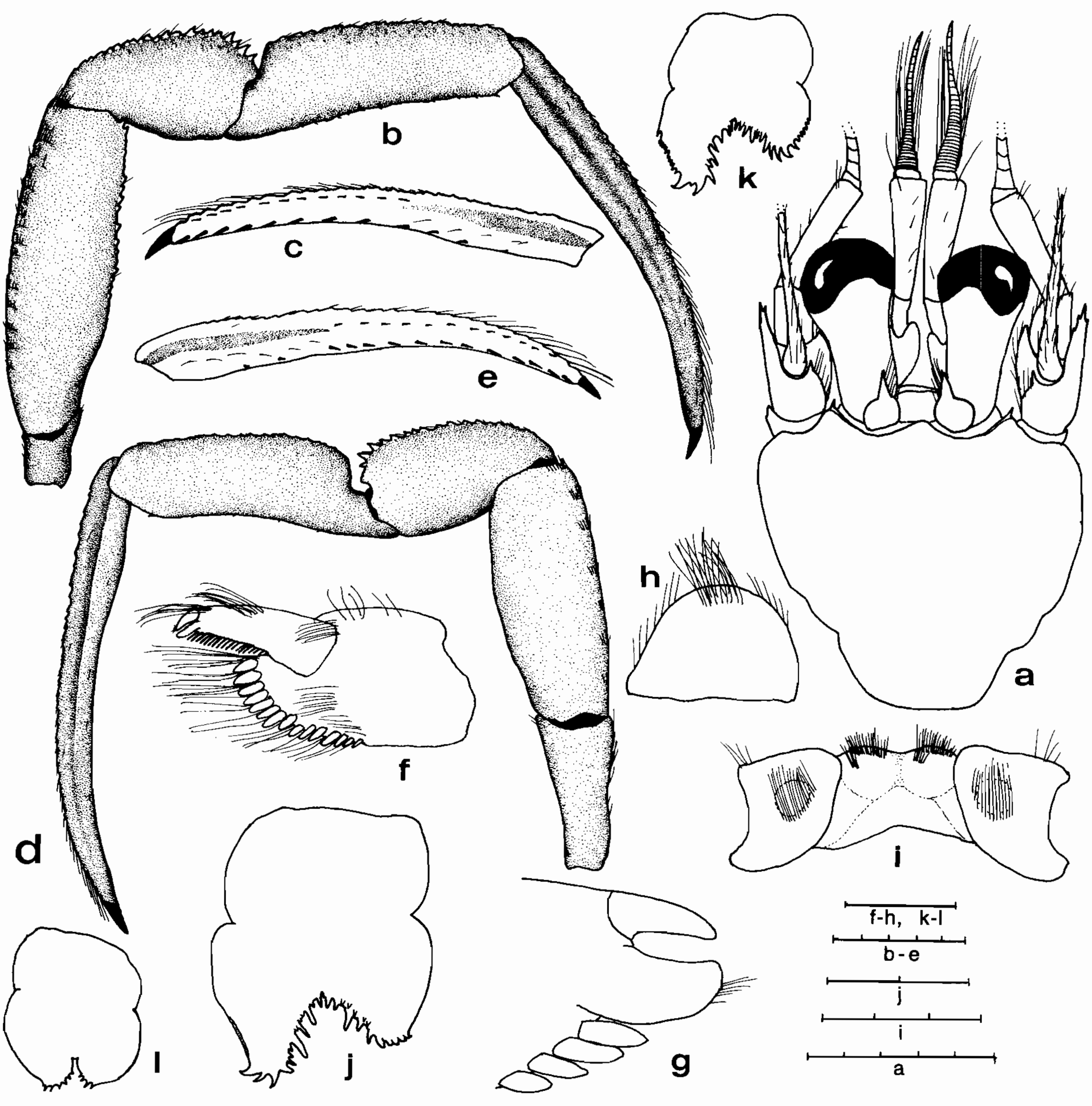

FIG. 25. — *Pagurus kaiensis* sp. nov., a-f, h-j, holotype ♂ (8.4 mm) from KARUBAR Stn DW 18; g, k, paratype ♀ (4.0 mm) from Stn CP 36. — l, *Pagurus compressipes* syntype ♂ (3.9 mm) (NHM 1881.31): **a**, shield and cephalic appendages; **b**, right second pereopod (lateral view); **c**, dactyl of right second pereopod (mesial view); **d**, left third pereopod (lateral view); **e**, dactyl of left third pereopod (mesial view); **f**, dactyl and propodus of left fourth pereopod (lateral view); **g**, tip of dactyl and preungual process of right fourth pereopod (lateral view); **h**, anterior lobe of sternite of third pereopods; **i**, coxae and sternite of fifth pereopods; **j-l**, telson. Scales equal 0.1 mm (g), 1.0 mm (f, h, k-l), 2.0 mm (j), 3.0 mm (i), and 5.0 mm (a-e).

margins each with row of low protuberances and stiff bristles, increasing in length distally; lateral and mesial faces each with shallow longitudinal sulcus at least in proximal half, lateral faces often also with dorsal and ventral row of fine setae, mesial faces each with short row of small corneous spinules dorsally and few setae ventrally; mesioventral or ventral surfaces each with 11 to 14 corneous spines, increasing in length distally. Propodi 1.30 to 1.50 longer than carpi; dorsal surfaces each with irregular row of spinulose protuberances or spinules, frequently accompanied by very short spiniform bristles; ventrodistal margins each usually with 1 or 2 corneous spinules, ventral surface with row of quite small corneous spinules, more numerous and closely-spaced on second pereopods of holotype. Carpi 0.65 to 0.75 length of meri; each with row of small spines or spinulose tubercles becoming strongest at distal angles and accompanied by very short, spiniform bristles and sparse short setae. Meri each with series of transverse rows of short setae on dorsal surfaces; second pereopods each with 2 or 3 small spines on ventromesial and ventrolateral distal margins, narrow ventral surface with irregular double row of small spines, third unarmed. Ischia with few setae most abundant dorsally. Propodal rasp of fourth pereopods with single row of corneous scales; dactyl with prominent preungual process (Figs 25f-g) at base of claw. Sternite of third pereopods with few long setae on subsemiovate or subsemicircular anterior lobe (Fig. 25h).

Sternite of fifth pereopods (Fig. 25i) developed anteriorly as two subovate lobes separated by shallow median groove, anterior margins each with tuft of moderately dense setae. Males with paired gonopores partially obscured by row of moderately long setae; 3 unequally biramous unpaired pleopods, pleopods 3 and 4 with exopods moderately well developed, endopods reduced, pleopod 5 with exopod moderately well developed, endopod rudimentary or vestigial. Females with paired gonopores, 4 unpaired pleopods, pleopods 2 to 4 with both rami well developed, pleopod 5 with exopod well developed, endopod markedly reduced.

Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 25j-k) with transverse suture; posterior lobes strongly asymmetrical, separated by indistinct or very small median cleft; terminal margins oblique, with marginal and submarginal spines, strongest at outer angles; lateral margins sometimes with row of small spines, or at least left with short marginal chitinous plate.

COLOR (in preservative). — Distal halves of ocular peduncles and penultimate segments of antennular peduncles orange. Chelipeds with overall faint orange tint, appreciably faded on chelae, but darker on carpi and meri; meri also with splotches of white. Ambulatory legs each with longitudinal stripe of orange on lateral face of carpus and on lateral, mesial, and ventral surfaces of dactyl.

HABITAT. — Unknown.

DISTRIBUTION. — Kai Islands, Indonesia; 210-268 m.

ETYMOLOGY. — The specific epithet is derived from the Kai Islands, the type locality of this species.

AFFINITIES. — *Pagurus kaiensis* does not appear closely allied to any of the other regional *Pagurus* species. In small specimens, the general shape of the left chela approaches that of *P. hirtimanus*, but without the dense setation of that species. In having long ambulatory dactyls and a single row of scales in the propodal rasp, *P. kaiensis* resembles *P. compressipes*, but the two are immediately distinguished by the markedly different armatures of the chelipeds (Figs 42g-h) and telson (Fig. 25l) of the latter species.

Pagurus capsularis sp. nov.

Figs 26a-k

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 1 ♂ (6.6 mm) (MNHN-Pg 5308). — Stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ♂ (3.2 mm) (MNHN-Pg 5309).

TYPES. — The male (6.6 mm) (MNHN-Pg 5308) from KARUBAR station DW 49 is the holotype. The other male is a paratype.

DESCRIPTION. — Shield (Fig. 26a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; surface with few tufts setae. Rostrum broadly triangular, terminating acutely or with terminal spine. Lateral projections obtusely triangular, with submarginal spine or spinule.

Ocular peduncles short, approximately 0.65 length of shield, slightly broader distally; corneae weakly dilated. Ocular acicles narrowly triangular, terminating acutely and with very small submarginal spine; separated basally by slightly more than half basal width of one acicle.

Antennular peduncles overreaching corneae by approximately 0.50 length of ultimate segment. Ultimate segment with 1 long and few shorter setae on dorsal surface. Penultimate segment with few short setae. Basal segment with numerous long stiff setae and strong spine on laterodistal margin dorsally.

Antennal peduncle reaching nearly to distal margin of cornea. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle obscured by tufts of long stiff setae. Second segment with dorsolateral distal angle very prominently produced, reaching to distal half of fourth segment, terminating in simple or bifid spine partially obscured by stiff setae; dorsomesial distal angle with acute spine, several long stiff setae on mesial margin. First segment with small spine on lateral margin distally, ventrolateral margin with 1 prominent spine. Antennal acicle moderately long, reaching to distal half of ultimate peduncular segment, but not overreaching distal margin of cornea; arcuate, terminating in acute spine, mesial margin with row of tufts of stiff setae. Antennal flagellum longer than outstretched right cheliped, with 1 to 3 short or long setae every 4 to 8 articles.

Maxillule with external lobe of endopod obsolete. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds unarmed.

Chelipeds grossly unequal. Right cheliped (Fig. 26b) (regenerating in paratype) with dactyl shorter than palm and overlapped by fixed finger; cutting edge with row of low broad calcareous teeth and adjacent row of tufts of short stiff setae; dorsal surface convex, with closely-spaced spinulose tubercles on mesial side of midline proximally, distally only with few tufts of setae; dorsomesial margin with row of small tuberculate spines, mesial surface with several low broad tubercles. Palm approximately equaling carpus in length; dorsomesial margin with row of small spines, convex dorsal surface with irregular rows of small spines and tubercles, 1 more prominent row of spines in midline, tubercles frequently with central corneous somewhat flask-shaped capsules (Fig. 26c); dorsal surface of fixed finger with row of spinules and double row of tufts of setae adjacent to cutting edge, latter with row of small calcareous teeth, terminating in strong calcareous claw; mesial face and lateral face dorsally with low unmodified tubercles or protuberances; all surfaces with scattered short setae. Carpus approximately as long as merus; dorsomesial margin with row of moderately strong spines and numerous long setae, dorsal surface with scattered setae, 1 irregular row of few spines adjacent to dorsomesial margin, 1 short row of quite small spines in midline and additional row adjacent to weakly delimited dorsolateral margin, distal margin with few spinules; mesial and lateral faces with scattered setae. Merus with few short transverse rows of setae; ventromesial margin with few small blunt spinules, but not ventrally produced into wing-like expansion; ventral surface with unmodified spinulose tubercles, ventrolateral margin with row of acute spines. Ischium unarmed.

Left cheliped (Fig. 26d) with dactyl exceeding length of palm by approximately third own length; cutting edge with row of corneous teeth, terminating in large corneous claw; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces with rows of tufts of moderately long stiff setae. Palm approximately half length of carpus; triangular in cross-section, dorsal surface elevated in midline but not forming distinct ridge or crest, with row of tuberculate spines extending onto proximal half of fixed finger; dorsolateral margin with row of spines, dorsolateral and dorsomesial surfaces strongly sloping ventrally, each with covering of tubercles, most of which provided with central corneous somewhat flask-shaped structure, more numerous laterally but not encompassing entire dorsal surface of fixed finger, dorsomesial margin not delimited. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, laterodistal margin with row of spines extending onto ventrolateral margin distally; dorsodistal margin with pair of strong spines, dorsomesial margin with row of equally strong spines; mesial, lateral and ventral surfaces with numerous low sometimes spinulose or spinose protuberances and tufts of long stiff setae. Merus with short transverse rows of stiff setae on dorsal margin; ventromesial margin with 1 prominent spine and few spinulose tubercles, partially masked by long stiff setae; ventrolateral margin with row of very strong acute spines and long stiff setae, ventral surface with spinulose tubercles and tufts of long stiff setae; mesial and lateral with low protuberances and setae. Ischium unarmed.

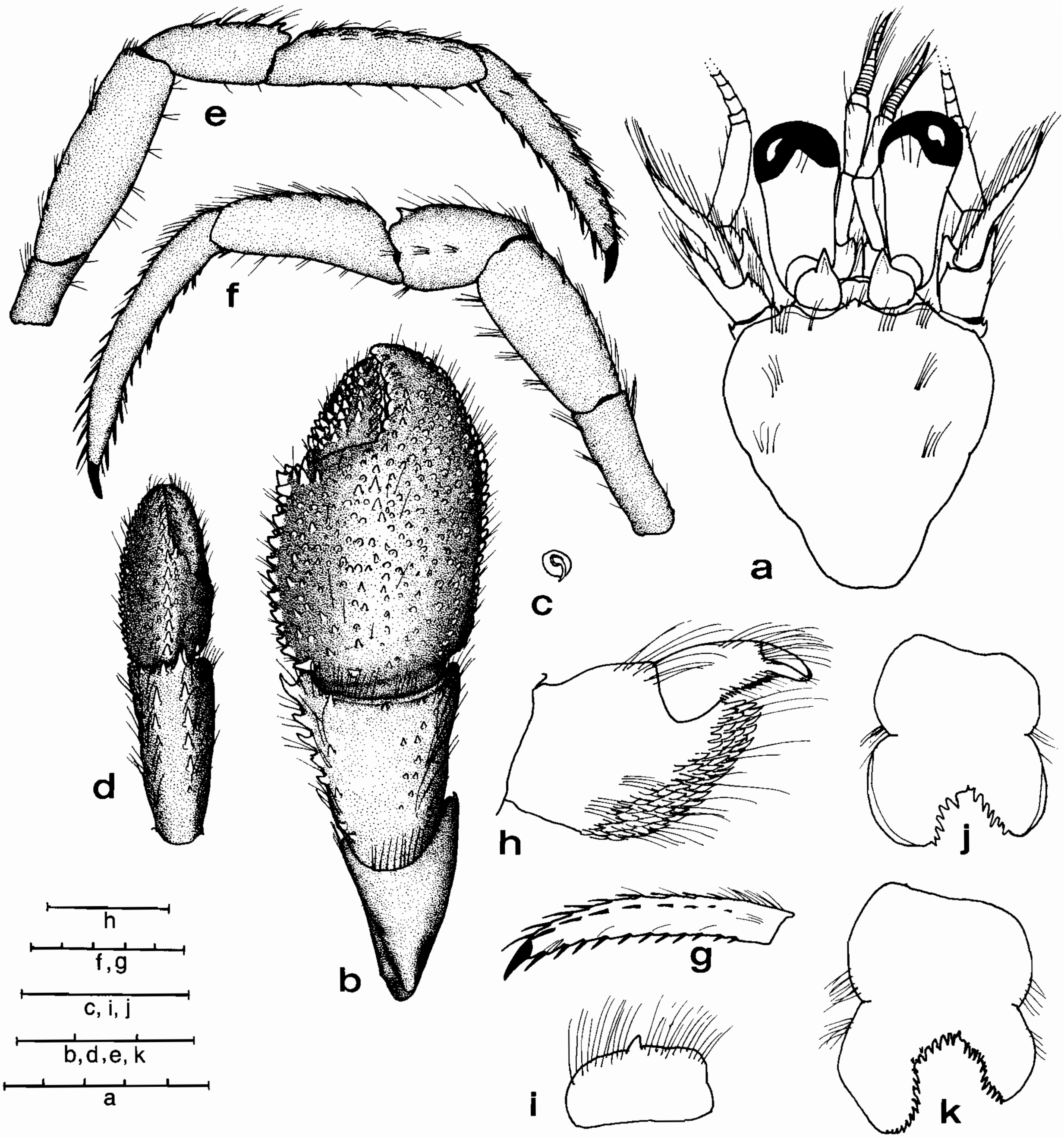

FIG. 26. — *Pagurus capsularis* sp. nov., a, f-h, k, paratype ♂ (6.6 mm) from KARUBAR Stn DW 49; b-e, i, j, holotype ♂ (3.2 mm) from Stn DW 50: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, capsulate tubercle; **d**, chela and carpus of left cheliped (dorsal view); **e**, right second pereopod (lateral view); **f**, left third pereopod (lateral view); **g**, dactyl of left third pereopod (mesial view); **h**, dactyl and propodus of right fourth pereopod (lateral view); **i**, anterior lobe of sternite of third pereopods; **j-k**, telson. Scales equal 0.5 mm (c, i), 1.0 mm (h, j), 3.0 mm (b, d-e, k), and 5.0 mm (a, f-g).

Ambulatory legs (Figs 26e-g) similar from left to right. Dactyls 1.35 to 1.50 longer than propodi; in dorsal view, straight; in lateral view, slightly curved ventrally; terminating in moderately long corneous claws; dorsal margins each with setae proximally and row of corneous spines, increasing in length distally; lateral faces with dorsal and ventral row of fine setae; mesial faces each with row of corneous spines dorsally and setae ventrally; ventral surfaces each with 7 to 12 strong corneous spines, increasing in length distally. Propodi 1.10 to 1.20 longer than carpi; dorsal surfaces each with row of low protuberances and tufts of stiff setae; ventrodistal margins each with 1 or 2 corneous spinules, ventral surface with row of widely-spaced quite small corneous spinules. Carpi 0.75 to 0.85 length of meri; each with dorsodistal spine and sparse row of tufts of setae; second pereopods also with small spine on dorsal surface in proximal half. Meri and ischia with dorsal and ventral tufts of setae. Propodal rasp of fourth pereopods (Fig. 26h) with multiple rows of sharp corneous scales; dactyl with prominent preungual process at base of claw. Anterior lobe of sternite of third pereopods (Fig. 26i) subsemicircular or roundly subrectangular, unarmed or with marginal spine and several long setae. Sternite of fifth pereopods developed anteriorly as 2 somewhat flattened semirectangular lobes separated by shallow median depression, anterior margins each with row of fine setae.

Females unknown. Males with 4 unpaired left pleopods; second small and uniramous in holotype, all 4 unequally biramous in paratype; exopods moderately well developed, endopods absent or rudimentary. Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 26j-k) with transverse suture; posterior lobes asymmetrical, separated by very small or faintly indicated median cleft; terminal margins oblique or weakly concave, each with row of moderately slender spines, not reaching to, or not stronger at outer angles, nor extending onto weakly calcified lateral margins.

COLOR (in preservative). — Ocular peduncles with patch or band of orange on dorsal surface proximally and partial orange stripe on ventral surface. Ambulatory legs with orange at distal margins of meri, proximal and distal margins of carpi and propodi and proximal margins of dactyls; distal tips of dactyls white.

HABITAT. — Unknown.

DISTRIBUTION. — Collected only in Tanimbar Islands, 184-210 m.

ETYMOLOGY. — From the Latin *capsula*, meaning a case or box, and reflecting the presence of central capsulate structures on many of the tubercles and spines on the dorsal surfaces of both chelae.

AFFINITIES. — The shape of left chela in *P. capsularis* and the presence of four unpaired male pleopods is very reminiscent of two other species found in the Maluku region, *P. hirtimanus* and *P. pergranulatus* (HAIG & BALL, 1988). *Pagurus capsularis* is readily differentiated from *P. hirtimanus* by the lack of a dense covering of setae on the chelae that is seen in the latter species. This new species is immediately distinguished from *P. pergranulatus* by marked differences in the ventromesial margin of the merus of the right cheliped. This margin in *P. pergranulatus* is developed into a distinct somewhat wing-like ventrally produced lobe and provided with a dense tuft of setae; no such development of this margin occurs in *P. capsularis*. Differences in the shape and armature of the right chelae in the two species, while also distinct, are less dramatic. In *P. capsularis*, the dorsodistal angle is armed with spines, but not noticeably produced as a subacute lobe; the dorsal surface is armed with numerous small spines and tubercles, with a somewhat irregular, more prominent row in the longitudinal midline. In contrast, *P. pergranulatus* has the dorsodistal angle of the palm produced as a subacute lobe (cf. ALCOCK & ANDERSON, 1897, pl. 31, fig. 1); the dorsal surface is provided with a series of granules each having what has been described as an anterior concavity or central depression (HENDERSON, 1896). No reference has been made by previous authors (e.g., HENDERSON, 1896; ALCOCK, 1905b; HAIG & BALL, 1988) to distinctive capsulate structures on the tubercles of the chelae of *P. pergranulatus*; however, in the single specimen available for examination ("*Soela*" station T17/43, 19°47.4'S, 116°31.4'E, 56-57 m; MNT) structures similar to those described for *P. capsularis* were observed. While the residual color patterns of the "*Soela*" specimen agree with those given by HAIG and BALL (1988) for *P. pergranulatus*, both clearly differ from the remnants of color in the specimens of *P. capsularis*.

The presence of a median row of spines on the dorsal surface of the right chela and three irregular rows of spines on the carpus of *P. capsularis* suggests a similarity with *P. samoensis* (Ortmann, 1892), but the KARUBAR species differs from ORTMANN'S in having the dorsal surface of the right chela strongly convex, and having much shorter antennal acicles, but longer dactyls of the ambulatory legs.

REMARKS. — The capsules occupying the central surface of the tubercles of the chelae in both *P. capsularis* and *P. pergranulatus* are reminiscent of the structures seen in *Nematopagurus spinulosensoris*. However, those of the former two species have a more ball-like base and elongate, slender and drawn-out distal portion, whereas the capsules of *N. spinulosensoris* are stouter and have a more tear-drop appearance. Since *P. capsularis* is known only from the holotype and single paratype, no attempt has been made to determine the internal structure of these capsules; nevertheless, a subterminal opening, similar to that observed in *N. spinulosensoris*, does appear to be present. The capsules of that species were shown to be highly complex structures (MCLAUGHLIN & LANE, 1975).

Pagurus haigae sp. nov.

Figs 27a-h, 43a-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 16, 05°17'S, 132°50'E, 315-349 m, 24.10.1991: 1 ♂ (18.6 mm) (MNHN-Pg 5310); 1 ♀ (12.1 mm) (MNHN-Pg 5310 bis). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ (10.1 mm) (MNHN-Pg 5311); 1 ♂ (7.3 mm) (SNHM 4812). — Stn CP 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♂ (14.1 mm, molt) (POLIPI).
Tanimbar Islands: stn CC 41, 07°45'S, 132°42'E, 401-393 m, 28.10.1991: 1 ♂ (11.5 mm) (USNM 276014).

TYPES. — The male (18.6 mm) (MNHN-Pg 5310) from KARUBAR station DW 16 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 27a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced; posterior margin truncate; surface with few tufts setae. Rostrum triangular, terminating acutely, with or without terminal spine. Lateral projections triangular, with strong marginal or submarginal spine.

Ocular peduncles moderately short, 0.50 to 0.75 length of shield, slightly broader distally; corneae weakly dilated; dorsal surface frequently with row of sparse setae. Ocular acicles roundly triangular, terminating subacutely and with strong submarginal spine; separated basally by 0.50 to nearly entire basal width of one acicle.

Antennular peduncles overreaching corneae by 0.25 to nearly entire length of ultimate segment. Ultimate segment usually with 1 or 2 setae at dorsodistal margin and also often with row of short setae on dorsal surface. Penultimate segment with very few short setae. Basal segment with hooked spine on laterodistal margin dorsally and few setae mesially.

Antennal peduncle overreaching distal margin of cornea by 0.25 to 0.50 length of ultimate segment; with supernumerary segment. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal angle sometimes partially obscured by tufts of long stiff setae. Second segment with dorsolateral distal angle prominently produced, reaching to or beyond distal half of fourth segment, terminating in simple or bifid spine and with 3 to 5 spines on mesial margin sometimes partially obscured by thick setae; dorsomesial distal angle with acute spine. First segment with spine on lateral margin distally, ventrolateral margin with 4 to 6 small spines laterally and distally. Antennal acicle long, reaching to distal half of ultimate peduncular segment, and considerably beyond distal margin of cornea; slightly sinuous, terminating in acute spine, mesial margin with row of tufts of stiff setae. Antennal flagellum shorter than outstretched right cheliped, with 2 very short setae every article and 1 to 3 longer setae every 4 to 8 articles.

Maxillule with external lobe of endopod vestigial. Ischium of third maxilliped with 1 accessory tooth on crista dentata. Sternite of third maxillipeds with strong spine on either side of midline.

Chelipeds grossly unequal; spines of chelae and carpi usually with tiny corneous tips and most practically obscured by tufts of long thick setae. Right cheliped (Figs 43a, c) with dactyl equal to length of palm; cutting edge

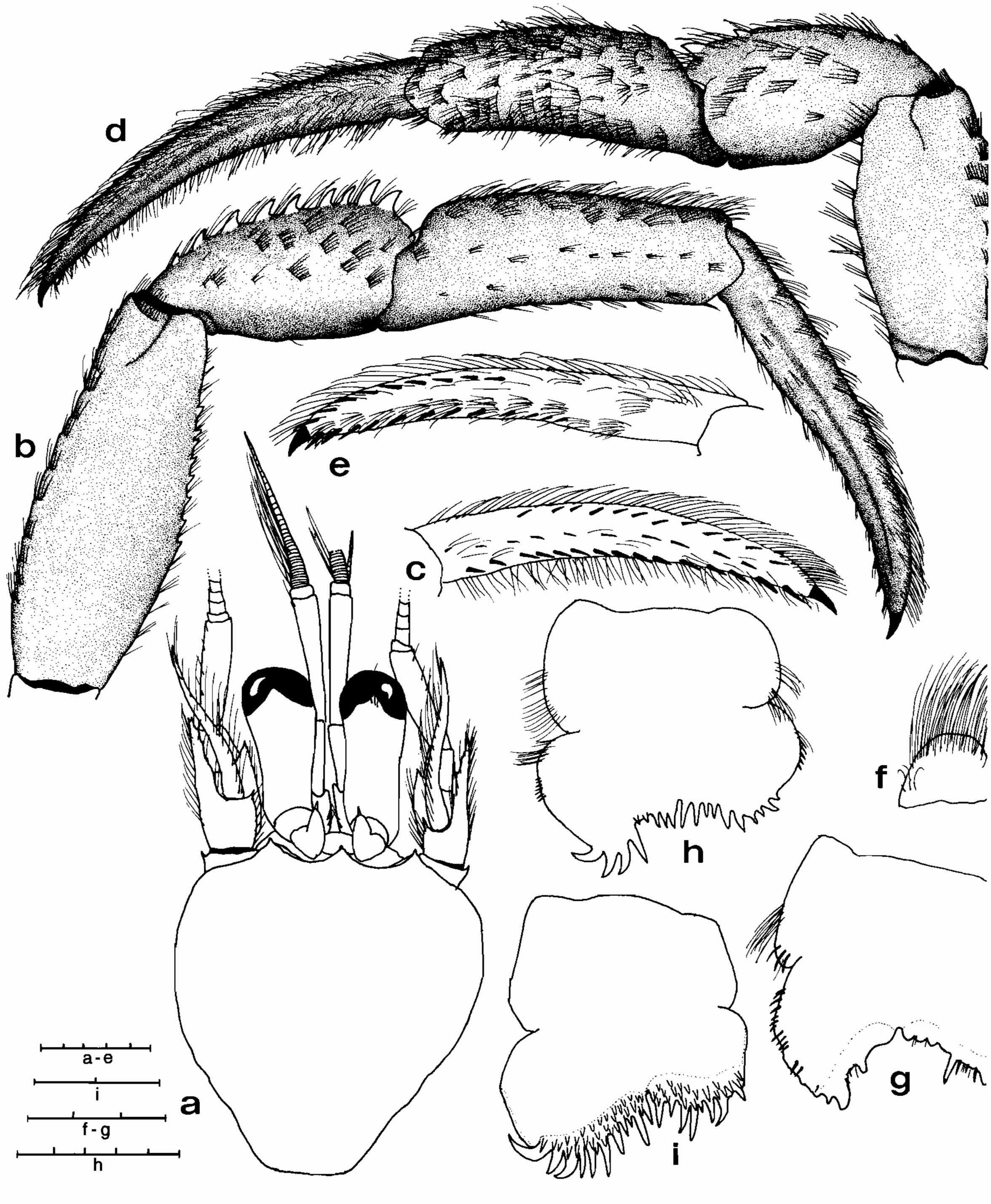

FIG. 27. — *Pagurus haigae* sp. nov., a-g, paratype ♀ (12.1 mm) from KARUBAR Stn CP 16; h, holotype ♂ (18.6 mm) from Stn CP 16. — i, *Pagurus yokoyai* Makarov, 1938, ♂ (8.5 mm) from Uchibo coast of Boso Peninsula, Japan, (CBM-ZC 1668): **a**, shield and cephalic appendages; **b**, right second pereopod (lateral view); **c**, dactyl of right second pereopod (mesial view); **d**, left third pereopod (lateral view); **e**, dactyl of left third pereopod (mesial view); **f**, anterior lobe of sternite of third pereopods; **g-i**, telson. Scales equal 2.0 mm (i), 3.0 mm (f-g), 5.0 mm (a-e, h).

with row of 4 strong calcareous teeth and short distal row of corneous teeth, terminating in corneous claw and slightly overlapped by fixed finger; dorsal surface convex, with median row of small spines decreasing in size distally but extending nearly to tip; dorsomesial margin with row of spines also decreasing in size distally; mesial and ventral surfaces with tufts of long thick setae. Palm 0.60 to 0.75 length of carpus; dorsomesial margin usually only weakly delimited by quasi double row of strong spines, frequently 1 more prominent spine or tubercle at dorsoproximal angle, convex dorsal surface with 8 or 9 irregular rows of strong spines; dorsolateral margin not distinctly delimited except on fixed finger; dorsal surface of fixed finger with median row of spines decreasing in size distally, cutting edge with few calcareous teeth, terminating in strong corneous claw; mesial, lateral and ventral surfaces with low sometimes spinulose protuberances and tufts of long thick setae. Carpus slightly shorter to as long as merus; dorsomesial margin with row of moderately strong spines, dorsal surface with few to numerous small spines or low sometimes spinulose protuberances and tufts of long thick setae, distal margin with row of spinules and few slightly larger spines; dorsolateral margin not delimited, lateral face with low sometimes spinulose protuberances and tufts of long setae, laterodistal margin with row of small spines; mesial face with few spines dorsally, scattered low protuberances and setae ventrally, mesiodistal margin with row of very small blunt spines; ventral surface with scattered setae. Merus subtriangular; dorsodistal margin with 2 to 4 slender spines, dorsal surface with few short transverse rows of setae; lateral face microscopically spinulose and with scattered fine setae, ventrolateral margin with row of small spines not extending to proximal margin but frequently terminating proximally in 1 or 2 larger blunt spines or tubercles; mesial face with numerous low protuberances and tufts of long setae, ventromesial margin with few small spines, sometimes 1 or 2 larger tubercles at proximal angle; ventral surface with scattered tufts of setae. Ischium unarmed, but with row of setae on distolateral and ventromesial margins.

Left cheliped (Figs 43b, d) with dactyl 1.75 to more than twice length of palm; cutting edge with row of corneous teeth, terminating in large corneous claw; dorsomesial margin not delimited or with 2 or 3 small spines proximally, dorsal midline unarmed or with few spinules or spinulose tubercles in proximal half; dorsal, mesial and ventral surfaces with rows of tufts of long thick setae. Palm slightly less than half length of carpus; triangular in cross-section, dorsal surface with row of strong spines decreasing in size distally, usually extending to distal half, occasionally nearly to tip, of fixed finger; dorsolateral margin with double row of strong spines, decreasing in size and becoming single row on fixed finger; dorsolateral and dorsomesial surfaces strongly sloping ventrally, lateral face with numerous strong spines; mesial face more frequently with smaller spines or spinulose tubercles, dorsomesial margin with row of 3 or 4 spines or tubercles; ventral surfaces of palm, fixed finger and dactyl all with tufts of long setae. Carpus approximately as long as merus; dorsolateral margin with row of acute spines, dorsodistal margin with 1 strong spine, dorsomesial margin with row of smaller spines, strongest proximally; laterodistal margin with few spines dorsally, lateral face with low frequently spinulose protuberances and long setae, ventrolateral margin with row of spines and moderately dense row of long setae; mesial faces with numerous tufts of long setae, ventromesial margin with 2 to 4 small, often blunt spines distally. Merus with short transverse rows of long setae on dorsal margin; mesial face with few low protuberances and setae, ventromesial margin with few small spines; lateral face spinulose, particularly ventrally, ventrolateral margin with row of very strong acute spines sometimes interspersed with shorter spines and row of long setae, frequently 1 or pair of stronger acute blunt spines on each margin proximally. Ischium with row of small spines on ventromesial margin.

Ambulatory legs (Figs 27b-e) with dactyls 1.20 to 1.45 longer than propodi; in dorsal view, very slightly twisted; in lateral view, slightly curved ventrally; terminating in moderately long corneous claws; dorsal margins each with 2 rows of long thick setae; lateral faces each with weak to prominent longitudinal sulcus and few setae (second and third right), moderately dense but randomly placed long setae on third left; mesial faces each with faint longitudinal sulcus (not shown in Figs 27c, e), second pair flanked dorsally and ventrally by long setae, sometimes also with dorsal row of corneous spines, third pair with row of corneous spines often interspersed with tufts of setae dorsally and medially; ventromesial surfaces each with 8 to 17 strong corneous spines, increasing in length distally, but partially obscured by thick setae. Propodi 1.10 to 1.35 longer than carpi; dorsal surfaces each with row of low transverse protuberances and tufts of setae; lateral faces each frequently with small tubercle at proximal margin medially or dorsally, second and third right pereopods each with 2 or 3 longitudinal rows of sparse tufts of setae, left third with entire surface covered (but not extremely densely) by short transverse rows of moderately short stiff setae; mesial faces with few scattered setae; ventrodistal margins each with 1 or 2 small corneous spinules, ventral surfaces with row of tufts of setae, more numerous on left and much denser on third left. Carpi 0.75 to nearly equaling length of meri; second pereopods each with row of strong spines partially obscured by long setae on dorsal surface, third with dorsodistal spine, dorsal surface unarmed or often with 1 to several smaller spines partially obscured by row of tufts of setae; lateral faces also with 2 or 3 longitudinal rows of sparse tufts of setae. Meri each with several transverse rows of long setae dorsally and ventrally, second also with single or double row of small spines on ventral margin. Ischia with dorsal and ventral tufts of setae, second each frequently with row of small spines on ventral margin. Propodal rasp of fourth pereopods with triple row of corneous scales. Sternite of third pereopods with few long setae on subsemicircular anterior lobe (Fig. 27f). Sternite of fifth pereopods developed anteriorly as two somewhat flattened semirectangular lobes separated by shallow median depression, anterior margins each with row of fine setae.

Males with 3 unequally biramous unpaired pleopods, all with exopods moderately well developed, endopods rudimentary. Females with paired gonopores, 4 unpaired biramous pleopods. Uropods asymmetrical; exopods and endopods both with well developed rasps. Telson (Figs 27g-h) with transverse suture; posterior lobes somewhat asymmetrical, separated by small median cleft; terminal margins slightly to strongly oblique, each with row of 2 to 5 strong calcareous spines interspersed with smaller calcareous or corneous spines; lateral margins usually with few to numerous corneous spinules and occasionally calcareous spines.

COLOR (in preservative). — General overall orange tint; somewhat mottled on shield. Antennal flagella alternating series of 8 to 10 transparent articles followed by similar number of burnt-orange. Meri of chelipeds and ambulatory legs with darker orange, but with white band on distal margin dorsally and laterally.

HABITAT. — One specimen occupying *Natica* shell.

DISTRIBUTION. — Collected in Kai and Tanimbar Islands, 265 to 401 m.

ETYMOLOGY. — This species is dedicated to the late Janet HAIG, who contributed so much to our knowledge of anomuran fauna of the Indo-Pacific.

AFFINITIES. — *Pagurus haigae* appears most similar to *P. brachiomastus* (Thallwitz, 1892) and *P. yokoyai* Makarov, 1938. Like *P. haigae*, both of these species have strongly spinose and setose chelae; the carpi of the ambulatory legs each carry a row of spines on the dorsal surface. Other characters shared by *P. haigae* and *P. brachiomastus* include a pair of large tubercles on the ventral surface of the merus of the right cheliped, usually densely setose lateral faces of the dactyl and propodus of the third left pereopod, and light or white colored band on the distal portion of the meri of the chelipeds and ambulatory legs. However, the shortness of the dactyls and spinose upper margins of the propodi of the ambulatory legs of *P. brachiomastus*, as well as its longer more slender ocular peduncles, will immediately distinguish this species from *P. haigae*. As indicated by MIYAKE (1978 : 98, text-fig. 37c) the dense setation on the lateral faces of the dactyl and propodus of the third left pereopod is a character restricted to females of *P. brachiomastus*. No sexual dimorphism in this character was noted in the KARUBAR specimens of *P. haigae*.

It is with *P. yokoyai* that *P. haigae* shares the greatest morphological likeness, and it would be impossible to distinguish the two taxa based on the descriptions of YOKOYA (1933) (as *Eupagurus gracilipes* Yokoya, not *E. gracilipes* Stimpson, 1858) or MAKAROV (1938, 1962). MIYAKE's (1978) description provides much greater detail, but only on the basis of color patterns and the illustrated telson (Text-fig. 45b) would differentiation be feasible. Having compared the KARUBAR specimens of *P. haigae* with three male specimens of *P. yokoyai* there is no doubt that the taxa are distinct. In addition to differences in the telson armature of the two species (Figs 27g-i), the right cheliped of the latter species lacks the strong tuberculate spines on the ventromesial margin of the merus, the carpus is longer and narrower, and the spines of the dorsal surface of the chela are stronger. The left chela of *P. yokoyai* is usually narrower and has fewer but stronger spines; the carpus is also narrower and the dorsomesial margin more weakly armed. The second pereopods have five to eight corneous spines on the distal halves of the ventral margins of the dactyls, and a double row of corneous spines on the mesial face dorsally.

REMARKS. — YOKOYA's (1933) description of *Eupagurus gracilipes* consisted of little more than a few illustrations and remarks on its differences from *Pagurus pectinatus* (Stimpson, 1858). MAKAROV (1938, 1962) noted, in a footnote to his diagnosis of STIMPSON's (1858) *P. gracilipes* that, YOKOYA's (1933) name was preoccupied, and proposed that the species be called *P. yokoyai*. MAKAROV (1938, 1962) did suggest that *P. yokoyai* was probably more closely related to *P. brachiomastus* than to *P. pectinatus*, which, in fact is the case. *Pagurus haigae*, like *P. brachiomastus* and *P. yokoyai*, shares numerous characters with *P. pectinatus*, such as strongly spinose and setose chelae; however, the much more elongate ocular peduncles and stronger rostrum of the latter species clearly set it apart from the former three species.

MIYAKE's (1978, Text-fig. 44) illustration of *P. yokoyai* is indicated as a female, but with only three unpaired left pleopods. This is either an illustrator's error or the sex of the illustrated specimen is incorrect, as it is most unlikely that the second left pleopod would be absent in this *Pagurus* species. One of the three specimens examined [♂ (8.5 mm) from Kushimoto, Wakayama, Japan] had well developed male gonopores, but four unpaired pleopods. However, there was no indication of rhizocephalan infestation that might have attributed to this apparent feminization.

?*Pagurus* sp.

Fig. 28a-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S, 133°01'E, 124-85 m, 25.10.1991: 1 ♂ (1.2 mm) (MNHN-Pg 5312).

DIAGNOSIS. — Shield (Fig. 28a) longer than broad. Rostrum obtusely triangular, reaching slightly beyond level of lateral projections. Lateral projections each with tiny submarginal spinule. Ocular peduncles moderately long; slightly shorter than extended antennal peduncles and reaching only to proximal half of ultimate segment of fully extended antennular peduncles, dorsal and mesial surfaces with few tufts of stiff setae; corneae not dilated. Ocular acicles moderately small, terminating subacutely and with strong submarginal spine. Antennal acicle reaching to base of cornea or slightly beyond; arcuate; with terminal spine and few tufts of stiff setae. Antennal flagella broken, but still reaching beyond distal margins of propodi of ambulatory legs, with 2 or 3 moderately long setae every 2 to 4 articles. Crista dentata well developed, with 1 accessory tooth. Sternite of third pereopods with slight median protuberance.

Right cheliped missing.

Left cheliped (Figs 28b-c) with palm slightly more than half length of dactyl. Dorsal surface of dactyl with row of widely-spaced small spines in midline. Palm subtriangular in cross-section; dorsal midline with row of spines extending to distal half of fixed finger; surface with numerous tufts of long setae, but not obscuring spines. Carpus with dorsomesial and dorsolateral row of few strong spines; ventrolateral distal angle with acute spine; tufts of long setae dorsally and ventrally. Merus with 2 strong spines on ventrolateral margin, 1 on ventromesial margin.

Ambulatory legs (Fig. 28d) (only second and third left) with dactyls only slightly longer than propodi; dorsal surfaces with tufts of setae; ventral margins each with row of 6 or 8 corneous spines. Propodi each with widely-spaced low protuberances and tufts of setae on dorsal surfaces; ventrodistal angles each with corneous spine, ventral surfaces each with row of widely-spaced very small corneous spinules. Carpi each with dorsodistal spine and few low protuberances with tufts on setae on dorsal surface, second also with 1 spine proximally, partially obscured by setae. Meri with low protuberances and tufts of setae dorsally and ventrally; second also with spine on ventral margin in distal half. Fourth pereopods semichelate; propodal rasp with single row of corneous scales.

Male with 3 unequally biramous left pleopods (third to fifth). Telson (Fig. 28e) with distinct transverse suture; slightly asymmetrical posterior lobes separated by prominent median cleft; terminal margins somewhat oblique, each with 4 moderately strong spines; lateral margins each with weakly serrated chitinous marginal band.

COLOR. — Unknown.

HABITAT. — Unknown.

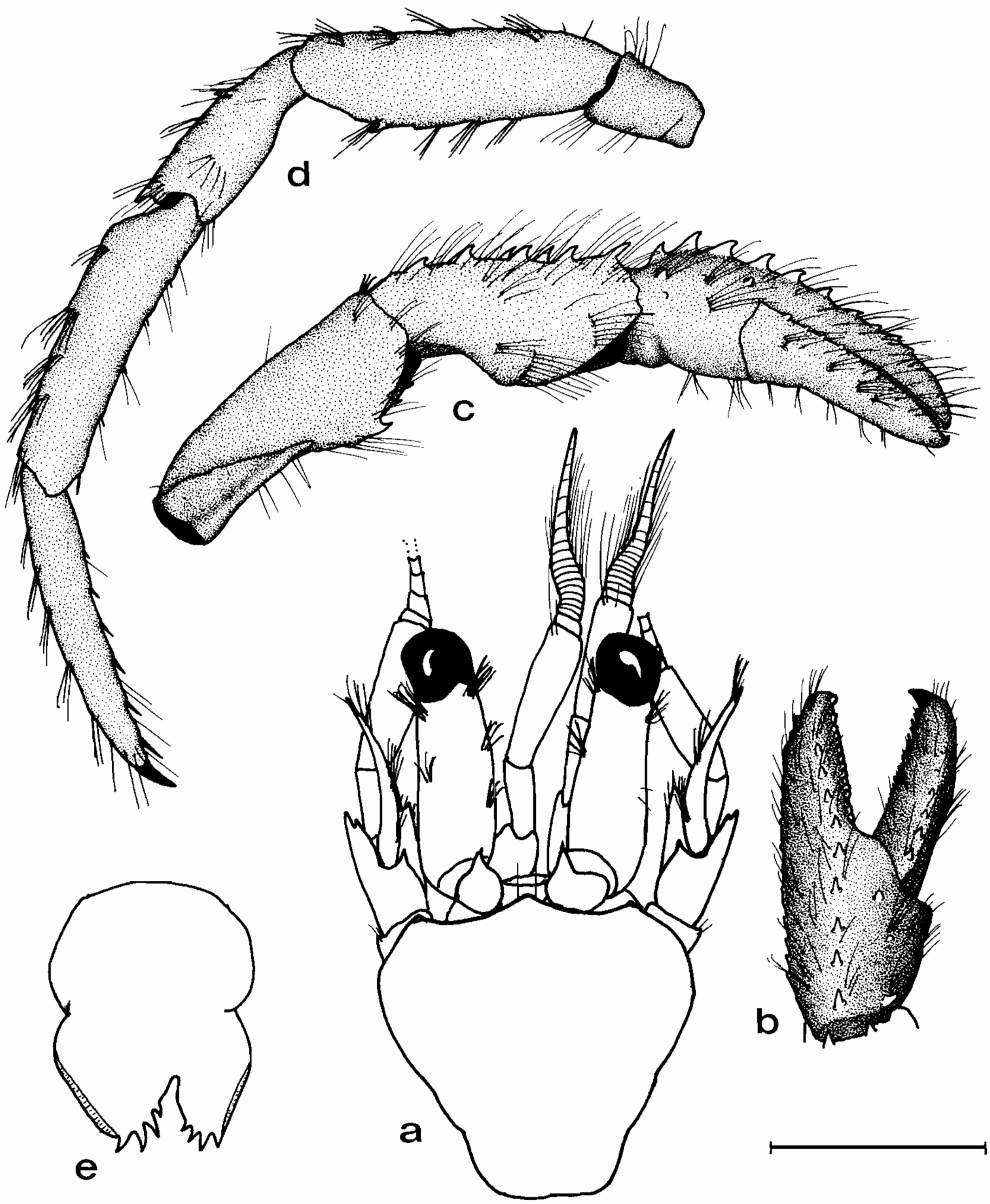

FIG. 28. — ?*Pagurus* sp. ♂ (1.2 mm) from KARUBAR Stn DW 22: **a**, shield and cephalic appendages; **b**, left chela (dorsal view); **c**, left cheliped (mesial view); **d**, left second pereopod (lateral view); **e**, telson. Scale equals 0.5 mm (e) and 1.0 mm (a-d).

DISTRIBUTION. — Known only from one station (DW 22) in Kai Islands, Indonesia; 124-85 m.

REMARKS. — This specimen is tentatively assigned to *Pagurus* as it lacks any secondary male sexual characters. The armature of the left cheliped is consistent with that seen in many *Pagurus* species, as is the structure and armature of the telson.

Genus *BATHYPAGUROPSIS* McLaughlin, 1994

Bathypaguropsis McLaughlin, 1994: 469.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with central dorsal surface sometimes only weakly calcified; rostrum well developed. Ocular acicles triangular, dorsal surface flattened or slightly convex. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod articulated, not recurved. Ischium of third maxilliped with well developed crista dentata and 1 accessory tooth.

Right cheliped massive, chela operculate or nearly so; propodal-carpal articulation approximately 30° from perpendicular; dactyl articulating obliquely with palm. Left cheliped moderately elongate, slender; propodal-carpal articulation approximately 30° to 60° counterclockwise from perpendicular; dactyl and fixed finger opening obliquely. Ambulatory legs with dactyls and propodi similar. Fourth pereopods semichelate, propodal rasp consisting of 1 or more, sometimes incomplete, rows of scales.

Males with paired gonopores, each partially masked by tuft of stiff setae; no paired pleopods or sexual tubes. Four unpaired pleopods on left, with exopods only moderately well developed, endopods markedly reduced. Females with paired gonopores. No paired pleopods; left second to fifth unpaired, second to fourth with both rami well developed and egg-carrying, fifth reduced as in males.

Telson with transverse suture; posterior lobes subtriangular; terminal margins oblique, unarmed or spinulose.

Bathypaguropsis rahayuae sp. nov.

Figs 29a-h, 42c-d

MATERIAL EXAMINED. — **Indonesia.** KARUBAR, *Kai Islands*: stn DW 14, 05°18'S, 132°38'E, 245-246 m, 24.10.1991: 1 ♂ (3.2 mm) (MNHN-Pg 5313).

TYPE. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 29a) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate. Rostrum prominent, triangular, acute, with terminal spinule. Lateral projections triangular, with small marginal spine. Posterior carapace with area between cardiac sulci and sulci cardiobranchalis weakly calcified.

Ocular peduncles slightly more than half shield length, dorsomesial surface with row of setae; corneae not dilated. Ocular acicles simple, triangular, with small marginal terminal spine; separated basally by width of rostrum, or approximately half basal width of one acicle.

Antennular peduncles moderately long, overreaching ocular peduncles by slightly less than entire length of ultimate segment. Basal segment with small acute spine on lateral surface dorsally. Penultimate segment with few scattered setae. Ultimate segment with few long setae on dorsal surface.

Antennal peduncles exceeding ocular peduncles by half length of ultimate segment, but reaching only to distal half of ultimate segment of antennular peduncle. Fifth and fourth segments with few scattered setae. Third segment with very strong spine at ventrodistal margin. Second segment with dorsolateral distal angle produced into broad, triangular process, terminating in acute spine, mesial margin unarmed, lateral margin with 1 or 2 spines; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin; ventral margin produced, with 1 spine laterally. Antennal acicle reaching beyond proximal margin of ultimate peduncular segment; slightly arcuate, with row of sparse tufts of setae on mesial margin and terminating in small spine. Antennal flagellum long, nearly overreaching outstretched right cheliped; every 1 or 2 articles usually with 2 or 3 very short (< 1 article length) setae, and often additional 1 or 2 longer setae every 2 to 5 articles.

Right cheliped (Figs 29b, 42c) massive, operculate. Dactyl broad, slightly shorter than palm; cutting edge with 1 very broad, faintly cusped, calcareous tooth, terminating in very small corneous claw; dorsal surface very slightly elevated in the midline proximally, with scattered low tubercles and few short transverse setal ridges in proximal

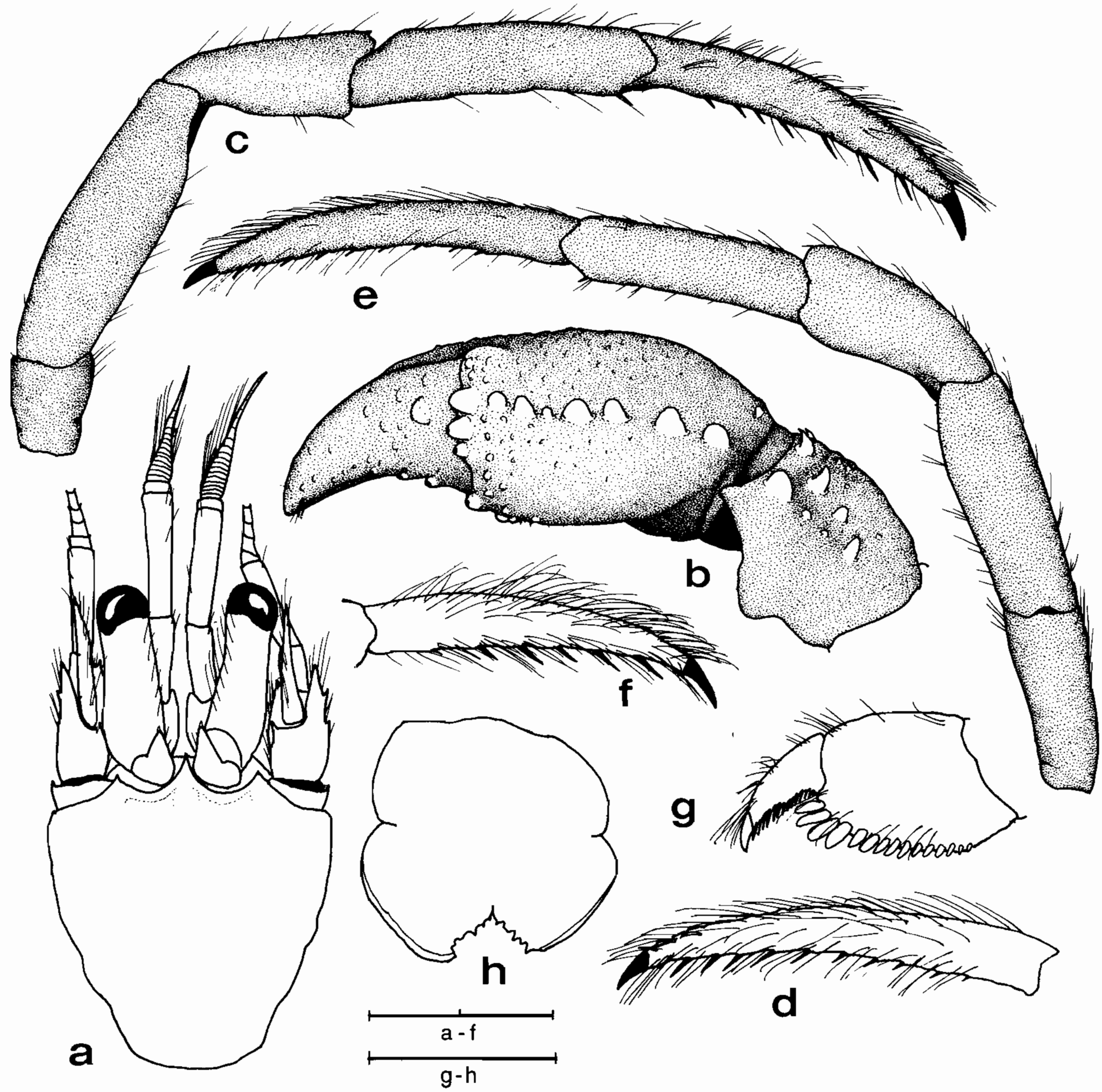

FIG. 29. — *Bathypaguropsis rahayuae* sp. nov., holotype ♂ (3.2 mm) from KARUBAR Stn DW 14: **a**, shield and cephalic appendages; **b**, carpus and chela of right cheliped (mesial view); **c**, right second pereopod (lateral view); **d**, dactyl of second left pereopod (mesial view); **e**, third left pereopod (lateral view); **f**, dactyl of third right pereopod (mesial view); **g**, propodus and dactyl of left fourth pereopod (lateral view); **h**, telson. Scales equal 1.0 mm (g-h) and 2.0 mm (a-f).

half, slightly pitted and with few tufts of setae distally; dorsomesial margin rounded, mesial face with low broad tubercles, 1 large blunt tubercle proximally; ventromesial margin with corneous-capped blunt tubercles. Palm with maximum breadth equal to length, nearly twice length of carpus; dorsomesial distal angle with prominent blunt spine, dorsomesial margin with row of rather widely-spaced blunt or subacute tuberculate spines; dorsal surface convex and covered with flattened granules and very low short ridges, with 1 rather inconspicuous tubercle at proximal margin; dorsolateral margin only faintly delimited by row of widely-spaced tiny spinules, slightly larger distally and on fixed finger; mesial face with scattered low spinules and spinulose tubercles or granules, particularly in distal half, distal margin with 2 blunt corneous-capped spines dorsally and 1 at ventral angle; lateral face with scattered granules, low tubercles and/or short transverse ridges; ventral surface with several large, flattened, blister-like tubercles, often with corneous caps, few similar tubercles on ventral surface of fixed finger; cutting edge of fixed finger with 3 calcareous teeth, terminating in very small corneous claw. Carpus slightly shorter than merus, subquadrate when viewed dorsally; dorsomesial distal angle somewhat depressed but with adjacent large blunt spine, dorsomesial margin with 1 moderately strong and 2 smaller spines in slightly irregular row, 1 additional strong spine on dorsal surface mesially, remainder of dorsal surface with scattered spinules or low blunt or spinulose tubercles, primarily in distal half; distal margin with 4 small spines extending onto lateral face; dorsolateral margin not delimited, lateral and mesial surfaces with scattered minute spinulose tubercles or granules, ventral surface with rounded unarmed distal ridge. Merus broadly subtriangular, armed on ventral surface by short row of blunt tubercles on ventrolateral proximal margin and 2 tubercles in midline proximally. Ischium unarmed.

Left cheliped (Fig. 42d) not reaching to base of dactyl of right, slender; propodal carpal articulation approximately 35° counterclockwise from perpendicular. Dactyl slightly longer than palm; surfaces unarmed but with scattered tufts of short setae; cutting edges of dactyl and fixed finger each with row of small corneous teeth in distal 0.50 to 0.65; terminating in small corneous claws. Palm little more than half length of carpus; all surfaces unarmed, but with few scattered setae, particularly on fixed finger. Carpus slightly shorter than merus; dorsomesial margin with 1 small spine at distal angle and 2 widely-spaced very small spines marginally; 1 tiny spinule at dorsolateral distal angle, dorsolateral margin not delimited. Merus entirely unarmed. Ischium with 2 minute spinules on ventromesial margin distally.

Ambulatory legs (Figs 29c-f) similar, but with right slightly longer than left. Dactyls 1.20 to 1.25 length of propodi; in dorsal view, straight; dorsal margins each with row of tufts of long setae; mesial faces each with dorsal and ventral sparse row of moderately long setae; lateral faces each with 1 row of very sparse tufts of short setae; ventral margins each with row of 7 to 10 corneous spines and few tufts of setae. Propodi slightly longer than carpi; each with few scattered setae on dorsal surface; ventrodistal angles each with 1 corneous spinule; mesial, lateral, and ventral surfaces with scattered setae. Carpi 0.75 to 0.80 length of meri; dorsodistal angles of right (only) each with very small spine, dorsal surfaces of all with few setae. Meri and ischia with scattered setae particularly on ventral margins. Fourth pereopods with propodal rasp (Fig. 29g) consisting of row of long corneous scales. Anterior lobe of sternite of third pereopods subrectangular, with central semicircle fringed with short setae.

Telson (Fig. 29h) with posterior lobes slightly asymmetrical, left larger; separated by moderate median cleft; terminal margins each with 5 very small spinules.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — Known only from the type locality in the Kai Islands, Indonesia; 245-246 m.

ETYMOLOGY. — This species is named for Dr D. L. RAHAYU, Indonesian Institute of Sciences, in recognition of her contributions to our knowledge of the regional hermit crab fauna.

AFFINITIES. — *Bathypaguropsis rahayuae* sp. nov. is the third species of this genus to be recognized, and despite the overall morphological similarities among the three taxa, it is most closely allied to *B. yaldwyni* McLaughlin, 1994. Although the ocular peduncles are shorter and the antennal acicles longer in *B. yaldwyni*, the general armature of the chelae and carpi of the chelipeds would be comparable if intraspecific variability in *B. rahayuae* was to approach that of *B. yaldwyni*. The terminal margins of the telson of *B. rahayuae* are armed with spinules as they are in *B. yaldwyni*, although the number in the single specimen of *B. rahayuae* is smaller. Nevertheless, the two species can be easily distinguished by the spines on the ventral margins of the ambulatory dactyls, 15 to 31 in *B. yaldwyni*, but only 7 to 10 in *B. rahayuae*. The smaller number of dactylar spines is similar to that of *B. marionensis* McLaughlin, 1994 (8 to 14); however, the strongly produced dorsomesial distal angle and more numerous marginal spines of the right chela, as well as the armed ventromesial margin of the left, clearly distinguish this species from *B. rahayuae*.

REMARKS. — McLAUGHLIN (1994) noted that one adult specimen of *B. yaldwyni* was parasitized by an unidentified rhizocephalan, and while female appearing pleopods were present, neither male nor female gonopores could be detected. The holotype of *B. rahayuae* similarly had been infected by an unidentified rhizocephalan, but no evidence of structural alteration nor feminization has been observed. Only normal male gonopores are present.

Genus *PYLOPAGUROPSIS* Alcock, 1905

Pylopaguropsis Alcock, 1905b: 133. — DE SAINT LAURENT-DECHANCÉ, 1966b: 259. — McLAUGHLIN & HAIG, 1989: 125.
Galapagurus Boone, 1932: 12.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular, sometimes slender. Antennal peduncles with supernumerary segmentation. Maxillule with external lobe of endopod very weakly to moderately well developed. Ischium of third maxilliped with 1 accessory tooth on well developed crista dentata.

Right cheliped usually massive, chela operculate or semioperculate; dactyl frequently articulating obliquely with palm.

Left cheliped moderately elongate, slender; propodal-carpal articulation usually twisted counterclockwise 30-70° from perpendicular when viewed dorsally; dactyl and fixed finger opening obliquely. Ambulatory legs with dactyls and propodi of second pair (third pereopods) frequently dissimilar. Fourth pereopods semichelate; propodal rasp of 1 to 4 rows of corneous scales.

Females with paired gonopores; paired first pleopods modified as gonopods, second to fifth unpaired. Males with paired gonopores, no paired pleopods or sexual tubes, 3 unequally biramous left pleopods. Telson with transverse suture; posterior lobes often asymmetrical; terminal margins oblique, concave or horizontal, usually armed with 1 to many spines; lateral margins unarmed or with 1 to 3, or sometimes row of small spines.

REMARKS. — HAIG and BALL (1988) reported two undescribed species of *Pylopaguropsis* from the *Alpha Helix* expedition. Although both species, *P. lewinsohni* McLaughlin & Haig, 1989 and *P. fimbriata* McLaughlin & Haig, 1989, had been recognized much earlier, their actual publication had been unavoidably delayed. Neither species is represented in the KARUBAR material.

Key to the Indonesian species of *Pylopaguropsis*

1. Palm of right chela fringed with spines and long setae; carpus of fourth pereopod with dorsodistal spine .... ***P. fimbriata****
— Palm of right chela not fringed with spines and long setae; carpus of fourth pereopod without dorsodistal spine **2**

2. Left chela with 1 or more rows of spines on dorsal surface .... ***P. laevispinosa***
— Left chela unarmed or with few scattered spinules or spinulose tubercles on dorsal surface.. .... **3**

3. Propodus of right third pereopod with 1 longitudinal sulcus on lateral face .... ***P. zebra***
— Propodus of right third pereopod with 3 longitudinal sulci on lateral face .... ***P. lewinsohni****

Pylopaguropsis zebra (Henderson, 1893)

Figs 30a, c, 43e-f

Eupagurus zebra Henderson, 1893: 425, pl. 39, figs 12-15.
Pagurus zebra - MIYAKE, 1975: 260, pl. 116, fig. 2; 1978: (in part) 108, fig. 43; 1982: 225.
Pylopagurus zebra - McLAUGHLIN & HAIG, 1989: 143, figs 3b, 5b, 7b, 9b, 11b, 13b (for complete synonymy).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 15, 05°17'S, 132°41'E, 212-221 m, 24.10.1991: 1 ♀ (2.7 mm) (POLIPI). — Stn DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ (1.8 mm) (USNM 275998).

Tanimbar Islands: stn DW 49, 08°00'S, 132°59'E, 206-209 m, 29.10.1991: 2 ♂, 1 ♀ (3.3-3.5 mm) (MNHN-Pg 5314).

DIAGNOSIS. — Shield (Fig. 30a) approximately as broad as long or slightly longer than broad. Rostrum prominent, acute, terminating in small spinule. Ocular peduncles overreached by antennular peduncles. Ocular acicles triangular, acute; separated basally by breath of rostrum.

Right chela (Fig. 43e) with dactyl compressed dorsoventrally; dorsomesial margin expanded and armed with row of strong spines, dorsal surface with several spines at dorsomesial proximal angle, few also on dorsal surface. Palm with irregular single or double row of low spines or spinulose tubercles on dorsomesial margin, dorsolateral margin with row of strong spines; dorsal surface with few irregular rows of small spines or spinulose tubercles, extending onto fixed finger. Carpus trapezoidal (dorsal view), with regular or irregular rows of spines or spinulose tubercles on dorsal surface, few strong spines on dorsodistal margin; mesial face strongly produced ventrally, ventromesial margin tuberculate. Merus with row of strong conical spines on produced ventromesial margin; mesial, lateral and ventral surfaces usually tuberculate.

Left cheliped (Fig. 43f) long and slender, reaching almost to middle of palm of right. Palm and fingers twisted counterclockwise approximately 45° from perpendicular. Dactyl unarmed. Palm with scattered low protuberances, some occasionally slightly spinulose. Carpus with row of small to moderately strong spines on dorsomesial margin, 1 prominent spine on dorsolateral distal angle and 1 or more spines, spinules or low protuberances on dorsolateral margin. Merus with row of small spines on ventromesial margin; ventrolateral margin with row of acute spines.

Ambulatory legs with second pair (third pereopods) dissimilar. Dactyls each with row of corneous spines on mesial face close to dorsal margin; ventral margins each with row of 8-10 strong corneous spines. Propodi each with 1 or 2 corneous spinules at ventrodistal margin. Third right pereopod with dactyl longer than left, 1.50 to twice as deep; laterally compressed; lateral face with prominent longitudinal sulcus; ventral margin with row of 13 or 14 strong corneous spines. Propodus with distinct dorsolateral margin, lateral face with shallow longitudinal sulcus dorsally, surface broad and flattened medially. Carpi of both second and third pereopods each with small spine at dorsodistal margin. Meri unarmed or with small spine on ventrolateral distal margin. Sternite of third pereopods with long narrow anterior lobe slightly protruded medially. Propodal rasp of fourth pereopods with 1 row of sharp corneous scales.

Telson (Fig. 30c) with posterior lobes separated by broad median cleft; terminal margins oblique, each with 3 or 4 strong spines, lateral margins with narrow corneous plate.

COLOR (in preservative). — Ocular peduncles with 2 longitudinal red stripes dorsally and 1 ventrally on white base color. Right cheliped with base color of pinkish-white on palm and carpus, red on merus; palm and carpus with scattered red spots, usually associated with tufts of setae, carpus also with broad longitudinal red stripe on mesial face; merus with several narrow longitudinal white stripes. Left cheliped with base color of pinkish-white; palm with two longitudinal red stripes and 1 prominent red spot on dorsal surface; carpus and merus each with dorsal, lateral and mesial longitudinal red stripes. Ambulatory legs each with longitudinal red stripes on lateral and mesial faces of all segments, carpi also with dorsal red stripe.

HABITAT. — Unknown.

DISTRIBUTION. — Northwestern Australia, Indonesia; South Africa, Japan; 102-125 meters.

REMARKS. — The KARUBAR specimens differ from the lectotype and other specimens described by MCLAUGHLIN and HAIG (1989) in having the carpus of the left cheliped less strongly armed. In the present specimens, the telsons all have strongly oblique terminal margins. The telson of the lectotype was reported missing by MCLAUGHLIN and HAIG (1989); their illustrated specimen from Japan had horizontal terminal margins.

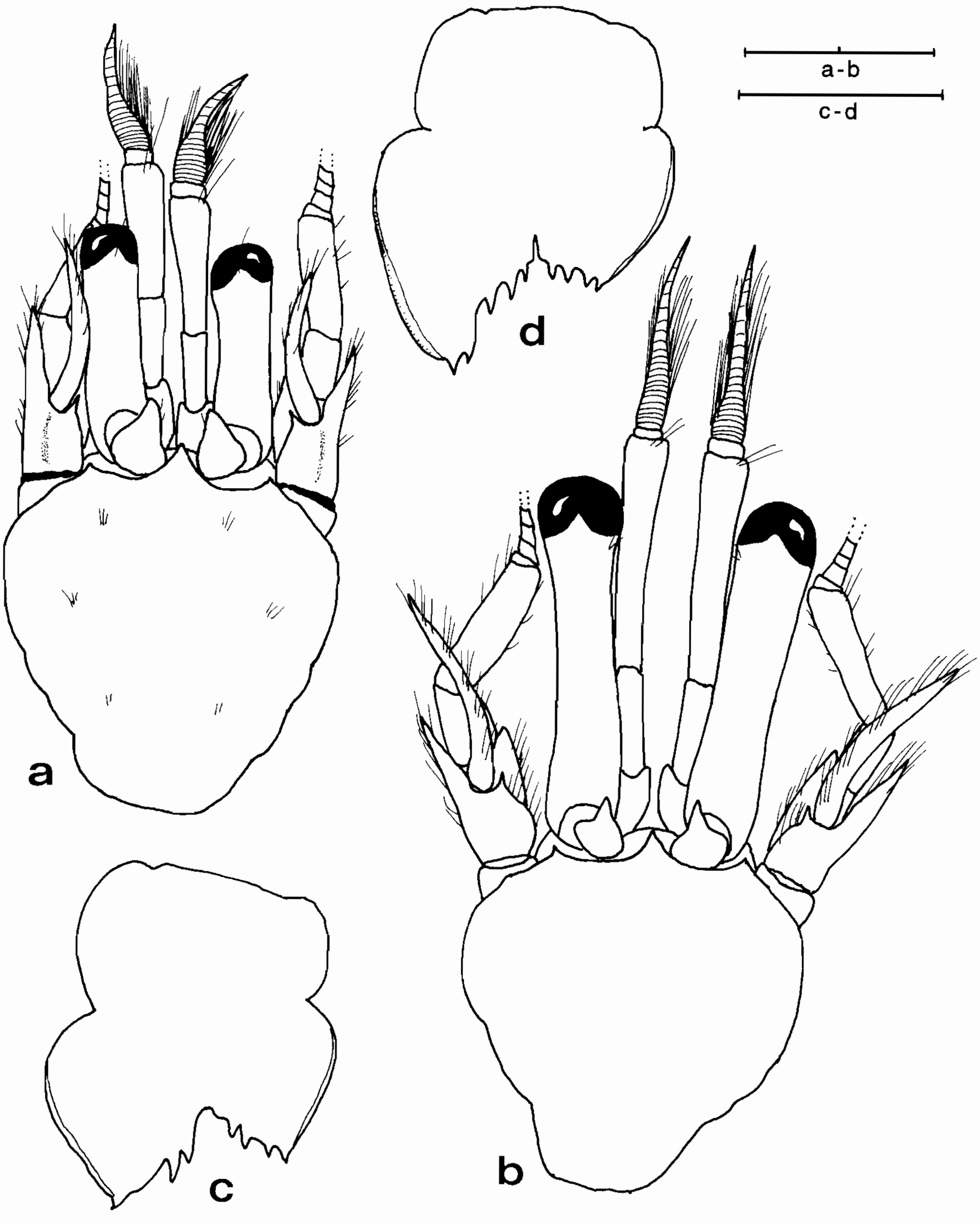

FIG. 30. — *Pylopaguropsis zebra* (Henderson, 1893), a, c, ♀ (3.3 mm) from KARUBAR Stn DW 49. — *Pylopaguropsis laevispinosa* McLaughlin & Haig, 1989, b, d, ♂ (3.2 mm) from Stn DW 22: **a-b**, shield and cephalic appendages; **c-d**, telson. Scales equal 1.0 mm (c-d) and 2.0 mm (a-b).

Pylopaguropsis laevispinosa McLaughlin & Haig, 1989

Figs 30b, d, 44a-b

Pylopaguropsis laevispinosa McLaughlin & Haig, 1989: 166, figs 4e, 6e, 8f, 10e, 12e, 13j, 21.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 22, 05°22'S,133° 01'E, 85-124 m, 25.10.1991: 3 ♂ (1.2-3.3 mm) (MNHN-Pg 5315). — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 26.10.1991: 1 ♀ (2.3 mm) (MNHN-Pg 5316).

Tanimbar Islands: stn DW 50, 07°59'S, 133°02'E, 184-186 m, 29.10.1991: 1 ov. ♀ (1.2 mm) (POLIPI).

DIAGNOSIS. — Shield (Fig. 30b) longer than broad. Rostrum obtusely triangular; terminating in small spinule. Ocular peduncles overreached by antennular peduncles. Ocular acicles triangular, acute; separated by slightly more than basal width of one acicle.

Right chela (Fig. 44a) somewhat dorsoventrally compressed; dactyl as long as palm or slightly shorter, articulation only slightly oblique; dorsomesial margin with row of strong spines, dorsal surface with scattered spines; ventromesial margin with row of spinulose tubercles. Palm with irregular single or double row of moderately strong spines on dorsomesial margin, dorsal surface of palm and fixed finger with numerous spines, sometimes forming irregular rows; dorsolateral margin with row of spines, strongest on fixed finger; ventral surface convex, tuberculate laterally and granular medially. Carpus with row of strong spines mesially and laterally on dorsal surface and irregular transverse row of strong spines on distal margin, extending onto mesial and lateral faces. Merus with row of acute spines on ventrolateral margin; ventromesial margin with row of acute spines, ventroproximal margin with prominent blunt tubercle.

Left cheliped (Fig. 44b) long, slender; chela twisted counterclockwise 30° to 40° from perpendicular. Dactyl with row of small spines on dorsal surface; dorsomesial margin with row of strong spines, not extending to tip. Palm with 2 irregular rows of strong spines in midline of sloping dorsal surface, 1 extending onto fixed finger as small spinulose tubercles, dorsal surface mesially and laterally each with row of moderately strong spines; ventral surface with 1 row of small spines laterally in distal portion of palm and proximal portion of fixed finger. Carpus with 2 rows of corneous-tipped spines on dorsal surface, strongest distally. Merus with row of strong acute spines on ventrolateral margin; ventromesial margin with row of smaller subacute spines, prominent spinulose tubercle at ventromesial proximal angle.

Ambulatory legs generally similar. Dactyls long and slender; ventral margins each with row of strong, corneous spinules. Propodi with lateral faces evenly convex, unarmed. Carpi each with dorsodistal spine and at least 2 or 3 (male) or row (female) of small spines (second) or with only dorsodistal spine (third). Sternite of third pereopods with anterior lobe subsemicircular. Propodal rasps of 4th pereopods with 1 row of corneous scales.

Telson (Fig. 30d) with asymmetrical posterior lobes separated by shallow median cleft; terminal margins oblique, each with few to several small spines, sometimes extending onto lateral margins, particularly on left.

COLOR (in preservative). — Shield orange tinged, rostral margin accentuated in dark orange. Ocular peduncles cream; acicles with margins accentuated in orange. Antennular peduncles cream, with faint yellowish brown in distal third of ultimate segment. Antennal peduncles with orange stripe on ultimate segment dorsally and on mesial face ventrally; fourth segment orange and white striped dorsally and white ventrally; acicle with broad orange longitudinal stripe on dorsal surface. Right cheliped with chela faint orange or cream-colored; carpus generally with faint orange hue, mesial, lateral and dorsal surfaces orange with white stripe proximally. Merus orange and white striped dorsally and on dorsal halves of mesial and lateral faces, ventral surface with faint orange hue. Left cheliped with chela very faint orange; carpus and merus with orange and white longitudinal stripes. Second and third pereopods with orange and white longitudinal stripes (MCLAUGHLIN & HAIG, 1989).

HABITAT. — Unknown.

DISTRIBUTION. — Okinawa and Indonesia; 3-125 m.

REMARKS. — *Pylopaguropsis laevispinosa* was described from two females collected in Okinawa, Ryukyu Islands. The present diagnosis has been modified to reflect the variations exhibited by large males of this species. The presence of *P. laevispinosa* in the Kai and Tanimbar Islands of Indonesia represents a major southern extension of the range of this species.

Genus *TOMOPAGUROPSIS* Alcock, 1905

Tomopaguropsis Alcock, 1905b: 136.

DIAGNOSIS. — Thirteen pairs of trichobranchiate gills. Shield with well developed rostrum. Ocular acicles triangular. Antennal peduncle with supernumerary segmentation. Maxillule with external lobe of endopod well developed, recurved. Third maxilliped with well developed crista dentata and 1 accessory tooth. Sternite of third maxillipeds with prominent spine on either side of midline.

Chelipeds subequal; right usually somewhat more robust. Ambulatory legs similar from left to right; carpus with or without dorsodistal spine. Fourth pereopod semichelate; propodal rasp with several rows of corneous scales. Fifth pereopods chelate.

Males with coxae of fifth pereopods symmetrical; paired gonopores; with or without paired first pleopods modified as gonopods, 4 unpaired unequally biramous left pleopods. Females with paired gonopores; no paired pleopods, 4 unpaired pleopods, second to fourth usually with both rami well developed, fifth reduced. Telson with transverse suture; posterior lobes separated by median cleft; terminal margins spinose.

TYPE SPECIES herein selected. — *Tomopaguropsis lantana* Alcock, 1905b.

REMARKS. — ALCOCK (1905b) established *Tomopaguropsis* to accommodate his new species *Tomopaguropsis lantana*, and *Eupagurus ?problematicus* A. Milne Edwards & Bouvier, 1893, an Atlantic species. In his original diagnosis of *Tomopaguropsis*, ALCOCK (1905b) reported that males were provided with a small pair of pleopods on the first abdominal somite. Although no mention was made of paired male pleopods in the original description of *E. ?problematicus*, ALCOCK's assignment of this taxon to *Tomopaguropsis* presumably was based on MILNE EDWARDS and BOUVIER's (1893: 153) subsequent remark: "Cette espèce se distingue des *Eupagurus* par ses pattes antérieures, dont les doigts sont mobiles dans un plan oblique, et par ses lamelles branchiales qui sont profondément bifides à l'extrémité. Ces deux caractères, et la plupart des autres, la rapprochent des *Parapagurus*, et l'on trouve même chez le mâle deux fausses pattes sexuelles antérieures, réduites à l'état de bourgeons très courts, ainsi que la trace d'une fausse patte sexuelle de la 2ème paire".

The presence of paired first pleopods modified as gonopods in *Tomopaguropsis* was the character that ALCOCK (1905b) likened to the condition reported by MILNE EDWARDS and BOUVIER (1893) for their genus *Tomopagurus* A. Milne Edwards & Bouvier, 1893. However, PROVENZANO (in FOREST & DE SAINT LAURENT, 1968) noted that normal males of *Tomopagurus* lacked paired first pleopods, and proposed that the presence of paired first pleopods in the holotype of *Tomopagurus rubropunctatus* A. Milne Edwards & Bouvier, 1893, was due to the feminizing effect of a rhizocephalan of the genus *Peltogaster*; females of *Tomopagurus* were known to have paired first pleopods. DE SAINT LAURENT (1970b) suggested that variation in the presence of paired pleopods in both sexes probably occurred not only in *Tomopagurus* but in *Tomopaguropsis* as well. To demonstrate this variation in *Tomopaguropsis*, she referred to an undescribed species which lacked male gonopods; in *Tomopagurus* she cited the notation by PROVENZANO (in FOREST & DE SAINT LAURENT, 1968). MCLAUGHLIN's (1981a) description of the new species, *Tomopagurus wassi* McLaughlin, a species lacking female paired first pleopods, and her (MCLAUGHLIN, 1981b) description of feminization in a male of *Rhodochirus* McLaughlin, 1981a, supported DE SAINT LAURENT's suggestion for *Tomopagurus*. I have not reviewed the holotype of *Tomopaguropsis problematica*, but I have examined four male specimens (UMML 4975, 4978-80); all lack paired first pleopods. Similarly, males of *T. crinita* sp. nov. lack paired pleopods. In all other respects, males of both species clearly are assignable to *Tomopaguropsis*.

ALCOCK (1905b) did not designate a type species for *Tomopaguropsis*, and the only other report of *T. lantana* is that of KEMP and SEWELL (1912) who noted the collection of one additional specimen during the 1910-1911 cruise of R.I.M.S.S. "*Investigator*". Although *T. problematica* was listed first in ALCOCK's (1905b) remarks, and has been reported more frequently (e.g., WILLIAMS, 1984; ABELE & KIM, 1986) it is probable that his generic diagnosis was based principally on the Indian taxon. *Tomopaguropsis lantana*, therefore, is herein selected as the type species. Whether or not paired first pleopods in males of *Tomopaguropsis* is a normally variable condition will only be determined when several males of *T. lantana* have been examined.

Tomopaguropsis crinita sp. nov.

Figs 31a-g, 44c-d

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 10, 05°21'S, 132°30'E, 329-389 m, 23.10.91: 1 ♂ (5.4 mm) (USNM 276012). — Stn DW 30, 05°39'S, 132°56'E, 111-118 m, 26.10.1991: 1 ♂ (3.7 mm) (USNM 276030). — Stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 ♀ (4.7 mm) (MNHN-Pg 5317).
Tanimbar Islands: stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 1 ♂ (4.1 mm) (MNHN-Pg 5318). — Stn DW 77, 08°57'S, 131°27'E, 346-352 m, 3.11.1991: 1 ♂ (4.3 mm) (MNHN-Pg 5319); 1 ♂ (2.4 mm) (POLIPI).

TYPES. — The male (4.3 mm) (MNHN-Pg 5319) from KARUBAR station DW 77 is the holotype. The other specimens are paratypes.

DESCRIPTION. — Shield (Fig. 31a) subtriangular, longer than broad; anterior margin between rostrum and lateral projections weakly concave; anterior margins sloping; posterior margin truncate; dorsal surface frequently only weakly calcified in midline, somewhat rugose laterally and with few tufts of setae. Rostrum broadly triangular, produced slightly beyond bases of ocular acicles; with very small terminal spinule. Lateral projections triangular, terminating subacutely, unarmed or with tiny spinule.

Ocular peduncles short and moderately stout; dorsomesial surface with row of long setae; corneae small, not dilated. Ocular acicles elongate and subtriangular, dorsally rounded, with tuberculate terminal spine and few setae distally; approximate, or separated basally by less than 0.30 basal width of one acicle.

Antennular peduncles overreaching distal margins of corneae by 0.70 to entire length of ultimate segment. Ultimate segment with row of long setae on dorsodistal margin. Penultimate segment glabrous or with very few scattered setae. Basal segment with small spine on dorsolateral margin medially.

Antennal peduncles overreaching distal margins of corneae by 0.25 to 0.60 length of ultimate segment. Fifth segment with few setae. Fourth segment with spinule at dorsodistal margin. Third segment with strong ventrodistal spine and long setae. Second segment with dorsolateral distal angle produced, terminating in bifid or simple spine, dorsal surface and lateral margin with long setae; dorsomesial distal angle with small spine. First segment usually with small spine on dorsolateral distal margin; ventral margin produced, unarmed. Antennal acicle moderately long, reaching nearly to distal margin of ultimate peduncular segment or sometimes well beyond; slightly arcuate; mesial and lateral margins and dorsal surface distally with very long setae; terminating in simple spine. Antennal flagellum moderately long, frequently reaching beyond tips of outstretched chelipeds; each article with several very long (> 6 articles length) setae.

Chelipeds subequal, left occasionally longer, but right slightly more robust; dactyls and fixed fingers horizontal or arched ventrally. Right cheliped (Figs 31b, 44c) with dactyl slightly shorter to slightly longer than palm; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces all with numerous tufts of long setae; cutting edge with 1 or 2 large calcareous teeth proximally, row of corneous teeth in distal half, terminating in corneous claw. Palm slightly shorter than carpus; usually with row of small spines on proximal 0.60 of dorsomesial margin, occasionally with only single spine at proximal angle; dorsal surfaces of palm and fixed finger with numerous rows of tufts of long setae and rarely 1 or 2 very small spinules in proximal third, dorsolateral margins not delimited; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with calcareous teeth proximally and row of fused or individual corneous teeth distally. Carpus approximately equaling length of merus; dorsomesial margin with row of spines, strongest distally, dorsodistal margin usually with 1 or 2 spines or spinulose tubercles, dorsolateral margin not delimited; surfaces all with long or short transverse sometimes slightly protuberant rows of long setae. Merus with short transverse rows of long setae on dorsal margin; dorsodistal margin with 2 or 3 spines; lateral face usually with scattered low, sometimes spinulose protuberances and tufts of setae; ventromesial and ventrolateral distal angles each with 1 distal spine and occasionally second spinule or spinulose protuberance on margin distally. Ischium with tuberculate ridge on lateroproximal margin, laterodistal margin usually with 2 or 3 tiny spinules; ventromesial margin with few low protuberances and tufts of short setae.

Left cheliped (Figs 31c, 44d) with dactyl slightly shorter to slightly longer than palm; often short hiatus between dactyl and fixed finger proximally; dorsomesial margin of dactyl not delimited; dorsal, mesial and ventral

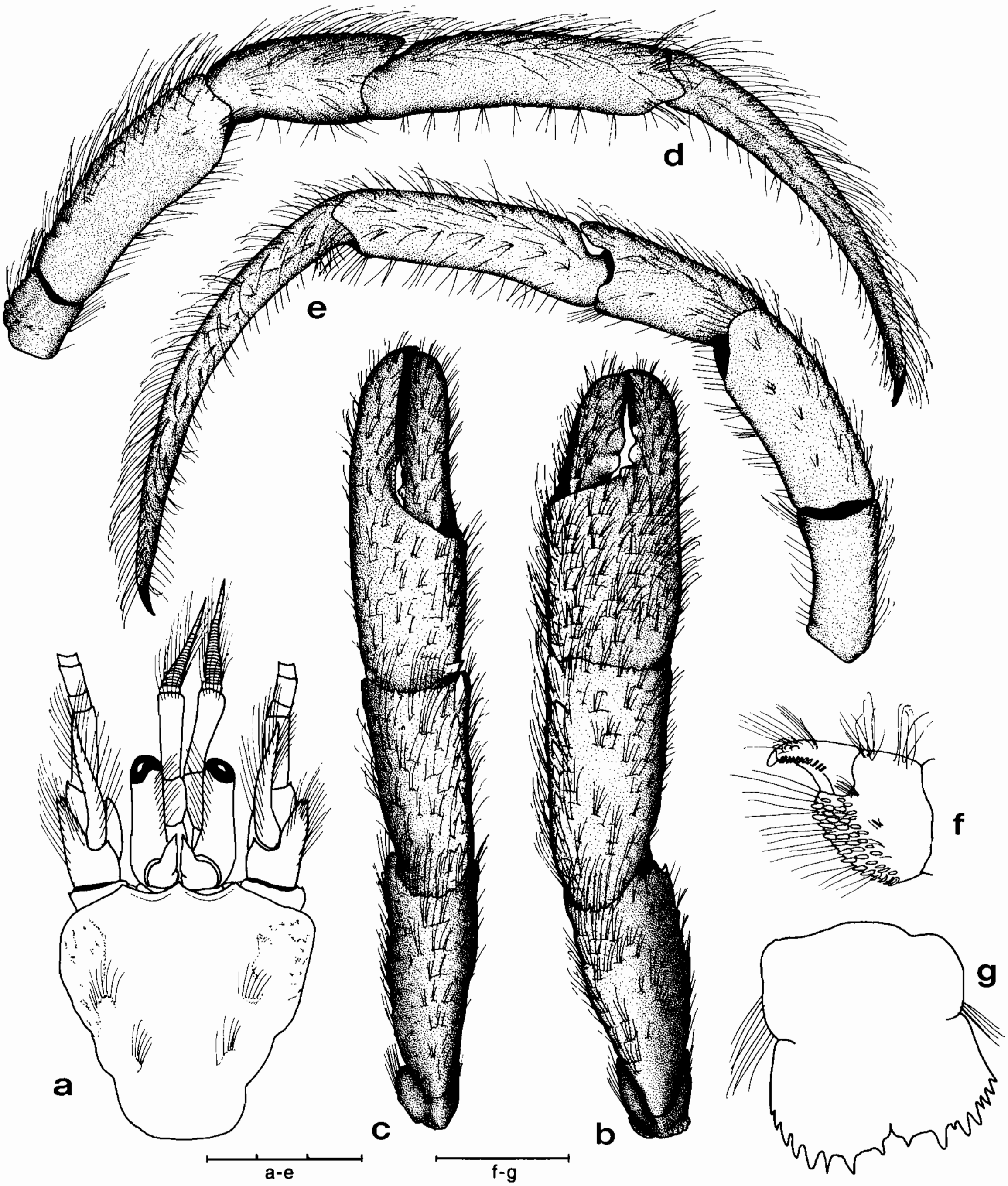

FIG. 31. — *Tomopaguropsis crinita* sp. nov., holotype ♂ (4.3 mm) from KARUBAR Stn DW 77: **a**, shield and cephalic appendages; **b**, right cheliped (dorsal view); **c**, left cheliped (dorsal view); **d**, right second pereopod (lateral view); **e**, left third pereopod (lateral view); **f**, dactyl and propodus of left fourth pereopod; **g**, telson. Scales equal 1.0 mm (f-g) and 3.0 mm (a-e).

surfaces all with numerous tufts of long setae; cutting edge with row of corneous teeth, terminating in corneous claw. Palm slightly shorter than carpus, dorsomesial margin with 1 spine at proximal angle and sometimes few additional small spines on margin in proximal half, dorsal surfaces of palm and fixed finger with numerous irregular rows of long setae, dorsolateral margins not delimited; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with row of very small calcareous teeth proximally, corneous teeth distally. Carpus approximately equaling length of merus; dorsodistal margin with 1 or 2 spines or spinules, dorsomesial distal angle with strong spine and 1 to 6 spines on dorsomesial margin, dorsolateral margin not delimited; surfaces with short transverse, sometimes slightly protuberant rows of long setae. Merus with short transverse, somewhat protuberant or spinulose rows of long setae on dorsal margin; dorsodistal margin with 1 or 2 small spines; ventromesial and ventrolateral distal angles each with 1 distal spine or spinule and occasionally second spinule or spinulose protuberance on margin distally; lateral surface frequently with low, sometimes spinulose protuberances in ventral half. Ischium with tuberculate ridge on lateroproximal margin, ventrolateral distal margin with 2 or 3 spinules; ventromesial margin with 1 or 2 spinulose protuberances and tufts of setae.

Ambulatory legs (Figs 31d-e) with dactyls 1.25 to nearly twice length of propodi; in dorsal view, slightly twisted; in lateral view, curved ventrally; all surfaces, but particularly dorsal and ventrolateral margins, with rows of long setae; mesial faces each with row of tufts of long setae; ventral margins also with 9 to 25 short, fine corneous spines. Propodi with transverse rows of long setae dorsally; scattered setae on mesial, lateral and ventral surfaces; ventromesial distal angles usually with 1 or 2 corneous spines. Carpi each frequently with spine at dorsodistal angle; surfaces, particularly dorsal and lateral, with numerous tufts of setae. Meri and ischia each with short transverse sometimes slightly protuberant rows of long setae particularly dorsally. Fourth pereopods without prominent preungual process at base of claw (Fig. 31f). Anterior lobe of sternite of third pereopods subquadrate, with convex median, marginally setose, elevation.

Abdomen of males with 4 unpaired, unequally biramous pleopods; endopods well developed, exopods approximately half length of endopods. Posterior margin of sixth abdominal somite with lateral angles each drawn out into prominent simple, bi- or trifid spine. Telson (Fig. 31g) with deep transverse suture; posterior lobes nearly symmetrical, separated by narrow to moderately broad median cleft; terminal margins rounded, armed with several blunt or acute, sometimes corneous-tipped spines, extending onto lateral margins.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the islands of Kai and Tanimbar, Indonesia; 111 - 346 m.

ETYMOLOGY. — From the Latin *crinitus* meaning long-haired, and referring to the very long setae of the antennal acicles, ocular peduncles, chelipeds and ambulatory legs of this species.

AFFINITIES. — In having quite dense setation on the chelipeds and ambulatory legs, as well as elongate and very prominent ocular acicles, *T. crinita* agrees with the description given by ALCOCK (1905b) for *T. lantana*. However, *T. crinita* lacks the rows of spinules on the chelae reported for *T. lantana*. ALCOCK's (1905b, pl. 13, fig. 4) depicts a dorsodistal spine on the carpus of each ambulatory leg of *T. lantana*; *T. crinita* lacks any carpal spine. In his generic diagnosis, ALCOCK attributed paired first pleopods modified as gonopods to males of *Tomopaguropsis*, and these are depicted for *T. lantana* (ALCOCK, 1905b, pl. 13, fig. 4a). As previously noted, male gonopods are not present in *T. crinita*, nor in the Atlantic species, *T. problematica*.

Tomopaguropsis miyakei sp. nov.

Figs 32a-h, 44e-f

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♀ (2.2 mm) (MNHN-Pg 5320).

TYPE. — The single specimen is the holotype.

DESCRIPTION. — Shield (Fig. 32a) approximately as long as broad; anterior margin between rostrum and lateral projections weakly concave; anterior margins sloping; posterior margin truncate; dorsal surface only weakly calcified centrally, with few setae laterally. Rostrum triangular, produced slightly beyond bases of ocular acicles; with small terminal spine. Lateral projections broadly triangular, terminating subacutely, with spine or spinule.

Ocular peduncles moderately short; dorsomesial surface with few long setae; corneae not dilated. Ocular acicles rather short, subtriangular, dorsally rounded, with terminal spine and few setae distally; separated basally by more than half basal width of one acicle.

Antennular peduncles overreaching distal margins of corneae by approximately 0.75 length of ultimate segment. Ultimate segment with 1 or 2 long setae on dorsodistal margin and 2 or 3 on dorsal margin. Penultimate segment with few scattered setae. Basal segment with prominent spine on dorsolateral margin medially.

Antennal peduncles slightly overreaching distal margins of corneae. Fifth segment with few setae. Fourth segment with transverse row of long setae adjacent to dorsodistal margin. Third segment with strong ventrodistal spine and long setae. Second segment with dorsolateral distal angle produced, terminating in simple spine, mesial margin with small spine, dorsal surface and lateral margin with long setae; dorsomesial distal angle with small spine. First segment with spine on dorsolateral distal margin; ventral margin produced and with 1 spine ventrolaterally. Antennal acicle moderately long, reaching nearly to distal margin of ultimate peduncular segment, slightly arcuate, mesial and lateral margin distally each with very long setae; terminating in simple spine. Antennal flagellum moderately long, reaching about to tips of outstretched chelipeds; each article with several very long setae, shortest proximally.

Chelipeds subequal, right somewhat longer and more robust; dactyls and fixed fingers weakly arched ventrally. Right cheliped (Figs 32b, 44e) with dactyl approximately equal to length of palm; dorsomesial margin not delimited; dorsal, mesial and ventral surfaces all with numerous tufts of long setae arising from small surface pits; cutting edge with 1 calcareous tooth proximally and row of corneous teeth in distal half, terminating in corneous claw. Palm about 0.75 length of carpus, dorsomesial margin with row of rather widely-spaced small spines on proximal 0.80 and second adjacent row, 1 distinct tubercle and 2 very small spinules in dorsal midline proximally; dorsal surfaces of palm and fixed finger with numerous tufts of long setae; dorsolateral margin rounded and with few tiny spinules on palm, but with row of small spines on proximal 0.75 of fixed finger; lateral and ventral surfaces with numerous tufts of long setae; cutting edge of fixed finger with 1 large calcareous tooth proximally and row of slender calcareous teeth interspersed with corneous teeth distally; 1 very prominent calcareous-tipped tubercle at proximal angle. Carpus approximately equaling length of merus; distal margin with few small spines dorsally and laterally; dorsomesial margin with row of moderately strong spines and adjacent mesial and lateral row of smaller spines and spinules; dorsolateral margin not delimited but dorsal surface laterally and lateral surface dorsally each with irregular transverse rows of spinulose protuberances and long setae; mesial and ventral surfaces with scattered long setae. Merus with sparse short setae on all surfaces; ventromesial margin with 2 very small spines distally and 2 larger spines proximally; ventrolateral margin with 1 spinule distally. Ischium with small spinulose tubercle on ventromesial margin.

Left cheliped (Figs 32c, 44f) with dactyl slightly longer than palm; dorsomesial margin of dactyl not delimited; surfaces all with few sparse tufts of long setae; cutting edge with row of corneous teeth; terminating in corneous claw and slightly overlapped by fixed finger. Palm approximately 0.75 length of carpus; widely-spaced double row of small spines on rounded dorsomesial margin; dorsal surfaces of palm and fixed finger with few small widely-spaced spines laterad of midline, strongest on fixed finger, and row of tiny spinules in region of rounded dorsolateral margin; surfaces all with scattered long setae; cutting edge of fixed finger with row of very small calcareous teeth proximally, corneous teeth distally. Carpus slightly shorter than merus; dorsomesial margin with irregular row of spines and few long setae, dorsolateral margin with irregular row of smaller spines; lateral face with few small spines at distal margin and 1 small spine centrally; 1 tiny spinule at ventrolateral distal angle; mesial and ventral surfaces with sparse tufts of setae. Merus with sparsely scattered setae on dorsal surface, lateral and mesial faces each with few low minutely spinulose protuberances and setae in ventral half; ventromesial margin with 1 small spine distally, 1 at midlength and cluster of 3 slightly larger spines proximally; ventrolateral margin with 1 distal spine. Ischium with 1 proximal and 1 distal small spine on ventromesial margin, distolateral margin with spinule dorsally.

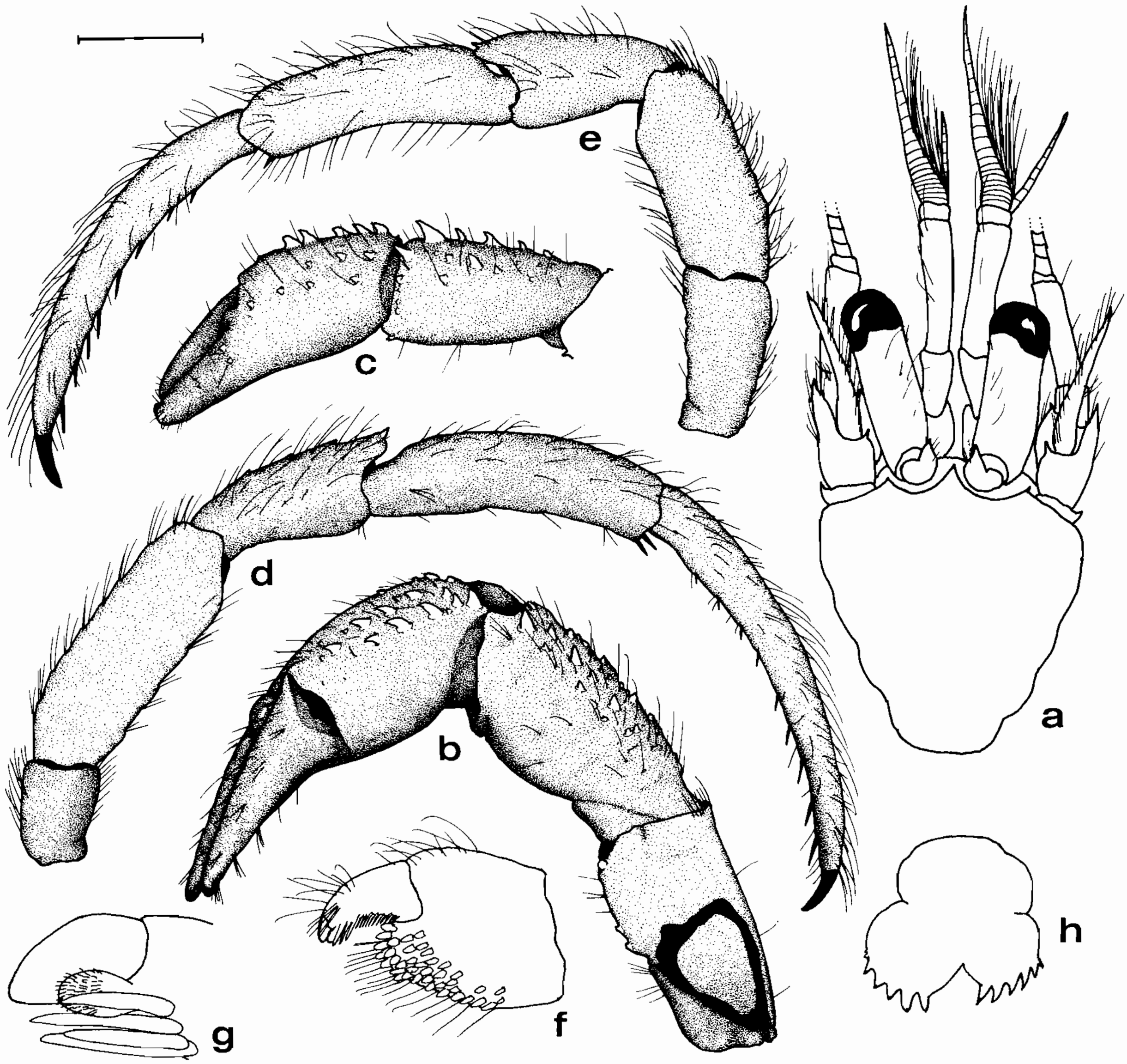

FIG. 32. — *Tomopaguropsis miyakei* sp. nov., holotype ♀ (2.2 mm) from KARUBAR Stn CP 35: **a**, shield and cephalic appendages; **b**, right cheliped (mesial view); **c**, carpus and chela of left cheliped (lateral view); **d**, right second pereopod (lateral view); **e**, left third pereopod (lateral view); **f**, dactyl and propodus of left fourth pereopod; **g**, tip of dactyl and preungual process of left fourth pereopod (lateral view); **h**, telson. Scale equal 0.1 mm (g), 0.5 mm (f), and 1.0 mm (a-e, h).

Ambulatory legs (Figs 32d-e) with dactyls 1.25 to 1.35 length of propodi; in dorsal view, slightly twisted; in lateral view, curved ventrally; all surfaces with sparse tufts of long rather stiff setae, most numerous dorsally; ventral margins few setae and 8 or 9 corneous spines. Propodi with numerous sparse tufts of long moderately stiff setae also most numerous dorsally; ventromesial distal angles each with 1 or 2 corneous spines. Carpi with spine at dorsodistal angle, second also with row of widely-spaced spinules on dorsal surface, both pairs with sparse tufts of setae dorsally and laterally. Meri and ischia each with dorsal and ventral row of low, sometimes spinulose protuberances and sparse setae. Anterior lobe of sternite of third pereopods subrectangular, with marginal setae. Fourth pereopods with moderately prominent preungual process at base of claw (Figs 32f-g).

Male not known. Females with very unequally biramous pleopods. Posterior margin of sixth abdominal somite with lateral angles rounded. Telson (Fig. 32h) with prominent transverse suture; posterior lobes nearly symmetrical, separated by V-shaped median cleft; terminal margins rounded, each armed with 5 acute, corneous-tipped and 2 very small spines on left, 5 on right, lateral margins not distinctly delimited.

COLOR. — Unknown.

HABITAT. — Unknown.

DISTRIBUTION. — At present known only from the type locality in the Kai Islands of Indonesia; 390 - 502 m.

ETYMOLOGY. — This species is dedicated to the eminent Japanese carcinologist, Dr. Sadayoshi MIYAKE, in recognition of his many contributions to our knowledge of the pagurid fauna of Japan.

AFFINITIES. — *Tomopaguropsis miyakei* appears more comparable to *T. lantana* than to *T. crinita*. The dorsal surfaces of the chelae of both *T. miyakei* and *T. lantana* are spinulose, while those of *T. crinita* are marked by transverse rows of setae. However, there are very few spinules on the right chela of *T. miyakei*, in contrast to the rows of spinules described by ALCOCK (1905b) for *T. lantana*. Two other differences between the two species are apparent. For *T. lantana* the ocular acicles are reported to be long and stout, perhaps similar to the ocular acicles of *T. crinita*. The ocular acicles of *T. miyakei* are neither long nor particularly stout. ALCOCK (1905b: 137) described the chelipeds and ambulatory legs as being "very hairy, but not so thickly so as to entirely conceal the surface sculpture". Although the chelipeds and ambulatory legs of *T. miyakei* are furnished with numerous sparse tufts of long setae, the setation could not be considered analogous to that described and illustrated for *T. lantana* (ALCOCK, 1905b, pl. 13, fig. 4).

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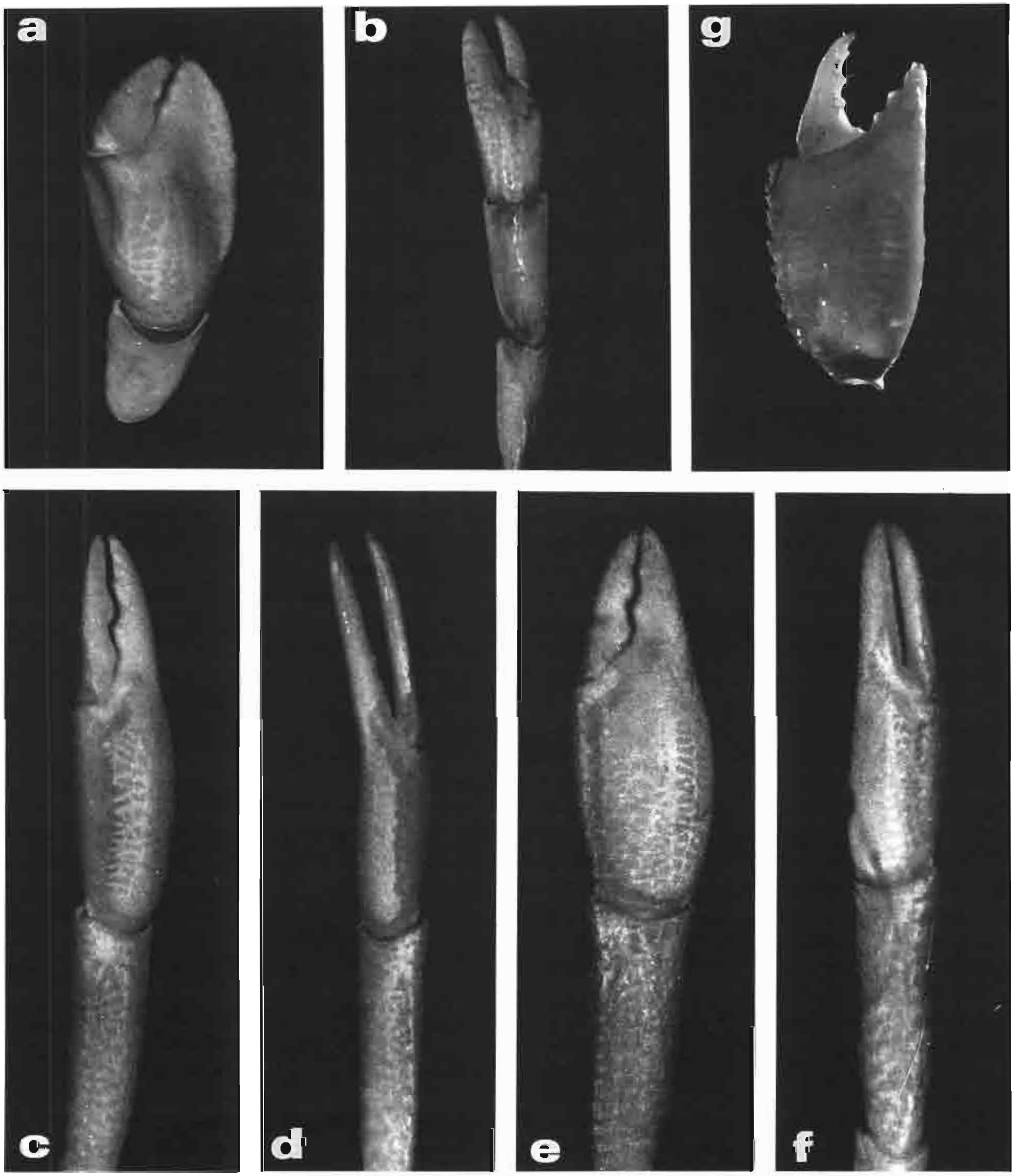

FIG. 33 a-b. — *Enneophyllus spinirostris* sp. nov., holotype ♂ (1.6 mm), KARUBAR Stn DW 49: **a**, carpus and chela of right cheliped; **b**, merus, carpus and chela of left cheliped.

FIG. 33 c-f. — *Enneopagurus garciagomezi* sp. nov., c-d, paratype ♂ (3.4 mm), KARUBAR Stn CP 71. — e-f, paratype ♀ (2.7 mm), KARUBAR Stn CP 75: **c**, **e**, carpus and chela of right cheliped; **d**, **f**, carpus and chela of left cheliped.

FIG. 33 g. — *Catapaguroides declivis* sp. nov., holotype ♂ (1.5 mm), KARUBAR Stn DW 49: chela of right cheliped.

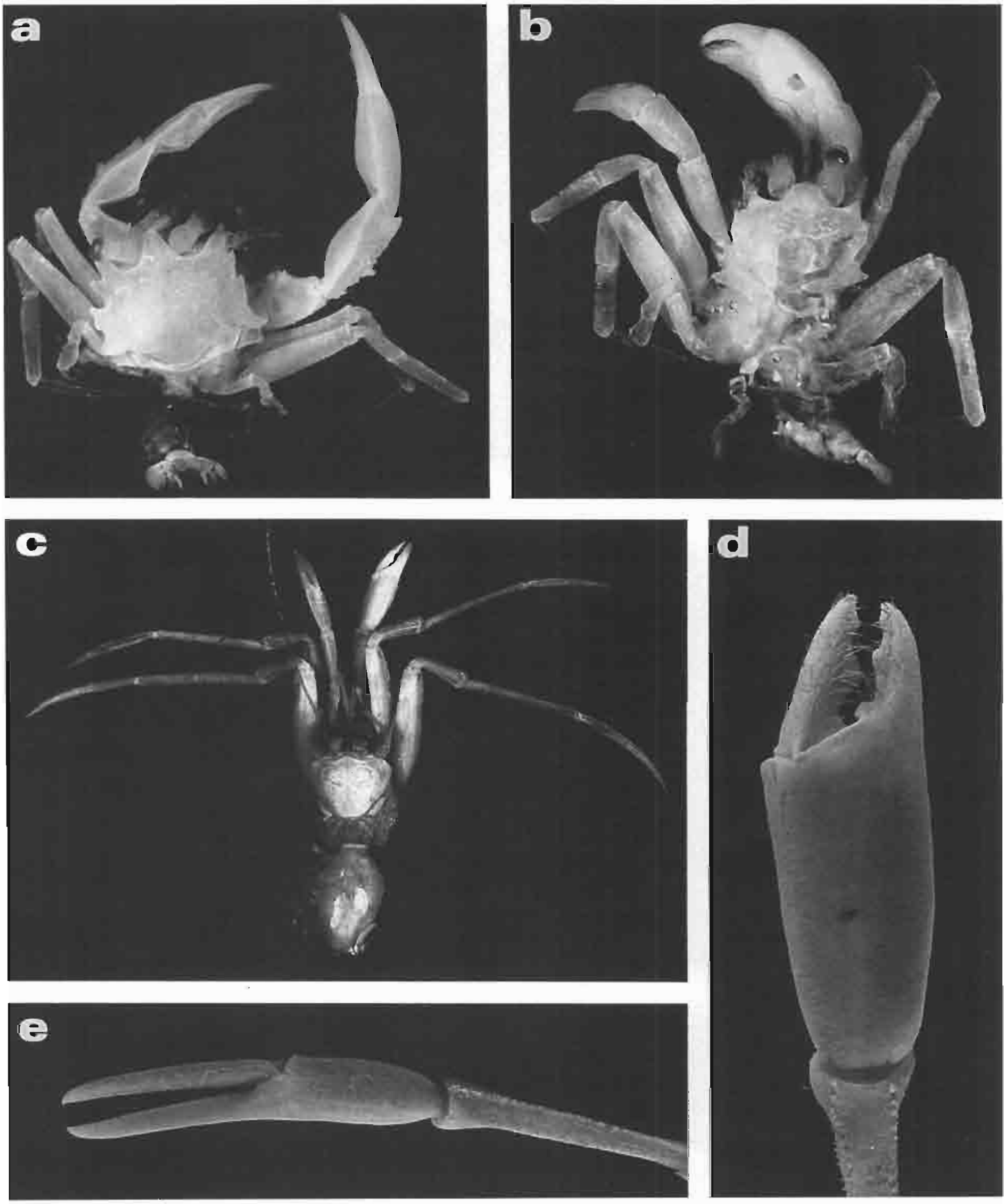

FIG. 34 a. — *Solitariopagurus tuerkayi* sp. nov., paratype ♂ (3.3 mm), KARUBAR Stn DW 50: whole animal.
FIG. 34 b. — *Porcellanopagurus jacquesi* sp. nov., holotype ♂ (2.8 mm), KARUBAR Stn DW 18: whole animal.
FIG. 34 c-e. — *Alainopaguroides lemaitrei* sp. nov., holotype ♂ (6.2 mm), KARUBAR Stn CP 59: **c**, whole animal; **d**, right chela; **e**, left chela and carpus.

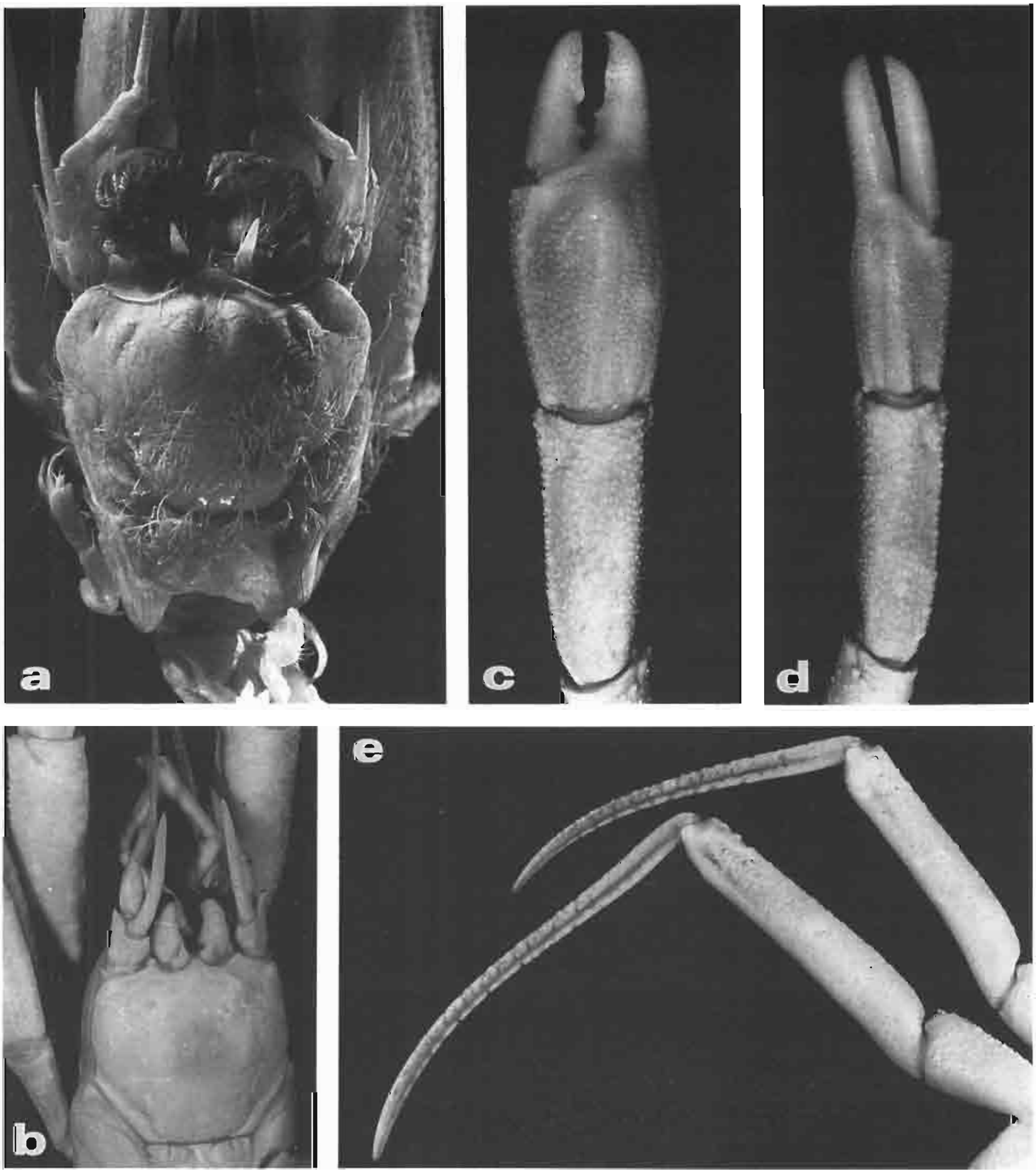

FIG. 35 a. — *Alainopaguroides lemaitrei* sp. nov., holotype ♂ (6.2 mm), KARUBAR Stn CP 59, carapace and cephalic appendages.

FIG. 35 b-e. — *Pagurodes inarmatus* Henderson, 1888, lectotype ♂ (7.0 mm), *"Challenger"* Stn 168: **b**, shield and cephalic appendages; **c**, right chela and carpus; **d**, left chela and carpus; **e**, dactyls and propodi of left second and third pereopods.

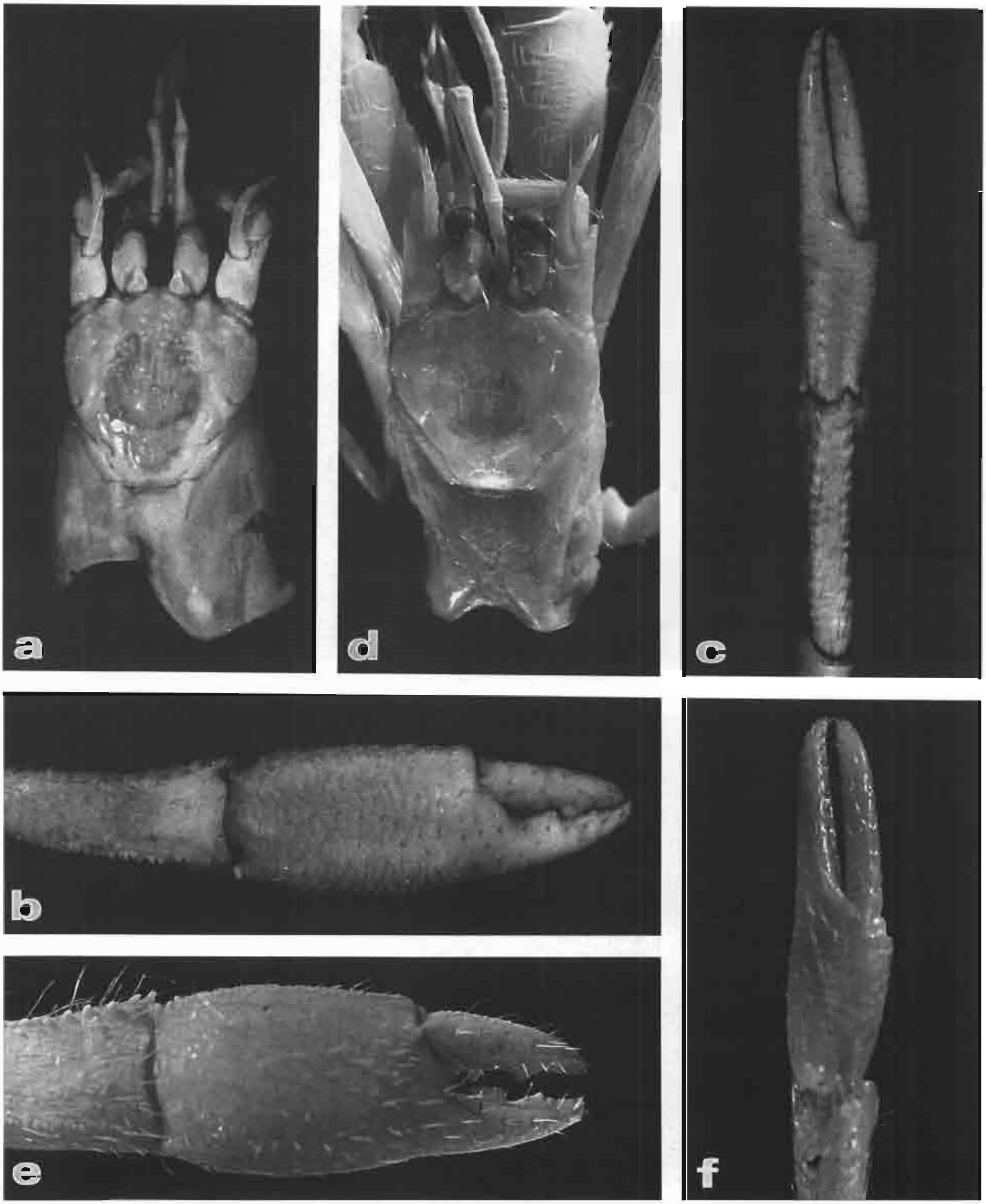

FIG. 36. — *Michelopagurus limatulus* (Henderson, 1888), new combination: a-c, holotype ♂ (3.1 mm), *"Challenger"* Stn 214 (NHM 88.33). — d-f, ♂ (2.8 mm), KARUBAR Stn CP 38: **a**, **d**, carapace and cephalic appendages; **b**, **e**, carpus (or part only) and chela of right cheliped; **c**, **f**, carpus (or part only) and chela of left cheliped.

FIG. 37 a-b. — *Pseudopagurodes piliferus* (Henderson, 1888), new combination, a-b, holotype ♀ (4.5 mm), *"Challenger"* Stn Tablas Islands (NHM 88.33): **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 37 c-e. — *Michelopagurus chacei* sp. nov., c-e, holotype ♂ (2.5 mm) from KARUBAR Stn DW 13: **c**, shield and cephalic appendages; **d**, carpus and chela of right cheliped; **e**, carpus and chela of left cheliped.

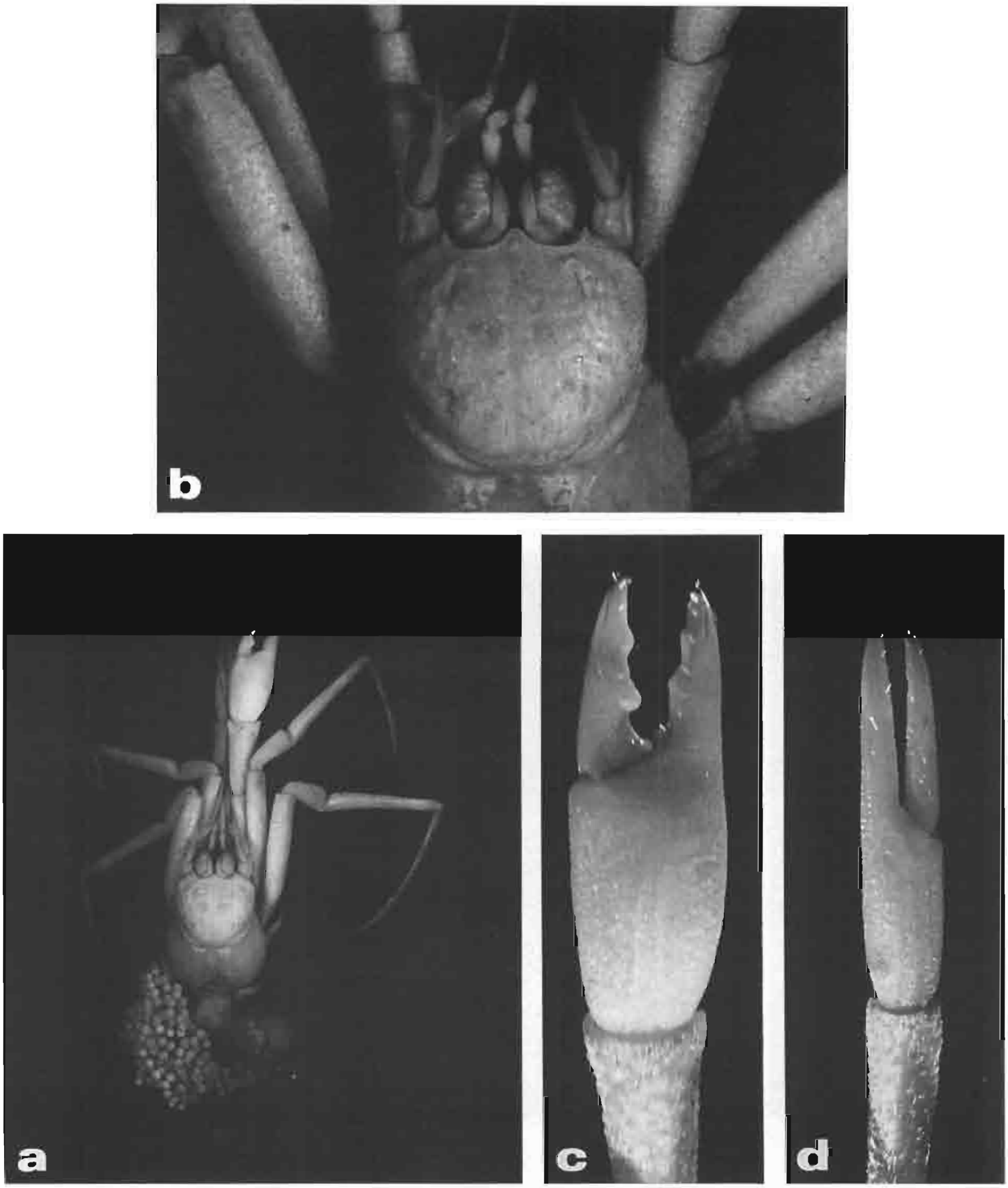

FIG. 38. — *Icelopagurus crosnieri* sp. nov., holotype ov. ♀ (4.3 mm), KARUBAR Stn CP 91: **a**, whole animal; **b**, enlarged shield and cephalic appendages; **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped.

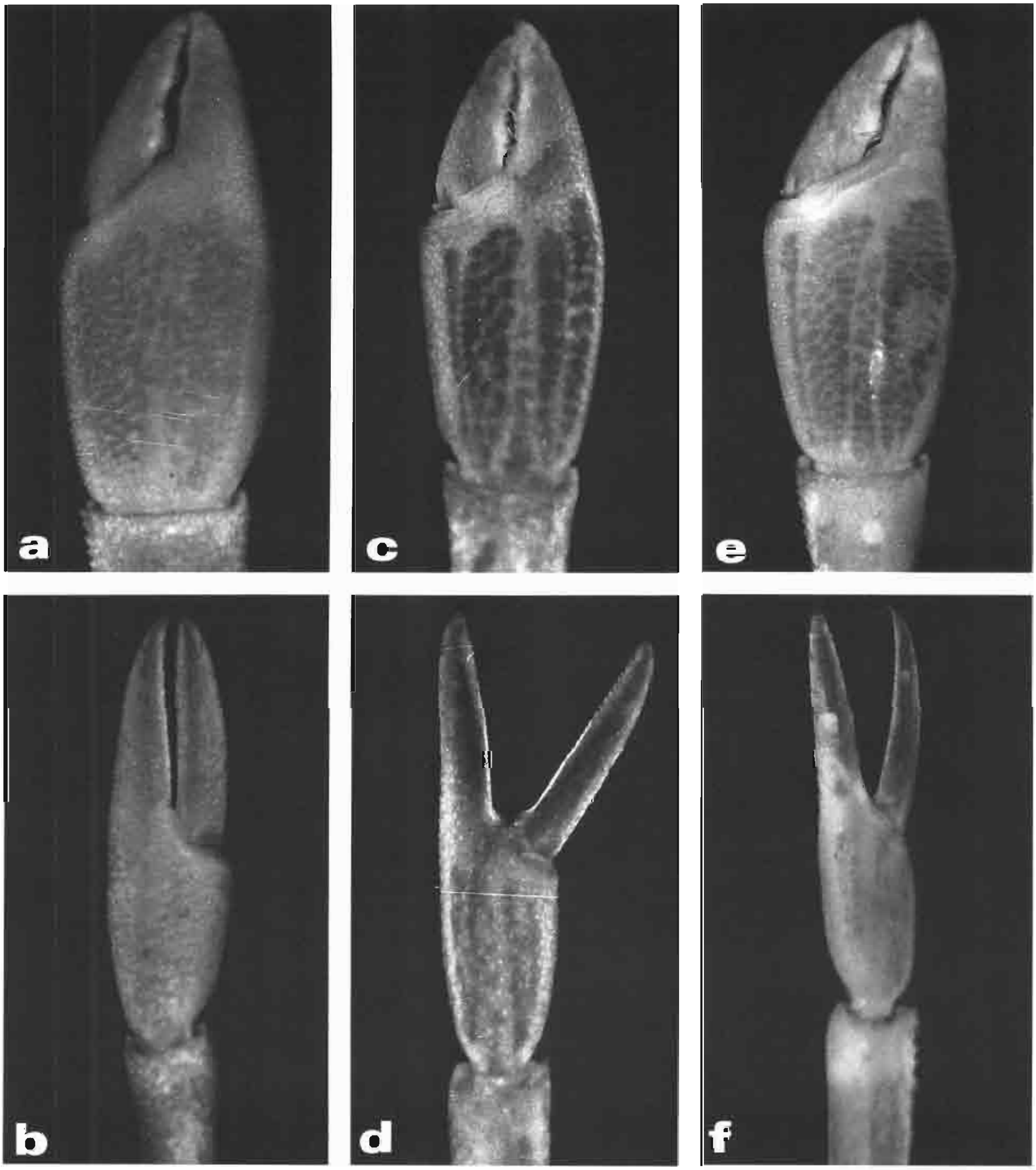

FIG. 39 a-b. — *Catapagurus oculocrassus* sp. nov., paratype ov.♀ (2.7 mm), KARUBAR Stn CP 21: **a**, chela of right cheliped; **b**, chela of left cheliped.

FIG. 39 c-d. — *Catapagurus tanimbarensis* sp. nov., holotype ♀ (2.1 mm), KARUBAR Stn DW 49: **c**, chela of right cheliped; **d**, chela of left cheliped.

FIG. 39 e-f. — *Catapagurus holthuisi* sp. nov., holotype ov. ♀ (2.8 mm), KARUBAR Stn CP 77: **e**, chela of right cheliped; **f**, chela of left cheliped.

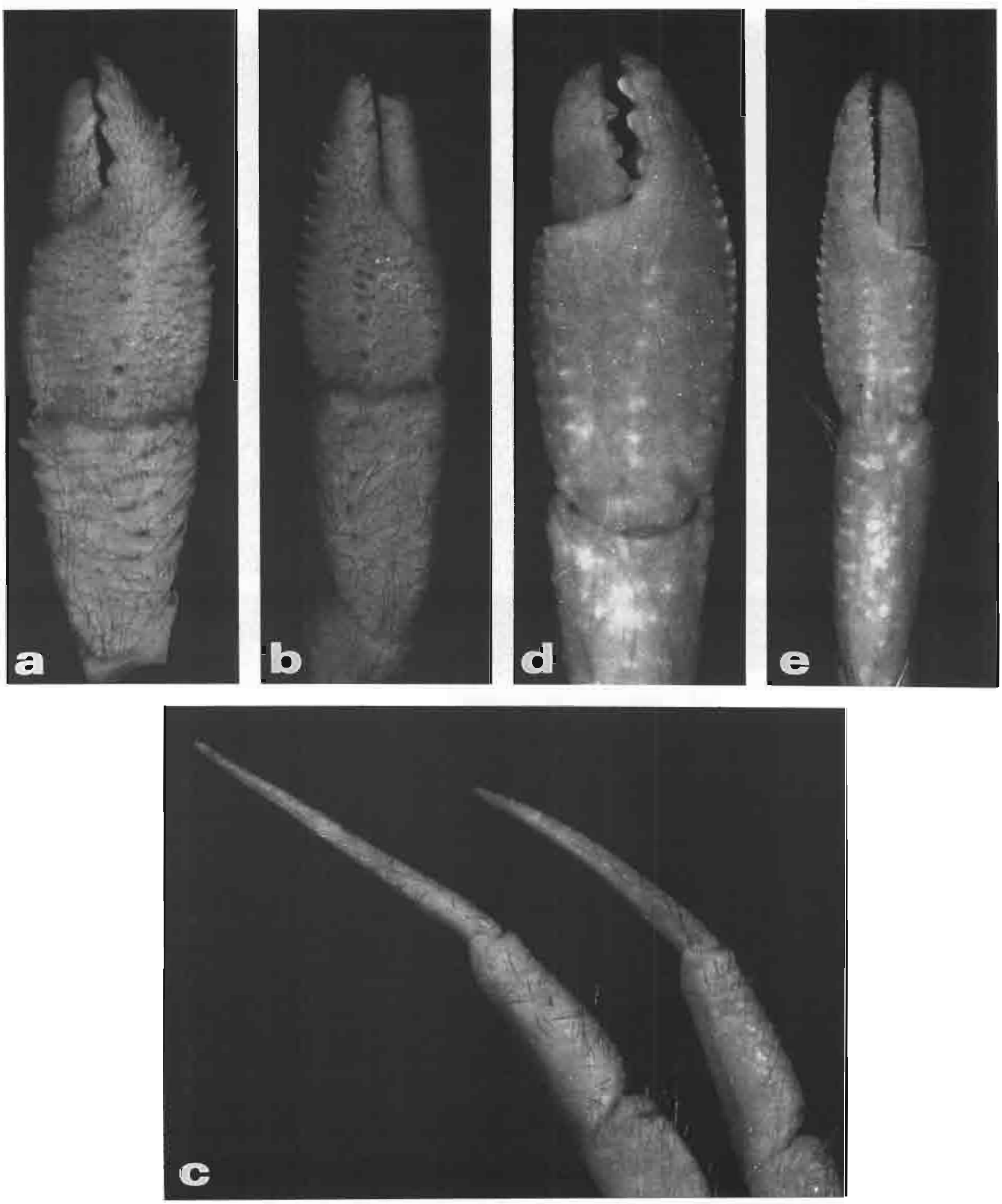

FIG. 40 a-c. — *Nematopagurus* cf. *indicus* Alcock, 1905, ♂ (5.2 mm), KARUBAR Stn DW 49: **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped; **c**, dactyls and propodi of left second and third pereopods.

FIG. 40 d-e. — *Nematopagurus* sp., ♀ (1.7 mm), KARUBAR Stn 18: **d**, chela of right cheliped; **e**, carpus and chela of left cheliped.

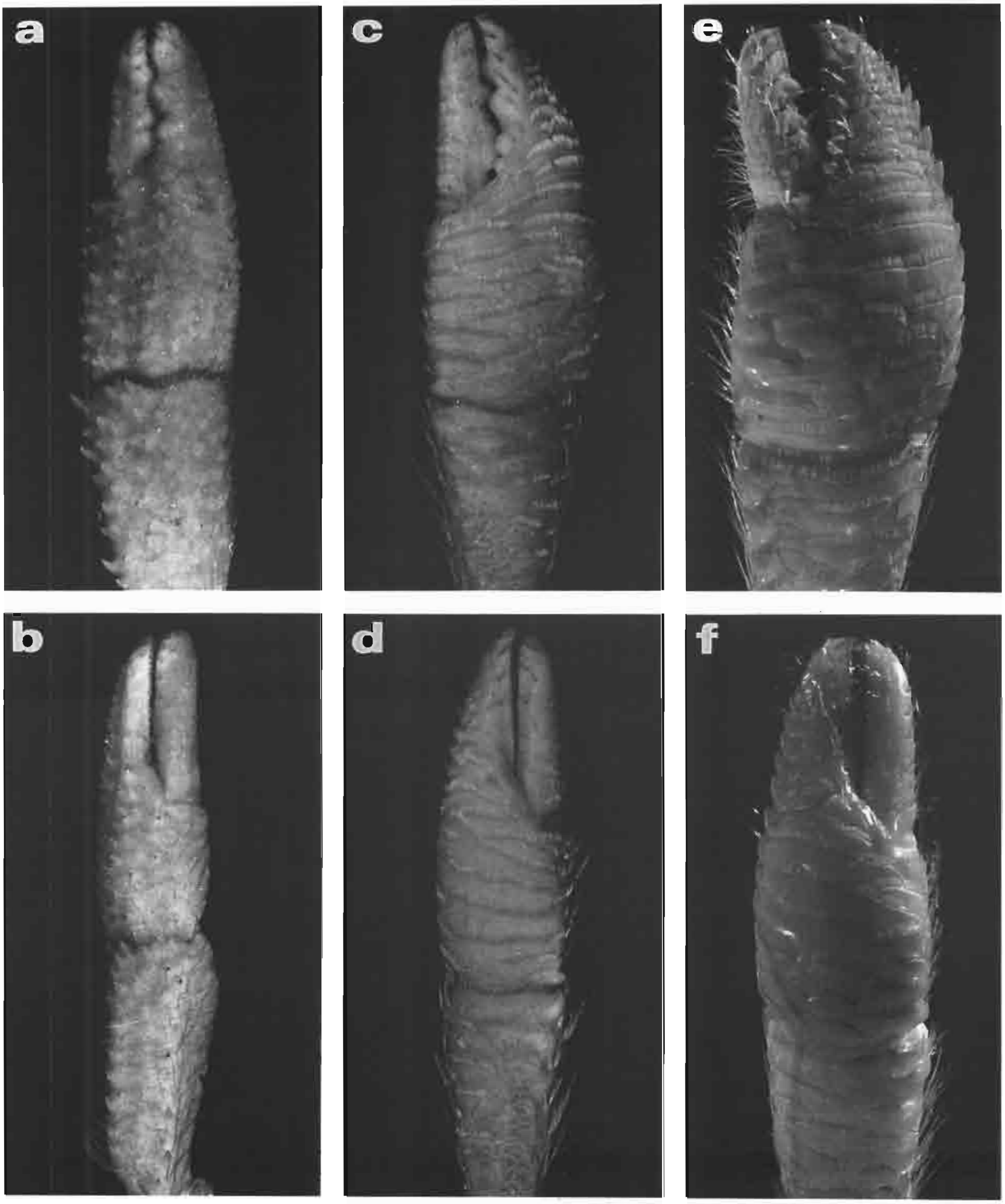

FIG. 41 a-b. — *Nematopagurus spinulosensoris* McLaughlin & Brock, 1974, ♀ (5.6 mm), KARUBAR Stn CP 86 **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 41 c-f. — *Nematopagurus scutelliformis* sp. nov., c-d, paratype ♀ (7.0 mm), KARUBAR Stn CP 83; e-f, paratype, ♀ (6.9 mm), KARUBAR, st. CP 101: **c**, **e**, carpus and chela of right cheliped; **d**, **f**, carpus and chela of left cheliped.

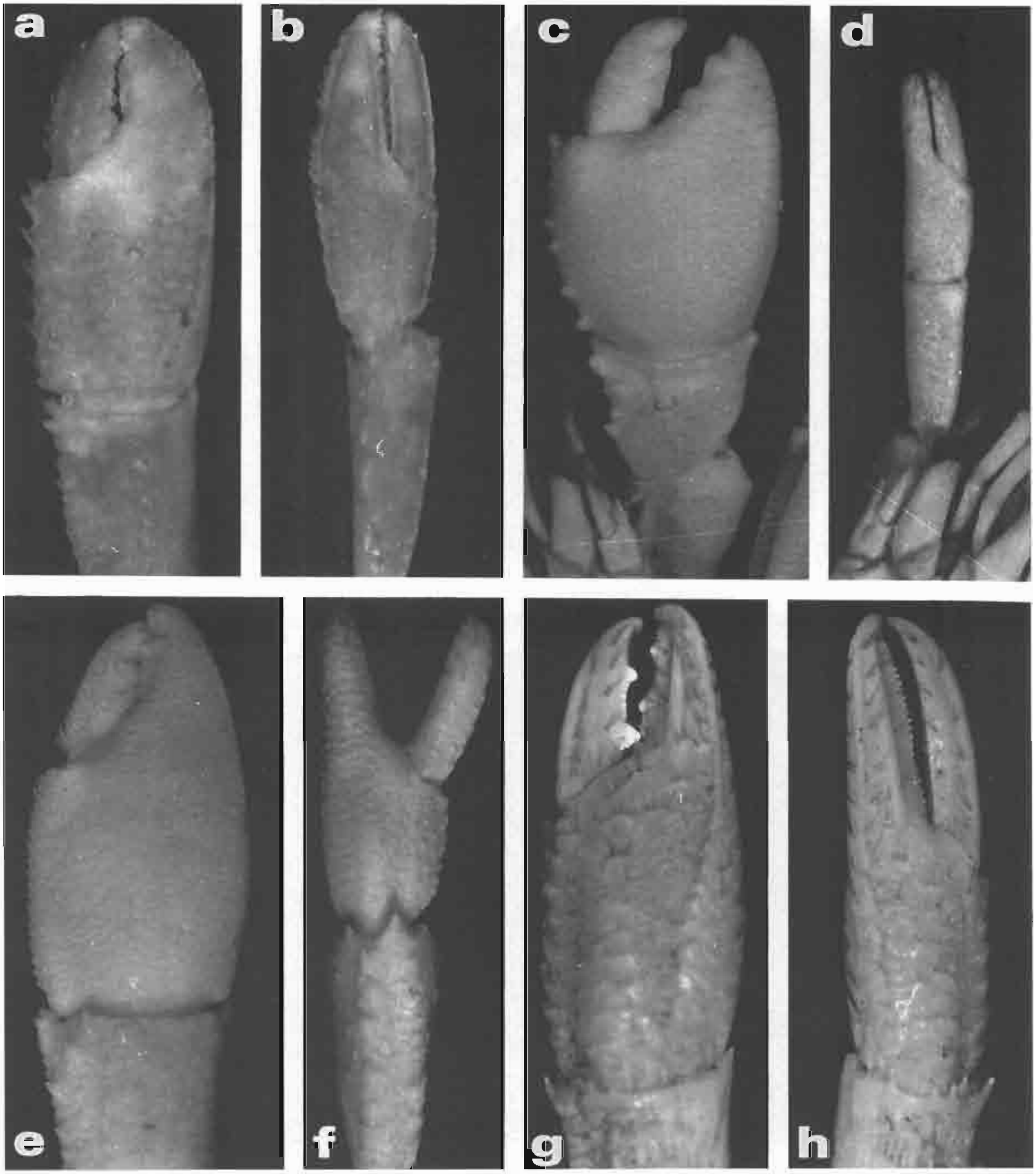

FIG. 42 a-b. — *Australeremus indonesiensis* sp. nov., holotype ♀ (1.9 mm), KARUBAR Stn DW 18: **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 42 c-d. — *Bathypaguropsis rahayuae* sp. nov., holotype ♂ (3.2 mm), KARUBAR Stn DW 14: **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped.

FIG. 42 e-f. — *Pagurus kaiensis* sp. nov., a-b, holotype ♂ (8.4 mm), KARUBAR Stn DW 18: **e**, chela of right cheliped; **f**, carpus and chela of left cheliped.

FIG. 42 g-h. — *Pagurus compressipes* (Miers, 1881), syntype ♂ (3.9 mm) NHM 1881.31: **g**, chela of right cheliped; **h**, chela of left cheliped.

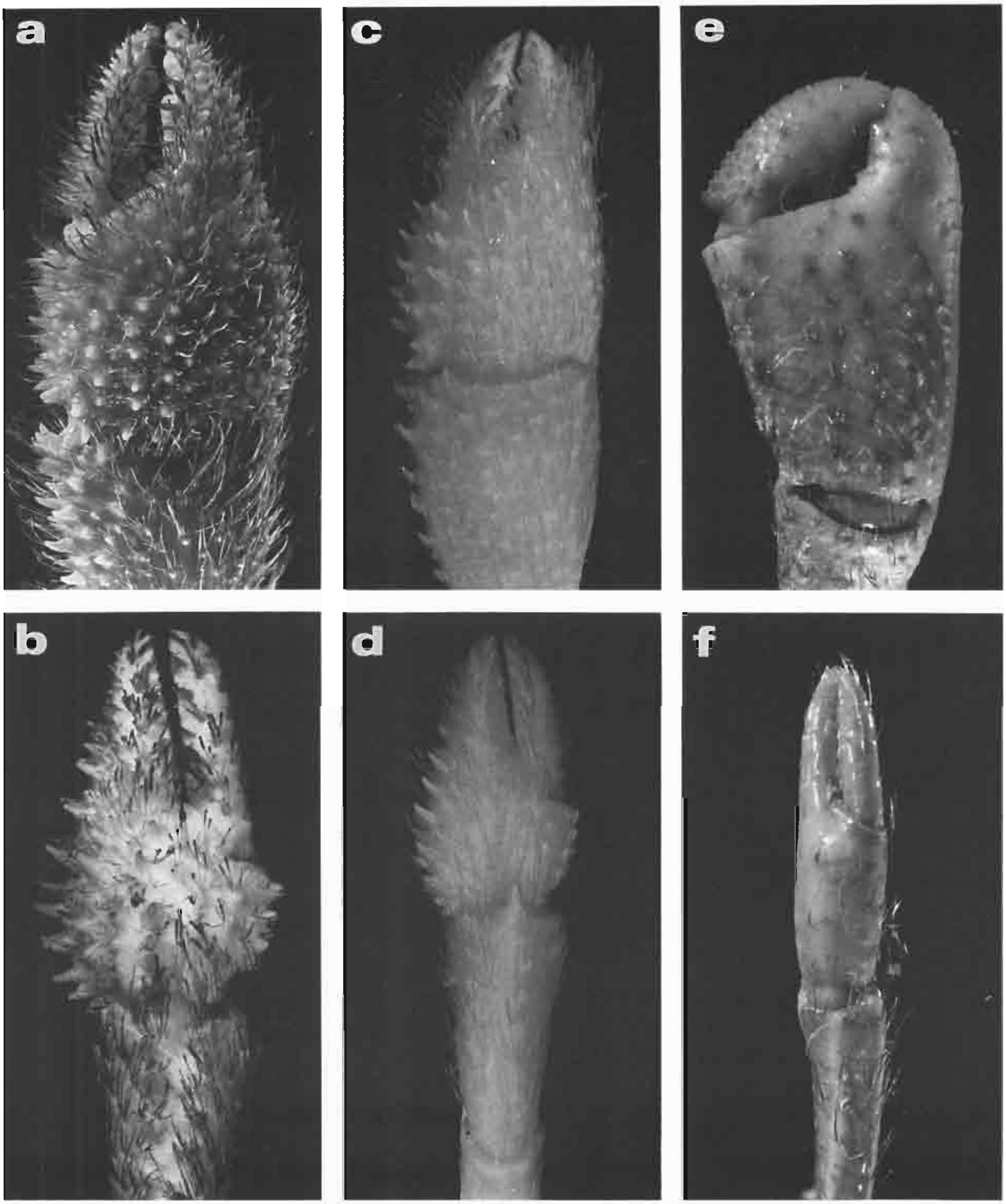

FIG. 43 a-d. — *Pagurus haigae* sp. nov., a-b, paratype ♀ (12.1 mm), KARUBAR Stn CP 16. — c-d, paratype ♂ (7.3 mm) from Stn CP 26: **a**, **c**, chela of right cheliped; **b**, **d**, chela of left cheliped.

FIG. 43 e-f. — *Pylopaguropsis zebra* (Henderson, 1893), ♀ (2.7 mm), KARUBAR Stn DW 15: **e**, chela of right cheliped; **f**, chela of left cheliped.

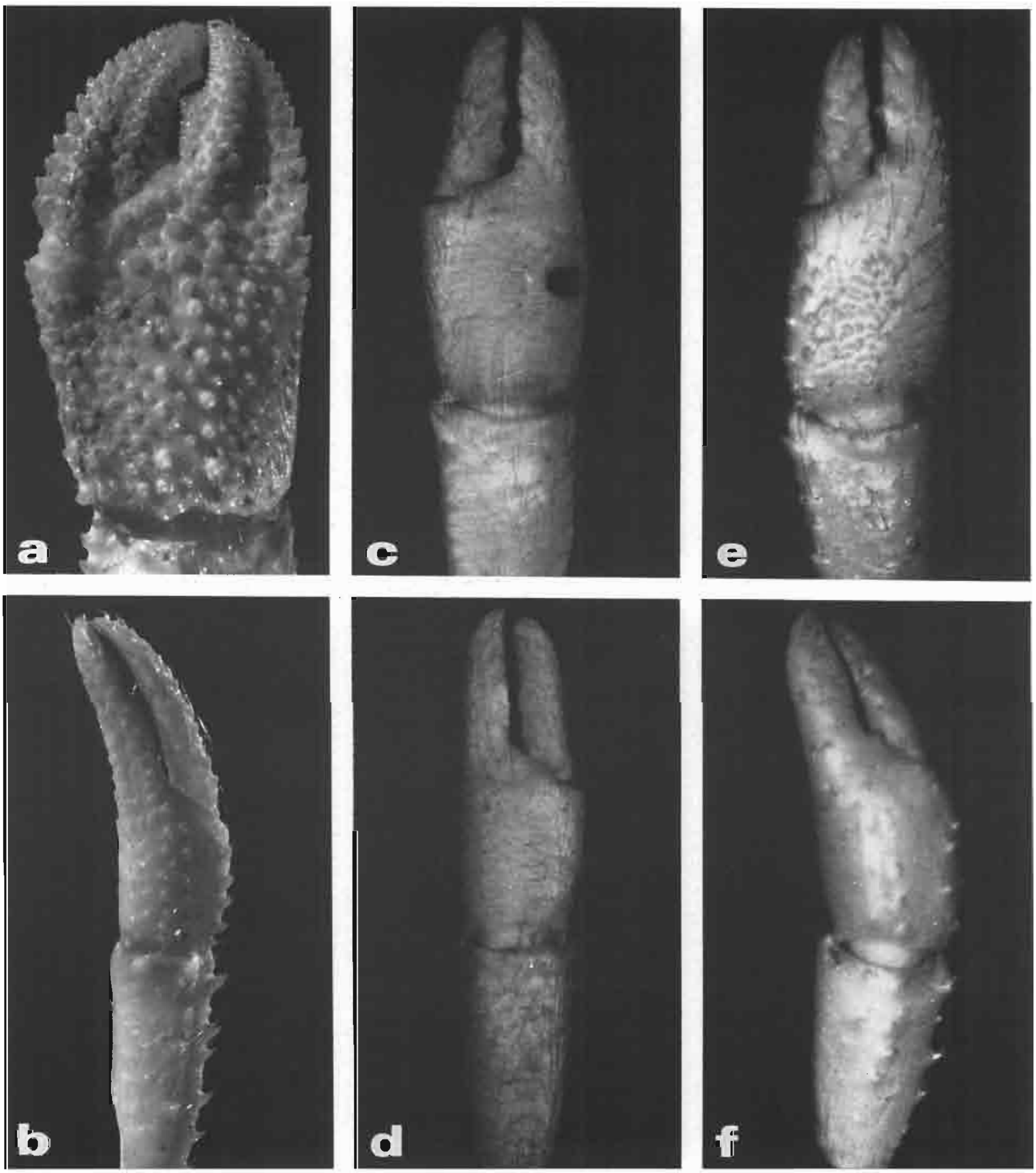

FIG. 44 a-b. — *Pylopaguropsis laevispinosa* McLaughlin & Haig, 1989, ♂ (3.2 mm), KARUBAR Stn DW 22: **a**, carpus and chela of right cheliped; **b**, carpus and chela of left cheliped.

FIG. 44 c-d. — *Tomopaguropsis crinita* sp. nov., paratype ♂ (5.4 mm), KARUBAR Stn CC 10: **c**, carpus and chela of right cheliped; **d**, carpus and chela of left cheliped.

FIG. 44 e-f. — *Tomopaguropsis miyakei* sp. nov., holotype ♀ (2.2 mm), KARUBAR Stn CP 35: **e**, carpus and chela of right cheliped; **f**, carpus and chela of left cheliped.

INDEX

Page numbers in bold indicates full taxonomic treatments, numbers in italics refer to illustrations.

11

Crustacea Decapoda: Parapaguridae from the KARUBAR Cruise in Indonesia, with descriptions of two new species

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ABSTRACT

During the French-Indonesian KARUBAR campaign, ten species and a megalopal stage of deep-water hermit crabs of the family Parapaguridae, were collected. Two of the species found in the collection are undescribed, *Oncopagurus glebosus* sp. nov., and *Paragiopagurus insolitus* sp. nov., and are characterized by several unusual or unique characters. One previously described species, *Oncopagurus orientalis* (de Saint Laurent, 1972), was found to be insufficiently defined. These three species are described or diagnosed, and illustrated. Another species, *Parapagurus latimanus* Henderson, 1888, is reported for the first time from Indonesia. Two megalopal stage specimens of a parapagurid species cannot be assigned with certainty based on current knowledge, to any species; they are also illustrated and discussed. A list of all 15 parapagurid species currently known from Indonesian waters is presented, including references where diagnoses and illustrations can be found.

RÉSUMÉ

Crustacea Decapoda: Parapaguridae récoltés lors de la campagne KARUBAR en Indonésie. Descriptions de deux espèces nouvelles.

Durant la campagne franco-indonésienne KARUBAR, 10 espèces et un stade mégalope de pagures d'eau profonde de la famille des Parapaguridae ont été récoltés. Deux de ces espèces sont nouvelles: *Oncopagurus glebosus* et *Paragiopagurus insolitus* et se distinguent par plusieurs caractères inhabituels ou uniques. Une espèce décrite précédemment, *Oncopagurus orientalis* (de Saint Laurent, 1972) s'est révélée mal définie. Ces trois espèces sont donc l'objet d'une description ou d'une diagnose et sont illustrées. Une autre espèce, *Parapagurus latimanus* Henderson, 1888, est signalée pour la première fois d'Indonésie. Deux mégalopes de Parapaguridae ne peuvent être rattachées avec certitude à aucune espèce connue; elles sont également illustrées et discutées. Une liste des 15 espèces de Parapaguridae, connues des eaux indonésiennes, est établie, accompagnée de références où des diagnoses et des illustrations les concernant peuvent être trouvées.

LEMAITRE, R., 1997. — Crustacea Decapoda: Parapaguridae from the KARUBAR Cruise in Indonesia, with descriptions of two new species. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 573-596. Paris ISBN: 2-85653-506-2.

INTRODUCTION

The family Parapaguridae Smith, 1882, redefined by DE SAINT LAURENT (1972), in recent years has been the subject of revisionary studies that have established new generic boundaries and proposed a number of new genera (LEMAITRE, 1989, 1993, 1996; OSAWA, 1995). As result, ten genera are now recognized, five of which are monotypic: *Probeebei* Boone, 1926, *Tylaspis* Henderson, 1885, *Typhlopagurus* de Saint Laurent, 1972, *Bivalvopagurus* Lemaitre, 1993, and *Tsunogaipagurus* Osawa, 1995; five others contain the remainder of the species: *Parapagurus* Smith, 1879, *Sympagurus* Smith, 1883, *Strobopagurus* Lemaitre, 1989, *Oncopagurus* Lemaitre, 1996, and *Paragiopagurus* Lemaitre, 1996.

The parapagurid fauna from Indonesia is known largely from collections obtained in earlier expeditions such as the U.S. *"Albatross"* (late 1800's to early 1900's), Dutch *Siboga* Expedition (1899-1900), the Danish Th. MORTENSEN's Pacific Expedition (1914-1916), and the Danish *Galathea* (1950-1952). Based on these collections, 12 species of parapagurids have been reported from various Indonesian localities (DE SAINT LAURENT, 1972; LEMAITRE, 1994, 1996).

During the recent French-Indonesian deep-water sampling campaign known as KARUBAR, conducted from October to November of 1991 on board the *"Baruna Jaya 1"*, seven of the 12 species known to occur in the Indonesian region were obtained. In addition, the KARUBAR material was found to contain two distinctive new species, *Oncopagurus glebosus* sp. nov., and *Paragiopagurus insolitus* sp. nov., described herein. One species, *Parapagurus latimanus* Henderson, 1888, had not been previously reported from this region. Another species in this material, previously included in the genus *Sympagurus*, *S. orientalis* (de Saint Laurent, 1972), but recently assigned by LEMAITRE (1996) to the genus *Oncopagurus*, was found to be insufficiently defined. It is illustrated and diagnosed. Also reported and discussed are two megalopal stage specimens of an undetermined species of parapagurid. Although based on current knowledge these postlarvae cannot be assigned to any species, they are of interest because of the paucity of information on the larval development of parapagurids (LEMAITRE & MCLAUGHLIN, 1992).

The KARUBAR material remains deposited in the Muséum national d'Histoire naturelle, Paris (MNHN), except for some duplicates deposited in the National Museum of Natural History, Smithsonian Institution, Washington D.C. (USNM). For comparative purposes, paratypic material of *Oncopagurus orientalis* (de Saint Laurent), borrowed from the Zöologisch Museum, Amsterdam (ZMA), and Zoologisk Museum, Copenhagen (ZMK), was examined.

In the material examined section, the length of the shield (to the nearest 0.1 mm), indicated in parentheses, is measured from the tip of the rostrum to the midpoint of the posterior margin of the shield. Measurements included for the megalopae are carapace length (CL), measured from the tip of the rostrum to the posterior midpoint of the carapace; and total length (TL), measured from the tip of the rostrum to the midpoint of the telson, excluding the telsonal setae. Abbreviations used are: immat. , immature (sex indetermined); ovig., ovigerous; Stn, station.

The KARUBAR campaign was named for the islands of Kai, Aru, and Tanimbar.

The general terminology employed follows MCLAUGHLIN (1974). In the descriptive text, the term "semichelate" to describe the condition of the fourth and fifth pereopods, is used following MCLAUGHLIN's (1997: 435) definition, i.e. "where the ventral margin of the propodus is produced beneath the dactyl to such an extent that flexion of the dactyl becomes more akin to the action of a dactyl against a fixed finger of a chelate appendage". This is in contrast with the "subchelate" condition, "in which the pereopod is developed as a prehensile structure by the folding back of the dactyl against the propodus".

SYSTEMATIC ACCOUNT

Family PARAPAGURIDAE Smith, 1882

Genus *STROBOPAGURUS* Lemaitre, 1989

Strobopagurus sibogae (de Saint Laurent, 1972)

Parapagurus sibogae de Saint Laurent, 1972: 116, figs 10, 23 (type locality: Indonesia, *Siboga* Exp. Stn 12).
Strobopagurus sibogae - LEMAITRE, 1989: 36; 1996: 167, fig. 1.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 2 ♀ 3.3, 4.7 mm (USNM 276034).

Tanimbar Islands: stn CP 83, 09°23'S, 131°00'E, 285-297 m, 4.11.1991: 1 ♀ 3.3 mm (MNHN-Pg 5380). — Stn CP 84, 09°23'S, 131°09'E, 275-246 m, 4.11.1991: 3 ♂ 3.4-4.4 mm, 1 ♀ 3.5 mm (MNHN-Pg 5381).

DISTRIBUTION. — Western Pacific: Indonesia; China Sea; Japan; and Australia. Depth: 40 to 550 m.

Genus *PARAPAGURUS* Smith, 1879

Parapagurus latimanus Henderson, 1888

Parapagurus latimanus Henderson, 1888: 91, pl. 9, fig. 2 (type locality: *"Challenger"* Stn 167A, New Zealand). — MURRAY, 1895: 597. — GORDAN, 1956: 338. — LEMAITRE, 1986: 526; 1989: 11. — LEMAITRE & MCLAUGHLIN, 1992: 762, fig. 9.
Parapagurus pilosimanus latimanus - DE SAINT LAURENT, 1972: 103, pl. 1, fig. 5.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 52, 08°03'S, 131°48'E, 1244-1266 m, 30.10.1991: 4 ♂ 4.2-8.9 mm, 2 ♀ 4.5, 4.8 mm (MNHN-Pg 5365). — Stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♂ 5.2 mm (USNM 276026).

DIAGNOSIS. — (See LEMAITRE & MCLAUGHLIN, 1992).

DISTRIBUTION. — Southern Australia (DE SAINT LAURENT, 1972); New Zealand; and now Indonesia. Depth: 909 to 1995 m.

Genus *SYMPAGURUS* Smith, 1883

Sympagurus brevipes (de Saint Laurent, 1972)

Parapagurus brevipes de Saint Laurent, 1972: 105, figs 2, 14 (type locality: Indonesia, *Siboga* Exp. Stn 12).
Sympagurus brevipes - LEMAITRE, 1989: 37; 1994: 412; 1996: 170, figs 2, 3a-b, 4, 5a, 6.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 05, 05°49'S, 132°18'E, 296-299 m, 22.10.1991: 1 ♂ 18.5 mm, 1 ♀ ovig. 16.0 mm (MNHN-Pg 5373). — Stn CP 09, 05°23'S, 132°29'E, 368-389 m, 23.10.1991: 1 ♀ ovig. 14.4 mm (MNHN-Pg 5374). — Stn CC 10, 05°21'S, 132°30'E, 329-389 m, 23.10.1991: 1 ♂ 23.2 mm, 2 ♀ 9.6, 14.0 mm, 1 ♀ ovig. 14.4 mm (USNM 276027). — Stn CP 16, 05°17'S, 132°50'E, 315-349 m, 24.10.1991: 1 ♀ ovig. 13.6 mm (MNHN-Pg 5367). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ 8.5 mm (MNHN-Pg 5370). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♀ 15.8 mm, 1 ♀ ovig. 12.9 mm (MNHN-Pg 5366). — Stn CP 37, 06°07'S, 132°42'E, 363-241 m, 27.10.1991: 1 ♂ 16.1 mm (MNHN-Pg 5375).

Tanimbar Islands: stn CP 39, 07°47'S, 132°26'E, 477-466 m, 28.10.1991: 1 ♂ 21.1 mm (MNHN-Pg 5377). — Stn CP 45, 07°54'S, 132°47'E, 302-305 m, 29.10.1991: 1 ♀ 15.8 mm (MNHN-Pg 5376). — Stn CC 57, 08°19'S, 131°53'E, 603-620 m, 31.10.1991: 1 immat. 3.7 mm (MNHN-Pg 5371). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 1 ♂ 5.5 mm, 1 ♀ 4.3 mm (MNHN-Pg 5372). — Stn CP 77, 08°57'S, 131°27'E, 352-346 m, 3.11.1991: 1 ♀ 5.4 mm (MNHN-Pg 5369).

KARUBAR. 1991. (No station data): 1 ♂ 22.5 mm (MNHN-Pg 5368).

DIAGNOSIS. — (See LEMAITRE, 1996).

DISTRIBUTION. — Indo-Pacific: Zanzibar; Indonesia; Philippines; and Australia. Depth: 210 to 794 m.

Sympagurus papposus Lemaitre, 1996

Sympagurus papposus Lemaitre, 1996: 180, figs 3c-d, 5 b, 8-10 (type locality: E of Broken Bay, New South Wales, Australia, FRV *Kapala* Stn K75-01-02).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CC 40, 07°46'S, 132°31'E, 443-468 m, 28.10.1991: 1 ♂ 13.4 mm, 2 ♀ ovig. 121.1, 12.3 mm (MNHN-Pg 5379). — Stn CC 41, 07°45'S, 132°42'E, 401-393 m, 28.10.1991: 1 ♂ 14.6 mm (USNM 276033). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ♂ 7.0 mm (MNHN-Pg 5378).

DIAGNOSIS. — (See LEMAITRE, 1996).

DISTRIBUTION. — Indo-Pacific: Madagascar; Indonesia: and Australia. Depth: 205 to 960 m.

REMARKS. — As pointed out by LEMAITRE (1996), this species is very similar to *S. dofleini* (Balss, 1912). Females of *S. papposus* can be separated from males or females of *S. dofleini* by the armature of the anterior lobes of the telson. The left anterior lobe of the telson, and sometimes also the right anterior lobe, are armed ventrolaterally with a fringe or cluster of slender corneous spines mixed with bristle-like setae in *S. papposus*. The anterior lobes have in both sexes at most a row of setae in *S. dofleini*. Males of the two species, however, can only be separated using a number of subtle differences. The anterolateral projections of the shield are broadly rounded, often obsolete, in *S. papposus*; the projections are broadly triangular, often terminating acutely in *S. dofleini*. The spines on the antennal scales are stronger, and more broadly spaced in *S. papposus* than in *S. dofleini*. The distal lobe of the male first gonopod is broader in *S. papposus* than in *S. dofleini*. The two species also seem to utilize different habitats or symbiotic associations. *S. papposus* has been found living exclusively in large zoanthids (*Epizoanthus* sp.) whereas *S. dofleini* is most frequently found living in large actinians (*Stylobates* sp.).

Genus *ONCOPAGURUS* Lemaitre, 1996

Oncopagurus minutus (Henderson, 1896)

Parapagurus minutus Henderson, 1896: 531 (type locality: off the north Maldive Atoll, *"Investigator"* Stn 150). — ALCOCK & ANDERSON, 1897: pl. 32, fig. 3, 3a. — ALCOCK, 1901: 222; 1905: 101, pl. 10, fig. 3. — GORDAN, 1956: 338 (lit). — DE SAINT LAURENT, 1972: 108.
Sympagurus minutus - LEMAITRE, 1989: 37; 1994: 412.
Oncopagurus minutus - LEMAITRE, 1996: 201, fig. 21.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 54, 08°21'S, 131°43'E, 836-869 m, 30.10.1991: 1 ♀ ovig. 3.1 mm (MNHN-Pg 5345). — Stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 ♂ 3.2 mm (MNHN-Pg 5346). — Stn CP 91, 08°44'S, 131°05'E, 884-891 m, 5.11.1991: 1 ♂ 3.0 mm (USNM 276030).

DIAGNOSIS. — (See LEMAITRE, 1996).

DISTRIBUTION. — Indo-Pacific: Maldives; Indonesia; and Australia. Depth: 800 to 2308 m.

Oncopagurus monstrosus (Alcock, 1894)

"?Parapagurus monstrosus" Alcock, 1894: 243 [type locality, by lectotype designation (LEMAITRE, 1996: 199): Bay of Bengal].

Sympagurus monstrosus - HENDERSON, 1896: 533. — ALCOCK & ANDERSON, 1897: pl. 32, fig. 4. — ALCOCK, 1901: 223. — LEMAITRE, 1989: 37; 1994: 412.
Sympagurus arcuatus var. *monstrosus* - ALCOCK, 1905: 104, pl. 10, fig. 5. — GORDAN, 1956: 341. — KEMP & SEWELL, 1912: 26.
Parapagurus monstrosus - DE SAINT LAURENT, 1972: 108. — MIYAKE, 1978: 72; 1982: 119, pl. 40, fig. 1. — BABA *et al.*, 1986: 302, fig. 146. — IMAFUKU, 1992: 234, unnumbered fig.
Oncopagurus monstrosus - LEMAITRE, 1996: 199, figs 19, 20.
Not *Parapagurus arcuatus* var. *monstrosus* - BALSS, 1912: 99, pl. 10, fig. 3. [= *Sympagurus brevipes* (de Saint Laurent, 1972)].

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CC 10, 05°21'S, 132°30'E, 329-389 m, 23.10.1991: 1 ♂ 6.1 mm (MNHN-Pg 5348), 1 ♀ 3.1 mm (USNM 276028). — Stn CP 12, 05°23'S, 132°37'E, 436-413 m, 23.10.1991: 1 ♂ 4.9 mm (MNHN-Pg 5351). — Stn CP 26, 05°34'S, 132°52'E, 265-302 m, 26.10.1991: 1 ♂ 5.1 mm (USNM 276029). — Stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 3 ♂ 3.2-4.3 mm, 2 ♀ 2.4, 2.5 mm (MNHN-Pg 5352).

Tanimbar Islands: stn CP 39, 07°47'S, 132°26'E, 477-466 m, 28.10.1991: 1 ♂ 3.4 mm (MNHN-Pg 5350). — Stn CP 69, 08°42'S, 131°53'E, 356-368 m, 2.11.1991: 1 ♂ 5.1 mm (MNHN-Pg 5349). — Stn CP 70, 08°41'S, 131°47'E, 413-410 m, 2.11.1991: 1 ♀ 4.5 mm (MNHN-Pg 5347).

DIAGNOSIS. — (See LEMAITRE, 1996).

DISTRIBUTION. — Indo-Pacific: Gulf of Aden; Bay of Bengal; Japan; Philippines; Indonesia; and Australia. Depth: 202 to 1000 m.

Oncopagurus orientalis (de Saint Laurent, 1972)

Figs 1-2

Parapagurus orientalis de Saint Laurent, 1972: 114, figs. 8, 16.
Sympagurus orientalis - LEMAITRE, 1989: 37; 1994: 412.

TYPE MATERIAL. — *Holotype*: **Philippines Islands**. *"Albatross"*: stn 5289, southern Luzon, 13°41'50"N, 120°58'30"E, 314 m, 22 07.1908: ♂ 2.9 mm (USNM 168311).

Paratypes: **Philippines Islands**. *"Albatross"*: stn 5268, Batangas Bay, 13°42'N, 120°57'15"E, 170 fms (311 m), 8.06.1908: 3 ♂ 2.0-2.4 mm (USNM 168320). — Th. MORTENSEN's Pacific Exp. 1914-16, 3 mi SW of Tucuran, 550 m, 10.03.1914: 1 ♀ 1.7 mm (ZMK).

Paratypes: **Indonesia**. *"Siboga"*: stn 137, 00°23.8'N, 127°29'E, 472 m, 3.VIII.1899, coll. M. WEBER: 2 ♂ 1.7, 1.9 mm (ZMA De 103.108). — *"Galathea"* Exp. 1950-52: stn 490, Bali Sea, 05°25'S, 117°03'E, 545-570 m, 14.09.1951: 1 ♀ ovig. 1.8 mm (ZMK).

ADDITIONAL MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♂ 2.5 mm, 1 ♀ 2.2 mm (MNHN-Pg 5353).

DIAGNOSIS. — Shield (Fig. 1a) as long as broad; dorsal surface weakly calcified medially; rostrum broadly rounded, with low dorsal ridge; anterior margins weakly concave; lateral projections broadly subtriangular, usually terminating in small spine; ventrolateral margin armed with small spine; posterior margin broadly rounded. Ocular peduncles more than half length of shield; ocular acicles subtriangular, terminating in strong bifid or occasionally multifid spine; corneae weakly dilated. Sternite of third maxillipeds with small spine on each side of midline. Antennular peduncle, when fully extended (not shown extended in Fig. 1a), exceeding distal margin of cornea by full length of ultimate segment. Antennal peduncle (Fig. 1b) not exceeding distal margin of cornea; third segment with strong ventromesial distal spine; second segment with dorsolateral distal angle produced, terminating in strong spine; first segment with small lateral spine; acicle not exceeding distal margin of cornea, mesial margin armed with 8 to 12 spines; flagellum with series of short setae (<1 article in length) and long setae (>3 articles in length) every 4 to 8 articles. Chelipeds markedly dissimilar, with some iridescence and moderately dense setae. Right cheliped (Fig. 2a-e) with chela longer than broad; fingers moderately curved ventromesially; dactyl with concave ventromesial face; palm with scattered small spines on dorsal face, dorsolateral and dorsomesial margins each well delimited by row of spines; mesial face of palm rounded, with small spines or tubercles. Left cheliped (Fig. 2f) with carpus weakly calcified on dorsal surface; carpus with dorsodistal spine. Ambulatory legs (Fig. 1c-d)

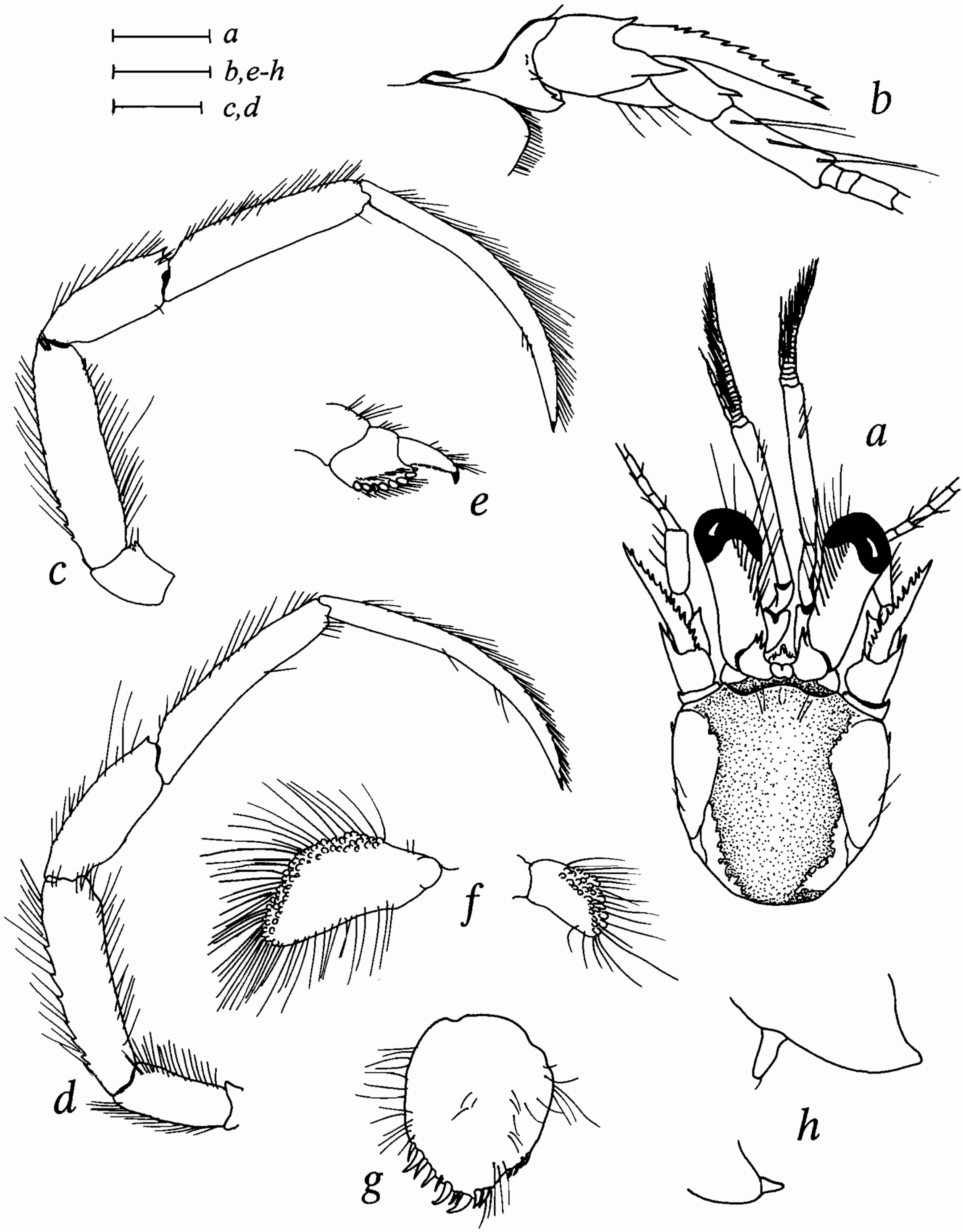

FIG. 1. — *Oncopagurus orientalis* (de Saint Laurent, 1972), KARUBAR Stn CP 35 (MNHN-Pg 5353). a-g, ♀ (2.2 mm); h, ♂ (2.5 mm): **a**, shield and cephalic appendages; **b**, right antennal peduncle, lateral view; **c**, right second pereopod, lateral view; **d**, right third pereopod, lateral view; **e**, propodus and dactyl of right fourth pereopod, lateral view; **f**, left (on left) and right (on right) uropods, dorsal view; **g**, telson, dorsal view; **h**, male second right (upper) and left (lower) pleopods, lateral view. Scales equal 1 mm (a, c, d), and 0.5 mm (b, e-h).

slender; dactyl with 1 to 4 minute spinules (usually not visible in lateral view) on ventromesial margin, and dorsal and dorsomesial rows of long setae; carpus with small dorsodistal spine; merus of right third pereopod with row of small spines on dorsal margin; meri of left second and third pereopods with dorsal margins unarmed. Anterior lobe of sternite of third pereopods with small marginal spine, setose. Fourth pereopod (Fig. 1e) with dactyl terminating in short, corneous claw in both sexes; propodal rasp consisting of ovate scales. Uropods and telson (Fig. 1f-g) markedly asymmetrical. Telson lacking transverse suture separating anterior and posterior lobes;

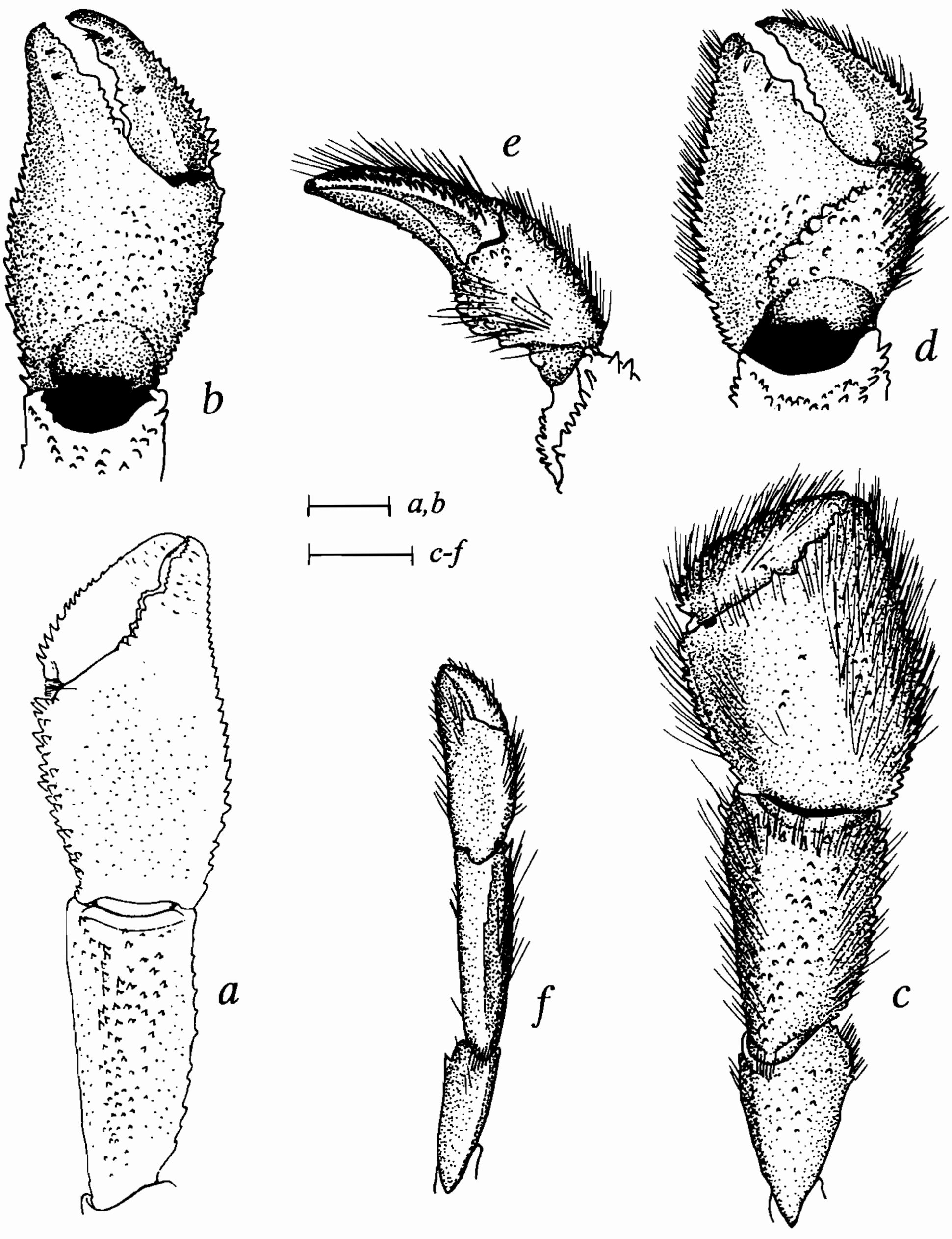

FIG. 2. — *Oncopagurus orientalis* (de Saint Laurent, 1972), a-b, holotype, ♂ (2.9 mm), *"Albatross"* Stn 5289, Philippines (USNM 168311); c-f, ♀ (2.2 mm), KARUBAR Stn CP 35 (MNHN-Pg 5353): **a**, carpus and chela of right cheliped (from DE SAINT LAURENT, 1972); **b**, chela of same, ventral view; **c**, right cheliped, dorsal view; **d-e**, chela of same in ventral (d) and mesial (e) views; **f**, left cheliped, dorsal view. Scales equal 1 mm.

posterior lobes separated by shallow U-shaped median cleft, right lobe weakly developed (frequently obsolete), terminal margins armed with often strongly curved corneous spines. Male lacking first gonopods; second gonopods (Fig. 1h) vestigial or rudimentary, unsegmented, usually paired, asymmetrical, or sometimes with unpaired left. Females with vestigial right second pleopod.

HABITAT AND SYMBIOTIC ASSOCIATIONS. — The KARUBAR specimens were found living in coarse-textured zoanthids. Other specimens have been found in gastropod shells.

DISTRIBUTION. — Indo-Pacific: Philippines; Moluccas; Indonesia. Depth: 300 to 575 m.

REMARKS. — *Oncopagurus orientalis* is one of four *Oncopagurus* species in which males lack first gonopods and the second gonopods are vestigial or rudimentary. The others are *O. haigae* de Saint Laurent, 1972, *O. tuamotu* Lemaitre, 1994, and *O. cidaris* Lemaitre, 1996. The multifid condition of the ocular acicles in *O. orientalis* is the most obvious character that immediately distinguishes this species from the other three. Although the four species are otherwise superficially similar, they differ in such characters as the shape and armature of the right cheliped; relative length of dactyls of ambulatory legs; presence or absence of sexual dimorphism in the dactyl of the fourth pereopod; and in males, degree of development of the second gonopods.

The right palm of *O. orientalis* shows some degree of variability in length, and also in armature of the ventral face. As expected, such variabilty is related to size and sex of the individuals. The palm of the male holotype, for example, is longer than broad (Fig. 2a), whereas in KARUBAR females the palm is broader than long (Fig. 2c). The armature of the ventral face can consist of scattered small tubercles (Fig. 2b), or scattered small tubercles and moderately large tubercles often arranged in an oblique row (Fig. 2d).

Oncopagurus glebosus sp. nov.

Figs 3-6

MATERIAL EXAMINED. — *Holotype*: **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 86, 09°26'S, 131°13'E, 225-223 m, 4.11.1991: ♂ 1.8 mm (MNHN-Pg 5342).

Paratypes: **Indonesia**. KARUBAR, *Tanimbar Islands*: stn DW 49, 08°00'S, 132°59'E, 210-206 m, 29.10.1991: 15 ♂ 1.4-2.6 mm, 2 ♀ ovig. 2.2, 2.3 mm, 1 juv. 1.2 mm (MNHN-Pg 5344). — Stn DW 80, 09°37'S, 131°02'E, 199-201 m, 4.11.1991: 5 ♂ 1.2-2.7 mm, 2 ♀ 1.2, 1.5 mm, 1 ♀ ovig. 1.8 mm (USNM 276035). — Stn CP 86, 09°26'S, 131°13'E, 225-223, 4.11.1991: 2 ♂ 1.3, 1.7 mm (MNHN-Pg 5343), 1 ♂ 2.3 mm, 2 ♀ 1.3, 2.7 mm, 1 ♀ ovig. 2.5 mm (USNM 276036).

DESCRIPTION. — Shield (Fig. 3a) as broad as long; dorsal surface weakly calcified on usually more than half of surface, with scattered tufts of short setae; rostrum broadly rounded, weakly produced, with short mid-dorsal ridge; anterior margins concave; lateral projections subtriangular, terminating in small spine; anterolateral margins sloping; posterior margin broadly rounded; ventrolateral margins of shield with small spine on one or both sides. Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, with dorsal row of long setae. Cornea moderately dilated. Ocular acicles subtriangular, terminating bluntly or subacutely; with strong submarginal spine; separated basally by less than basal width of 1 acicle.

Antennular peduncle long, slender; when fully extended (not shown extended in Fig. 3a), exceeding distal margin of cornea by entire length of ultimate segment. Ultimate segment twice as long as penultimate segment, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed with 1 small spine, and strong spine proximally. Ventral flagellum usually with 5 or 6 articles.

Antennal peduncle (Fig. 3b) reaching distal margin of cornea. Fifth segment unarmed, but with scattered setae. Fourth segment with strong dorsodistal spine. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, simple spine; mesial margin with spine on dorsodistal angle. First segment with 1 small spine on lateral face; ventromesial angle produced, with row of 3 or 4 small spines laterally. Antennal acicle slightly curved outward (in dorsal view), not reaching distal margin of cornea, terminating in strong spine (rarely bifid); mesial margin armed with row of 8 to 11 spines. Flagellum

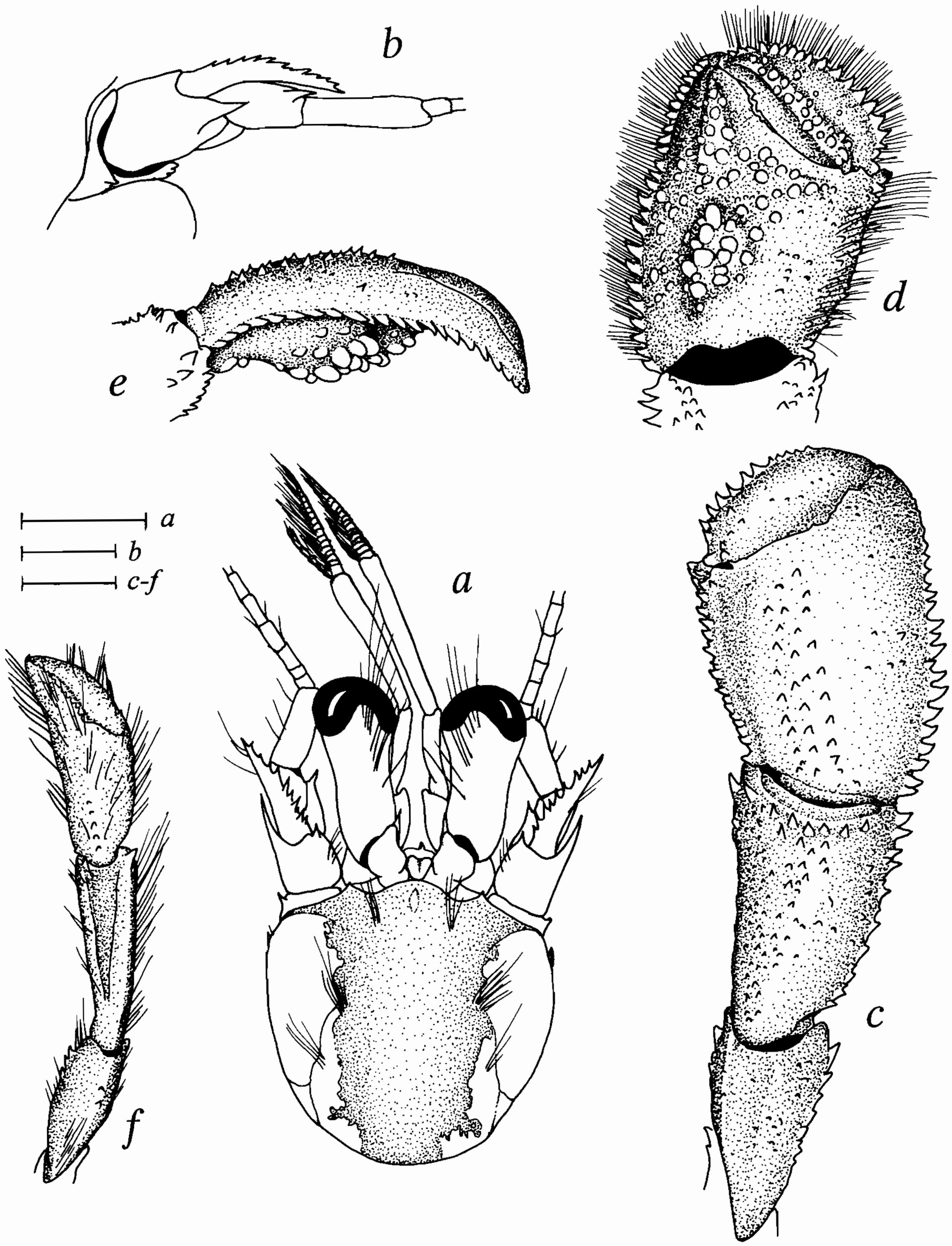

FIG. 3. — *Oncopagurus glebosus* sp. nov., paratype ♂ (2.3 mm), KARUBAR Stn CP 86 (USNM 276036): **a**, shield and cephalic appendages; **b**, right antennal peduncle, lateral view; **c**, right cheliped, lateral view (setae omitted); **d-e**, chela of same in ventral (d) and lateral (e) views (setae ommited in e); **f**, left cheliped, dorsal view. Scales equal 1 mm (a, c-f), and 0.5 mm (b).

long, exceeding extended right cheliped and ambulatory legs; with serial arrangement of short (<1 article in length) and long (3-5 articles in length) setae every 2-4 articles.

Mandible (Fig 4a) as figured. Maxillule (Fig. 4b) with external lobe of endopod weakly developed, internal lobe with 1 long seta. Maxilla (Fig. 4c) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 4d) with endopod exceeding exopod in distal extension. Second maxilliped (Fig. 4e) with exopod about 4 times as long as broad. Third maxilliped (Fig. 4f) with exopod about 6.5 times as long as broad; crista dentata consisting of about 8 calcareous or corneous-tipped teeth; basis with 1 tooth mesially; coxa unarmed or with small tooth mesially. Sternite of third maxillipeds with small spine on each side of midline.

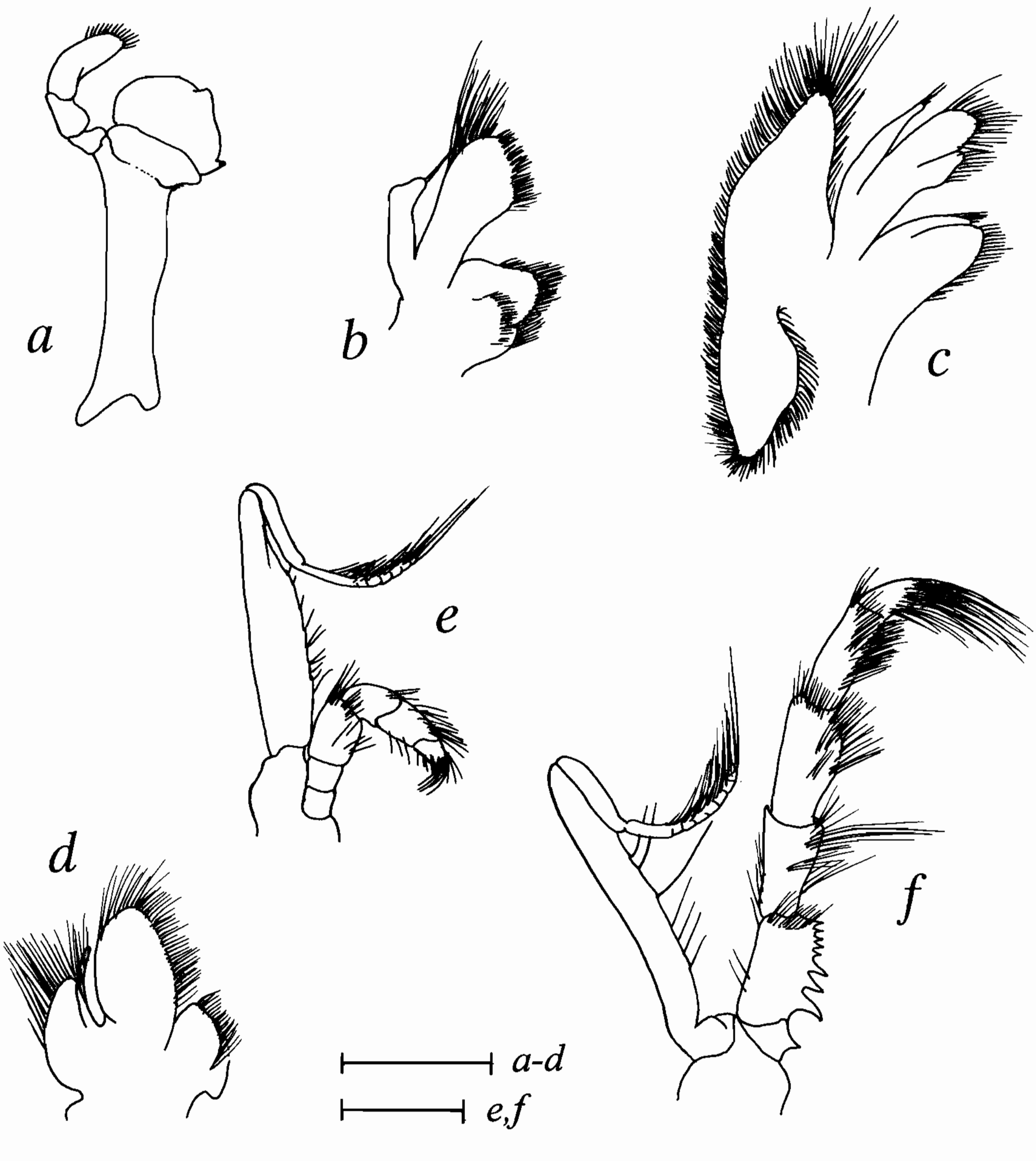

FIG. 4. — *Oncopagurus glebosus* sp. nov., paratype ♂ (2.3 mm), KARUBAR Stn CP 86 (USNM 276036). Left mouthparts, internal view (plumose condition of setae not shown): **a**, mandible; **b**, maxillule; **c**, maxilla; **d**, first maxilliped; **e**, second maxilliped; **f**, third maxilliped. Scales equal 0.5 mm.

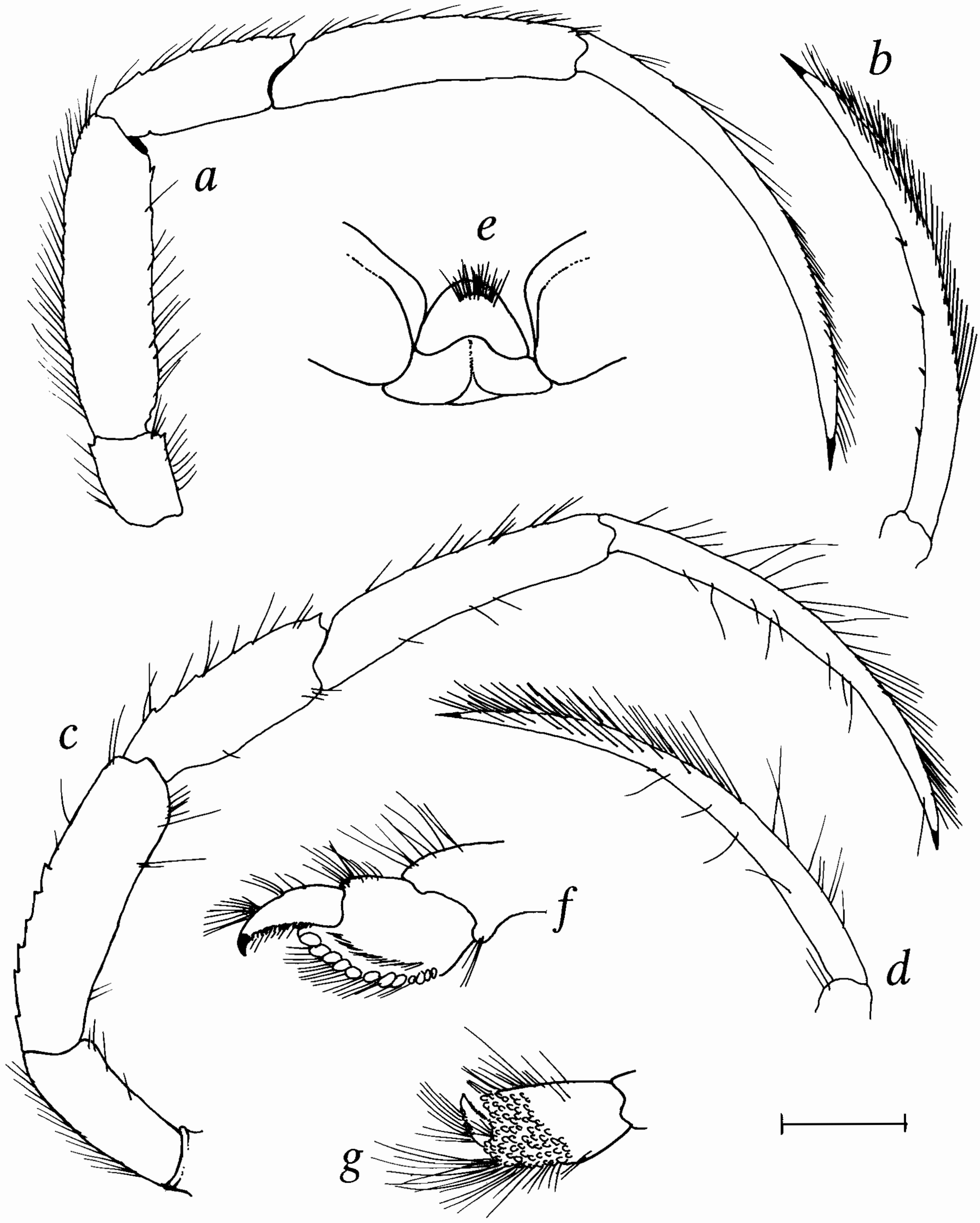

FIG. 5. — *Oncopagurus glebosus* sp. nov., paratype ♂ (2.3 mm), KARUBAR Stn CP 86 (USNM 276036): **a**, second right pereopod, lateral view; **b**, dactyl of same, mesial view; **c**, right third pereopod, lateral view; **d**, dactyl of same, mesial view; **e**, sternite of third pereopods, ventral view; **f**, propodus and dactyl of left pereopod, lateral view; **g**, propodus and dactyl of left fifth pereopod, lateral view. Scale equals 1 mm (a-d), and 0.5 mm (e-g).

Chelipeds markedly dissimilar. Right cheliped (Fig. 3c-e) massive; dorsal surfaces of merus, carpus and chela each with moderately dense setae (not shown in Fig. 3c, e); chela with dense fringe of long setae on lateral and mesial margins. Fingers curved ventromesially, terminating in small, usually blunt corneous claws; cutting edges with irregularly-sized calcareous teeth. Dactyl about as long as mesial margin of palm, set at strongly oblique angle to longitudinal axis of palm; mesial margin broadly curved, well delimited by row of strong spines diminishing in size distally; dorsal face with scattered small tubercles; ventral face with longitudinal ridge covered with irregular rows of tubercles; ventromesial face concave. Fixed finger broad at base, dorsal face with scattered small tubercles, lateral margin well delimited by row of spines; ventrolateral face often strongly concave, ventral face with median longitudinal ridge covered with irregular rows of tubercles. Palm longer than broad, dorsolateral margin well delimited by row of strong spines; dorsomesial margin delimited by row of spines; mesial face rounded, with scattered tubercles; dorsal surface with irregular rows of spines medially; ventral surface (Fig. 3d-e) with irregularly arranged tubercles or blunt spines, and raised frequently very prominent cluster of tubercles medially. Carpus with dorsolateral margin usually well delimited by row of spines distally, rounded proximally; dorsodistal margin with row of spines; dorsal face with numerous small spines; ventromesial margin with row of spines; ventral face with scattered small tubercles. Merus with scattered tubercles on dorsal face; ventromesial margin with row of spines. Ischium with ventromesial row of spines. Coxa with ventromesial and ventrolateral margins each with small distal spine.

Left cheliped (Fig. 3f) usually weakly calcified on dorsolateral face of carpus and on lateral face of merus. Fingers terminating in small corneous claws; dorsal and ventral surfaces unarmed except for scattered tufts of setae; cutting edge of dactyl with row of minute, fused corneous teeth; cutting edge of fixed finger with row of regularly spaced, small, evenly-sized calcareous teeth. Dactyl slightly longer than length of mesial margin of palm. Palm unarmed except for scattered setae and proximomedial row of blunt spines on dorsal face. Carpus with strong dorsodistal spine, and smaller spine laterally on dorsodistal margin; dorsal margin with long setae; ventral face smooth. Merus with long setae on dorsal margin; with ventrolateral row of spines, and small ventromesial spine distally. Ischium and coxa each with 1 small spine on ventromesial and ventrolateral margins distally.

Ambulatory legs (Fig. 5a-d) similar, exceeding extended right cheliped by approximately 0.25 length of dactyl. Dactyls broadly curved, about 1.6 times as long as propodi, and terminating in sharp corneous claws; each with dorsal and dorsomesial rows of long setae, and 1-5 minute spinules on ventromesial margin. Propodi each with row of setae on dorsal margin. Carpi each with small dorsodistal spine, and setae dorsally. Meri unarmed except for 1 or 2 small ventrodistal spines (second pereopod) or with row of small spines on dorsal margin (third pereopod). Ischia with small dorsodistal and ventrodistal spine (second) or unarmed (third). Coxae with 1 small spine on ventromesial and ventrolateral margins distally (second) or unarmed (third). Anterior lobe of sternite of third pereopods (Fig. 5e) rounded, setose, unarmed or with small subdistal spine.

Fourth pereopod (Fig. 5f) semichelate. Dactyl terminating in sharp corneous claw; with ventrolateral row of small corneous spinules. Propodus longer than broad, rasp formed of 1 row of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 5g) semichelate. Propodal rasp extending to mid-length of segment.

Uropods and telson (Fig. 6a-c) markedly asymmetrical. Telson lacking transverse suture; dorsal surface with scattered setae; posterior lobes separated by shallow unarmed cleft, terminal margin of lobes armed with long, often strongly curved corneous spines.

Males with paired first and second gonopods; first gonopods not yet appearing or not fully developed in juveniles (SL <1.5 mm). First gonopods (Fig. 6d) each with nearly flat distal lobe and long marginal setae. Second gonopods (Fig. 6e) each with distal segment flat; distal half of distal segment with long setae marginally and on anterior face; basal segments each with row of setae laterally. Females with vestigial second right pleopod.

HABITAT. — Gastropod shells.

DISTRIBUTION. — Known so far only from Tanimbar Islands, Indonesia. Depth: 199 to 225 m.

ETYMOLOGY. — The specific name is from the Latin *glebosus*, meaning lumpy, and is in reference to the lumpy appearance given by tubercles to the ventral face of the right chela.

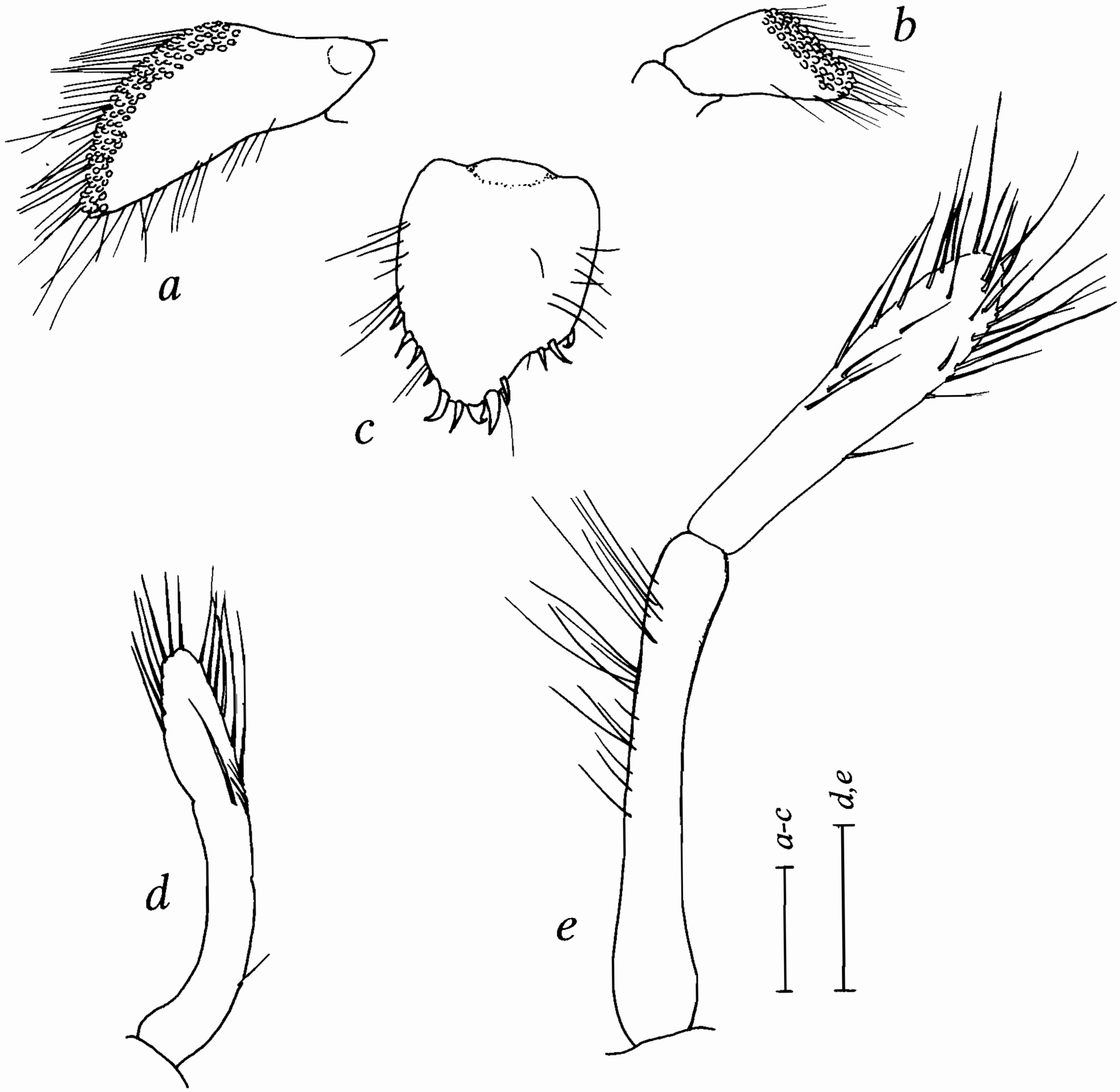

FIG. 6. — *Oncopagurus glebosus* sp. nov., paratype ♂ (2.3 mm), KARUBAR Stn CP 86 (USNM 276036): **a-b**, left (a) and right (b) uropods, dorsal view; **c**, telson, dorsal view; **d**, male first left gonopod, mesial view; **e**, male second left gonopod, anterior view. Scales equal 0.5 mm (a-c), and 0.25 mm (d-e).

REMARKS. — *Oncopagurus glebosus* sp. nov. is distinguished not only from all its congeners but from all other parapagurids, by the unique condition of the ocular acicles. This is the only species in the family known to have ocular acicles with a submarginal spine. The ocular acicles in all other parapagurids (except the highly specialized *Tylaspis anomala* Henderson, 1885, which lacks acicles), terminate in a simple to multifid marginal spine.

The distinct armature of the ventral surface of the right palm also distinguishes *O. glebosus* sp. nov. from other *Oncopagurus* species. The ventral surface has numerous irregularly arranged tubercles, some of which frequently form a prominent cluster medially (Fig. 3d). The cluster is usually markedly raised above the surface; in small individuals (SL < 1.5 mm) it is not as prominent, and the tubercles may be smaller and wider apart than in large individuals. The presence of prominent armature in the form of spines or variously shaped tubercles on the ventral face of the right chela is a condition present in three other parapagurid species, *Paragiopagurus boletifer* (de Saint Laurent, 1972), *P. rugosus* (de Saint Laurent, 1972), and *Tsunogaipagurus chuni* (Balss, 1911).

Genus ***PARAGIOPAGURUS*** Lemaitre, 1996

Paragiopagurus acutus (de Saint Laurent, 1972)

Parapagurus acutus acutus de Saint Laurent, 1972: 113, figs 7, 18 (type locality: Philippines, *"Albatross"* Stn 5222).
Sympagurus acutus acutus - LEMAITRE, 1989: 37; 1994: 412.
Paragiopagurus acutus - LEMAITRE, 1996: 211, figs 25-26.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 26.10.1991: 1 ♀ immat. 1.5 mm (MNHN-Pg 5362). — Stn CP 27, 05°33'S, 132°51'E, 304-314 m, 26.10.1991: 1 ♀ 4.7 mm (MNHN-Pg 5359). — Stn CP 36, 06°05'S, 132°44'E, 268-210 m, 27.10.1991: 1 ♂ 6.4 mm (MNHN-Pg 5360).

Tanimbar Islands: stn CC 56, 08°16'S, 131°59'E, 552-549 m, 31.10.1991: 2 ♂ 4.8, 5.2 mm, 1 ♀ 3.7 mm (USNM 276032). — Stn CP 67, 08°58'S, 132°06'E, 233-146 m, 1.11.1991: 3 ♀ 4.3-4.6 mm, 1 ♀ ovig. 3.7 mm (MNHN-Pg 5355). — Stn CP 77, 08°57'S, 131°27'E, 352-346 m, 3.11.1991: 4 ♂ 5.2-6.6 mm (MNHN-Pg 5358). — Stn CP 79, 09°16'S, 131°22'E, 250-239 m, 3.11.1991: 9 ♂ 2.2-4.5 mm, 6 ♀ 3.7-4.5 mm, 2 ♀ ovig. 4.0, 4.3 mm (USNM 276031). — Stn CP 83, 09°23'S, 131°00'E, 285-297 m, 4.11.1991: 2 ♂ 4.1, 6.0 mm (MNHN-Pg 5356). — Stn CP 84, 09°23'S, 131°09'E, 275-246 m, 4.11.1991: 26 ♂ 1.7-4.6 mm, 12 ♀ 1.6-4.0 mm, 12 ♀ ovig. 3.0-3.9 mm (MNHN-Pg 5361). — Stn CP 85, 09°22'S, 131°14'E, 245-240 m, 4.11.1991: 8 ♂ 3.5-5.0 mm (MNHN-Pg 5357). — Stn CP 86, 09°26'S, 131°13'E, 225-223 m, 4.11.1991: 3 ♂ 2.2-3.7 mm (MNHN-Pg 5354).

DIAGNOSIS. — (See LEMAITRE, 1996).

COLOR. — The following coloration is based on a male (6.4 mm, Stn CP 36, MNHN-Pg 5360) after preservation in alcohol for four years. Overall straw white to yellowish. Shield with small light orange area on each side of anterior half. Ocular peduncles dark orange on ventral face, dorsal face faded orange. Right cheliped with dorsal surface of chela having small light orange area proximally; carpus with three wide orange stripes (one dorsal, one mesial, one lateral); merus with two stripes (one lateral, one mesial). Carpus of left cheliped with orange stripe on lateral face, and light orange tint on mesial face. Ambulatory legs with orange tint on lateral faces of carpi and propodi (more strongly colored on carpi); with orange area on lateral and mesial faces of meri.

DISTRIBUTION. — Western Pacific: Philippines, China Sea, Indonesia, Japan, and Australia. Depth: 146-558 m.

Paragiopagurus insolitus sp. nov.

Figs 7-10

MATERIAL EXAMINED. — *Holotype*: **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 26.10.1991: ♂ 2.2 mm (MNHN-Pg 5363).

Paratypes: **Indonesia**. KARUBAR, *Kai Islands*: stn DW 28, 05°31'S, 132°54'E, 448-467 m, 26.10.1991: 3 ♂ 1.3-1.8 mm, 1 ♀ ovig. 1.7 mm (MNHN-Pg 5364); 1 ♂ 2.0 mm, 1 ♀ ovig. 1.6 mm (USNM 276037).

DESCRIPTION. — Shield (Fig. 7a) slightly longer than broad; dorsal surface weakly calcified on usually more than half of surface, with scattered short setae; rostrum broadly rounded, weakly produced, with short mid-dorsal ridge; anterior margins weakly concave; lateral projections subtriangular, terminating in small spine; anterolateral margins sloping; posterior margin broadly rounded; ventrolateral margins with small spine on one or both sides. Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, each with dorsal row of long setae. Cornea at most weakly dilated. Ocular acicles subtriangular, terminating in long slender spine reaching nearly to mid-length of ocular peduncles; separated basally by less than basal width of 1 acicle.

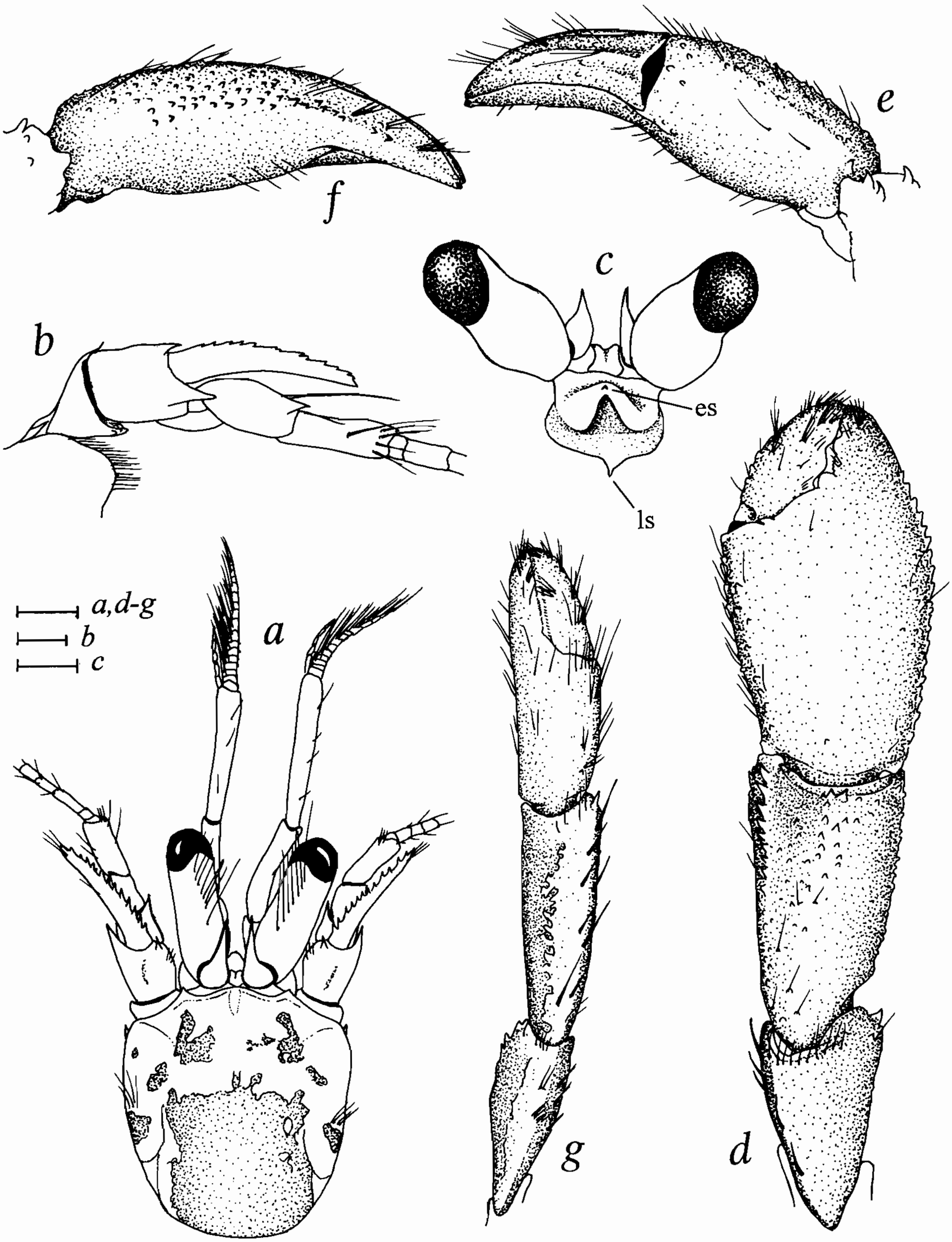

FIG. 7. — *Paragiopagurus insolitus* sp. nov., KARUBAR Stn DW 28. a-b, d-g, holotype ♂ (2.2 mm) (MNHN-Pg 5363); c, paratype ♂ (2.0 mm) (USNM 276037): **a**, shield and cephalic appendages; **b**, right antennal peduncle, lateral view; **c**, epistome, ocular peduncles and acicles, anterior view (es, epistomial spine; ls, labral spine); **d**, right cheliped, dorsal view; **e-f**, chela of same in mesial (e) and lateral (f) views; **g**, left cheliped, dorsal view. Scales equal 0.5 mm (a, d-g), and 0.25 mm (b, c).

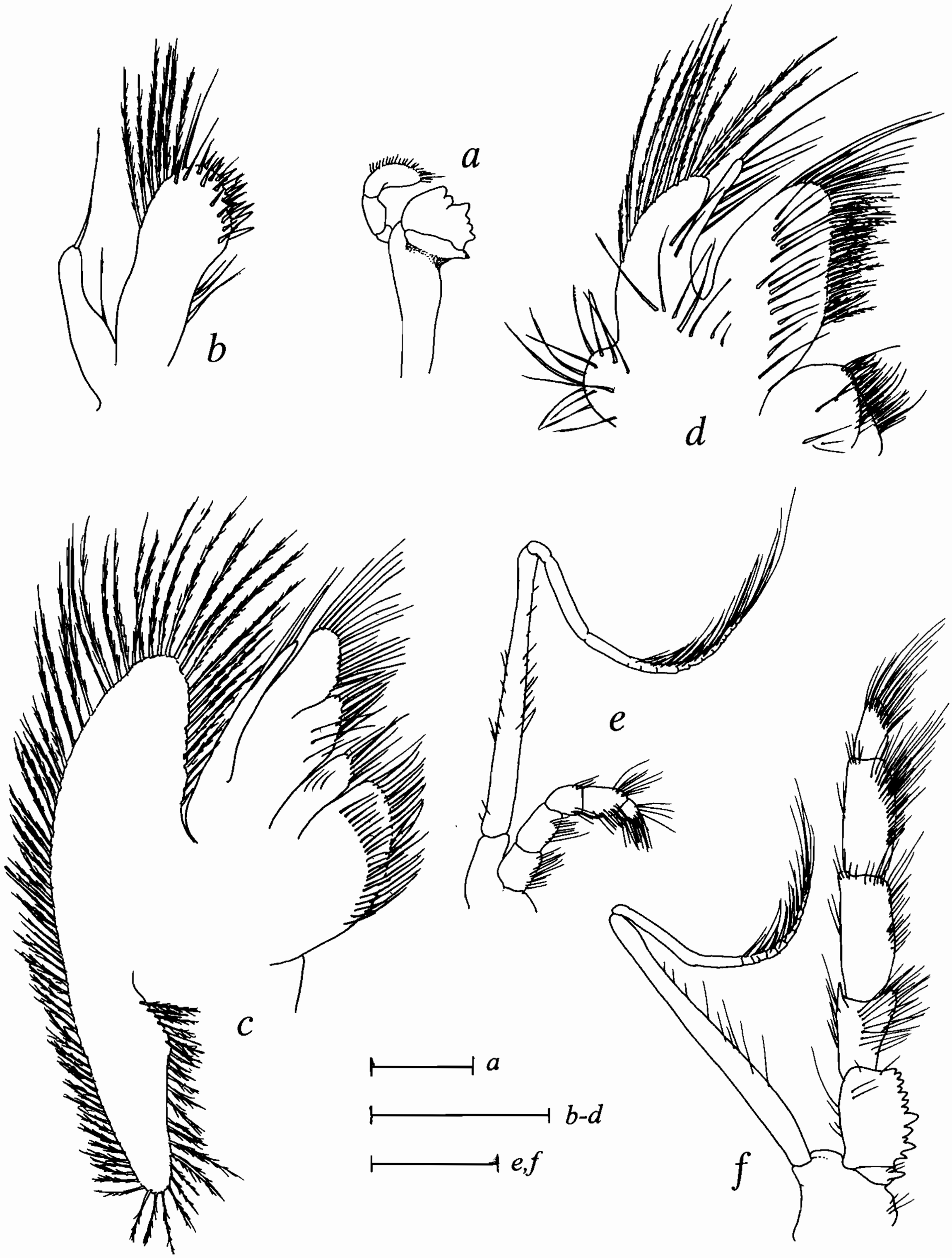

FIG. 8. — *Paragiopagurus insolitus* sp. nov., paratype ♂ (2.0 mm), KARUBAR Stn DW 28 (USNM 276037). Left mouthparts, internal view: **a**, mandible; **b**, maxillule (proximal endite not shown); **c**, maxilla; **d**, first maxilliped; **e**, second maxilliped; **f**, third maxilliped. Scales equal 0.5 mm (a), 1 mm (b-d), and 0.25 mm (e, f).

Antennular peduncle long, slender, exceeding distal margin of cornea by about one-fifth of penultimate segment. Ultimate segment twice as long as penultimate segment, with scattered setae. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed with small spine, and strong spine proximally. Ventral flagellum usually with 5 or 6 articles.

Antennal peduncle (Fig. 7b) exceeding distal margin of cornea by about one-fifth length of fifth segment. Fifth segment unarmed, but with scattered setae. Fourth segment with strong dorsodistal spine. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, simple spine; mesial margin with spine on dorsodistal angle. First segment with lateral face unarmed; ventromesial angle produced, with row of 3 or 4 small spines laterally. Antennal acicles slightly curved outward (in dorsal view), slightly exceeding distal margins of corneae, terminating in strong spine; mesial margins armed with row of 10 to 13 spines. Flagellum long, exceeding extended right cheliped and ambulatory legs; with short setae 1 flagellar article in length or less.

Mandible (Fig. 8a) with incisor process consisting of several irregularly-shaped teeth. Maxillule (Fig. 8b) with external lobe of endopod obsolete, internal lobe with 1 long seta. Maxilla (Fig. 8c) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 8d) with endopod exceeding exopod in distal extension. Second maxilliped (Fig. 8e) with long, slender exopod about 10 times as long as broad. Third maxilliped (Fig. 8f) with long, slender exopod about 10 times as long as broad; merus with dorsodistal spine; crista dentata consisting of about 12 calcareous or corneous-tipped teeth; basis with 1 tooth mesially; coxa unarmed. Sternite of third maxillipeds with spine on each side of midline. Epistome (Fig. 7c) with median region strongly produced anteriorly (somewhat pyramid-shaped with ventral face concave); terminating in small, often inconspicuous blunt spine.

Chelipeds markedly dissimilar. Right cheliped (Fig. 7d-f) with sparse setae; surfaces of merus, carpus, and chela with some iridescence. Fingers weakly curved ventromesially, terminating in small, usually blunt corneous claws; cutting edges with irregularly-sized calcareous teeth. Dactyl shorter than length of mesial margin of palm, set at moderately oblique angle to longitudinal axis of palm; mesial margin broadly curved, weakly delimited proximally by irregular row of few small tubercles; dorsal face with scattered small tubercles and tufts of setae; ventral face elevated along midline forming longitudinal ridge. Fixed finger broad at base, dorsal face with scattered small tubercles and tufts of setae; lateral margin well delimited proximally by row of spines. Palm longer than broad, dorsolateral margin at most weakly delimited by row of small spines or tubercles; dorsomesial margin weakly delimited by row of small well-spaced spines; dorsal surface smooth or at most with scattered small spines or tubercles laterally and mesially; mesial face rounded, with scattered tubercles; ventral surface smooth. Carpus with rounded lateral and mesial faces; dorsal surface with irregular rows of small spines or tubercles; dorsomesial margin delimited in distal half by row of small spines; dorsodistal margin with 3 or 4 median spines; ventromesial margin with row of spines; ventral face with scattered small tubercles. Merus with scattered tubercles on dorsal and ventral faces; dorsal surface with longitudinal row of bristle-like setae, and row of setae on dorsodistal margin; ventromesial margin with row of spines. Ischium unarmed. Coxa with ventromesial and ventrolateral margins each with small distal spine.

Left cheliped (Fig. 7g) usually weakly calcified laterally on carpus and merus. Fingers terminating in small corneous claws; dorsal and ventral surfaces unarmed except for scattered tufts of setae; cutting edge of dactyl with row of minute, fused corneous teeth; cutting edge of fixed finger with row of low small teeth. Dactyl about as long as length of mesial margin of palm. Palm unarmed; with scattered setae. Carpus with small dorsodistal spine; dorsal margin with bristle-like setae; ventral face smooth. Merus with bristle-like setae on dorsal margin; usually with small spine on ventrolateral margin, and 1 to 3 spines on ventromesial margin. Ischium unarmed. Coxa with ventromesial and ventrolateral margins each with small spine distally.

Ambulatory legs (Fig. 9a-d) similar right from left, exceeding extended right cheliped by approximately 0.25 length of dactyls. Dactyls broadly curved, each about 1.5 times as long as propodus, and terminating in sharp corneous claw; with dorsal and dorsomesial rows of long setae, and 5 to 8 minute spinules on ventromesial margin. Propodi each with row of short setae on dorsal margin. Carpi each with small dorsodistal spine, and short setae dorsally. Meri unarmed. Ischia unarmed or each with small spine on ventrolateral margin distally. Coxae of second pereopods each with 1 small spine distally and 1 small spine proximally on ventromesial margin; coxae of third pereopods unarmed. Anterior lobe of sternite of third pereopods (Fig. 9e) sub-semicircular, unarmed, setose.

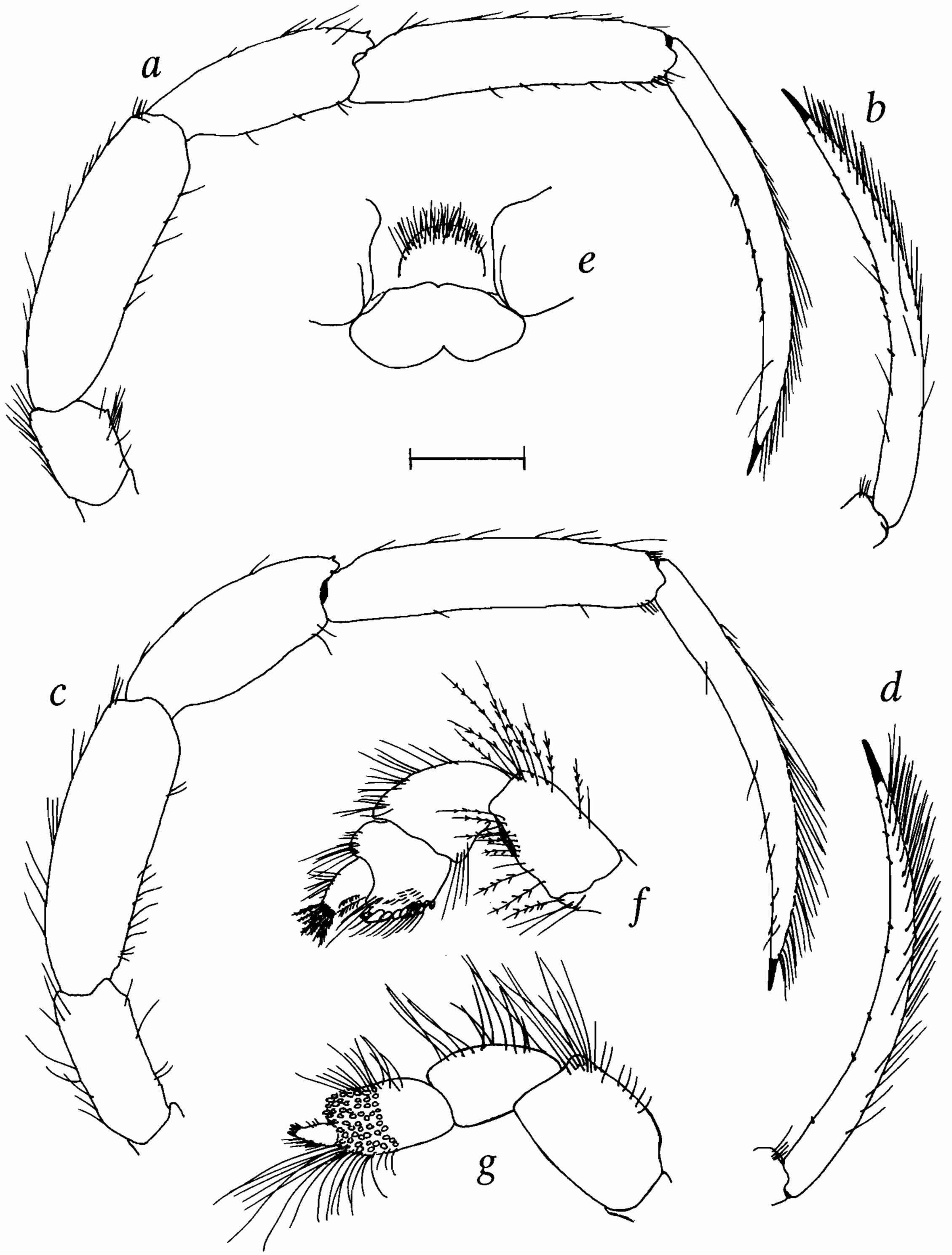

FIG. 9. — *Paragiopagurus insolitus* sp. nov., KARUBAR Stn DW 28. a-e, holotype ♂ (2.2 mm) (MNHN-Pg 5363); f-g, paratype ♂ (2.0 mm) (USNM 276037): **a**, right second pereopod, lateral view; **b**, dactyl of same, mesial view; **c**, right third pereopod, lateral view; **d**, dactyl of same, mesial view; **e**, sternite of third pereopods, ventral view; **f**, left fourth pereopod, lateral view; **g**, left fifth pereopod, lateral view. Scale equals 0.5 mm (a-d), and 0.25 mm (e-g).

Fourth pereopod (Fig. 9f, 10a) semichelate. Dactyl terminating in blunt corneous claw almost entirely masked by long, stiff plumose setae arising near base of claw; with ventrolateral row of small corneous spinules. Propodus shorter than greatest height; rasp formed of 1 row of rounded or ovate scales. Carpus with long setae on dorsal margin. Merus with rows of long plumose setae on dorsal and ventral margins.

Fifth pereopod (Fig. 9g) semichelate. Dactyl with about 4 or 5 fused corneous spines distally. Propodal rasp extending to mid-length of segment.

Gills phyllobranchiate.

Uropods and telson (Fig. 10b-c) markedly asymmetrical. Telson lacking transverse suture; dorsal surface with scattered setae; posterior lobes separated by wide and shallow unarmed cleft, terminal margins of lobes armed with long, often strongly curved corneous spines.

Males lacking first gonopods, and with paired second gonopods. Second gonopods (Fig. 10d) each with distal segment flat; distal segment with long setae marginally and on anterodistal face; basal segments each with scattered setae, with or without rudimentary exopod. Females lacking vestigial second right pleopod; fifth left pleopod not egg carrying.

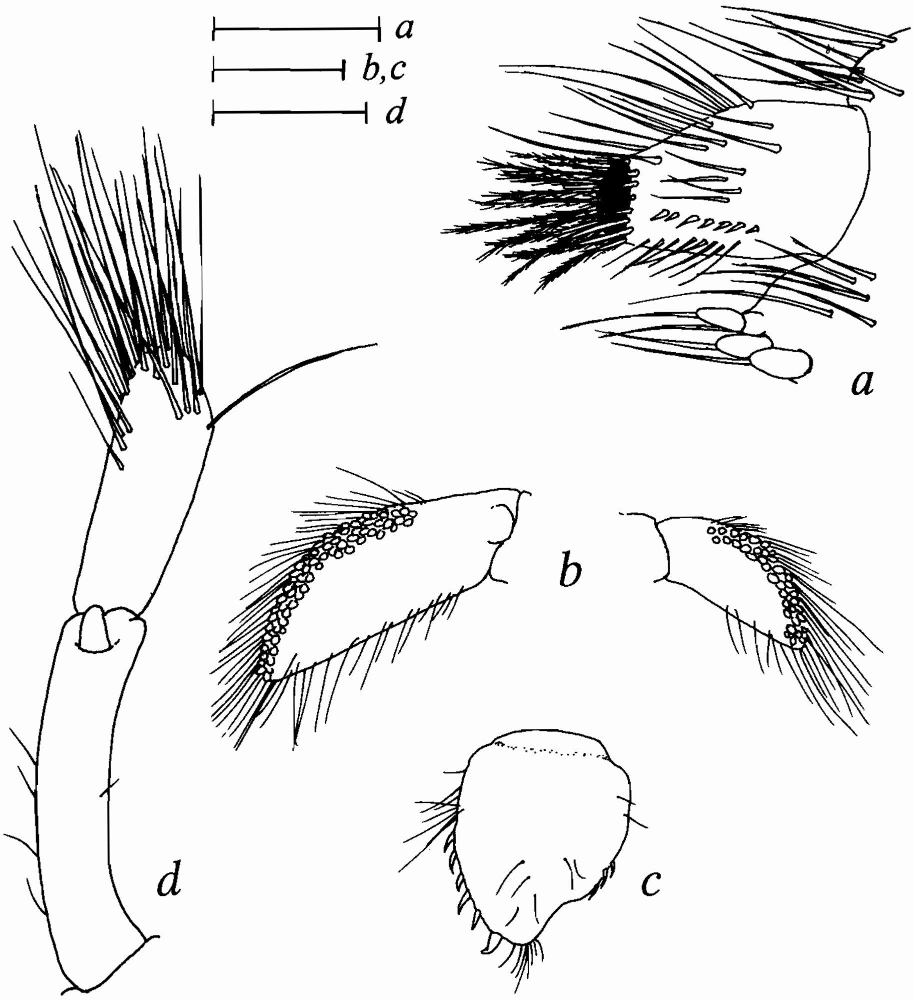

FIG. 10. — *Paragiopagurus insolitus* sp. nov., KARUBAR Stn DW 28. a, d, paratype ♂ (2.0 mm) (USNM 276037); b-c, holotype ♂ (2.2 mm): **a**, dactyl and distal end of propodus of left fourth pereopod, lateral view; **b**, left (b) and right (c) uropods, dorsal view; **c**, telson, dorsal view; **d**, left second gonopod, anterior view. Scales equal 0.2 mm (a), 0.5 mm (b, c), and 0.25 mm (d).

HABITAT. — Unknown (probably gastropod shells).

DISTRIBUTION. — Known so far only from the Kai Islands, Indonesia. Depth: 448 to 467 m.

ETYMOLOGY. — The specific name is from the Latin *insolitus*, unusual. The name is given for the unusual condition of the ocular acicles, epistome, maxillipeds, and fourth pereopods.

REMARKS. — *Paragiopagurus insolitus* sp. nov. is a singularly distinctive species. The shape or conformation of the ocular acicles, mouthparts, epistome, and dactyl of the fourth pereopod, are unusual or unique among parapagurids. The relative length of the terminal spine of the ocular acicles is the longest known for any parapagurid, and usually reaches nearly to midlength of the ocular peduncles. The incisor process of the mandible is unusual in that it consists of several irregularly-shaped teeth (Fig. 8a), rather than having a single small median tooth as in all other parapagurids for which the mandibles have been described. The second and third maxillipeds each have a very long and slender exopod that is nearly 10 times as long as broad (Fig. 8e-f); in other parapagurids the exopod is at most six times as long as broad. The epistome is strongly produced anteriorly, forming a somewhat pyramid-shaped process with a concave ventral face (Fig. 7c); in other parapagurids the epistome is evenly rounded.

The specialized setal arrangement seen on the dactyl of the fourth pereopod of *P. insolitus* sp. nov., is unique among parapagurids (Fig. 10a). The claw of the dactyl is almost entirely masked by long plumose setae that arise near the base and all around the claw. Although the function of this setal arrangement is unknown, it bears some similarity with that reported by DE SAINT LAURENT (1968a, b) and MCLAUGHLIN (1997) for species of the pagurid genus *Decaphyllus* de Saint Laurent, 1968.

Megalopa

Fig 11

MATERIAL EXAMINED. — **Indonesia**. KARUBAR, *Tanimbar Islands*: stn CP 59, 08°20'S, 132°11'E, 405-399 m, 31.10.1991: 1 specimen (CL 5.5 mm, TL 23.4 mm), in gastropod shell (USNM 276038). — Stn CP 87, 08°47'S, 130°49'E, 1017-1024 m, 5.11.1991: 1 specimen (CL 5.6 mm, TL 22.1 mm) (MNHN-Pg 5382).

REMARKS. — Although the two megalopal stage specimens reported herein evidently belong to the Parapaguridae, they cannot be assigned with certainty at the present time to any particular species. The complete larval rearing for any parapagurid species has not been achieved beyond the second zoeal stage (WILLIAMSON & VON LEVETZOW, 1967; PROVENZANO unpublished). The two KARUBAR specimens are identical morphologically, and appear to be of the same species.

Of the two KARUBAR stations where parapagurid megalopae were obtained, no adult parapagurid stages were found at Stn CP 59. Adult specimens of *Parapagurus latimanus* and *Oncopagurus minutus* were obtained at Stn CP 87; conceivably the megalopae might be of one of these two species. However, *O. minutus* is a species whose adult individuals are small, growing rarely to the size of the KARUBAR megalopae. Based on station co-occurrence and size, it is more likely that the megalopae are of *P. latimanus*, a species whose individuals can grow to a size considerably larger than these postlarvae.

The KARUBAR specimens show similarities with the megalopae assigned by LEMAITRE & MCLAUGHLIN (1992: 754, Figs 6-7) to *Sympagurus dimorphus* (Studer, 1883), but clearly differ at least in the cephalic shield, development of the rostrum, and armature of the chelipeds. The shield in the KARUBAR megalopae (Fig. 11a) has a more pronounced and longer median longitudinal ridge on the anterior half than in *S. dimorphus*. The rostrum is terminally rounded in both the KARUBAR and *S. dimorphus* megalopae; however, in the former, the rostrum has a membranous ventral extension (Fig. 11a-b) that is more developed than in the latter. The right and left chelipeds of the KARUBAR specimens have spines or small tubercles on the dorsomesial margins of the palm and dactyl, and on the dorsal margin of the carpus (Fig. 11c-d); the chelipeds are unarmed in the megalopae assigned to *S. dimorphus*.

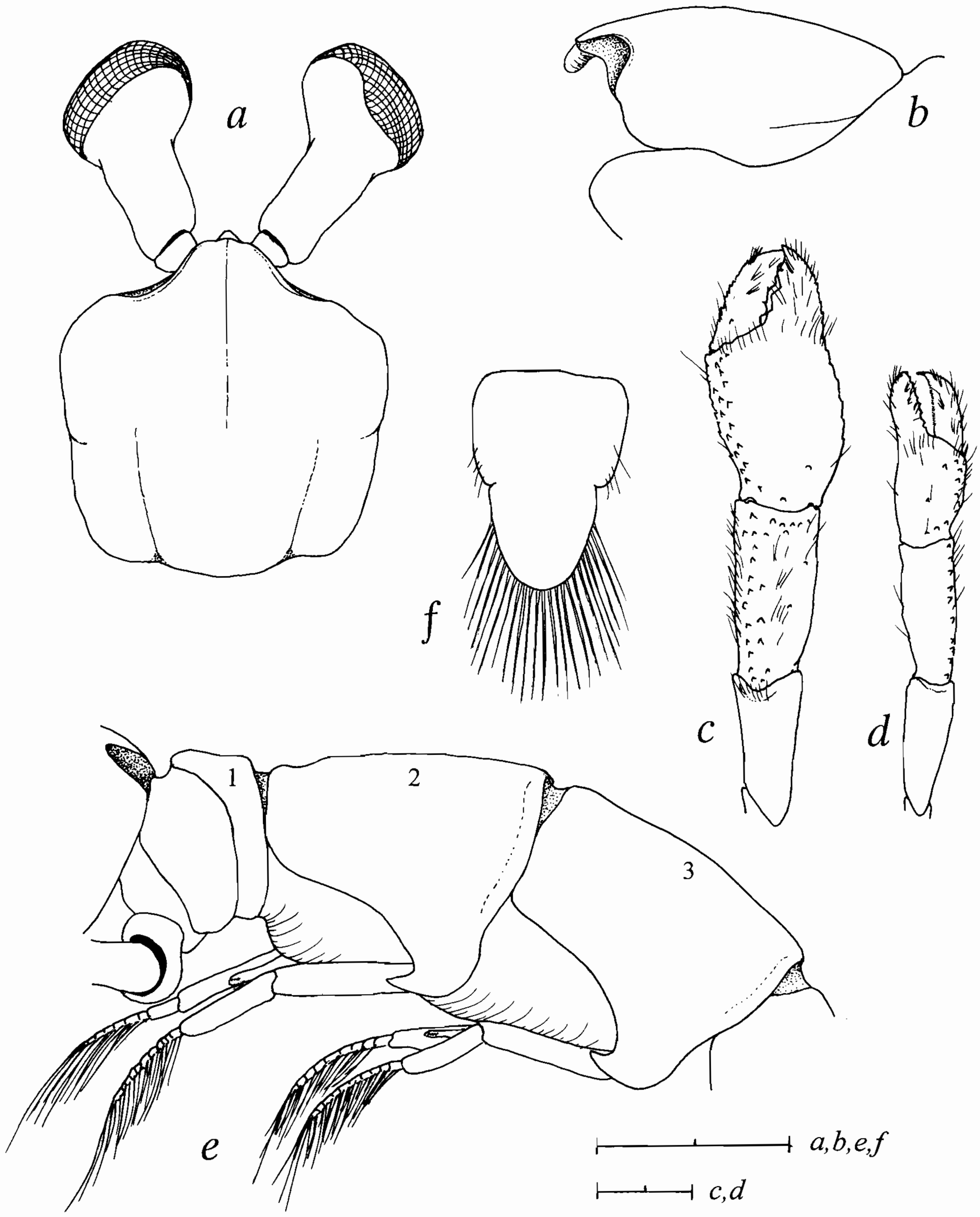

FIG. 11. — *Megalopa* (CL 5.6 mm, TL 22.1 mm), KARUBAR Stn CP 87 (MNHN-Pg 5382): **a**, shield and ocular peduncles; **b**, shield, left lateral view; **c**, right cheliped, dorsal view; **d**, left cheliped, dorsal view; **e**, abdominal somites 1-3, left lateral view; **f**, telson, dorsal view. Scales equal 2 mm.

GENERAL REMARKS AND LIST OF INDONESIAN PARAPAGURIDS

Recent studies based largely on specimens obtained during the KARUBAR campaign indicate that the Indonesian region harbors a previously unrecognized impressive diversity of hermit crabs of the family Paguridae (McLAUGHLIN, 1997). The Indonesian parapagurid fauna contains a total of 15 species, or about 25% of the 59 species of the family currently known worldwide, and evidently does not approach the species richness of the Paguridae from the region. However, the discovery of two new species, *Oncopagurus glebosus* and *Paragiopagurus insolitus*, characterized by unusual or unique conditions previously unknown in the family, are indicative of the broad range of morphological diversity that exists in the Parapaguridae.

The following is a list of the 15 species and megalopa of Parapaguridae currently known from Indonesian waters, including references where diagnoses and illustrations can be found. An asterisk indicates that the species was not obtained during the KARUBAR campaign.

Parapagurus latimanus Henderson, 1888 — DE SAINT LAURENT (1972, as *P. pilosimanus latimanus*); LEMAITRE & McLAUGHLIN (1992).

Strobopagurus sibogae (de Saint Laurent, 1972) — DE SAINT LAURENT (1972, as *Parapagurus sibogae*); LEMAITRE (1996).

**Sympagurus affinis* (Henderson, 1888) — DE SAINT LAURENT (1972, as *Parapagurus affinis*); LEMAITRE (1994).

Sympagurus brevipes (de Saint Laurent, 1972) — DE SAINT LAURENT (1972, as *Parapagurus brevipes*); LEMAITRE (1996).

**Sympagurus dofleini* (Balss, 1912) — LEMAITRE (1994).

Sympagurus papposus Lemaitre, 1996 — LEMAITRE (1996).

**Sympagurus planimanus* (de Saint Laurent, 1972) — DE SAINT LAURENT (1972, as *Parapagurus planimanus*); LEMAITRE (1996).

**Sympagurus trispinosus* (Balss, 1911) — LEMAITRE (1996).

**Oncopagurus indicus* (Alcock, 1905) — LEMAITRE (1996).

Oncopagurus minutus (Henderson, 1896) — LEMAITRE (1996).

Oncopagurus monstrosus (Alcock, 1894) — LEMAITRE (1996).

Oncopagurus orientalis (de Saint Laurent, 1972) — DE SAINT LAURENT (1972, as *Parapagurus orientalis*); this report.

Oncopagurus glebosus sp. nov.

Paragiopagurus acutus (de Saint Laurent, 1972) — DE SAINT LAURENT (1972, as *Parapagurus acutus acutus*); LEMAITRE (1996).

Paragiopagurus insolitus sp. nov.

Megalopa (sp. indet.) — this report.

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12

Crustacea Decapoda: Species of the genera *Agononida* Baba & de Saint Laurent, 1996 and *Munida* Leach, 1820 (Galatheidae) from the KARUBAR Cruise

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ABSTRACT

Twenty six species of galatheid crustaceans belonging to the genera *Agononida* Baba & de Saint Laurent, 1995 and *Munida* Leach, 1820, were caught off the Molucca archipelago, during the KARUBAR Cruise (October-November, 1991). Three species are described as new: *A. emphereia, M. compacta* and *M. punctata.*

RÉSUMÉ

Crustacea Decapoda : Espèces des genres *Agononida* Baba & de Saint Laurent, 1995 et *Munida* Leach, 1820 (Galatheidae) récoltées lors de la campagne KARUBAR.

Les espèces des genres *Agononida* Baba & de Saint Laurent, 1995, et *Munida* Leach, 1820, récoltées dans l'archipel des Moluques sont au nombre de 26. Trois espèces (*A. emphereia, M. compacta* et *M. punctata*) sont nouvelles. *A. emphereia*, proche de *A. soelae* (Baba, 1986) et de *A. incerta* (Henderson, 1888) se différencie facilement par l'armature de la carapace. *M. compacta* est proche de *M. rhodonia* Macpherson, 1994, mais se différencie par la forme et l'armature des chélipèdes. *M. punctata* se distingue de *M. rubrodigitalis* Baba, 1994, par la forme du rostre.

INTRODUCTION

The genera *Agononida* Baba & de Saint Laurent, 1995 and *Munida* Leach, 1820 are represented in Indonesian waters by more than 15 species (BABA, 1988; BABA & de SAINT LAURENT, 1995; MACPHERSON, 1993, 1994; MACPHERSON & BABA, 1993). During a recent cruise (KARUBAR) carried out in October-November

MACPHERSON, E., 1997. — Crustacea Decapoda: Species of the genera *Agononida* Baba & de Saint Laurent, 1995 and *Munida* Leach, 1820 (Galatheidae) from the KARUBAR Cruise. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 597-612. Paris ISBN 2-85653-506-2.

1991 to the Molucca Archipelago (Kai and Tanimbar islands) (see CROSNIER et all., 1997), numerous representatives of these genera were collected. The aim of this paper is to study this interesting collection.

The types of the new species and other material have been deposited in the collections of the Muséum national d'Histoire naturelle, Paris (MNHN), the Puslitbang Oseanologi-LIPI, Jakarta (POLIPI) and the National Museum of Natural History, Washington. When no information on the depository is provided, the material is held by the MNHN, Paris. Measurements given are of carapace length excluding rostrum, and the terminology used mainly follows previous papers (MACPHERSON & de SAINT LAURENT, 1991). In order to avoid repetitious descriptions, only distinctive characters have been included in the text.

LIST OF STATIONS

The abbreviations of the gears used are: DW = Waren dredge, CP = Beam trawl, CC = Otter trawl.

Station DW 1. — 22.10.1991, 05°46'S, 132°10'E, 156-305 m: *M. agave, M. caesura, Munida* sp.
Station DW 2. — 22.10.1991, 05°47'S, 132°13'E, 209-240 m: *M. leptitis, M. philippinensis, Munida* sp.
Station CP 5. — 22.10.1991, 05°49'S, 132°18'E, 296-299 m: *A. incerta, A. squamosa, M. caesura, M. leptitis, Munida* sp.
Station CP 6. — 22.10.1991, 05°49'S, 132°21'E, 287-298 m: *A. incerta, M. agave, M. striola, Munida* sp.
Station CP 9. — 23.10.1991, 05°23'S, 132°29'E, 368-389 m: *A. incerta, M. compacta, M. punctata, M. striola.*
Station CC 10. — 23.10.1991, 05°21'S, 132°30'E, 329-389 m: *A. incerta, A. similis, M. compacta.*
Station CP 12. — 23.10.1991, 05°23'S, 132°37'E, 413-436 m: *A. incerta, A. similis, M. compacta.*
Station DW 13. — 24.10.1991, 05°26'S, 132°38'E, 417-425 m: *M. compacta.*
Station DW 14. — 24.10.1991, 05°18'S, 132°38'E, 245-246 m: *M. caesura, M. leptitis.*
Station CP 15. — 24.10.1991, 05°17'S, 132°41'E, 212-221 m: *M. agave.*
Station CP 16. — 24.10.1991, 05°17'S, 132°50'E, 315-349 m: *A. incerta, M. caesura, M. striola.*
Station CP 17. — 24.10.1991, 05°15'S, 133°01'E, 439-459 m: *M. compressa.*
Station DW 18. — 24.10.1991, 05°18'S, 133°01'E, 205-212 m: *M. agave, M. caesura, M. hyalina, M. rufiantennulata.*
Station CP 19. — 25.10.1991, 05°15'S, 133°01'E, 576-605 m: *A. soelae, M. compacta.*
Station CP 20. — 25.10.1991, 05°15'S, 132°59'E, 769-809 m: *M. curvirostris, M. microps.*
Station CC 21. — 25.10.1991, 05°14'S, 133°00'E, 688-694 m: *A. emphereia, M. compacta, M. curvirostris.*
Station DW 22. — 25.10.1991, 05°22'S, 133°01'E, 85-124 m: *M. clinata, M. minuta.*
Station CP 25. — 26.10.1991, 05°30'S, 132°52'E, 336-346 m: *A. incerta, A. squamosa, M. caesura, M. leviantennata, M. punctata, M. rubrodigitalis.*
Station CP 26. — 26.10.1991, 05°34'S, 132°52'E, 265-302 m: *A. incerta.*
Station CP 27. — 26.10.1991, 05°33'S, 132°51'E, 304-314 m: *A. incerta, A. squamosa, M. caesura.*
Station DW 32. — 26.10.1991, 05°47'S, 132°51'E, 170-206 m: *M. japonica.*
Station CP 33. — 27.10.1991, 06°05'S, 132°38'E, 307-311 m: *A. incerta, M. striola.*
Station CP 35. — 27.10.1991, 06°08'S, 132°45'E, 390-502 m: *A. incerta, M. compacta, M. leviantennata, M. punctata.*
Station CP 36. — 27.10.1991, 06°05'S, 132°44'E, 210-268 m: *A. squamosa, M. caesura, M. striola.*
Station CP 39. — 28.10.1991, 07°47'S, 132°26'E, 466-477 m: *M. compacta.*
Station CC 40. — 28.10.1991, 07°46'S, 132°31'E, 443-468 m: *A. incerta, M. compacta.*
Station CC 41. — 28.10.1991, 07°45'S, 132°42'E, 393-401 m: *A. incerta, M. compacta.*
Station CC 42. — 28.10.1991, 07°53'S, 132°42'E, 350-354 m: *A. incerta, A. similis, M. caesura, M. compacta, M. striola.*
Station DW 44. — 29.10.1991, 07°52'S, 132°48'E, 291-295 m: *M. caesura.*
Station CP 45. — 29.10.1991, 07°54'S, 132°47'E, 302-305 m: *A. incerta., M. caesura.*
Station CP 46. — 29.10.1991, 08°01'S, 132°51'E, 271-273 m: *A. incerta, A. similis, M. caesura.*

Station CP 47. — 29.10.1991, 08°01'S, 132°55'E, 235-246 m: *A. incerta, A. similis, M. striola.*
Station DW 49. — 29.10.1991, 08°00'S, 132°59'E, 206-210 m: *M. japonica, M. leptitis, M. philippinensis.*
Station CC 56. — 31.10.1991, 08°16'S, 131°59'E, 549-552 m: *M. compacta.*
Station CC 57. — 31.10.1991, 08°19'S, 131°53'E, 603-620 m: *A. soelae, M. compacta.*
Station CC 58. — 31.10.1991, 08°19'S, 132°02'E, 457-461 m: *M. compacta.*
Station CP 59. — 31.10.1991, 08°20'S, 132°11'E, 399-405 m: *A. incerta, M. compacta.*
Station CP 62. — 01.11.1991, 09°01'S, 132°42'E, 246-253 m: *A. similis., M. compacta.*
Station CP 63. — 01.11.1991, 08°00'S, 132°58'E, 213-214 m: *A. similis, M. armata.*
Station CP 65. — 01.11.1991, 09°14'S, 132°27'E, 174-176 m: *M. armata, M. philippinensis.*
Station CP 66. — 01.11.1991, 09°01'S, 132°09'E, 211-217 m: *A. similis.*
Station CP 67. — 01.11.1991, 08°58'S, 132°06'E, 146-233 m: *A. similis, M. philippinensis, M. striola.*
Station CP 69. — 02.11.1991, 08°42'S, 131°53'E, 356-368 m: *A. incerta, M. compacta, M. leviantennata, M. striola.*
Station CP 70. — 02.11.1991, 08°41'S, 131°47'E, 410-413 m: *A. incerta, M. compacta.*
Station CP 71. — 02.11.1991, 08°38'S, 131°44'E, 477-480 m: *A. incerta, M. compacta.*
Station CP 72. — 02.11.1991, 08°36'S, 131°33'E, 676-699 m: *A. eminens.*
Station CP 75. — 03.11.1991, 08°46'S, 131°36'E, 451 m: *M. compacta.*
Station CP 76. — 03.11.1991, 08°50'S, 131°33'E, 400-401 m: *A. incerta, M. compacta.*
Station CP 77. — 03.11.1991, 08°57'S, 131°27'E, 346-352 m: *A. incerta, M. compacta, M. leviantennata.*
Station CP 78. — 03.11.1991, 09°06'S, 131°24'E, 284-295 m: *A. similis.*
Station CP 79. — 03.11.1991, 09°16'S, 131°22'E, 239-250 m: *A. similis, M. kuboi, M. striola.*
Station CP 82. — 04.11.1991, 09°32'S, 131°02'E, 215-219 m: *A. similis.*
Station CP 83. — 04.11.1991, 09°23'S, 131°00'E, 285-297 m: *A. incerta, A. similis, M. kuboi, M. philippinensis, M. striola.*
Station CP 84. — 04.11.1991, 09°23'S, 131°09'E, 246-275 m: *A. incerta, M. kuboi, M. philippinensis, M. striola.*
Station CP 85. — 04.11.1991, 09°22'S, 131°14'E, 240-245 m: *A. incerta, A. similis, M. rubrodigitalis, M. striola.*
Station CP 86. — 04.11.1991, 09°26'S, 131°13'E, 223-225 m: *A. similis.*
Station CP 87. — 05.11.1991, 08°47'S, 130°49'E, 1017-1024 m: *M. microps.*

SYSTEMATIC ACCOUNT

Genus *AGONONIDA* Baba & de Saint Laurent, 1995

Agononida emphereia sp. nov.

Fig. 1

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 21, 688-694 m: 1 ♂ 18,5 mm (MNHN-Ga 3947); 3 ♂ 18.2 to 21.4 mm; 1 ov. ♀ 20.5 mm (MNHN-Ga 3948).

TYPES. — The male of 18.5 mm from the Stn 21 (MNHN-Ga 3947) has been selected as holotype, the other specimens are paratypes.

ETYMOLOGY. — From the Greek, *emphereia*, likeness (considered here as a substantive in apposition), in reference to the similarity between the new species and other closely related species.

DESCRIPTION. — Carapace with numerous secondary striae and scales. One protogastric spine behind each epigastric spine (practically absent in one specimen). One small spine on hepatic region, usually on each side. Three or four spines in a row on each branchiocardiac boundary, anteriormost postcervical, larger than remainder.

Cardiac region with 1-2 spines (absent in one specimen). Posterior border of carapace unarmed. Anterolateral spine pronounced, situated at anterolateral angle of carapace. Branchial margins with 4 spines. Fourth to seventh thoracic sternites with numerous short arcuate striae. Second, third and fourth abdominal segments each with 4 spines on anterior transverse ridge; posterior ridge of fourth segment with strong median spine. Eye moderately large, maximum corneal diameter about 1/3 length of anterior border of carapace between bases of external orbital spines. Basal antennular segment (distal spines excluded) not exceeding eye, distolateral spine shorter than distomesial. Distomesial prolongation of first antennal segment well developed, reaching rostral tip; second segment with 2 strong distal spines, distomesial spine slightly overreaching third segment, 1-2 spines on mesial border; third segment unarmed. Flexor margin of merus of third maxilliped with median spine, extensor border with distal spine. Fingers of cheliped unarmed, fixed finger bifid distally. First walking leg about 3 times carapace length. Dactylus of walking legs about 2/3 propodus length, armed with small spine-like setae on median third of ventral border.

REMARKS. — The new species is closely related to *A. soelae* (Baba, 1986) from North-West Australia, New Caledonia and Indonesia and *A. incerta* (Henderson, 1888) (see below) in the general spination of the carapace. The three species have spines on the anterior and posterior ridges of the fourth abdominal. The new species differs from *A. soelae* in the following aspects:

— The carapace and sternal plastron are less rugose in *A. soelae* than in the new species.

— The distomesial prolongation of the first antennal segment is short in *A. soelae*, reaching the end of the second segment of the antennal peduncle; this prolongation is very long in the new species, clearly overreaching the antennal peduncle and reaching rostral tip.

— The posterior border of the carapace is unarmed in the new species, whereas *A. soelae* has 4-6 spines.

— The extensor border of the merus of the third maxilliped is armed with one distal spine in *A. emphereia*, unarmed in *A. soelae*.

The new species is distinguished from *A. incerta* by the following characters:

— Two protogastric spines in the new species, absent in *A. incerta*.

— One small hepatic spine, usually on each side, is present in *A. emphereia*, absent in *A. incerta*.

— The cardiac spines are always absent in *A. incerta*, whereas in *A. emphereia* they are usually present.

DISTRIBUTION. — Indonesia, between 688 and 694 m.

Agononida eminens (Baba, 1988)

Munida eminens Baba, 1988: 95, fig. 35; 1994: 11. — MACPHERSON, 1994: 456, fig. 72; 1995: 392.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 72, 676-699 m: 1 ♂ 15.8 mm.

DISTRIBUTION. —The species was described from specimens collected in the Philippines between 564 and 686 m (BABA, 1988). Since then the species has been cited in eastern Australia, New Caledonia, Loyalty Islands, Chesterfield Islands, Wallis and Futuna area and Indonesia, between 650 and 970 m (BABA, 1994; MACPHERSON, 1994; 1995). The present material has been collected from 676-699 m.

Agononida incerta (Henderson, 1888)

Munida incerta Henderson 1888: 130, pl. 13, fig. 4a. — BABA, 1988: 106; 1994: 12. — MACPHERSON, 1994: 478, fig. 74; 1995: 394.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 5, 296-299 m: 6 ♂ 17.4 to 27.0 mm; 12 ♀ 15.8 to 21.5 mm. — Stn 6, 287-298 m: 7 ♂ 14.5 to 31.0 mm; 3 ov. ♀ 21.6 to 25.4 mm; 16 ♀ 11.5 to 27.0 mm. — Stn 9, 368-389 m: 9 ♂ 11.8 to 20.0 mm; 8 ♀ 12.0 to 17.6 mm; 1 juv. 5.0 mm (POLIPI). — Stn 10, 329-389 m: 8 ♂ 13.3 to 30.7 mm; 5 ov. ♀ 21.3 to 23.8 mm; 3 ♀ 22.4 to 23.6 mm. — Stn 12, 413-436 m: 3 ♂ 12.4 to 29.3 mm; 3 ov. ♀

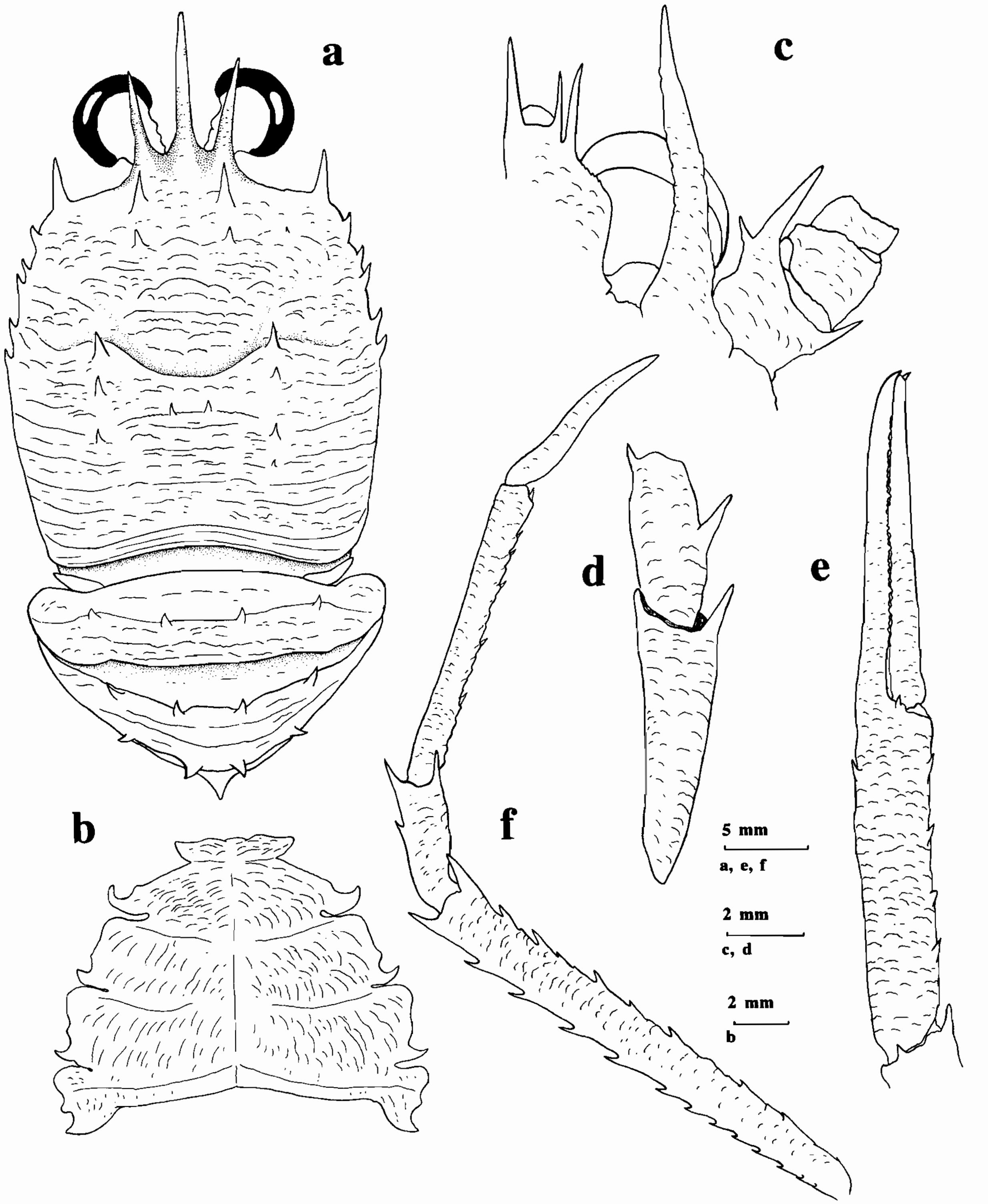

FIG. 1. — *Agononida emphereia* sp. nov., ♂ 18.5 mm, holotype from Stn 21: **a**, carapace and abdomen, dorsal view; **b**, sternal plastron; **c**, ventral view of cephalic region, showing antennular and antennal peduncles; **d**, right third maxilliped, proximal segments of endopod, lateral view; **e**, left chela, dorsal view; **f**, right first walking leg, lateral view.

20.0 to 24.0 mm; 4 ♀ 12.5 to 30.7 mm; 1 juv. 8.0 mm (POLIPI). — Stn 16, 315-349 m: 5 ♂ 17.6 to 24.6 mm; 2 ♀ 12.0 and 18.0 mm. — Stn 25, 336-346 m: 3 ♂ 11.8 to 27.0 mm; 5 ov. ♀ 11.0 to 23.0 mm; 1 juv. 5.6 mm. — Stn 26, 265-302 m: 1 juv. 5.3 mm. — Stn 27, 304-314 m: 1 ♂ 19.5 mm. — Stn 33, 307-311 m: 2 ♂ 14.8 and 15.0 mm; 1 ♀ 7.0 mm. — Stn 35, 390-502 m: 9 ♂ 11.5 to 27.0 mm; 3 ♀ 11.0 to 20.0 mm. — Stn 40, 443-468 m: 7 ♂ 18.3 to 35.8 mm; 3 ov. ♀ 25.2 to 36.8 mm; 12 ♀ 13.4 to 30.6 mm (POLIPI). — Stn 41, 393-401 m: 11 ♂ 13.8 to 40.4 mm; 4 ov. ♀ 21.3 to 30.5 mm; 5 ♀ 10.6 to 25.2 mm; 1 juv. 10.4 mm. — Stn 42, 350-354 m: 4 ♂ 15.0 to 20.6 mm; 2 ov. ♀ 24.1 and 24.4 mm; 2 ♀ 15.0 and 19.7 mm. — Stn 45, 302-305 m: 1 ♀ 9.5 mm. — Stn 46, 217-273 m: 2 ♂ 28.4 and 31.5. — Stn 47, 235-246 m: 3 ♂ 27.4 to 29.8 mm; 1 ov. ♀ 24.6 mm; 2 ♀ 17.5 to 26.4 mm. — Stn 59, 399-405 m: 6 ♂ 9.7 to 15.6 mm; 1 ov. ♀ 22.4 mm; 6 ♀ 14.7 to 15.0 mm (POLIPI). — Stn 69, 356-368 m: 2 ♂ 23.5 and 25.7 mm; 3 ov. ♀ 22.0 to 25.6 mm; 1 ♀ 16.8 mm. — Stn 70, 410-413 m: 3 ♂ 14.5 to 16.4 mm; 10 ♀ 15.0 to 18.4 mm (POLIPI). — Stn 71, 477-480 m: 3 ♀ 11.4 to 14.4 mm. — Stn 76, 400-401 m: 3 ♂ 9.7 to 18.5 mm; 4 ♀ 15.8 to 25.0 mm. — Stn 77, 346-358 m: 1 ♂ 23.0 mm; 1 ov. ♀ 25.8 mm (POLIPI). — Stn 83, 285-297 m: 1 ♂ 32.4 mm; 2 ov. ♀ 23.6 and 27.8 mm; 1 ♀ 16.3 mm. — Stn 84, 246-275 m: 2 ♂ 13.5 and 17.6 mm; 1 ♀ 6.8 mm. — Stn 85, 240-245 m: 8 ♂ 16.0 to 30.5 mm; 1 ♀ 25.0 mm.

DISTRIBUTION. — Known from east African coast, Japan, Philippines, Indonesia, eastern Australia, New Caledonia, Loyalty Islands, Chesterfield Islands, Wallis and Futuna, and Kiribati, between 17 and 720 m. The specimens examined were collected in 217-502 m.

Agononida similis (Baba, 1988)

Munida similis Baba, 1988: 129, figs 49-50.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 10, 329-389 m: 10 ♂ 16.0 to 23.6 mm; 2 ov. ♀ 20.0 and 20.7 mm; 6 ♀ 14.3 to 21.0 mm. — Stn 12, 413-436 m: 1 ♀ 12.6 mm. — Stn 42, 350-354 m: 1 ♂ 14.7 mm; 5 ♀ 11.6 to 13.3 mm. — Stn 46, 271-273 m: 1 ♀ 16.5 mm. — Stn 47, 235-246 m: 4 ♂ 14.0 to 21.0 mm; 3 ov. ♀ 19.0 to 22.4 mm; 7 ♀ 14.0 to 19.1 mm. — Stn 62, 246-253 m: 8 ♂ 11.8 to 22.0 mm; 1 ov. ♀ 19.1 mm; 6 ♀ 5.7 to 17.8 mm (POLIPI). — Stn 63, 214-215 m: 2 ♂ 18.0 and 19.1 mm; 1 ♀ 14.8 mm. — Stn 66, 211-217 m: 1 ♂ 13.6 mm; 2 ♀ 15.4 and 16.0 mm (POLIPI). — Stn 67, 146-233 m: 7 ♂ 7.8 to 20.4 mm; 5 ♀ 9.0 to 18.5 mm. — Stn 78, 284-295 m: 4 ♀ 5.6 to 8.4 mm. — Stn 79, 239-250 m: 9 ♂ 15.0 to 16.6 mm; 1 ov. ♀ 17.2 mm; 3 ♀ 8.0 to 17.5 mm (POLIPI). — Stn 82, 215-219 m: 1 ♂ 20.6 mm; 1 ov. ♀ 20.5 mm. — Stn 83, 285-297 m: 7 ♀ 5.6 to 8.0 mm. — Stn 84, 246-275 m : 2 ♀ 6.8 and 7.3 mm. — Stn 85, 240-245 m: 11 ♂ 12.5 to 22.0 mm; 4 ov. ♀ 17.7 to 18.0 mm; 5 ♀ 13.0 to 14.5 mm; 1 juv. 9.0 mm (POLIPI). — Stn 86, 223-225 m: 7 ♂ 15.4 to 21.7 mm; 4 ♀ 15.1 to 16.5 mm (POLIPI).

REMARKS. — *Agononida similis* is closely related to *A. squamosa* Henderson, 1885 (see below). Both species can be distinguishable by the shape of the rostrum and the mesiodistal spine of the first segment of the antennal peduncle (BABA, 1988). The specimens examined here always have the posterior border of the carapace without spines, whereas in all other specimens of *A. squamosa* examined two spines are present. Although BABA (1988) showed certain variations in the presence of these spines, the constancy here observed suggests that this character may have a specific value.

DISTRIBUTION. — Philippines and Indonesia in 263-494 m (BABA, 1988). The present material has been collected between 146 and 436 m.

Agononida soelae (Baba, 1986)

Munida soelae Baba, 1986: 2, fig. 3; 1988: 82 (key). — MACPHERSON, 1994: 530.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 19, 576-605 m: 1 ♂ 13.4 mm. — Stn 57, 603-620 m: 1 ♂ 19.0 mm.

DISTRIBUTION. — North-West Australia and New Caledonia, between 450 and 600 m (BABA, 1986; MACPHERSON, 1994). Indonesia, between 576 and 620 m.

Agononida squamosa (Henderson, 1885)

Munida squamosa Henderson, 1885: 409; 1888, 131, pl. 13, fig. 1. — MACPHERSON, 1993: 425, fig. 1 h-i; 1994: 537, fig. 96; 1995: 406. — BABA, 1994: 16.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 5, 296-299 m: 2 ♀ 11.6 and 12.0 mm; 1 ov. ♀ 16.2 mm; 1 ♀ 10.0 mm. — Stn 25, 336-346 m: 1 ov. ♀ 14.0 mm (USNM). — Stn 27, 304-314 m: 1 ♀ 13.5 mm; 1 ov. ♀ 14.7 mm; 1 ♀ 10.6 mm (POLIPI). — Stn 36, 210-268 m: 2 ♀ 7.7 and 9.4 mm.

DISTRIBUTION. — Japan, Indonesia, Admiralty Islands, northeastern Australia, New Caledonia, Loyalty Islands and Wallis Island, between 176 and 752 m (MACPHERSON, 1994, 1995). The material examined here was collected in 210-346 m.

Genus ***MUNIDA*** Leach, 1820

Munida agave Macpherson & Baba, 1993

Munida agave Macpherson & Baba, 1993: 387, figs 1-2.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 1, 156-305 m: 5 ♂ 4.0 to 8.0 mm; 5 ♀ 5.1 to 9.3 mm. — Stn 6, 289-298 m: 1 ♂ 10.7 mm. — Stn 15, 212-221 m: 2 ♀ 5.0 and 5.7 mm. — Stn 18, 212-221 m: 4 ♂ 5.0 to 6.3 mm; 2 ♀ 4.0 and 5.1 mm.

REMARKS. — The specimens examined are not well preserved and the antennular peduncles of many specimens are broken. Therefore, one of the important specific characters (the length of the distal spines) is often unknown. Most of the morphological characters agree quite well with the description of *M. agave*. However, the number of spines along the anterior border of the second abdominal segment is variable (0 to 6) and in one specimen the thoracic sternites are squamate (smooth in *M. agave*). As it was pointed out in the original description, probably more than one species are included in this complex. Therefore, in view of the difficulties in the correct identification, the present material is provisionally referred to *M. agave* until more specimens become available.

DISTRIBUTION. — Japan and Philippines in 89-197 m (MACPHERSON & BABA, 1993), Indonesia, between 156 and 305 m.

Munida armata Baba, 1988

Munida armata Baba, 1988: 86, fig. 31. — MACPHERSON, 1993: 427.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 63, 214-215 m: 5 ♂ 12.7 to 16.0 mm. — Stn 65, 174-176 m: 2 ♂ 16.0 and 16.2 mm; 2 ♀ 7.7 to 13.4 mm (POLIPI).

DISTRIBUTION. — Philippines in 182-216 m (BABA, 1988; MACPHERSON, 1993), Indonesia, between 174 and 215 m.

Munida caesura Macpherson & Baba, 1993

Munida caesura Macpherson & Baba, 1993: 388, fig. 3.

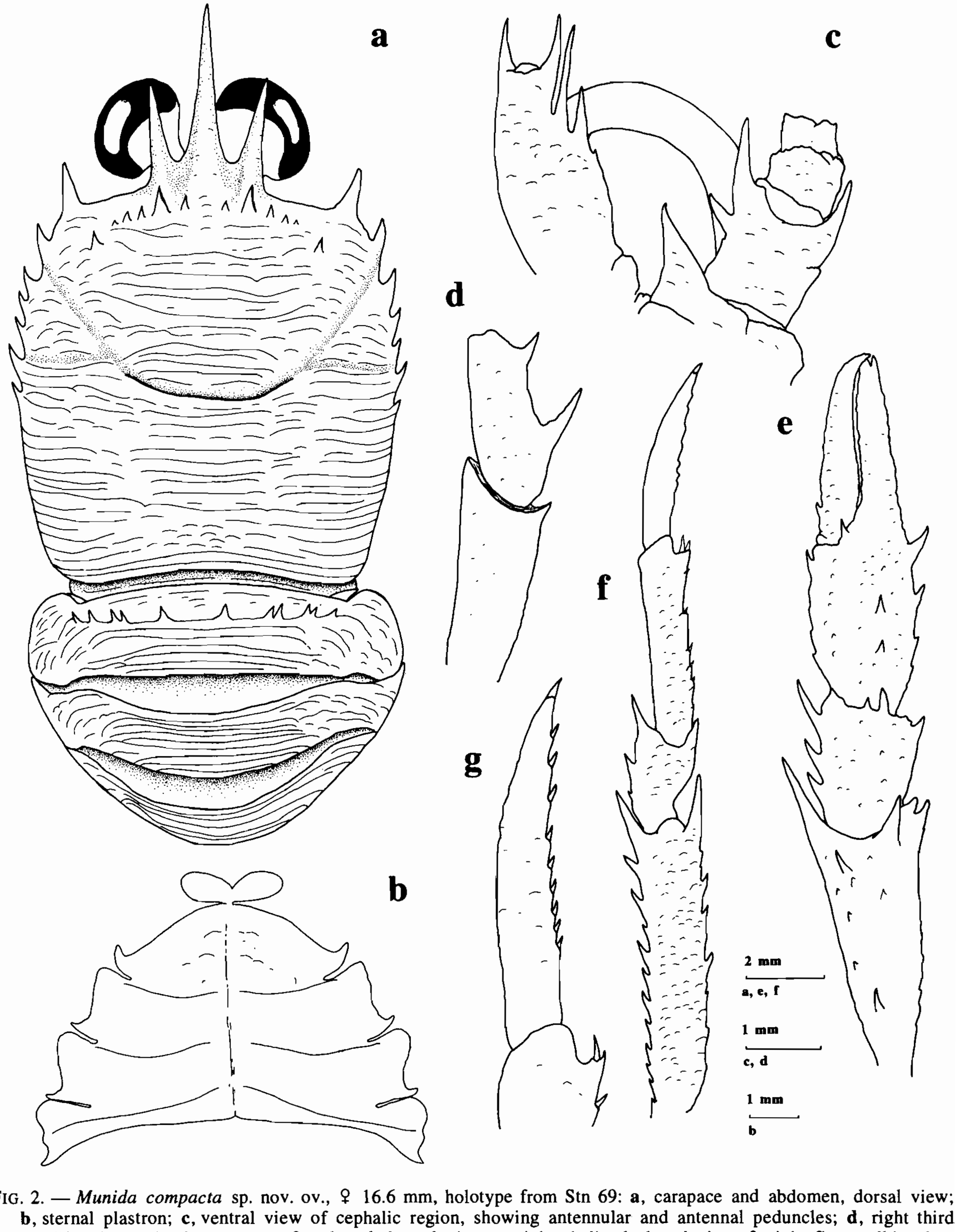

FIG. 2. — *Munida compacta* sp. nov. ov., ♀ 16.6 mm, holotype from Stn 69: **a**, carapace and abdomen, dorsal view; **b**, sternal plastron; **c**, ventral view of cephalic region, showing antennular and antennal peduncles; **d**, right third maxilliped, proximal segments of endopod, lateral view; **e**, right cheliped, dorsal view; **f**, right first walking leg, lateral view; **g**, dactylus of right first walking leg, lateral view.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 1, 156-305 m: 5 ♂ 4.7 to 8.6 mm; 6 ♀ 3.6 to 9.3 mm. — Stn 5, 296-299 m: 15 ♂ 7.6 mm to 17.5 mm; 20 ♀ 9.7 to 15.3 mm. — Stn 14, 245-246 m: 2 ♂ 9.0 and 12.4 mm; 3 ♀ 10.0 to 14.8 mm (USNM). — Stn 16, 315-349 m: 3 ♂ 9.0 to 10.5 mm (POLIPI). — Stn 18, 205-212 m: 10 ♂ 3.1 to 9.3 mm; 4 ♀ 4.0 to 8.5 mm. — Stn 25, 336-346 m: 1 ♂ 8.1 mm; 3 ♀ 9.0 to 14.4 mm. — Stn 27, 304-314 m: 2 ♂ 8.3 and 11.0 mm; 1 ♀ 12.5 mm. — Stn 36, 210-268 m: 1 ov. ♀ 15.2 mm; 2 ♀ 12.6 and 17.7 mm. — Stn 42, 170-206 m: 1 ♂ 10.8 mm. — Stn 44, 291-295 m: 3 ♀ 3.4 to 9.6 mm. — Stn 45, 302-305 m: 1 ♀ 9.3 mm. — Stn 46, 271-273 m: 4 ♂ 8.4 to 10.3 mm; 2 ov. ♀ 12.3 and 12.5 mm; 1 ♀ 8.9 mm (POLIPI).

DISTRIBUTION. — Japan, Philippines, Indonesia in 250-390m (MACPHERSON & BABA, 1993). The present material was collected in 156-346 m.

Munida clinata Macpherson, 1994

Munida clinata Macpherson, 1994: 457, fig. 11.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 22, 85-124 m: 4 ♂ 4.0 to 5.4 mm.

DISTRIBUTION. — *Munida clinata* was described from specimens collected in the Philippines, New Caledonia and Chesterfield Islands, between 28 and 245 m (MACPHERSON, 1994). The material from Indonesia was caught in 85-124 m.

Munida compacta sp. nov.

Fig. 2

Munida curvirostris Macpherson, 1993: 428 (in part).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 9, 368-389 m: 23 ♂ 8.3 to 13.3 mm; 39 ♀ 10.1 to 17.4 mm (USNM). — Stn 10, 329-389 m: 17 ♂ 11.4 to 19.7 mm; 34 ♀ 9.0 to 17.3 mm. — Stn 12, 413-436 m: 6 ♂ 10.0 to 16.4 mm; 5 ♀ 11.8 to 17.5 mm (POLIPI). — Stn 13, 417-425 m: 1 ♂ 11.6 mm . — Stn 19, 576-605 m: 1 ♀ 6.2 mm. — Stn 21, 688-694 m: 6 ♂ 6.3 to 18.6 mm; 11 ♀ 5.7 to 16.5 mm. — Stn 35, 390-502 m: 7 ♂ 9.0 to 16.0 mm; 8 ♀ 12.7 to 19.0 mm. — Stn 39, 466-477 m: 9 ♂ 8.2 to 16.8 mm; 1 ov. ♀ 16.0 mm; 8 ♀ 7.4 to 15.4 mm. — Stn 40, 443-468 m: 12 ♂ 11.5 to 17.4 mm; 10 ♀ 12.2 to 21.0 mm (USNM). — Stn 41, 393-401 m: 6 ♂ 14.0 to 18.3 mm; 5 ♀ 9.0 to 18.1 mm. — Stn 42, 350-354 m: 6 ♂ 13.6 to 20.0 mm; 4 ov. ♀ 17.4 to 19.4 mm. — Stn 56, 549-552 m: 4 ♂ 12.7 to 15.0 mm; 1 ♀ 16.2 mm. — Stn 57, 603-620 m: 1 ♀ 8.7 mm. — Stn 58, 457-461 m: 1 ♂ 18.8 mm. — Stn 59, 399-405 m: 10 ♂ 8.8 to 19.4 mm; 2 ov. ♀ 16.6 and 17.5 mm; 13 ♀ 8.3 to 18.2 mm (POLIPI). — Stn 62, 246-253 m: 1 ♀ 12.0 mm. — Stn 69, 356-368 m: 13 ♂ 8.6 to 20.3 mm; 1 ov. ♀ 16.6 mm (MNHN-Ga 3949); 4 ov. ♀ 16.8 to 20.6 mm; 16 ♀ 8.7 to 22.8 mm. — Stn 70, 410-413 m: 1 ♂ 14.7 mm; 5 ♀ 9.8 to 18.4 mm. — Stn 71, 477, 480 m: 1 ♂ 9.7 mm; 6 ♀ 9.4 to 15.2 mm. — Stn 75, 451-452 m: 2 ♂ 14.0 and 15.3 mm; 3 ♀ 9.4 to 14.1 mm. — Stn 76, 400-401 m: 5 ♂ 10.0 to 15.0 mm; 3 ♀ 10.0 to 11.4 mm. — Stn 77, 346-352 m: 3 ♀ 18.3 to 19.0 mm (POLIPI).

TYPES. — The ovigerous female of 16.6 mm from Stn 69 (MNHN Ga 3949) has been selected as the holotype, the other specimens are paratypes.

ETYMOLOGY. — From the Latin, *compactus*, thick, in reference to the shape of the carapace.

DESCRIPTION. — Carapace with numerous secondary striae. Intestinal region with numerous scales. Anterolateral spine well developed, situated at anterolateral angle. Branchial margins with 5 well developed spines. Fourth thoracic sternite with a few short arcuate striae; fifth to seventh without striae. Abdominal segments with numerous transverse striae; second segment with 9-11 spines on anterior ridge. Eye large, maximum corneal diameter about 2/5 length of anterior border of carapace between bases of anterolateral spines of carapace. Basal segment of antennule (distal spines excluded) ending at same level of cornea, distal spines subequal. First segment of antennal peduncle with distomesial spine nearly reaching end of second segment; distomesial spine of second segment exceeding third segment, usually with accompanying small spine proximally. Extensor margin of merus of third maxilliped unarmed. Distomesial spine of cheliped merus well developed, reaching midpoint of carpus. Fixed finger with one distal spine; movable finger with basal spine. First walking leg about twice carapace length; dactylus as long as propodus, with spine-like setae reaching distal part of ventral margin.

REMARKS. — *Munida compacta* is closely related to *M. curvirostris* Henderson, 1885 (see below). Both species have five spines on the lateral margins of the carapace behind the cervical groove, the front margins are transverse, the eyes are large, the abdominal segments have spines along the anterior ridge of the second tergite, the lateral portions of the posterior thoracic sternites have no granules, the distal spines on the basal antennular segment are subequal and the extensor margin of the merus of the third maxilliped is unarmed. However, the species are easily differentiable in several regards. The new species has numerous secondary striae and scales on the carapace and abdominal segments (more than 5 secondary striae on the second abdominal segment). These striae and scales are practically absent in *M. curvirostris* (less than 5 secondary striae on the second abdominal segment). Furthermore, in *M. compacta* the dactylus of the walking legs is as long as the propodus, whereas in *M. curvirostris* the dactylus is clearly shorter than the propodus.

The new species also resembles *Munida rhodonia* Macpherson, 1994, from New Caledonia, Loyalty and Chesterfield Islands (MACPHERSON, 1994).

However, they can be distinguished by several differences:

— The chelipeds are clearly different. They are more massive in *M. rhodonia* than in the new species and the spines on the dorsal side of the palm are very small in *M. rhodonia*, whereas they are well developed in the new species. Moreover, in the new species, the distomesial spine of the merus of the cheliped reaches or overreaches the midlength of the carpus; in *M. rhodonia*, this spine usually does not reach the midlength of this article.

— In *M. rhodonia* the dactylus of the first walking leg is clearly shorter than the propodus. In the new species the dactylus is as long as the propodus.

DISTRIBUTION. — Indonesia, between 246 and 694 m.

Munida compressa Baba, 1988

Munida compressa Baba, 1988: 91, figs 33-34. — MACPHERSON, 1993: 427.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 17, 439-459 m: 1 ♀ 14.4 mm.

DISTRIBUTION. — Japan, Southern China Sea, Philippines, Arafura and Molucca Seas in 180-668 m (BABA, 1988; MACPHERSON, 1994). The present specimen was collected between 439 and 459 m.

Munida curvirostris Henderson, 1885

Munida curvirostris Henderson, 1885: 412. — MACPHERSON, 1993: 428 (in part).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 20, 769-809 m: 14 ♂ 7.2 to 15.6 mm; 5 ov. ♀ 13.5 to 18.7 mm; 20 ♀ 8.3 to 14.8 mm. — Stn 21, 688-694 m: 4 ♂ 5.6 to 18.3 mm; 2 ♀ 13.8 and 14.1 mm.

REMARKS. — A revision of *M. curvirostris* Henderson, 1885 is presently being prepared by BABA. Several samples from MUSORSTOM 1 (Station 50), MUSORSTOM 2 (Station 75) and CORINDON (Stations 209 and 276) cruises (see MACPHERSON, 1993) were incorrectly identified as *M. curvirostris*, belonging instead to *M. compacta* (see above).

DISTRIBUTION. — East coast of Africa, Arabian Sea, Maldives, Andaman Sea, Japan, Philippines, Indonesia, eastern Australia, between 141 and 1360 m (BABA, 1988; MACPHERSON, 1994). The present material was collected from 688-809 m.

Munida hyalina Macpherson, 1994

Munida hyalina Macpherson, 1994: 477, fig. 22.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 18, 205-212 m: 2 ♂ 3.6 and 4.1 mm.

REMARKS. — The specimens from Indonesia are similar to the type material. However, one specimen has 4 small spines on the branchial margins (3 spines in the types) and one transverse stria posterior to the median ridge on the second abdominal segment (absent in the types).

DISTRIBUTION. — New Caledonia and Chesterfield Islands, between 310 and 720 m (MACPHERSON, 1994) and Indonesia, between 205 and 212.

Munida japonica Stimpson, 1858

Munida japonica Stimpson, 1858: 252. — MACPHERSON & BABA, 1993: 399, fig. 9 (references and synonymy).

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 32, 170-206 m: 5 ♂ 3.2 to 9.5 mm; 1 ov. ♀ 9.6 mm; 3 ♀ 4.3 to 4.5 mm. — Stn 49, 206-209 m: 4 ♂ 4.3 to 14.2 mm; 1 ♀ 6.5 mm.

DISTRIBUTION. — *Munida japonica* has been previously cited in Japan and the Philippines in 102-220 m (MACPHERSON & BABA, 1993). The present material has been collected between 170 and 209 m.

Munida kuboi Yanagita, 1943

Munida kuboi Yanagita, 1943: 20, figs 5-6. — BABA, 1988: 109, fig. 40; 1990: 964. — MACPHERSON, 1993: 431.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 79, 239-250 m: 2 ♂ 11.0 and 11.8 mm; 1 ♀ 10.8 mm. — Stn 83, 285-297 m: 3 ♂ 10.6 to 14.0 mm; 6 ♀ 8.6 to 15.5 mm (POLIPI). — Stn 84, 246—250 m: 5 ♂ 10.1 to 13.2 mm; 1 ♀ 10.8 mm.

DISTRIBUTION. — South Africa, Madagascar, Japan, Philippines and Indonesia, between 78 and 405 m (BABA, 1988, 1990; MACPHERSON, 1994). The specimens examined here were collected between 239 and 297 m.

Munida leptitis Macpherson, 1994

Munida leptitis Macpherson, 1994: 487, fig. 27; 1995: 394, fig. 14.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 2, 209-240 m: 3 ♂ 4.8 to 5.3 mm; 2 ♀ 3.6 and 4.3 mm; 1 juv. 2.4 mm. — Stn 5, 296-299 m: 1 ♂ 4.0 mm. — Stn 14, 245-246 m: 3 ♂ 4.7 to 5.1 mm; 7 ♀ 4.0 to 5.1 mm. — Stn 49, 206-210 m: 4 ♂ 3.3 to 4.4 mm; 1 ov. ♀ 3.6 mm; 4 ♀ 3.0 to 4.0 mm.

REMARKS. — The specimens examined agree quite well with the type material. However, in some the movable finger of the chelipeds has some spines along the mesial border (only one basal spine in the types). Furthermore, the dactylus of the walking legs in the specimens from Stn 14 are unarmed on the terminal third of the ventral margin (armed with movable spines along the whole border in the types). These differences suggest the existence of several forms or species (see also MACPHERSON, 1995). *Munida leptitis* was described from only two specimens collected in New Caledonia and Loyalty Islands, therefore the discovery of additional topotypic specimens would be desirable in order to determine the variability of the species and to confirm the identity of the present material.

DISTRIBUTION. — New Caledonia and Loyalty Islands, between 21 and 440 m (MACPHERSON, 1994), Wallis and Futuna area (MACPHERSON, 1995). The specimens from Indonesia were collected between 206 and 299 m.

Munida leviantennata Baba, 1988

Munida leviantennata Baba, 1988: 111, figs 41, 42; 1994: 12, fig. 5. — MACPHERSON, 1994: 491; 1995: 395.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 25, 336-346 m: 1 ♂ 11.5 mm. — Stn 35, 390-502 m: 2 ♂ 16.3 and 16.7 mm; 1 ♀ 14.8 mm (POLIPI). — Stn 69, 356-368 m: 1 ♂ 7.7 mm. — Stn 77, 346-352 m: 1 ♂ 17.7 mm.

DISTRIBUTION. — Philippines, Indonesia, eastern Australia, New Caledonia, Chesterfield Islands and Wallis Island, between 300 and 660 m (BABA, 1988, 1994; MACPHERSON, 1994). The present material was obtained between 336 and 502 m.

Munida microps Alcock, 1894

Munida microps Alcock, 1894: 326. — BABA, 1988: 122; 1994: 13. — MACPHERSON, 1994: 496, fig. 32; 1995: 397.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 20, 769-809 m: 1 ♀ 15.0 mm. — Stn 87, 1017-1024 m: 1 ov. ♀ 13.7 mm.

DISTRIBUTION. — Previously known from Arabian Sea, Maldives Islands, Philippines, Indonesia, southeastern Australia, New Caledonia, Chesterfield Islands, Wallis and Futuna Islands, between 970 and 1240 m (MACPHERSON, 1994). The present material was collected between 686 and 1024 m.

Munida minuta Macpherson, 1993

Munida minuta Macpherson, 1993: 432, fig 3.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 22, 85-124 m: 2 ♂ 3.6 and 4.0 mm.

DISTRIBUTION. — Philippines in 92-97 m (MACPHERSON, 1993). The specimens from Indonesia were obtained in 85-124 m.

Munida philippinensis Macpherson & Baba, 1993

Munida philippinensis Macpherson & Baba, 1993: 410, fig. 16.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 2, 209-240 m: 1 ♂ 6.3 mm; 2 ♀ 4.0 and 5.3 mm. — Stn 49, 206-209 m: 1 ♂ 4.4 mm; 1 ov. ♀ 4.9 mm (USNM). — Stn 65, 174-176 m: 1 ♂ 5.0 mm. — Stn 67, 146-233 m: 2 ♂ 6.2 and 6.6 mm; 2 ov. ♀ 7.2 and 7.8 mm. — Stn 83, 285-297 m: 1 ov. ♀ 7.0 mm (POLIPI). — Stn 84, 246-275 m: 1 ♂ 6.6 mm (POLIPI).

DISTRIBUTION. — Philippines, in 170-220 m (MACPHERSON & BABA, 1993). Indonesia, between 146 and 297 m.

Munida punctata sp. nov.

Fig. 3

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 9, 368-389 m: 3 ♂ 8.2 to 11.0 mm; 2 ♀ 8.0 and 8.3 mm (MNHN-Ga 3952). — Stn 25, 336-346 m: 3 ♂ 8.6 to 10.5 mm (MNHN-Ga 3953). — Stn 35, 390-502 m: 1 ♂ 12.7 mm (MNHN-Ga 3950); 2 ♂ 10.5 to 12.4 mm; 2 ♀ 10.0 and 12.0 mm (MNHN-Ga 3951).

TYPES. — The male of 12.7 mm from Stn 35 (MNHN-Ga 3950) has been selected as holotype, the other specimens are paratypes.

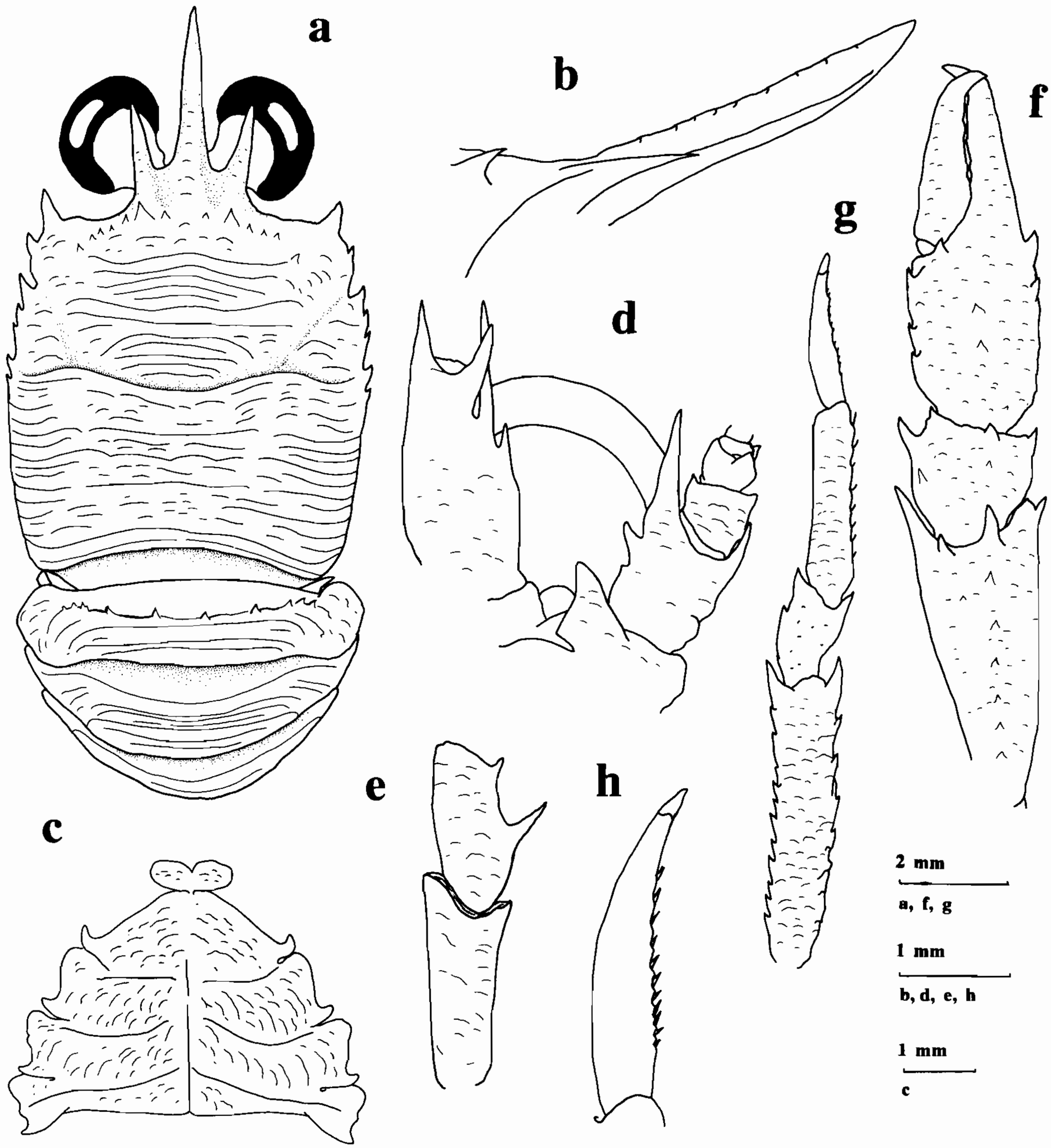

FIG. 3. — *Munida punctata* sp. nov., ♂ 12.7 mm, holotype from Stn 35: **a**, carapace and abdomen, dorsal view; **b**, rostrum, lateral view; **c**, sternal plastron; **d**, ventral view of cephalic region, showing antennular and antennal peduncles; **e**, right third maxilliped, proximal segments of endopod, lateral view; **f**, right cheliped, dorsal view; **g**, right first walking leg, lateral view; **h**, dactylus of right first walking leg, lateral view.

ETYMOLOGY. — From the Latin, *puncta*, point, puncture, in reference to the red point near the rostrum tip.

DESCRIPTION. — Carapace with numerous secondary striae. Intestinal region with some median scales. Rostrum spiniform, not laterally compressed. Anterolateral spine moderately short, situated at anterolateral angle, not reaching level of sinus between rostrum and supraocular spine. Branchial margins with 5 small spines. Thoracic sternites with numerous short arcuate striae. Second abdominal segment with 8-9 spines along anterior transverse ridge. Second and third segments each with some transverse striae. Males with two gonopods on first and second abdominal segments. Eye large, maximum corneal diameter about 1/2 length of anterior border of carapace between bases of external orbital spines. Basal segment of antennule (distal spines excluded) ending at level of cornea, distal spines subequal. First segment of antennal peduncle with short distomesial spine, clearly not reaching end of second segment; distomesial spine of second segment long, barely exceeding antennal peduncle. Extensor margin of merus of third maxilliped unarmed. Distomesial spine of cheliped merus well developed, though not reaching midpoint of carpus. Movable finger of chelipeds with basal spine, fixed finger with terminal spine. First walking leg about twice carapace length. Dactyli of walking legs slightly shorter or as long as propodus, with spinules along entire ventral margin.

REMARKS. — The new species resembles *Munida rubrodigitalis* Baba, 1994, from northeastern Australia, New Caledonia, Loyalty Islands and Indonesia (BABA, 1994; MACPHERSON, 1994, see also below). Both species have five spines on the branchial margin, the second abdominal segment armed with spines along the anterior ridge, the distal spines on the basal antennular segment subequal, short chelipeds and a red, distal mark on the rostrum (specimens in preservative). However, they can be easily distinguished by the shape of the rostrum, which is laterally compressed in *M. rubrodigitalis*, whereas in the new species it is clearly spiniform.

DISTRIBUTION. — Indonesia, between 336 and 502 m.

Munida rubrodigitalis Baba, 1994

Munida rubrodigitalis Baba, 1994: 13, fig. 6.
Munida sp. — MACPHERSON, 1994: 558, figs 13b, 90.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 25, 336-346 m: 1 ♀ 9.0 mm (MNHN-Ga 3660). — Stn 83, 285-297 m: 1 ♂ 13.3 mm; 2 ♀ 11.6 and 12.5 mm.

DISTRIBUTION. — Eastern Australia, between 497 and 503 m (BABA, 1994), New Caledonia and Loyalty Islands in 466-650 m (MACPHERSON, 1994). Indonesia, between 285 and 346 m.

Munida rufiantennulata Baba, 1969

Munida rufiantennulata Baba, 1969: 23, fig. 7; 1988: 128; 1989: 131. — MACPHERSON, 1994: 523, figs. 46, 83.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 18, 205-212 m: 3 ♂ 4.3 to 9.4 mm; 7 ♀ 3.0 to 7.7 mm.

DISTRIBUTION. — Japan, Philippines, Indonesia, New Caledonia, Loyalty Islands, Mattew and Hunter Islands and Chesterfield Islands, between 379 and 610 m (BABA, 1969, 1988, 1989; MACPHERSON, 1994). The material examined here was collected in 205-212 m.

Munida striola Macpherson & Baba, 1993

Munida striola Macpherson & Baba, 1993: 416, fig. 20.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 6, 287-298, 1 ov. ♀ 10.3 mm. — Stn 9, 368-389 m: 1 ♂ 12.0 mm; 5 ♀ 10.8 and 11.5 mm. — Stn 16, 315-349 m: 1 ♀ 14.7 mm. — Stn 33, 307-311 m: 1 ♂ 10.3 mm. — Stn 36, 210-268 m: 1 ♀ 10.5 mm. — Stn 42, 350-354 m: 1 ♂ 15.5 mm. — Stn 47, 235-246 m: 1 ♂ 13.3 mm. — Stn 67, 146-233 m: 1 ♂ 8.0 mm. — Stn 69, 356-368 m: 5 ♂ 13.5 to 17.5 mm; 8 ov. ♀ 12.0 to 17.0 mm; 1 ♀ 15.0 mm. — Stn 79, 239-250 m: 8 ♂ 12.2 to 12.9 mm; 2 ov. ♀ 12.0 and 13.3 mm; 2 ♀ 12.0 and 13.4 mm. — Stn 83, 285-297 m: 8 ♂ 7.4 to

15.4 mm; 4 ov. ♀ 12.0 to 17.0 mm; 4 ♀ 7.7 to 13.6 mm. — Stn 84, 246-275 m: 5 ♂ 12.4 to 17.5 mm; 1 ov. ♀ 16.5 mm; 3 ♀ 12.1 to 14.0 mm. — Stn 85, 240-245 m: 2 ♂ 11.6 and 15.0 mm; 1 ov. ♀ 13.5 mm.

DISTRIBUTION. — *M. striola* has been cited in Japan, Philippines and Indonesia in 215-300 m (MACPHERSON & BABA, 1993). The material examined here was collected between 146 and 389 m.

Munida sp.

MATERIAL EXAMINED. — **Indonesia**. KARUBAR: stn 1, 156-305 m: 3 ov. ♀ 7.1 to 8.0 mm. — Stn 2, 209-240 m : 3 ♂ 8.5 to 10.7 mm. — Stn 5, 296-299 m: 7 ♂ 10.3 to 10.6 mm; 1 ov. ♀ 9.2 mm; 3 ♀ 8.3 to 8.5 mm. — Stn 6, 289-298 m: 11 ♂ 10.5 to 12.0 mm; 4 ov. ♀ 8.3 to 10.3 mm; 3 ♀ 10.3 to 11.5 mm.

REMARKS. — This species is actually being studied by K. BABA (Kumamoto University, Japan) and probably it belongs to a new genus (K. BABA, personnal communication).

DISTRIBUTION. — Indonesia, between 156 and 305 m.

ACKNOWLEDGEMENTS

I am very grateful to A. CROSNIER of ORSTOM and M. K. MOOSA from the Puslitbang Oseanologi-LIPI for their support and help and for making this interesting material available to me. Thanks are also due to K. BABA (Kumamoto University) for his comments, suggestions and improvements of the manuscript.

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13

Crustacea Decapoda: Ethusinae (Dorippidae), mainly from the KARUBAR Cruise

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ABSTRACT

Material of Ethusinae collected by a French-Indonesian expedition in Indonesia (KARUBAR, 1991), and two French expeditions to Wallis and Futuna Islands (MUSORSTOM 7, 1992), and off New Caledonia (BATHUS 3, 1993) yielded a total of 11 species belonging to three genera. One genus and five species are new and three species are recorded for the first time from Indonesia.

RÉSUMÉ

Crustacea Decapoda : Ethusinae (Dorippidae) récoltés principalement lors de la campagne KARUBAR.

Les Ethusinae récoltées par une expédition franco-indonésienne en Indonésie (KARUBAR, 1991) et deux autres expéditions françaises aux îles Wallis et Futuna (MUSORSTOM 7, 1992) et en Nouvelle-Calédonie (BATHUS 3, 1993), comprennent 11 espèces appartenant à 3 genres. Un genre et cinq espèces sont nouveaux pour la science et trois espèces n'avaient jamais été encore signalées en Indonésie.

INTRODUCTION

This report is based on the collections taken during a Franco-Indonesian expedition in Indonesia (KARUBAR, 1991), and two French expeditions at Wallis and Futuna Islands (MUSORSTOM 7, 1992) and off New Caledonia (BATHUS 3, 1993).

Eleven species, belonging to 3 genera, have been identified, of which one genus and 5 species are described as new, and 3 species (marked with an asterisk in the accompanying list) are reported for the first time from Indonesia.

CHEN Huilian (H. L. CHEN), 1997. — Crustacea Decapoda: Ethusinae (Dorippidae), mainly from the KARUBAR Cruise. *In*: A. CROSNIER & P. BOUCHET (eds), Résultats des Campagnes MUSORSTOM, Volume 16. *Mém. Mus. natn. Hist. nat.*, **172**: 613-625. Paris ISBN: 2-85653-506-2.

Contribution no. 2557, Institute of Oceanology, Academia Sinica, Qingdao, China.

LIST OF SPECIES

Subfamily ETHUSINAE Guinot, 1977
Parethusa glabra gen. et sp. nov.
Ethusa dilatidens sp. nov.
Ethusa indica Alcock, 1894
Ethusa indonesiensis sp. nov.
Ethusa longidentata sp. nov.
Ethusa sexdentata (Stimpson, 1858)
Ethusa bicornuta sp. nov.
**Ethusa brevidentata* Chen, 1993
Ethusa desciscens Alcock, 1896
**Ethusa investigatoris* Alcock, 1896
**Ethusa pubescens* Chen, 1993

SYSTEMATIC ACCOUNT

Subfamily ETHUSINAE Guinot, 1977

Genus ***PARETHUSA*** nov.

DIAGNOSIS. — Carapace longer than broad, swollen, dorsal and ventral surfaces smooth. Grooves and regions very indistinct. Front thin, separated into 2 broadly triangular teeth (the external side of the two median frontal; teeth is angled, suggestive of the beginning of a tooth) by a large, V-shaped notch. Basal segment of antennules not swollen, eyes located on ventral surface, eye-stalks short, stout and movable. Last two legs short and small, dactyli talon shaped.

TYPE SPECIES. — *Parethusa glabra* sp. nov. by present designation.

GENDER. — Feminine.

ETYMOLOGY. — The name is formed by a combination of the Greek word *par* (near) and the feminine name *Ethusa*.

REMARKS. — This new genus is closely related to *Ethusa* and *Ethusina*, but may be distinguished from them by the following:

	Parethusa	*Ethusa*	*Ethusina*
1. Carapace	smooth	granular and hairy, or granular and hairless	granular and hairy, or granular and hairless
2. Groove and regions	indistinct	distinct	distinct
3. Location of eyes	ventral surface	dorsal surface	ventral surface
4. Eyestalks	short, stout and movable	long, slender and movable	short, stout and immovable
5. Number of frontal teeth	2	4	4

The new genus is characterized by the presence of talon-shaped dactyli on the last two legs, the long and slender second pleopods and the teeth of the front (2 broadly triangular ones). I am inclined to consider *Parethusa* as a primitive member of the Ethusinae.

Parethusa glabra sp. nov.

Figs 1-2

MATERIAL EXAMINED. — **Indonesia**. *Kai Islands*. KARUBAR: st. CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♂ holotype 8.3 x 8.0 mm (MNHN-B 22886).

DESCRIPTION. — Carapace inflated, slightly longer than broad. Dorsal and ventral surfaces smooth. Grooves and regions very indistinct, only urogastric and cardiac-intestinal regions slightly defined. Front thin, separated into two broadly-triangular teeth by a large V-shaped notch. Orbit very small, with a small V-shaped notch between frontal and exorbital teeth, dorsal surface with a broad, shallow groove. Exorbital teeth blunt, short, with outer border converging inwardly. Base of antennules not swollen. Eyes located on ventral surface, eyestalks short, stout and movable.

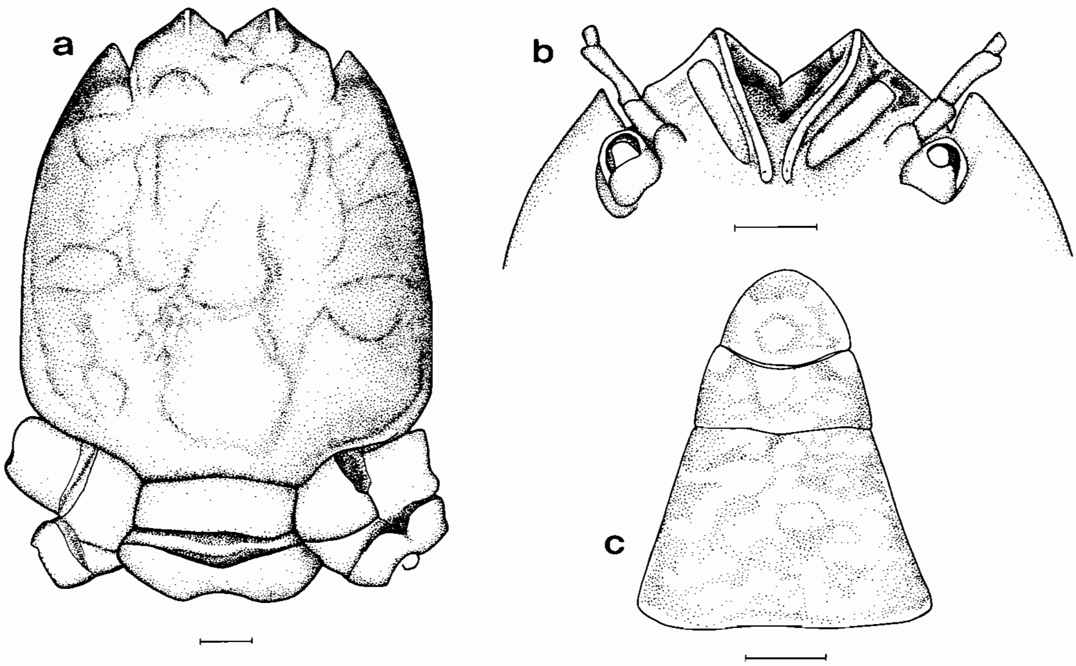

FIG. 1. — *Parethusa glabra* gen. et sp. nov., ♂ holotype (MNHN-B 22886): **a**, carapace; **b**, anterior portion of carapace (ventral view); **c**, male abdomen. Scales = 1 mm.

Chelipeds nearly symmetrical, surface smooth. Merus 4.5 times longer than high, palm twice as long as high. Fingers as long as propodus, cutting edges without teeth.

Second and third pereiopods long and smooth, third longest and fourth shortest of all pereiopods. Merus of third 7.5 times longer than high and propodus 5 times as long as high. Dactylus longer than propodus. Fourth pereiopods short and stout, 3 times longer than high, carpus longer than propodus, propodus 2.5 times longer than high, distal part with some spines.

Male abdomen moderately broad, consisting of five segments (3rd-5th fused): first stout, 3 times as long as second. Base of fused segments strongly convex on each side, depressed in middle. Sixth segment 2.7 times longer than broad, anterior border depressed. Telson bluntly triangular.

Male first pleopods stout, basal half twice as broad as distal half, with a small notch distally. Second pleopods longer than first, distal part curved and thin.

Genus *ETHUSA* Roux, 1830

Ethusa dilatidens sp. nov.

Fig. 3

MATERIAL EXAMINED. — **Indonesia**. *Tanimbar Islands*. KARUBAR: st. CP 83, 09°23'S, 131°00'E, 285-297 m, 04.11.1991: 1 ♂ holotype 12.0 x 12.2 mm (MNHN-B 22887).

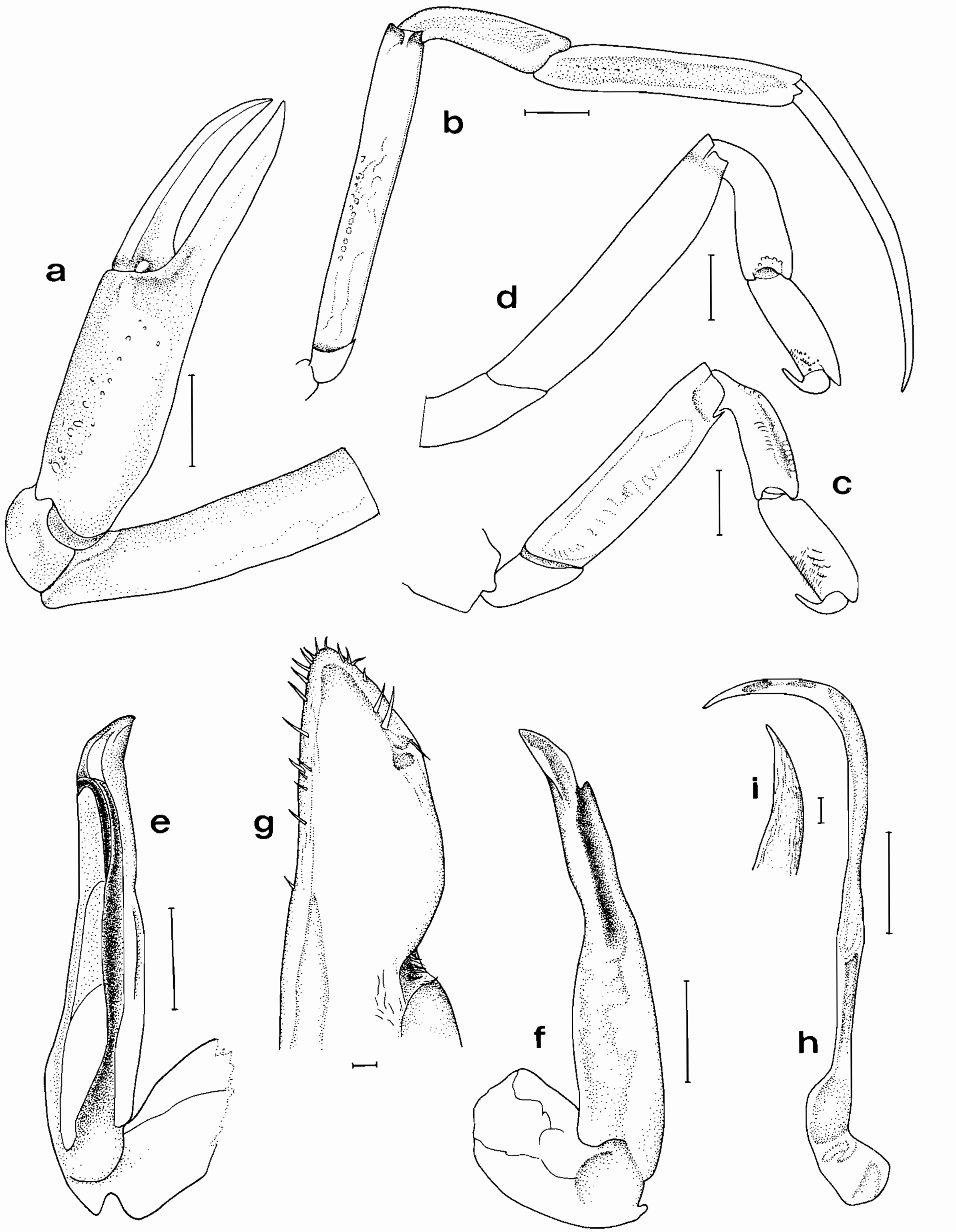

FIG. 2. — *Parethusa glabra* gen. et sp. nov., ♂ holotype (MNHN-B 22886): **a**, cheliped; **b**, third pereiopod; **c**, fourth pereiopod; **d**, fifth pereiopod; **e-g**, male first pereiopod; **h-i**, second male pleopod. Scales: a-f, h = 1 mm; g, i = 0.1 mm.

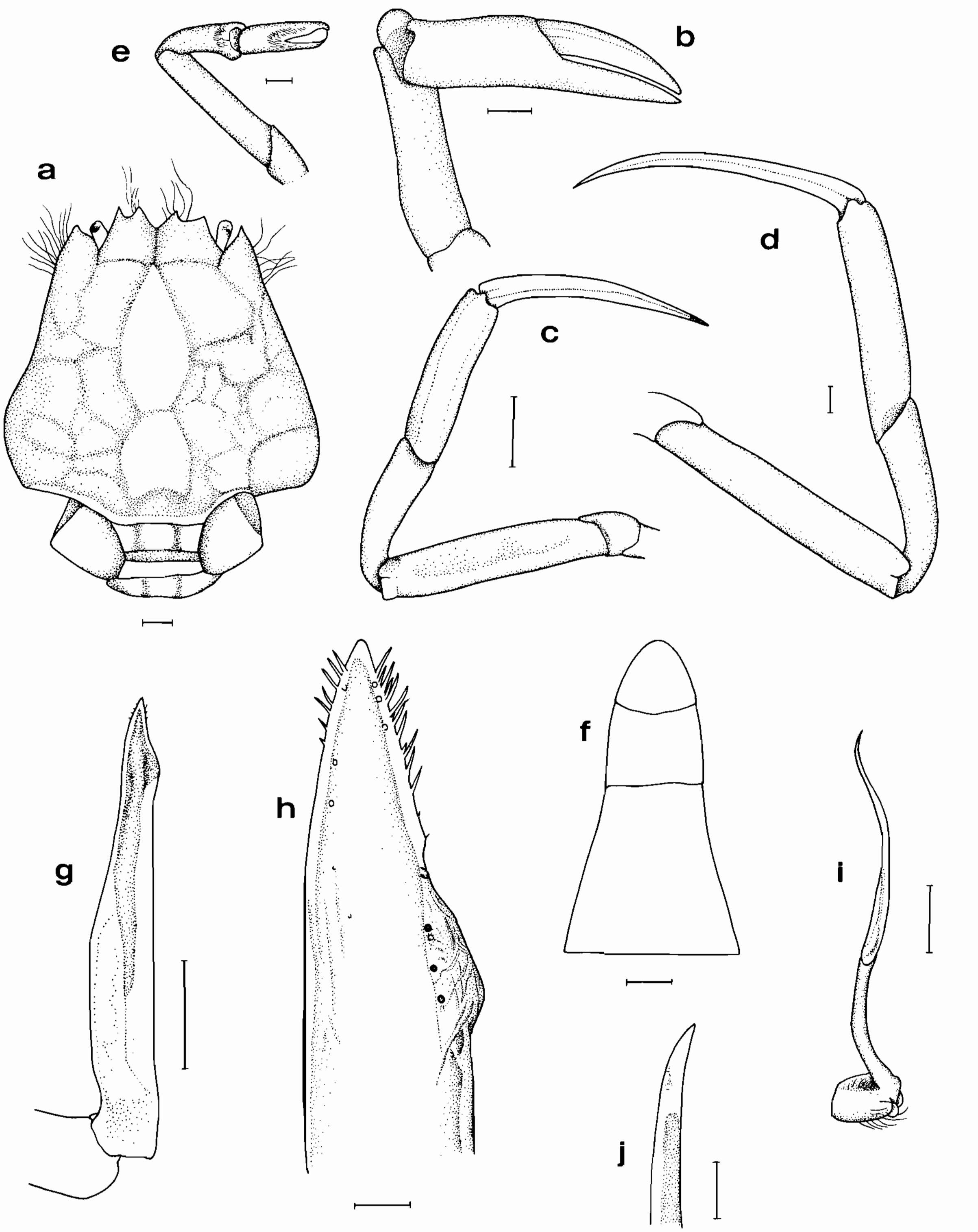

FIG. 3. — *Ethusa dilatidens* sp. nov., ♂ holotype (MNHN-B 22887): **a**, carapace; **b**, cheliped; **c**, second pereiopod; **d**, third pereiopod; **e**, fourth pereiopod; **f**, male abdomen; **g-h**, male first pleopod; **i-j**, male second pleopod. Scales : a-g = 1 mm, h, j = 0.1 mm.

DESCRIPTION. — Carapace slightly broader than long, dorsal surface with very fine granules and short pubescence. Cervical and branchial grooves and regions distinct. Branchial regions strongly convex, mesogastric and cardiac-intestinal regions slightly convex. Front divided into 4 short teeth by one V-shaped and 2 U-shaped notches. Exorbital teeth broad at base, slightly broader than long, outer borders converging inwards.

Chelipeds symmetrical, palm twice as long as high and slightly longer than fingers, cutting edges of fingers without teeth.

Second and third pereiopods smooth and hairless. Third pereiopod (left only) the longest: merus 5.6 times longer than high and propodus 4 times longer than high ; merus of second pereiopod only 4.5 times and propodus only 3.2 times longer than high. Right fourth pereiopod short, with fine granules and short hairs near the tip. Carpus as long as propodus.

Male abdomen consisting of 5 segments (3rd-5th fused): first 1.5 times as long as second. Sixth segment 1.15 times longer than broad. Telson bluntly triangular, broader than long.

Male first pleopods moderately stout, basal half thicker than distal, gradually narrowed distally, slightly produced at distal 1/7, and both borders of distal end with some spines. Male second pleopods slender, tip sharp.

ETYMOLOGY. — The name is formed by a combination of the Latin *dilatus* (expanded) and *dens* (tooth), in reference to the shape of the exorbital teeth.

REMARKS. — The new species is similar to *Ethusa sexdentata* (Stimpson, 1858) in the shape of the carapace, but can easily be distinguished from it by the exorbital teeth being broader than long, its outer border converging inwards, the symmetrical male chelipeds, and the form of the male first pleopod. *Ethusa dilatidens* is also similar to *E. obliquidens* Chen, 1993, but differs from the latter in having the exorbital teeth longer than broad ; the telson of male abdomen broadly triangular or semi-circular ; the first segment 1.5 times longer than the second; and the distal end of first pleopods blunty rounded.

Ethusa indica Alcock, 1894

Ethusa indica Alcock, 1894: 405 ; 1896: 283. — ALCOCK & ANDERSON, 1895, pl. 14, fig. 2. — CHEN, 1993: 324. — NAGAI, 1995: 60, pl. 1, fig. 6.

MATERIAL EXAMINED. — **Indonesia**. *Kai Islands*. KARUBAR: st. CP 12,05°23'S, 132°37'E, 436-413 m, 23.10.1991: 1 ♂ 12.3 x 12.2 mm ; 3 ♀ 9.0 x 9.0 - 13.0 x 12.9 mm (MNHN-B 22867). — St. CP 35, 06°08'S, 132°45'E, 390-502 m, 27.10.1991: 1 ♂ 5.8 x 5.6 mm (MNHN-B 22872).

Tanimbar Islands. KARUBAR: st. CP 38, 07°40'S, 132°27'E, 620-666 m, 28.10.1991: 1 ♂ 5.8 x 5.8 mm (MNHN-B 22868). — St. CP 53, 08°18'S, 131°41'E, 1026-1053 m, 30.10.1991: 1 ovig. ♀ 8.6 x 8.7 mm (MNHN-B 22871). — St. CP 54, 08°21'S, 131°43'E, 836-869 m, 30.10.1991: 1 ♂ 8.4 x 8.3 mm, 10 ♀ (2 ovig.) 10.5 x 10.8 - 12.0 x 12.0 mm (MNHN-B 22862). — St. CC 56, 08°16'S, 131°59'E, 552-549 m, 31.10.1991: 2 ♂ 5.0 x 4.9 - 5.9 x 5.9 mm (MNHN B 22864). — St. CC 57, 08°19'S x 131°53'E, 603-620 m, 31.10.1991: 4 ♂ 5.5 x 5.4 - 6.5 x 6.4 mm ; 1 ♂ 8.0 x 8.0 mm (MNHN-B 22857). — St. CP 59, 08°20'S, 132°11'E, 399-405 m, 31.10.1991: 7 ♀ (3 ovig.) 7.4 x 7.7 - 9.7 x 10.3 mm (MNHN-B 22856). — St. CP 62, 09°11'S, 132°42'E, 246-253 m, 01.11.1991: 1 ♂ 6.5 x 6.5 mm, 2 ♀ 7.0 x 7.1 - 7.2 x 7.5 mm (POLIPI). — St. CP 69, 08°42'S, 131°53'E, 356-368 m, 02.11.1991: 1 ♀ 7.0 x 8.0 mm (MNHN-B 22873). — St. CP 70, 08°41'S, 131°47'E, 410-413 m, 02.11.1991: 4 ♂ 6.7 x 6.7 - 7.0 x 8.0 mm, with parasitic Isopoda (MNHN-B 22869). — St. CP 71, 08°38'S, 131°44'E, 477-480 m, 02.11.1991: 3 ♂ 6.3 x 6.1 - 6.5 x 6.6 mm, 5 ♀ 7.0 x 7.2 - 7.9 x 8.0 mm (MNHN-B 22866). — St. CP 73, 08°29'S, 131°33'E, 840-855 m, 02.11.1991: 1 ovig. ♀ 10.9 x 11.0 mm (POLIPI). — St. CP 75, 08°46'S, 131°36'E, 400 m, 03.11.1991: 2 ♂ 6.0 x 6.3 - 6.0 x 6.5 mm, 2 ♀ 7.0 x 7.0 - 8.1 x 8.2 mm (MNHN-B 22858). — St. CP 76, 08°50'S, 131°33'E, 400-401 m, 03.11.1991: 1 ♂ 6.3 x 6.3 mm, 1 ♀ 7.0 x 7.2 mm (POLIPI). — St. CP 87, 08°47'S, 130°49'E, 1017-1024 m, 05.11.1991: 2 ♀ 8.3 x 8.4 mm - 8.5 x 8.5 mm (MNHN-B 22859). — St. CP 89, 08°39'S, 131°08'E, 1048-1084 m, 05.11.1991: 4 ♂ 7.8 x 7.4 - 9.0 x 8.9 mm, 6 ♀ (2 ovig.) 8.5 x 8.5 - 10.8 x 11.0 mm (MNHN-B 22860). — St. CP 91, 08°44'S, 131°05'E, 884-890 m, 05.11.1991: 2 ♂ 7.4 x 7.2 - 7.5 x 7.3 mm, 8 ♀ 8.0 x 8.0 - 10.3 x 10.3 mm (MNHN-B 22863).

DISTRIBUTION. — This species is very common in the Indo-Pacific Region, ranging from the Maldive Islands and Sri Lanka eastward to the Philippines, China and Japan, and southward to Indonesia and New Caledonia.

Ethusa indonesiensis sp. nov.

Fig. 4

MATERIAL EXAMINED. — **Indonesia.** *Kai Islands.* KARUBAR: st. DW 18, 05°18'S, 133°01'E, 205-212 m, 24.10.1991: 1 ♂ holotype 7.5 x 7.5 mm (MNHN-B 22888).

DESCRIPTION. — Carapace as long as broad, dorsal surface covered with very fine granules and short pubescence. Grooves shallow and broad. Regions distinct: protogastric, metabranchial and cardiac regions strongly convex, mesogastric, metagastric, urogastric and intestinal regions slightly convex. Posterior part of orbit and mid-line of front depressed. Front divided into 4 subequal teeth. Exorbital teeth short and broad at base, distal ends sharp.

Male chelipeds very unequal: merus of larger cheliped 3 times longer than high, palm swollen, longer than high. Fingers shorter than palm, cutting edges without teeth ; merus of smaller cheliped 4 times as long as high, palm twice as long as high. Fingers longer than palm, cutting edges without teeth.

Third pereiopods longest, meri 7 times longer than high. Propodi slightly shorter than dactyli and 5.5 times longer than high. Dactyli claw-shaped.

Male abdomen consisting of five segments (3rd-5th segments fused): first as long as second and sixth as long as telson. Telson blunty triangular.

Male first pleopods stout, basal 4/5 stouter, distal part tapered and with some spines. Second pleopods longer than first, distal half lamelliform.

ETYMOLOGY. — This species is named after the country where it has been found, Indonesia.

REMARKS. — This species is similar to *Ethusa paragymaea* Chen, 1993 but differs from the latter in having the carapace slightly longer, the male first pleopods with a foot-shaped tip, and the palm of the smaller cheliped as long as the fingers.

Ethusa longidentata sp. nov.

Fig. 5

MATERIAL EXAMINED. — **Indonesia.** *Kai Islands.* KARUBAR: st. DW 28, 05°31'S, 132°54'E, 448-467 m, 26.10.1991: 1 ♂ holotype 6.4 x 6.0 mm (MNHN-B 22884); 1 ♀ paratype 7.0 x 7.0 mm (MNHN-B 22889).

DESCRIPTION. — Carapace longer than broad in male, as long as broad in female, dorsal surface covered with fine granules, borders of exorbital and frontal teeth with sharp granules. Grooves and regions distinct, posterior part (behind frontal and orbital regions) concave. Protogastric and mesogastric regions slightly convex, metagastric and urogastric regions depressed. Cardiac-intestinal and branchial regions convex. Front divided into 4 teeth by one V-shaped and 2 U-shaped notches. Exorbital teeth long and acute, stouter in male than in female.

Merus, carpus and palm of male cheliped (right only) covered with fine granules. Palm longer than high and slightly shorter than fingers. Fingers smooth, cutting edges without teeth.

Pereiopods covered with fine granules. Third pleopod longest, merus of medium length, 4 times (right), 5 times (left) as long as high. Carpus long. Propodus 3.8 times as long as high. Dactylus longer than propodus. Merus of P2 4 times and palm 3 times longer than high. Last two legs slender and short.

Male abdomen with fine granules, consisting of five segments (3rd-5th fused): first segment stout, 3 times as long as second. Fused segments trapezoid, base swollen. Sixth segment rectangular. Telson bluntly rounded.

Male first pleopods stout, slightly curved, twisted and gradually narrowed from base to distal end: distal part with spines. Second pleopods slender, distal end thin and sharp.

ETYMOLOGY. — The name is formed by a combination of the Latin *longus* (long) and *dentata* (toothed), in reference to the shape of the exorbital tooth.

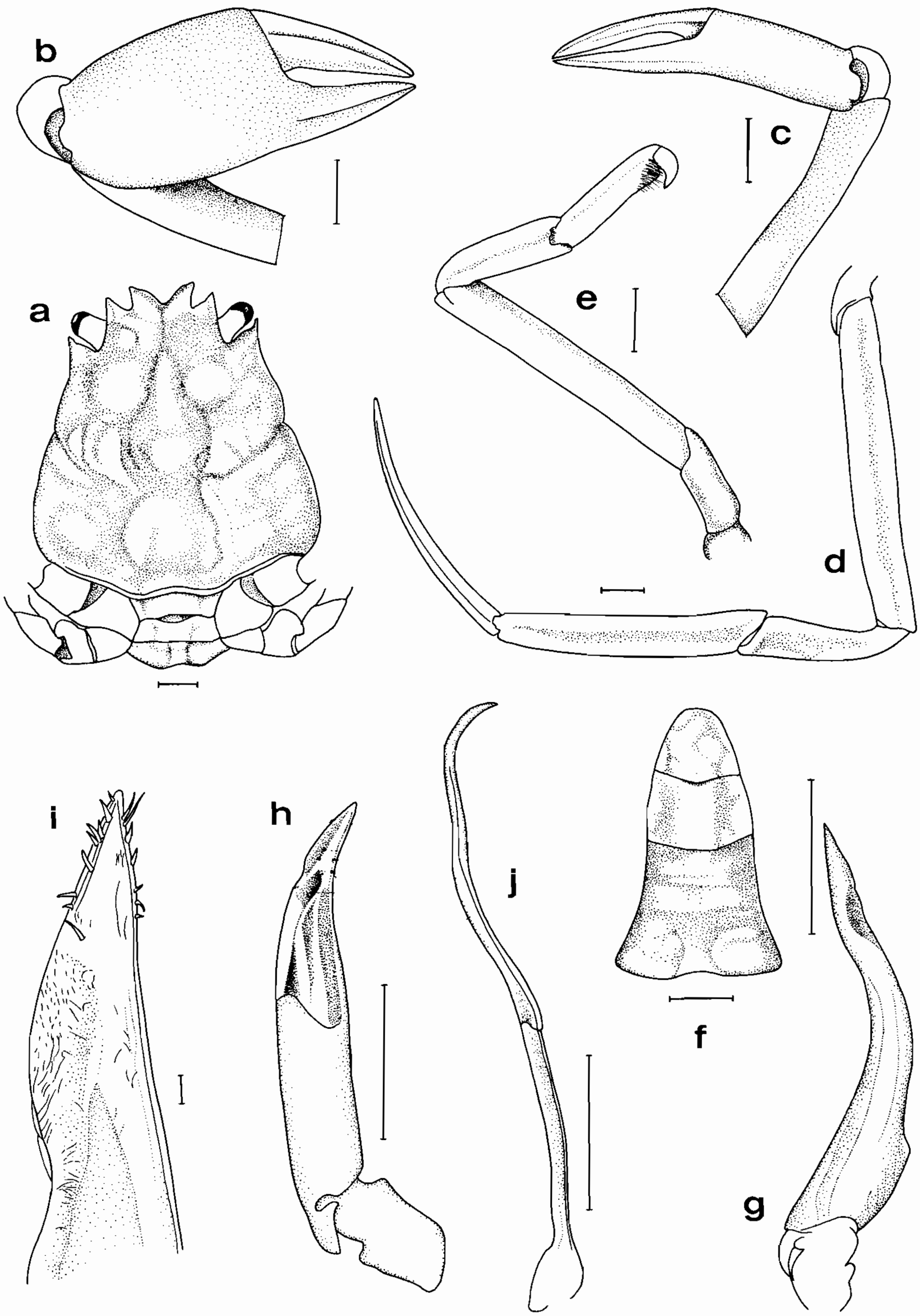

FIG. 4. — *Ethusa indonesiensis* sp. nov. ♂ holotype (MNHN-B 22888): **a**, carapace; **b**, larger cheliped; **c**, smaller cheliped; **d**, third pereiopod; **e**, fifth pereiopod; **f**, male abdomen; **g-i**, first pleopod; **j**, second pleopod. Scales: a-g, j = 1 mm; i = 0.1 mm.

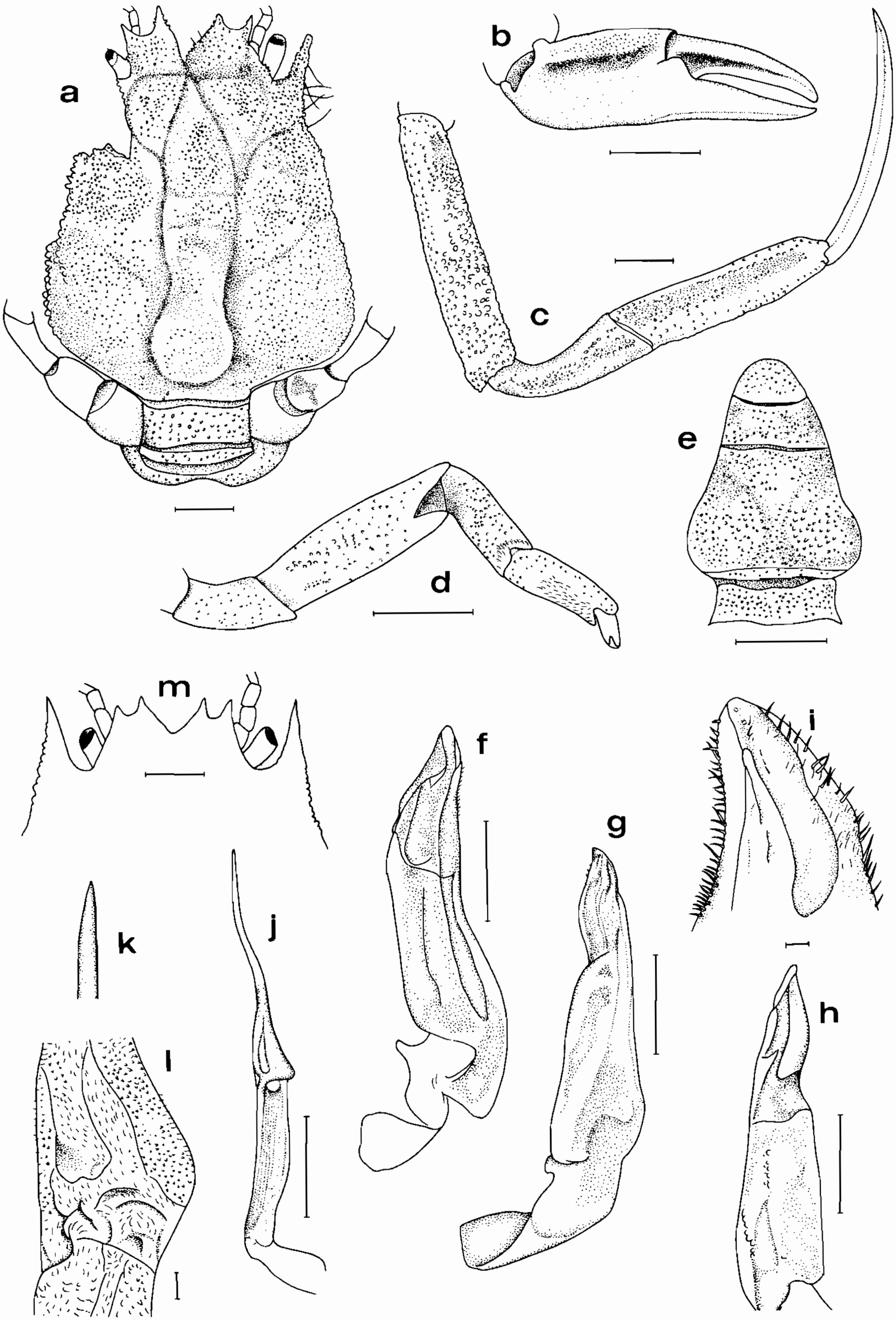

FIG. 5. — *Ethusa longidentata* sp. nov. **a-l**: ♂ holotype (MNHN-B 22884): **a**, carapace (damaged); **b**, cheliped; **c**, third pereiopod; **d**, fifth pereiopod; **e**, abdomen; **f-i**, first pereiopod; **j-l**, second pereiopod. — **m**: ♀ paratype (MNHN-B 22889), anterior portion of carapace. Scales: a-h, j, m = 1 mm; i, k-l = 0.1 mm.

REMARKS. — This new species is similar to *Ethusa makasarica* Chen, 1993 but they can be distinguished as follows:

	Ethusa makasarica	*Ethusa longidentata*
Carapace	pubescent and granular	granular and hairless
First two segments of male abdomen	first 1.28 times as long as second	first 3 times as long as second
Male first pleopods	flat and thin	stout

Ethusa sexdentata (Stimpson, 1858)

Dorripe sexdentata Stimpson, 1858: 163.
Ethusa sexdentata - STIMPSON, 1907: 168, pl. 19, fig. 4. — CHEN, 1993: 335, fig. 14. — NAGAI, 1995: 59, pl. 1, fig. 4.

MATERIAL EXAMINED. — **Indonesia**. *Kai Islands*. KARUBAR: st. CP. 25, 05°30'S, 132°52'E, 336-346 m, 26.10.1991: 1 ♂ 13.4 x 13.0 mm (POLIPI).
Tanimbar Islands. KARUBAR: st. CP. 79, 09°16'S, 131°22'E, 239-250 m, 03.11.1991: 2 ♀ 8.0 x 8.1 mm, 9.5 x 9.5 mm, ovig. (MNHN-B 22880).

DISTRIBUTION. — Japan, China, Philippines, Indonesia, New Caledonia, Andaman Sea and Nicobar Islands.

Genus ***ETHUSINA*** Smith, 1884

Ethusina bicornuta sp. nov.

Fig. 6

MATERIAL EXAMINED. — **Indonesia**. *Tanimbar Islands*. KARUBAR: st. CP 87, 08°47'S, 130°49'E, 1017-1024 m, 05.11.1991: 1 ♂ holotype 7.6 x 7.0 mm (MNHN-B 22885).

DESCRIPTION. — Carapace covered with fine sparse granules and pubescence, longer than broad. Grooves and regions distinct: protogastric, mesogastric and cardiac-intestinal regions slightly convex, but lower than metabranchial regions. Front swollen, divided into 4 teeth by 3 notches: median frontal teeth short, half as long as lateral teeth. Exorbital teeth needle-like, only reaching to base of lateral frontal teeth. Lateral borders of carapace arched. Posterior border slightly convex.

Chelipeds slightly unequal, right somewhat larger than left: right palm 1.43 times (left 1.54 times) as long as high. Both palms as long as fingers. Right movable finger with blunt, obscure teeth and a large tooth near base ; immovable finger with blunt teeth ; cutting edges of smaller cheliped with blunt teeth.

Second and third pereiopods smooth and hairless. Third pereiopod longest: merus 9 times as long as high and propodus 7.5 times as long as high, dactylus very long. Last two pereiopods slender and short, with short, sparse hairs.

Male abdomen consisting of five segments (3rd-5th fused): first two segments subequal. Fused segment depressed at middle of base. Sixth segment rectangular. Telson semicircular.

Male first pleopods stout, basal 2/3 swollen, twice as broad as distal 1/3, distal end divided into two horns by a V-shaped notch.

ETYMOLOGY. — The name is formed by a combination of the latin *bis* (two) and *cornutus* (horned), in reference to the distal end of the first pleopods.

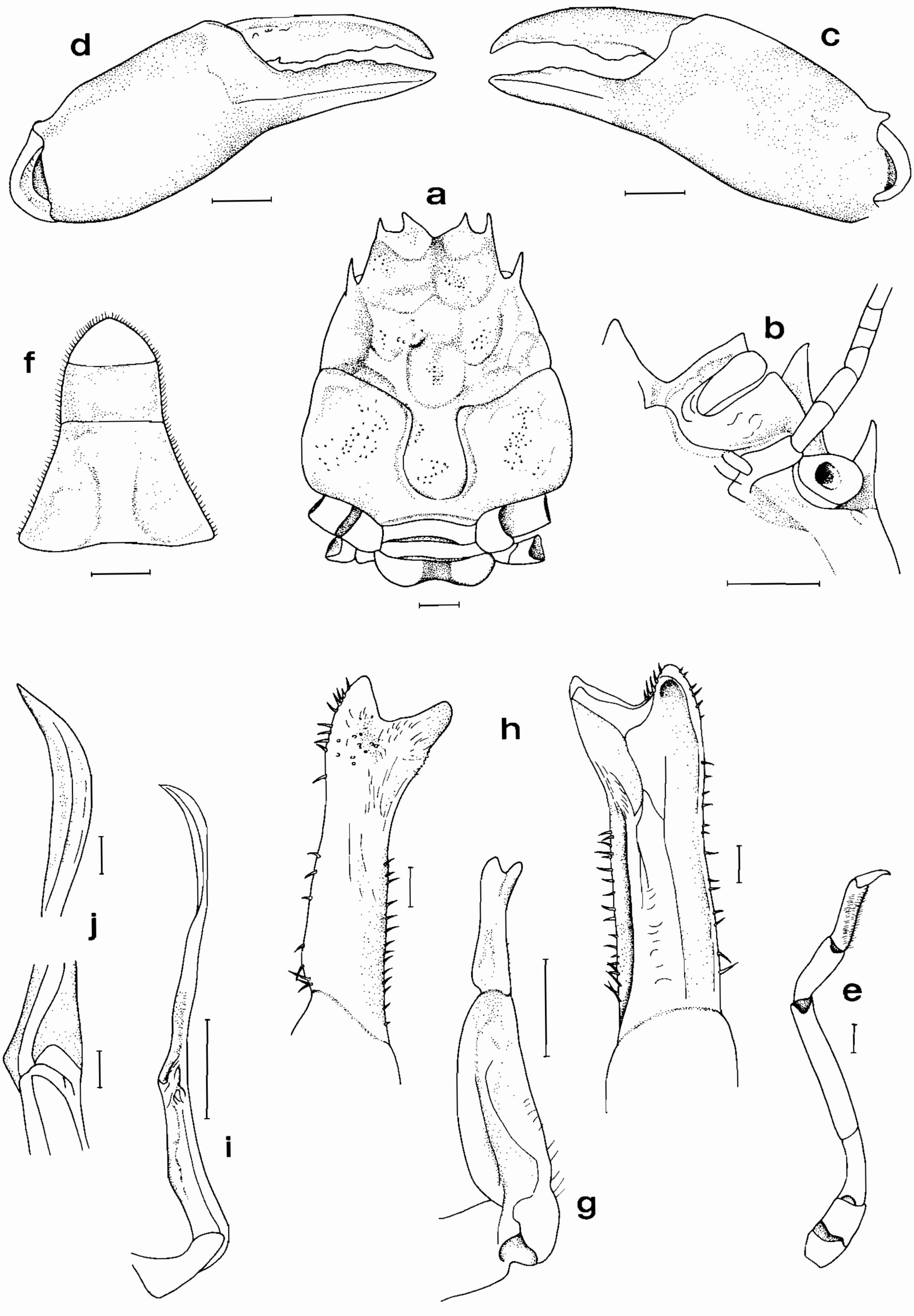

FIG. 6. — *Ethusina bicornuta* sp. nov., ♂ holotype (MNHN-B 22885): **a**, carapace; **b**, anterior portion of carapace (ventral); **c**, larger cheliped; **d**, smaller cheliped; **e**, fifth pereiopod; **f**, abdomen; **g-h**, first pleopod; **i-j**, second pleopod. Scales: a-g, i = 1 mm; h, j = 1.1 mm.

REMARKS. — This new species closely resembles *Ethusina investigatoris* Alcock, 1895, but differs from the latter in having shorter exorbital and lateral frontal teeth, the first two segments of male abdomen subequal, and the distal end of the first pleopod with two horns.

Ethusina brevidentata Chen, 1993

Ethusina brevidentata Chen, 1993: 337, fig. 16.

MATERIAL EXAMINED. — **Indonesia**. *Kai Islands*. KARUBAR: st. CC 21, 05°14'S, 133°00'E, 688-694 m, 25.10.1991: 1 ♀ 8.5 x 8.7 (MNHN-B 22882).

DISTRIBUTION. — Known only from New Caledonia and Indonesia.

Ethusina desciscens Alcock, 1896

Ethusina desciscens Alcock, 1896: 286. — ALCOCK & MCARDLE, 1903: 62, fig. 2,2a. — CHEN, 1993: 337.

MATERIAL EXAMINED. — **Indonesia**. *Tanimbar Islands*. KARUBAR: st. CP 53, 08°18'S, 131°41'E, 1026-1053 m, 30.10.1991: 1 ovig. ♀ 8.9 x 9.3 mm (MNHN-B 22876). — St. CP 87, 08°47'S, 130°49'E, 1017-1024 m, 05.11.1991: 1 ♀ 8.4 x 8.5 mm (MNHN-B 22875). — St. CP 89, 08°39'S, 131°08'E, 1058-1084 m, 05.11.1991: 3 ovig. ♀ 9.0 x 9.6 mm, 9.1 x 9.7 mm, 9.9 x 10.1 mm (MNHN-B 22877). — St. CP 91, 08°44'S, 131°05'E, 884-891 m, 05.11.1991: 2 ♀ 9.0 x 9.2, 9.2 x 9.4 mm (ovig.) (POLIPI).

DISTRIBUTION. — China, the Philippines, Indonesia, Andaman Sea, Laccadive Sea and Madagascar.

Ethusina investigatoris Alcock, 1896

Ethusina investigatoris Alcock, 1896: 285. — ALCOCK & MCARDLE, 1903: fig. 3,3a. — CHEN, 1986: 135, fig. 14.

MATERIAL EXAMINED. — **Indonesia**. *Tanimbar Islands*. KARUBAR: st. CP 87, 08°47'S, 130°49'E, 1017-1024 m, 05.11.1991: 2 ♂ 7.4 x 7.2, 7.9 x 7.6 mm (MNHN-B 22883).

DISTRIBUTION. — East China Sea, Bay of Bengal and Laccadive Sea, at depths of 1115 to 2378 m.

Ethusina pubescens Chen, 1993

Ethusina pubscens Chen, 1993: 341, fig. 19.

MATERIAL EXAMINED. — **Wallis and Futuna Islands**. MUSORSTOM 7: st. DW 565, 11°47'04"S, 178°25'03"W, 900 m, 20.05.1992: 1 ♂ 7.6 x 7.5 mm (MNHN-B 22879).
New Caledonia. BATHUS 3: st. CP 842, 23°05'S, 166°48'E, 830 m, 01.12.1993: 1 ♂ 10.9 x 11.0 mm (MNHN-B 22878).

DISTRIBUTION. — New Caledonia, Wallis and Futuna Islands.

ACKNOWLEDGEMENTS

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14

Echinodermata Crinoidea : Les Pentacrines récoltées lors de la campagne KARUBAR en Indonésie

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RÉSUMÉ

Les crinoïdes pédonculés recueillis par la campagne KARUBAR (îles Kai et Tanimbar : Indonésie) sont des Pentacrines (Pentacrinidae) appartenant au genre *Saracrinus*. Trois espèces dont une nouvelle (*S. moosai*) sont décrites. Cette faible diversité détonne avec l'abondante richesse mise en évidence par les auteurs du début du siècle dans les eaux indonésiennes. Cette faune s'étage entre 210 et 430 m de profondeur. Le matériel important (165 spécimens) permet, entre autres, de préciser le champ de variation des principaux caractères morphologiques de la couronne de bras et du pédoncule de ces trois espèces et de les comparer avec les Pentacrines du reste du sud-ouest Pacifique.

ABSTRACT

Echinodermata Crinoidea: Pentacrinidae collected during the KARUBAR Cruise in Indonesia.

The stalked crinoids collected during the KARUBAR cruise (Kai and Tanimbar Islands: Indonesia) belong to the genus *Saracrinus* (Pentacrinidae). Three species in this genus are described, one of which, *S. moosai*, is new. The samples come from depths between 210 and 430 m. This pentacrinid fauna is abundant (165 specimens) but less diverse than the rich fauna collected elsewhere in Indonesia (Sulu Sea, Celebes Sea, Timor Sea, Banda Sea, Java Sea). Twelve species of pentacrinid were sampled by previous cruises: *Saracrinus angulatus*, *S. suluensis*, *S. acutus*, *S. cingulatus*, *S. murrayi*, *S. batheri*, *S. nobilis*, *S. superbus*, *S. varians*, *Metacrinus serratus*, *Diplocrinus sibogae*, *Hypalocrinus naresianus*. Data on morphological features, biometry, arm branching and ossicle articulations are given for each species collected during the KARUBAR cruise. Stalk, arm and pinnular joints were observed using scanning electron microscopy with regard to their taxonomic importance. As numerous individuals of each species were collected, it was possible to study the variation of crown and stem characters. It appears that the stems and arms of these species, and especially for *S. angulatus*, exhibit intraspecific polymorphism. One of the consequences of these studies is a reduction of the number of recognised species. Some of these forms are interpreted as a consequence of ecophenotypic or geographical variations. Thus, for example, *S. suluensis*, *S. acutus*, *S. cingulatus* and *S. batheri* are synonyms of *S. angulatus*, while *S. superbus* and *S. varians* are synonyms of *S. nobilis*.

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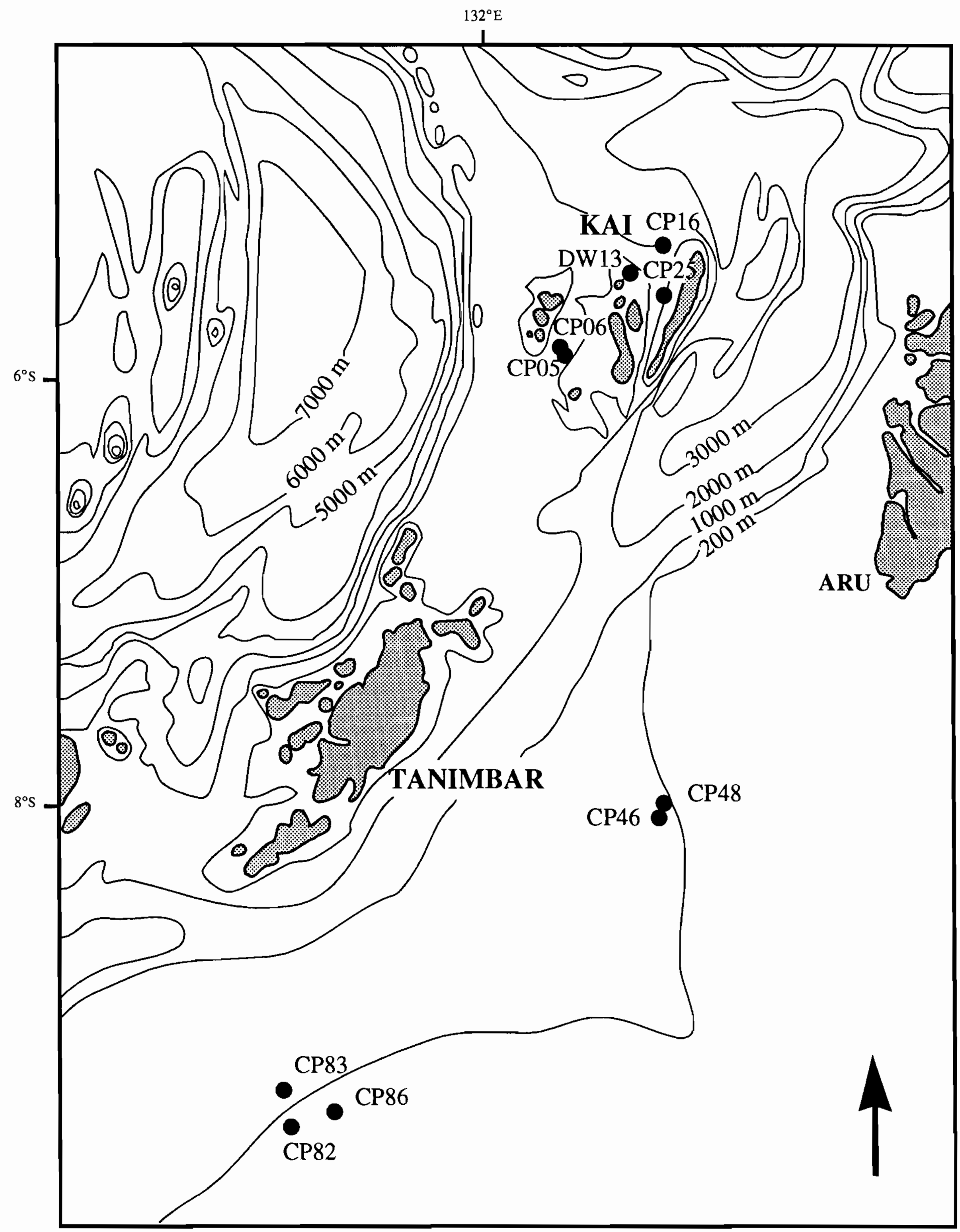

FIG. 1. — Localisation des stations où des *Saracrinus* (Pentacrines) ont été récoltés lors de la mission KARUBAR.

SOMMAIRE

INTRODUCTION

Les différentes expéditions du siècle dernier [celles du *"Challenger"*, 1873-1876 (P.H. CARPENTER, 1884) et de la *"Siboga"*, 1899-1900 (L. DÖDERLEIN, 1907, A.H. CLARK, 1908a)] et la campagne océanographique danoise de 1922 (Th. MORTENSEN, 1923) ont permis de récolter, pour la première fois, un matériel assez abondant de crinoïdes pédonculés dans les eaux indonésiennes. Parmi ce matériel, le genre *Saracrinus*, autrefois décrit sous le nom de *Metacrinus*, était particulièrement bien représenté. L'extrême variabilité de ces organismes avait conduit les auteurs à une multiplication du nombre des espèces. Des travaux récents (ROUX, 1981 ; BOURSEAU & ROUX, 1989 ; AMÉZIANE-COMINARDI, 1991) nous conduisent à regrouper le matériel récolté lors du siècle dernier en trois espèces (tabl. 1).

Dénomination ancienne	Auteur	Dénomination actuelle
Metacrinus angulatus	P.H. Carpenter, 1884	**Saracrinus angulatus**
Metacrinus cingulatus	P.H. Carpenter, 1884	
Metacrinus tuberosus	P.H. Carpenter, 1884	
Metacrinus suluensis	L. Döderlein, 1907	
Metacrinus acutus	L. Döderlein, 1907	
Metacrinus batheri	A.H. Clark, 1909a	
Metacrinus nobilis var. *tenuis* var. *sumatranus* var. *timorensis*	P.H. Carpenter, 1884 T. Gislen, 1922 T. Gislen, 1922 T. Gislen, 1922	**Saracrinus nobilis**
Metacrinus murrayi	P.H. Carpenter, 1884	
Metacrinus superbus	P.H. Carpenter, 1884	
Metacrinus varians	P.H. Carpenter, 1884	**Saracrinus varians**

TABLEAU 1. — Inventaire et dénomination actuelle des espèces de Pentacrines récoltées dans les eaux indonésiennes lors des campagnes du siècle dernier.

Une campagne récente (octobre 1991), KARUBAR, s'est déroulée au large des îles Kai, Tanimbar et Aru. Un abondant matériel (165 spécimens récoltés dont 158 mesurés) de crinoïdes pédonculés a été recueilli entre 210 et 430 m de profondeur (fig. 1). Cette faune comporte un seul genre de Pentacrine (*Saracrinus*), réparti en trois espèces dont une est nouvelle pour la science. L'étude de cette faune est conçue comme directement complémentaire de celle des faunes du sud-ouest Pacifique et une comparaison sera établie entre les populations de *Saracrinus* provenant des différentes régions du Pacifique occidental (fig. 2). Grâce au grand nombre de spécimens récoltés, l'analyse quantitative des variations des principaux caractères morphologiques du pédoncule et de la couronne a pu être réalisée. Une telle démarche permet ainsi de cerner la variabilité intraspécifique qui s'avère être importante pour les Pentacrines.

Le lecteur voudra bien se reporter aux ouvrages suivants pour ce qui concerne tout spécialement la morphologie des Pentacrines, leur systématique, leur écologie (ROUX, 1981 ; BOURSEAU & ROUX, 1989 ; BOURSEAU *et al.*, 1991 ; AMÉZIANE-COMINARDI, 1991).

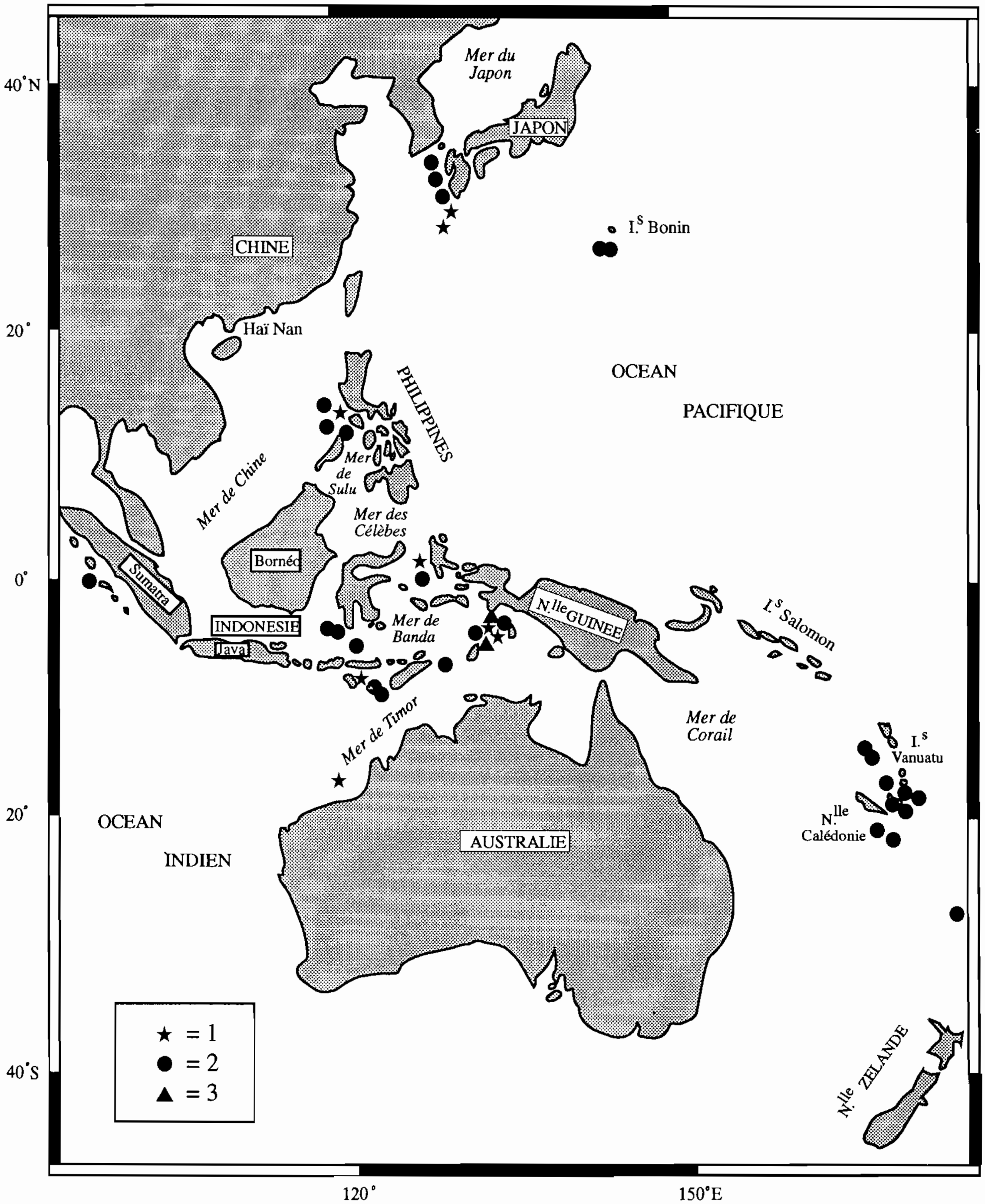

FIG. 2. — Localisation des sites à *Saracrinus* (Pentacrines) dans le Pacifique occidental.
1 = *S. angulatus* ; 2 = *S. nobilis* ; 3 = *S. moosai*.

LISTE DES STATIONS À PENTACRINES

KARUBAR. **Stations situées au large des îles Kai.**

Station CP 05, 22.10.91, 05°49'S-132°18'E, 296-299 m : *Saracrinus nobilis* (11 exemplaires numérotés de sp. n°2 à sp. n°12), *Saracrinus angulatus* (26 exemplaires numérotés de sp. n°1 à sp. n°25 et sp. n°61), *Saracrinus moosai* sp. nov. (24 exemplaires numérotés de sp. n°1 à sp. n°24).

Station CP 06, 22.10.91, 05°49'S-132°21'E, 298-287 m : *Saracrinus nobilis* (2 exemplaires numérotés de sp. n°14 à sp. n°15), *Saracrinus angulatus* (1 exemplaire numéroté sp. n°26).

Station DW 13, 24.10.91, 05°26'S-132°38'E, 417-425 m : *Saracrinus angulatus* (1 exemplaire non mesuré).

Station CP 16, 24.10.91, 05°17'S-132°50'E, 315-349 m : *Saracrinus nobilis* (1 exemplaire numéroté sp. n°13), *Saracrinus angulatus* (27 exemplaires numérotés de sp. n°27 à sp. n°49 et sp. n°58 à sp. n°60), *Saracrinus moosai* sp. nov. (38 exemplaires numérotés de sp. n°25 à sp. n°62).

Station CP 25, 26.10.91, 05°30'S-132°52'E, 336-346 m : *Saracrinus angulatus* (6 exemplaires numérotés de sp. n°50 à sp. n°55).

KARUBAR. **Stations situées entre les îles Aru et Tanimbar.**

Station CP 46, 29.10.91, 08°01'S-132°51'E, 271-273 m : *Saracrinus nobilis* (9 exemplaires numérotés de sp. n°16 à sp. n°22, deux spécimens n'ont pas été mesurés).

Station CP 48, 29.10.91, 08°00'S-132°58'E, 223-218 m : *Saracrinus nobilis* (1 exemplaire numéroté sp. 1).

KARUBAR. **Stations situées au large des îles Tanimbar.**

Station CP 82, 04.11.91, 09°32'S-131°02'E, 219-215 m : *Saracrinus nobilis* (10 exemplaires numérotés de sp. n°23 à sp. n°32), *Saracrinus angulatus* (2 exemplaires numérotés de sp. n°56 à sp. n°57).

Station CP 83, 04.11.91, 09°23'S-131°00'E, 285-297 m : *Saracrinus nobilis* (1 exemplaire numéroté sp. 33).

Station CP 86, 04.11.91, 09°26'S-131°13'E, 225-223 m : *Saracrinus nobilis* (5 exemplaires numérotés de sp. n°34 à sp. n°35, trois spécimens n'ont pas été mesurés).

ÉTUDE SYSTÉMATIQUE

Genre *SARACRINUS* A.H. Clark, 1923

Rappelons rapidement les principales caractéristiques du genre *Saracrinus*, avant d'entreprendre une analyse plus détaillée des différentes espèces : la première division des bras se situe, le plus fréquemment, au niveau de la quatrième brachiale (I Br 4 ax), il s'ensuit que le nombre de primibrachiales (I Br) est toujours inférieur à 6 ; les synostoses (articulations non fonctionnelles) des primibrachiales sont localisées au niveau de la première et de deuxième primibrachiale (I Br 1+2).

Saracrinus angulatus (Carpenter, 1884)

Fig. 3-6, 11-12

SYNONYMIE (limitée aux références importantes).

Metacrinus angulatus Carpenter, 1884 : 344. — A. H. CLARK, 1908b : 671. — ROUX, 1977 : 45.
Metacrinus tuberosus Carpenter, 1884 : 369.
Metacrinus cingulatus Carpenter, 1884 : 347.
Metacrinus acutus Döderlein, 1907 : 35.
Metacrinus suluensis Döderlein, 1907 47.
Metacrinus batheri A. H. Clark, 1909 : 85.
Saracrinus acutus - A. H. CLARK, 1923 : 9.
Saracrinus angulatus - A. H. CLARK, 1923 : 9. — ROUX, 1981 : 484. — BOURSEAU & ROUX, 1989 : 117. — AMÉZIANE-COMINARDI, 1991 : 73.

N° du spécimen Station	Sp. 1 CP 05	Sp. 2 CP 05	Sp. 3 CP 05	Sp. 4 CP 05	Sp. 5 CP 05	Sp. 6 CP 05	Sp. 7 CP 05	Sp. 8 CP 05	Sp. 9 CP 05	Sp. 10 CP 05	Sp. 11 CP 05	Sp. 12 CP 05
Diamètre proximal	6,9	6,4	5,0	7,0	6,5	7,1	6,8	7,4	6,6	6,5	6,9	5,9
Diamètre distal	6,3	6,3	5,0	6,5	6,1	6,5	6,6	6,9	6,6	5,7	6,5	5,8
Nombre d'internodales*	$7^{13};8^{2}$ 9^{2}	$8^{3};10^{1}$	$7^{6};8^{8};9^{1}$	7^{21}	$7^{8};8^{5}$	$7^{4};8^{14};9^{1}$	$7^{4};8^{9}$	$6^{4};7^{24}$ 8^{3}	$7^{21};8^{2}$	$7^{26};8^{1}$	$7^{11};8^{1}$	$7^{21};8^{1}$
Longueur noditaxis	10,7	10,1	11,0	8,9	8,8	10,7	10,5	9,3	10,6	10,0	10,8	8,6
Epaisseur maximale de l'internodale	1,0	1,1	1,2	1,4	1,3	1,2	1,1	1,1	1,1	1,4	1,2	1,2
Epaisseur maximale de la nodale	1,8	1,4	1,5	2,0	2,0	1,8	1,9	1,5	1,4	1,7	1,6	1,4
Dernier noditaxis avec pores	18	15	14	18	15	18	22	18	17	18	18	18
Longueur des cirres	36,7	39,4	36,8	41,8	44,2	47,9	53,0	42,6	47,7	45,9	48,1	43,6
Nb d'articles/cirre	48	50	44	49	50	47	47	48	47	46	45	58
Longueur couronne	115	112	85	120	118	-	125	164	-	-	164	-
Nombre de bras	>31	>60	>30	>76	>58	>51	>65	>48	>58	>52	>78	>61
IBr ax*	4^{5}	$4^{3};5^{1};8^{1}$	$4^{4};6^{1}$	4^{5}	4^{5}	4^{5}	4^{5}	4^{5}	$4^{4};5^{1}$	4^{5}	4^{5}	$4^{4};5^{1}$
IIBr ax*	$7^{6};8^{2}$	$5^{1};7^{1};8^{1}$ $9^{4};11^{3}$	$7^{1};9^{4}$	$7^{6};8^{2};9^{2}$	$7^{2};8^{2}$ $9^{6};10^{1}$	$9^{7};10^{1}$ 11^{1}	$7^{7};8^{1};9^{2}$	$5^{1};6^{1}$ $7^{6};9^{2}$	$7^{3};9^{1}$ $10^{5};11^{1}$	$7^{3};8^{3}$ $9^{2},10^{1}$	$6^{6};7^{4}$	$6^{1};7^{4}$ $9^{4};8^{1}$
IIIBr ax*	$13^{6};14^{2}$ $15^{1};17^{3}$	$9^{3};11^{4}$ $12^{2};13^{5}$ $15^{3};17^{1}$	$11^{7};14^{1}$	$9^{5};11^{7};13^{4}$ $14^{1};15^{3}$	$11^{11};12^{1}$ $13^{4};14^{1}$ 15^{3}	$9^{2};10^{1}$ $11^{11};13^{2}$	$2^{1};9^{1};10^{1}$ $11^{7};12^{1};13^{5}$ $15^{3};16^{1}$	$9^{7};11^{6}$ 13^{2}	$9^{3};11^{10}$ $12^{2};13^{1}$ 14^{1}	$9^{3};10^{2}$ $11^{6};12^{1}$ 13^{3}	$11^{4};12^{2};13^{9}$ $14^{1};15^{1};16^{1}$	$9^{6};11^{6}$ 13^{4}
IVBr ax*	-	$11^{1};13^{3}$ $14^{1};15^{4}$ $16^{1};17;19^{5}$ $21^{1};22^{2}$	$15^{1};16^{2}$ $17^{1};19^{2}$ 21^{1}	$9^{1};11^{5};13^{8}$ $15^{9};17^{4};18^{1}$ $19^{1};21^{2};27^{1}$	$13^{4};15^{6}$ $16^{1};17^{3}$ $18^{1};19^{2}$ 23^{1}	$12^{1};15^{4}$ $17^{1};18^{1}$ $19^{2};21^{9}$ 23^{4}	$9^{1};10^{1};14^{1}$ $15^{3};17^{4};18^{1}$ $19^{6};21^{1}$ 23^{2}	$15^{4};17^{7}$ $18^{1};29^{1}$	$11^{2};14^{2};15^{3}$ $16^{1};17^{6};18^{1}$ $19^{1};21^{2};23^{2}$ 25^{1}	$11^{1};13^{2}$ $15^{2};16^{1}$ $17^{6};19^{1}$	$11^{1};13^{1};14^{1}$ $15^{8};16^{1};17^{6}$ $18^{1};19^{6};21^{5}$ $22^{1};23^{1};25^{1}$	$15^{1};17^{7}$ $18^{1};19^{4}$ $21^{1};23^{2}$ 27^{2}
VBr ax*	-	-	-	$15^{2};19^{2};22^{1}$	-	-	$15^{1};18^{2}$ 21^{1}	-	-	-	$17^{2};19^{2}$ $21^{1};25^{1}$	-
Largeur IBr	4,4	4,6	4,6	6,3	5,1	5,6	5,7	6,2	4,6	4,9	6,1	5,5
Largeur IIBr	4,3	3,7	3,0	4,0	3,4	3,7	4,1	4,5	3,6	3,5	4,4	3,1
Largeur IIIBr	2,8	2,8	2,2	2,9	2,7	2,9	3,2	3,6	2,7	2,6	3,3	2,3
Longueur de P1	21,9	17,8	13,1	19,5	17,3	-	18,1	20,0	19,2	16,7	-	-
Nb d'articles/P1	17	14	11	15	17	-	14	15	23	17	-	-
Longueur de PBr	14,3	13,9	8,5	-	14,5	14,0	12,4	16,9	-	12,5	-	-
Nb d'articles/PBr	22	20	17	-	20	20	20	19	-	20	-	-

TABLEAU 2. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus angulatus* (îles Kai et Tanimbar).
* : en exposant, nombre de cas observés ; ++ : pores interarticulaires présents sur toute la longueur du pédoncule ; les caractères de type continu sont exprimés en mm.

N° du spécimen Station	Sp. 13 CP 05	Sp. 14 CP 05	Sp. 15 CP 05	Sp. 16 CP 05	Sp. 17 CP 05	Sp. 18 CP 05	Sp. 19 CP 05	Sp. 20 CP 05	Sp. 21 CP 05	Sp. 22 CP 05	Sp. 23 CP 05
Diamètre proximal	6,3	7,1	7,5	6,1	6,7	6,4	5,9	6,2	6,2	6,1	6,5
Diamètre distal	5,4	7,0	6,7	5,8	6,5	5,9	6,0	6,7	5,5	5,9	5,6
Nombre d'internodales*	$6^{4};7^{12}$	7^{20}	$7^{8};8^{13};9^{3}$ $10^{1};11^{2};12^{1}$	$7^{10};8^{1}$	7^{27}	$7^{12};8^{5}$	$8^{10};9^{2}$	$7^{6};8^{8}$	$7^{4};8^{10};9^{1}$	$6^{7};7^{23}$	$7^{14};8^{10}$
Longueur noditaxis	9,2	11,4	13,4	7,8	9,7	8,1	9,7	11,1	10,8	8,2	10,1
Epaisseur maximale de l'internodale	1,2	1,5	1,2	1,2	1,4	1,3	1,2	1,1	1,1	1,3	1,2
Epaisseur maximale de la nodale	1,6	2,0	1,9	1,5	1,6	1,6	1,5	1,6	1,6	1,5	2,1
Dernier noditaxis avec pores	15	16	++	18	15	19	17	19	14	16	16
Longueur des cirres	40,8	45,0	44,3	30,6	43,2	44,3	39,9	43,,0	40,7	47,0	46,4
Nb d'articles/cirre	47	47	52	34	46	43	42	42	52	54	45
Longueur couronne	115	148	140	-	135	-	110	122	-	115	-
Nombre de bras	>63	>45	>56	>24	62	-	>77	>61	>60	>81	>64
IBr ax*	$3^{1};4^{4}$	4^{5}	4^{5}	$3^{1};4^{2};5^{1}$	4^{5}	-	4^{5}	$4^{4};5^{1}$	4^{5}	4^{5}	4^{5}
IIBr ax*	$5^{1};6^{2}$ $7^{5};8^{1}$	$7^{5};9^{3}$	$5^{1};6^{3};7^{4}$ $8^{1};9^{1}$	$1^{1};7^{4}$ $8^{1};10^{1}$	$5^{2};6^{3};7^{2}$ $8^{2};9^{1}$	-	$7^{6};9^{4}$	$7^{9};8^{1}$	$7^{4};8^{2};9^{4}$	$6^{3};7^{5};9^{2}$	$6^{4};7^{2};9^{4}$
IIIBr ax*	$9^{2};11^{5}$ $12^{3};13^{6}$ 14^{1}	$9^{2};11^{2}$ $13^{3};14^{2}$	$11^{2};13^{7}$ $14^{1};15^{1}$	$7^{1};8^{1}$ 12^{1}	$9^{1};11^{7};12^{1}$ $13^{7};14^{1}$ $15^{1};16^{3}$	-	$9^{2};10^{1};11^{9}$ $12^{1};13^{5};15^{1}$ 17^{1}	$9^{1};11^{7};12^{1}$ $13^{8};15^{1}$	$11^{2};12^{3}$ $13^{8};14^{3}$	$9^{3};10^{2};11^{8}$ $12^{4};13^{2};15^{1}$	$9^{2};11^{6};13^{6}$ $15^{4};17^{1}$
IVBr ax*	$14^{1};15^{6}$ $17^{4};18^{2}$ $19^{7};21^{3}$ $23^{2};27^{1}$	-	$13^{1};15^{4};16^{1}$ $17^{3};18^{1};19^{2}$ $20^{1};21^{2};22^{1}$ 25^{1}	$11^{1};12^{1}$ $13^{1};17^{1}$	$15^{7};17^{5}$ $18^{2};19^{2}$ $23^{6};25^{2}$	-	$11^{1};12^{1};13^{6}$ $15^{2};16^{2};17^{7}$ $19^{12};21^{1}$ 23^{3}	$9^{1};13^{2};14^{1}$ $15^{1};16^{2};17^{4}$ $19^{1};20^{2};21^{5}$ $23^{2};25^{2};31^{1}$	$15^{3};16^{4};17^{7}$ $18^{2};19^{7};21^{1}$ 25^{1}	$11^{1};12^{2};13^{2};15^{8}$ $17^{6};18^{3};19^{4};21^{3}$ $23^{1};25^{1};27^{2};29^{1}$ 31^{1}	$14^{1};15^{5};17^{3}$ $18^{1};19^{5};20^{2}$ $21^{2};23^{2};27^{1}$ 31^{1}
VBr ax*	-	-	19^{1}	16^{1}	-	-	-	-	-	$15^{1};17^{1};19^{2}$ $23^{1};25^{1}$	-
Largeur IBr	5,6	5,7	6,4	5,7	5,9	-	5,0	5,0	5,2	5,2	4,7
Largeur IIBr	3,9	3,7	4,4	3,4	4,2	-	4,7	4,0	4,1	3,8	3,4
Largeur IIIBr	2,7	2,8	3,4	2,5	3,7	-	2,5	2,9	3,1	2,7	2,1
Longueur de P1	-	-	18,9	16,0	-	-	20,9	-	-	-	-
Nb d'articles/P1	-	-	16	15	-	-	17	-	-	-	-
Longueur de PBr	-	15,2	-	12,2	-	-	-	-	-	-	-
Nb d'articles/PBr	-	26	-	22	-	-	-	-	-	-	-

TABLEAU 3. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus angulatus* (suite). Même légende que celle du tableau 2.

Lors d'un précédent travail (AMÉZIANE-COMINARDI, 1991), je signalais que *Saracrinus angulatus* était une espèce polymorphe. De nombreuses espèces telles que *Saracrinus acutus*, *S. cingulatus*, *S. batheri*, *S. suluensis*, espèces typologiques, exprimaient cette variabilité, raison pour laquelle J.-P. BOURSEAU & M. ROUX (1989) intégraient tous ces taxons au sein de *S. angulatus*. Le faible nombre de spécimens récoltés alors, restreignait notre champ d'investigation, l'apport de quelques spécimens nouveaux m'avait permis de mettre en évidence les points suivants :

- l'espèce *S. tuberosus* correspond également à un variant de *S. angulatus* ;
- la grande variabilité de *S. angulatus* s'exprime aussi bien au niveau des caractères morphologiques externes qu'au niveau des articulations ;
- enfin, bien que les diverses populations de *S. angulatus* du Pacifique occidental soient très proches, elles se différencient les unes par rapport aux autres par au moins une caractéristique. Il semblerait qu'il existe une évolution des caractères morphologiques en fonction de la localité géographique.

Les soixante et un spécimens de *S. angulatus* prélevés au large des îles Kai et Tanimbar vont permettre de fournir un complément appréciable à la compréhension de cette espèce.

DESCRIPTION DE LA MORPHOLOGIE EXTERNE. — Les spécimens indonésiens de *Saracrinus angulatus* tendent à être robustes (fig. 12 A) et leurs principaux caractères morphologiques se trouvent dans les Tableaux 2 à 6.

N° du spécimen Station	Sp. 24 CP 05	Sp. 25 CP 05	Sp. 26 CP 06	Sp. 27 CP 16	Sp. 28 CP 16	Sp. 29 CP 16	Sp. 30 CP 16	Sp. 31 CP 16	Sp. 32 CP 16	Sp. 33 CP 16	Sp. 34 CP 16	Sp. 35 CP 16	Sp. 36 CP 16
Diamètre proximal	6,9	8,1	6,4	5,5	6,9	4,3	7,6	6,9	5,9	3,6	6,6	6,2	5,9
Diamètre distal	6,0	7,7	5,9	5,5	6,5	2,8	5,6	-	5,5	4,9	5,7	6,5	5,2
Nombre d'internodales*	$6^{2};7^{16}$ $8^{7};10^{1}$	$6^{11};7^{39}$	$6^{3};7^{21}$	$7^{10};8^{10};9^{5}$	$6^{1};7^{14}$ 8^{4}	$9^{13};10^{6}$ 11^{1}	$7^{16};8^{9}$ 9^{4}	7^{3}	$7^{12};8^{4}$	$7^{2};8^{4}$ 9^{3}	$7^{13};8^{6}$ 9^{4}	$6^{9};7^{16}$	$6^{3};7^{14}$ 8^{3}
Longueur noditaxis	10,4	7,3	8,5	10,5	9,6	11,2	10,9	-	11,7	11,2	10,0	10,6	10,3
Epaisseur maximale de l'internodale	1,2	1,3	1,2	1,2	1,2	1,2	1,3	-	1,3	1,2	1,4	1,5	1,2
Epaisseur maximale de la nodale	2,0	1,8	1,4	1,4	1,4	1,4	1,7	-	1,7	1,5	1,7	2,0	1,5
Dernier noditaxis avec pores	18	18	16	14	16	17	17	-	17	17	19	20	21
Longueur des cirres	41,7	46,4	46,1	35,5	42,0	36,4	43,0	-	41,8	35,3	37,8	43,7	43,8
Nb d'articles/cirre	52	59	61	40	50	39	47	-	42	50,0	49	50	46
Longueur couronne	-	-	-	100	125	65	150	109	125	120	-	-	153
Nombre de bras	>23	>61	>63	60	66	>26	59	>62	>58	>44	>38	>47	>59
IBr ax*	4^{5}	$4^{4};5^{1}$	$3^{1};4^{4}$	4^{5}	4^{5}	4^{5}	4^{5}	$4^{3};5^{2}$	$4^{4};5^{1}$	$4^{3};5^{2}$	$4^{4};6^{1}$	4^{5}	4^{5}
IIBr ax*	$5^{1};7^{7}$	$6^{3};7^{6}$ 9^{1}	$5^{1};6^{1};7^{3}$ $8^{3};9^{1};11^{1}$	$7^{5};8^{1};9^{4}$	$7^{4};8^{1}$ 9^{5}	$7^{1};8^{1};9^{3}$ $10^{1};11^{1}$	$7^{4};8^{3}$ 9^{3}	$5^{1};8^{3}$ $9^{5};7^{1}$	$7^{2};9^{8}$	$7^{1};8^{1}$ 9^{5}	$7^{5};8^{2}$ 9^{1}	$7^{2};8^{2}$ 9^{5}	$8^{1};9^{7}$ 10^{1}
IIIBr ax*	$13^{1};14^{1}$ 15^{1}	$11^{3};12^{4}$ $13^{5};14^{4}$ $15^{1};16^{1}$	$10^{3};11^{8};12^{1}$ $13^{3};14^{1};16^{1}$	$6^{1};9^{7}$ $11^{10};13^{2}$	$11^{10};13^{7}$ $14^{2};15^{1}$	$11^{1};13^{1}$ $15^{2};16^{1}$ 17^{2}	$11^{8};13^{5}$ 15^{7}	$9^{1};11^{4}$ $13^{11};15^{3}$	$11^{4};12^{1}$ $13^{6};15^{6}$ 16^{1}	$11^{3};13^{6}$ 15^{4}	$11^{2};12^{1}$ $13^{2};14^{3}$ $15^{4};16^{1}$	$11^{7};12^{1}$ $13^{3};15^{2}$	$9^{3};11^{6};12^{1}$ $13^{5};14^{1}$ 15^{1}
IVBr ax*	$18^{1};21^{1}$	$14^{1};15^{1};16^{2}$ $17^{3};18^{4};19^{1}$ $20^{4};22^{3};23^{2}$ 25^{2}	$13^{2};14^{2};15^{1}$ $16^{3};17^{5};18^{1}$ $19^{3};21^{2};22^{1}$ $23^{2};26^{1};27^{2}$	$9^{1};12^{2};13^{7}$ $14^{1};15^{4}$ $16^{1};17^{2}$ $18^{1};19^{1}$	$11^{4};13^{3}$ $15^{7};16^{1}$ $17^{11};27^{1}$	15^{1}	$13^{6};15^{7}$ $17^{3};19^{2}$ 23^{1}	$11^{1};13^{6}$ $15^{6};16^{2}$ $17^{4};19^{2}$ $23^{1};25^{1}$	$9^{1};11^{3}$ $13^{3};14^{1}$ $15^{7};16^{1}$ $17^{3};21^{2}$	$11^{2};13^{5}$ $15^{4};17^{1}$ 19^{1}	$15^{1};17^{1}$ $18^{1};19^{1}$ $23^{1};25^{2}$	$12^{1};13^{1}$ $15^{5};16^{1}$ $17^{4};19^{2}$ $21^{1};22^{1}$	$13^{1};14^{2};15^{4}$ $16^{2};17^{3};19^{3}$ $20^{1};21^{2};23^{1}$ $24^{1};25^{1}$
VBr ax*	-	-	-	-	-	-	-	-	15^{1}	-	-	-	-
Largeur IBr	5,9	6,6	5,0	4,8	5,5	3,2	4,6	5,0	4,9	4,1	5,0	6,3	5,4
Largeur IIBr	4,2	5,1	3,8	3,4	3,7	2,7	3,9	3,4	3,5	2,9	4,0	4,0	3,7
Largeur IIIBr	3,3	3,8	2,8	2,3	2,7	2,0	2,4	2,8	2,5	2,3	3,0	3,2	2,9
Longueur de P1	-	-	-	-	21,6	13,1	-	16,4	20,0	12,6	15,7	-	14,0
Nb d'articles/P1	-	-	-	-	17	12	-	16	14	11	14	-	10
Longueur de PBr	12,5	17,5	-	11,0	14,6	12,5	-	15,0	13,2	10,8	16,2	15,0	12,6
Nb d'articles/PBr	14	22	-	14	20	21	-	22	22	17	23	20	19

TABLEAU 4. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus angulatus* (suite). Même légende que celle du tableau 2.

Le pédoncule.

La section transversale du pédoncule est très étoilée ; quelquefois elle tend à prendre une forme pentagonale. Les arêtes se marquent fortement (fig. 12 E). Les pédoncules sont, en général, de forte taille. En effet, en partie proximale, leur diamètre varie de 3,6 à 9 mm (la moyenne se situant à 6,1 mm). Leur ornementation s'exprime sous différentes formes :

- carène fine, régulière, continue et non tuberculée ;
- carène fine, régulière, discontinue s'estompant au niveau des arêtes où elle est remplacée par une protubérance isolée ;

N° du spécimen Station	Sp. 37 CP 16	Sp. 38 CP 16	Sp. 39 CP 16	Sp. 40 CP 16	Sp. 41 CP 16	Sp. 42 CP 16	Sp. 43 CP 16	Sp. 44 CP 16	Sp. 45 CP 16	Sp. 46 CP 16	Sp. 47 CP 16	Sp. 48 CP 16
Diamètre proximal	5,9	5,8	6,5	6,9	7,5	6,7	6,9	6,4	6,5	6,6	4,4	6,2
Diamètre distal	5,0	5,5	5,5	6,4	6,9	6,6	6,2	6,0	6,1	6,0	3,0	5,4
Nombre d'internodales*	$6^{1};7^{9}$ 8^{2}	$7^{9};8^{10}$	$7^{4};8^{19}$ 9^{5}	$7^{12};8^{16}$ 9^{7}	$6^{3};7^{32}$	$6^{6};7^{19}$	$6^{5};7^{26}$	$7^{22};8^{12}$ 9^{1}	$7^{12};8^{16}$ 9^{1}	$6^{2};7^{33};8^{1}$	$6^{5};7^{10}$	$7^{5};8^{10}$
Longueur noditaxis	9,8	9,1	12,2	12,9	11,0	8,9	8,7	9,3	10,5	9,2	7,5	10,5
Epaisseur maximale de l'internodale	1,0	1,5	1,2	1,3	1,3	1,5	1,2	1,4	1,5	1,0	1,1	1,5
Epaisseur maximale de la nodale	1,4	1,9	1,5	1,8	1,5	1,9	1,6	1,8	1,8	1,4	1,4	1,7
Dernier noditaxis avec pores	23	22	17	19	19	22	19	16	18	22	12	16
Longueur des cirres	39,3	38,9	35,2	49,0	48,9	41,0	45,5	40,7	44,4	43,5	29,2	51,2
Nb d'articles/cirre	52	44	48	54	53	46	50	47	55	47	33	54
Longueur couronne	115	120	112	139	129	135	144	130	155	130	105	175
Nombre de bras	>48	>59	>51	>61	>49	>76	>45	>40	>31	>56	>38	>41
IBr ax*	4^{5}	4^{5}	4^{5}	$4^{4};5^{1}$	4^{5}	4^{5}	$4^{4};6^{1}$	$3^{1};4^{4}$	4^{5}	4^{5}	4^{5}	4^{5}
IIBr ax*	9^{9}	$7^{1};9^{9}$	$7^{1};9^{7}$ 11^{2}	$5^{1};6^{5};7^{4}$	$5^{1};6^{3}$ $7^{2};9^{1}$	$6^{1};7^{8};9^{1}$	$6^{1};7^{6};9^{2}$	$7^{6};9^{1}$	$7^{2};8^{1}$ $9^{6};10^{1}$	$7^{4};8^{5};9^{1}$	$7^{1};9^{9}$	$7^{3};8^{2}$ 9^{4}
IIIBr ax*	$11^{2};13^{5}$ 15^{9}	$9^{4};11^{7};13^{3}$ $14^{1};15^{1};16^{1}$	11^{2} 13^{11} 15^{4}	$9^{4};11^{2}$ $12^{3};13^{5}$ $14^{1};15^{2}$	$9^{1};11^{6}$ $12^{3};13^{4}$	$8^{1};9^{1};10^{1}$ $11^{9};12^{2};13^{5}$	$9^{2};11^{4};12^{2}$ $14^{1};15^{2};16^{1}$	$11^{2};12^{1}$ $13^{3};15^{2}$ 16^{1}	$13^{3};15^{4}$	$11^{9};13^{2};15^{2}$ $16^{1};17^{2};18^{1}$	$13^{6};14^{3}$ $17^{4};18^{4}$ 21^{1}	$11^{4};13^{3}$ $15^{4};16^{1}$
IVBr ax*	$13^{3};15^{9}$ 17^{2}	$8^{1};13^{2};15^{6}$ $16^{2};17^{2};18^{1}$ $19^{2};23^{1};25^{2}$ 27^{1}	15^{10} 17^{4}	$14^{6};15^{1}$ $16^{2};17^{5}$ $18^{5};19^{1}$ 22^{3}	$11^{1};14^{1}$ $15^{2};16^{3}$ $17^{1};18^{2}$ $19^{1};21^{4}$	$13^{2};15^{7};17^{6}$ $18^{2};19^{5};20^{1}$ $21^{4};23^{1};29^{1}$	$11^{1};13^{1};15^{2}$ $16^{1};17^{1};18^{2}$ $19^{3};23^{1};28^{1}$	$13^{1};15^{3}$ $16^{1};17^{3}$ $19^{1};21^{2}$ $23^{2};27^{1}$	$13^{1};17^{2}$ 19^{1}	$11^{2};13^{1};14^{1}$ $15^{6};16^{2};17^{3}$ $19^{1};20^{1};21^{1}$ 24^{1}	-	$13^{1};15^{5}$ $17^{2};19^{1}$ 29^{1}
VBr ax*	-	$19^{1};27^{1}$	-	23^{1}	15^{2}	-	-	-	-	$17^{1};23^{1}$	-	-
Largeur IBr	4,4	5,1	4,5	4,9	5,1	6,0	5,1	5,1	4,5	4,8	4,2	4,9
Largeur IIBr	3,2	4,1	3,5	3,6	3,8	4,1	3,7	3,9	3,6	3,6	3,2	3,4
Largeur IIIBr	2,6	2,9	2,3	2,6	3,2	2,8	2,9	2,7	2,4	2,4	2,5	2,3
Longueur de P1	-	-	-	-	21,4	-	15,6	17,5	-	-	-	16,9
Nb d'articles/P1	-	-	-	-	14	-	15	15	-	-	-	15
Longueur de PBr	12,7	11,8	14,4	10,9	13,9	-	11,6	14,5	-	-	-	14,1
Nb d'articles/PBr	18	17	19	18	18	-	20	30	-	-	-	25

TABLEAU 5. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus angulatus* (suite). Même légende que celle du tableau 2.

N° du spécimen Station	Sp. 49 CP 16	Sp. 50 CP 25	Sp. 51 CP 25	Sp. 52 CP 25	Sp. 53 CP 25	Sp. 54 CP 25	Sp. 55 CP 25	Sp. 56 CP 82	Sp. 57 CP 82	Sp. 58 CP 16	Sp. 59 CP 16	Sp. 60 CP 16	Sp. 61 CP 05
Diamètre proximal	6,3	5,8	6,4	6,0	6,5	6,9	6,7	7,2	5,9	6,9	7,0	6,5	7,9
Diamètre distal	6,5	5,7	5,9	6,0	6,5	6,2	6,9	6,1	5,4	6,0	6,5	6,5	7,8
Nombre d'internodales*	$6^{2};7^{32}$ 8^{4}	$3^{2};4^{2}$ $7^{45};8^{2}$	$7^{2};8^{5}$ 9^{5}	$6^{1};7^{22}$ 8^{7}	$6^{2};7^{16}$ 8^{6}	$6^{10};7^{27}$ 8^{1}	$6^{9};7^{20}$	$6^{1};7^{18}$ 8^{2}	$8^{7};9^{15}$	$5^{1};6^{15}$ 7^{9}	$5^{5};6^{30}$	$6^{37};7^{12}$	6^{42}
Longueur noditaxis	9,5	12,3	12,3	10,0	11,5	10,0	9,5	11,3	11,7	10.2	9,4	8,3	7,1
Epaisseur maximale de l'internodale	1,4	1,3	1,3	1,4	1,5	1,3	1,2	1,3	1,3	1,4	1,3	1,5	1,6
Epaisseur maximale de la nodale	1,8	2,0	2,0	1,9	1,8	1,7	1,5	1,7	1,5	1,6	1,7	1,9	2,1
Dernier noditaxis avec pores	++	17	15	17	21	14	14	16	14	20	18	19	16
Longueur des cirres	47,0	47,8	40,1	40,7	41,0	60,9	43,7	49,3	43,1	45.0	46,2	47,1	45,0
Nb d'articles/cirre	68	50	47	45	42	52	48	46	49	51	54	50	48
Longueur couronne	-	130	134	115	122	152	110	114	-	-	138	145	137
Nombre de bras	>47	>57	>60	>57	66	>62	>65	>57	>29	>51	>60	>36	73
IBr ax*	$4^{4};6^{1}$	4^{5}	4^{5}	4^{5}	$4^{3};5^{1};6^{1}$	4^{5}	4^{5}	$4^{4};6^{1}$	4^{5}	4^{5}	4^{5}	$3^{1};4^{4}$	$3^{1};4^{3};5^{1}$
IIBr ax*	$6^{1};7^{4}$ $8^{1};9^{1}$	$6^{1};7^{3}$ 9^{4}	$6^{1};7^{6}$ $8^{1};9^{2}$	$7^{3};8^{4}$ $9^{2};10^{1}$	7^{10}	$8^{1};9^{7}$ 10^{2}	$7^{4};8^{1}$ 9^{5}	7^{10}	$7^{7};9^{1}$	$6^{2};7^{2}$ 9^{3}	$6^{3};7^{3}$ $8^{1};10^{1}$	$6^{1};7^{2}$ 9^{5}	$7^{8};9^{2}$
IIIBr ax*	$9^{2};11^{1}$ $12^{1};13^{5}$ $14^{2};15^{2}$ 16^{1}	$9^{3};10^{1}$ $11^{5};12^{2}$ $13^{2};15^{2}$ 17^{2}	$9^{1};11^{8}$ $12^{2};13^{6}$ $14^{1};15^{2}$	$10^{1};11^{7}$ $12^{2};13^{5}$ $14^{1};15^{3}$ 17^{1}	$10^{1};11^{2}$ $12^{1};13^{8}$ $14^{1};16^{2}$ $17^{2};18^{2}$	$9^{4};11^{2}$ $12^{1};13^{7}$ 15^{4}	$11^{3};12^{2}$ $13^{10};14^{1}$ 15^{2}	$11^{2};13^{11}$ 14^{2}	$11^{2};13^{3}$ 17^{1}	$7^{1};9^{1}$ $11^{8};13^{3}$	$9^{4};10^{2};11^{7}$ $12^{1};13^{1}$	$9^{2};11^{4}$ 13^{2}	$9^{2};11^{7};12^{2}$ $13^{7};14^{1}$ 15^{1}
IVBr ax*	$15^{2};16^{2}$ $17^{5};18^{2}$ $19^{2};20^{1}$ 25^{2}	$11^{3};13^{1}$ $14^{1};15^{4}$ $17^{3};18^{1}$ $22^{1};23^{1}$ $25^{1};28^{1}$	$11^{1};12^{1}$ $13^{4};15^{3}$ $16^{2};17^{5}$ $21^{2};22^{1}$	$13^{3};15^{3}$ $16^{1};17^{4}$ $18^{2};19^{2}$ 21^{2}	$13^{6};15^{9}$ $17^{6};19^{5}$ 23^{1}	$11^{3};13^{4}$ $14^{5};15^{4}$ $17^{4};19^{3}$	$10^{1};11^{4}$ $12^{1};13^{9}$ $14^{1};15^{4}$ $17^{1};18^{1}$ $19^{1};20^{1}$	$13^{1};15^{2}$ $17^{5};19^{1}$ $21^{4};23^{1}$ $24^{2};25^{1}$ 33^{1}	$15^{1};17^{1}$ $19^{1};21^{1}$ 23^{1}	$11^{2};13^{4}$ $15^{4};16^{2}$ $17^{4};18^{1}$ $19^{1};21^{1}$ 29^{1}	$13^{2};14^{3};15^{4}$ $16^{1};17^{3};18^{2}$ $19^{2};21^{2};22^{1}$ $23^{1};24^{2};25^{2}$ $26^{1};29^{1}$	$13^{3};14^{1}$ $15^{1};17^{2}$ $19^{2};20^{1}$ $21^{1};24^{1}$	$13^{1};14^{1};15^{5}$ $16^{2};17^{2};18^{4}$ $19^{5};21^{3};24^{1}$ $23^{1};25^{2};33^{1}$
VBr ax*	-	23^{1}	-	-	-	$15^{1};18^{1}$	-	19^{1}	-	$19^{1};20^{1};21^{1}$	-	-	$18^{1};19^{1};25^{1}$
Largeur IBr	4,7	4,7	4,7	5,0	5,2	4,7	4,2	5,3	5,2	5,2	6,0	4,6	6,2
Largeur IIBr	3,4	2,9	3,8	3,7	3,5	3,7	3,6	4,9	4,1	3,9	4,0	3,5	4,3
Largeur IIIBr	1,9	2,3	2,8	2,7	3,0	2,6	3,1	3,9	3,6	3,2	3,3	2,5	3,2
Longueur de P1	-	-	-	14,9	15,6	15,5	12,7	19,9	18,4	17,3	21,6	18,5	-
Nb d'articles/P1	-	-	-	12	14	11	10	15	16	14	16	19	-
Longueur de PBr	13,6	11,6	-	14,0	11,6	10,1	8,2	11,9	10,2	9,8	16,5	-	-
Nb d'articles/PBr	20	20	-	20	17	21	12	17	17	15	20	-	-

TABLEAU 6. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus angulatus* (suite). Même légende que celle du tableau 2.

- carène irrégulière, tuberculée ;
- enfin, apparition ponctuelle de quelques tubercules.

Le nombre d'internodales par noditaxis mature présente également une importante variabilité (tabl. 7). Il est compris entre 3 et 13 et se localise le plus fréquemment à 7. En dehors de la partie la plus proximale du pédoncule, certains spécimens présentent une forte hétérométrie des internodales qui résulte souvent de l'adjonction de nouvelles columnales. Les pores interarticulaires restent ouverts en partie distale sur une grande portion du pédoncule. Ils peuvent, occasionnellement, être ouverts sur toute la longueur du pédoncule comme le montrent deux spécimens (n°15 et n°49). Le spécimen n°59, quant à lui, se caractérise par des apparitions et disparitions régulières sur tout le pédoncule.

	Valeur minimale	Valeur maximale	Mode	Coefficient de variation (%)	Nombre d'observations
Nombre d'internodales	3	12	7	10.6	1322
Dernier noditaxis avec pores	12	23	18	22.7	56
IBr ax	3	6	4	9,3	276
IIBr ax	1	11	7	16,1	518
IIIBr ax	2	21	11-13	16,4	870
IVBr ax	8	33	15	21,3	991

TABLEAU 7. — Variabilité de quelques caractères morphologiques chez *Saracrinus angulatus* (îles Kai et Tanimbar).

Le calice et la couronne de bras.

Les basales jointives montrent des formes différentes :

- basale aussi haute que large avec une apophyse distale pointue qui se marque fortement et qui recouvre les premières columnales ;
- basale piriforme, renflée et avec une apophyse distale peu marquée ;
- enfin, basale trapue possédant une apophyse peu marquée et émoussée, ainsi que deux apophyses externes peu accentuées.

Le rapport de la largeur sur la hauteur des basales est en moyenne égal à 1,2. Les radiales, quant à elles, sont jointives, lisses et de forme rectangulaire. Le rapport de leur largeur sur leur hauteur est égal à 3. Les radiales du spécimen n° 52 présentent une apophyse inférieure.

De soixante à quatre-vingts bras constituent la couronne (fig. 12 B). Les brachiales sont le plus souvent lisses mais parfois prennent un aspect rugueux. Le nombre de dichotomies atteint rarement cinq. Celui des brachiales par série augmente progressivement et régulièrement des I Br aux V Br (tabl. 7). Les coefficients de variation sont très élevés à l'exception de celui des I Br. La largeur des brachiales décroît depuis les I Br jusqu'aux IV Br. Pour les I Br, cette largeur est comprise entre 3,2 mm et 6,1 mm (moyenne = 5,1 mm) ; pour les II Br, elle se situe entre 2,7 mm et 5,1 mm (moyenne = 3,8 mm) et pour les III Br, elle est comprise entre 1,9 mm et 3,9 mm (moyenne = 2,8 mm).

Les premières pinnules sont composées en moyenne de 15 articles et ont une longueur d'environ 17,5 mm. Ces pinnules sont massives et servent à protéger la masse viscérale. Les pinnules médianes (des II Br aux III Br) possèdent en moyenne 20 articles pour une longueur de 12,9 mm. Elles servent à véhiculer les particules nutritives. La taille des pinnules est en relation avec celle des pédoncules ; plus l'individu est gros et plus les pinnules tendent à être importantes. C'est pourquoi, contrairement à certains auteurs (MACKNIGHT, 1973 ; CHANG & LIAO, 1963), la taille des pinnules ne peut en aucun cas être un critère discriminant différentes espèces. Enfin, un *S. angulatus* (spécimen n° 29) présente la particularité de posséder une pinnule bifide (fig. 12 C-D). En partie distale, une des pièces de cette pinnule se comporte comme une axillaire et il y a dichotomie.

En introduction, je rappelle que les *S. angulatus* récoltés auparavant dans différentes régions du Pacifique occidental se caractérisent par leur importante variabilité intraspécifique et leurs caractères morphologiques qui évoluent suivant le lieu géographique. Les *S. angulatus* prélevés au large des îles Kai et Tanimbar présentent également une importante variabilité morphologique. Il serait maintenant intéressant d'effectuer une analyse globale en comparant, entre elles, ces populations de divers secteurs géographiques. Cette démarche permettrait de vérifier ainsi la validité des résultats obtenus lors de mes précédents travaux (AMÉZIANE-COMINARDI, 1991).

Analyse géographique de la diversité spécifique de *S. angulatus*.

La localité géographique (pour des coordonnées précises, se référer à AMÉZIANE-COMINARDI, 1991), le nombre de spécimens, l'appartenance au muséum et l'auteur des mesures des *S. angulatus* utilisés pour l'analyse globale se trouvent dans le Tableau 8.

Secteur géographique	Nombre de spécimens	Muséum
Japon	7	U.S.N.M. Washington *
Philippines	2 7	U.S.N.M. Washington * M.N.H.N. Paris **
Indonésie : mer de Timor mer de Banda	2 61	R.N.H. Leiden *** M.N.H.N. Paris ***
Australie	8	M.A.G.N.T.D. Sydney ***

TABLEAU 8. — Répartition géographique et nombre de spécimens de tous les *Saracrinus angulatus* récoltés dans le Pacifique occidental.
* : détermination et mesures de A.H. CLARK ; ** : détermination et mesures de J.-P. BOURSEAU & M. ROUX ; *** : détermination et mesures personnelles.

Ces populations sont donc regroupées en quatre grands secteurs. L'Indonésie est découpée en deux sous-secteurs : la mer de Timor et le secteur oriental de la mer de Banda (îles Kai et Tanimbar). Bien que l'échantillonnage soit très restreint pour la population de la mer de Timor (deux individus), je traiterai ce secteur géographique indépendamment de celui, proche, de la mer de Banda. En effet, les deux spécimens de la mer de Timor présentent une très forte variabilité morphologique et des caractéristiques particulières qui peuvent correspondre :

- soit à des organismes qui se trouvent à un pôle morphologique extrême d'une population plus homogène, population comprenant entre autres les individus de la mer de Banda ;
- soit à des organismes qui appartiennent à une population dont les caractères morphologiques se distinguent bien de ceux de la population de la mer de Banda.

La dernière hypothèse se justifie par certaines observations faites sur les *Saracrinus nobilis* dans les eaux indonésiennes (AMÉZIANE-COMINARDI, 1991). En effet, ces populations de *S. nobilis* se caractérisent par des variations morphologiques bien distinctes suivant les localités géographiques (ex. mer de Banda, mer de Timor, Sumatra,...).

Le pédoncule.

Les faunes de Timor, d'Australie et d'Indonésie se caractérisent par les diamètres pédonculaires les plus gros (fig. 3). En effet, les diamètres sont compris entre : 6,1 mm et 6,8 mm (moyenne = 6,4 mm) pour la faune australienne ; 3,6 mm et 8,1 mm (moyenne = 6,5 mm) pour la faune de la mer de Banda et égaux à 9 mm pour la faune de Timor. En revanche, les diamètres pédonculaires des faunes japonaise et philippine restent dans l'ensemble peu élevés. Ils se situent, respectivement, entre 4,1 mm et 5 mm (moyenne = 4,5 mm) et entre 2,8 mm et 6,5 mm (moyenne = 4,7 mm). La faune de la mer de Banda présente le champ de variation le plus large et dans lequel s'insèrent parfaitement les autres champs. La faune de la mer de Timor (Indonésie) se distingue des autres par son très large intervalle de valeurs, excentré par rapport au reste des autres faunes car les diamètres pédonculaires sont très élevés. Ce large éventail de valeurs se traduit par un coefficient de variation exceptionnellement élevé alors que ceux des faunes des autres secteurs géographiques sont beaucoup plus faibles (tabl. 9). Enfin, les valeurs des modes sont soit égales (mer de Timor, Australie), soit supérieures (Japon, Philippines, mer de Banda) à celle de la population totale.

Il semble qu'il existe une évolution du nombre d'internodales par noditaxis mature en fonction de la latitude. En effet, dans le domaine intertropical, Australie et Indonésie (mer de Banda et de celle de Timor), les populations de *S. angulatus* possèdent un faible nombre d'internodales (autour de 7). Quand nous nous éloignons de ces basses latitudes pour monter vers le Nord, Philippines puis Japon, le nombre d'internodales croît (8-9). Il serait intéressant de voir l'évolution de ce caractère vers les hautes latitudes de l'hémisphère Sud, mais malheureusement nous n'avons pas encore de populations de ces régions. L'évolution du nombre d'internodales par noditaxis mature semble être symétrique de part et d'autre de l'Équateur. En outre, cette évolution latitudinale globale peut être masquée partiellement par une variabilité locale plus ou moins importante.

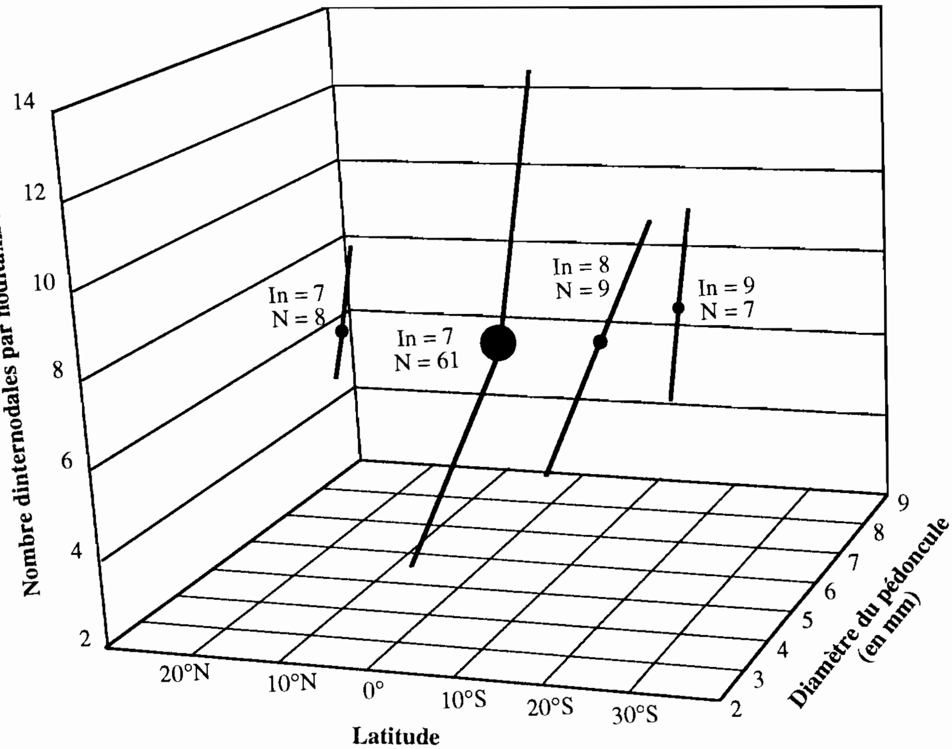

FIG. 3. — Variation du nombre d'internodales par noditaxis mature en fonction du diamètre maximal du pédoncule et de la latitude chez *Saracrinus angulatus*.

In : mode du nombre d'internodales par noditaxis mature ; **N** : nombre d'individus ; ● : mode pour le nombre d'internodales, la grosseur du point représente la taille de la population.

La partie proximale du pédoncule se caractérise chez les Pentacrines par la présence de pores interarticulaires. Cette zone, qui caractérise la zone de forte croissance des pédoncules, est toujours mieux développée chez des individus adultes que sur des formes juvéniles. L'étude du paramètre "zone d'extension des pores interarticulaires dans la partie proximale du pédoncule" (fig. 4) montre que :

- cette zone d'extension des pores interarticulaires peut être très développée (faune de Banda) ;
- au contraire, elle peut être restreinte (faune japonaise et philippine) ;
- enfin, le reste de la faune se répartit entre ces deux extrémités.

L'analyse de ce paramètre indique que la faune du Japon et celle des Philippines présentent pour ce caractère une tendance pédomorphique.

La couronne de bras.

L'organisation de la couronne de bras varie suivant les secteurs (fig. 5). Les faunes philippine et japonaise présentent une organisation statistiquement plus régulière que montre une variabilité globale plus restreinte. En effet, le nombre d'ossicules par série brachiale augmente régulièrement et progressivement. Les faunes de Timor, de la mer de Banda et d'Australie tendent à posséder moins d'ossicules par tronc brachial.

N = 85		Valeur minimale	Valeur maximale	Mode	Coefficient de variation (%)	Nombre d'observations
Nombre d'internodales	J.	7	11	9	8,7	129
	P.	6	10	8	12,5	181
	T.	3	13	7	32,3	45
	A.	6	9	7	9,7	138
	E.	3	13	7	13.8	1941
Dernier noditaxis avec pores	J.	8	10	9	9,0	7
	P.	11	17	13	15,9	11
	T.	-	-	-	-	1
	A.	15	17	16	5,5	8
	E	8	23	18	13,1	87
I Br ax	J.	3	6	4	14,5	26
	P.	3	5	4	5,0	49
	T.	4	6	4	17,2	19
	A.	2	11	4	40,7	22
	E.	2	11	4	9,4	407
II Br ax	J.	6	10	8	13,3	46
	P.	5	11	8	16,3	96
	T.	4	8	6	24,3	12
	A.	1	11	6	26,8	37
	E.	1	11	7	16,2	735
III Br ax	J.	9	20	13	17,0	69
	P.	9	19	13	16,2	152
	T.	8	26	13	30,6	38
	A.	9	18	13	14,4	66
	E.	2	26	13	16,4	1238
IV Br ax	J.	12	27	17	19,7	46
	P.	9	29	19	17,8	120
	T.	9	25	17	20,1	36
	A.	11	22	15	16,8	72
	I.	8	33	15	21,5	1330

TABLEAU 9. — Variabilité de quelques caractères morphologiques chez *Saracrinus angulatus* selon les secteurs géographiques.
N = nombre d'individus ; J. = Japon ; P. = Philippines ; T. = Timor ; A. = Australie ; E. = Ensemble des *S. angulatus* récoltés dans le Pacifique occidental.

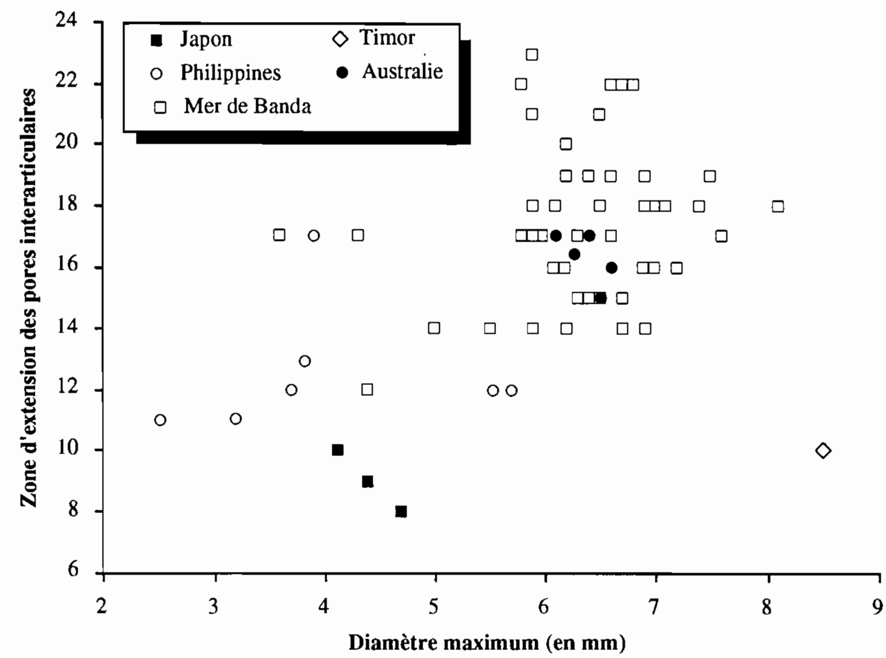

FIG. 4. — Longueur de la zone d'extension des pores interarticulaires en fonction du diamètre maximum chez *Saracrinus angulatus* selon les secteurs géographiques.

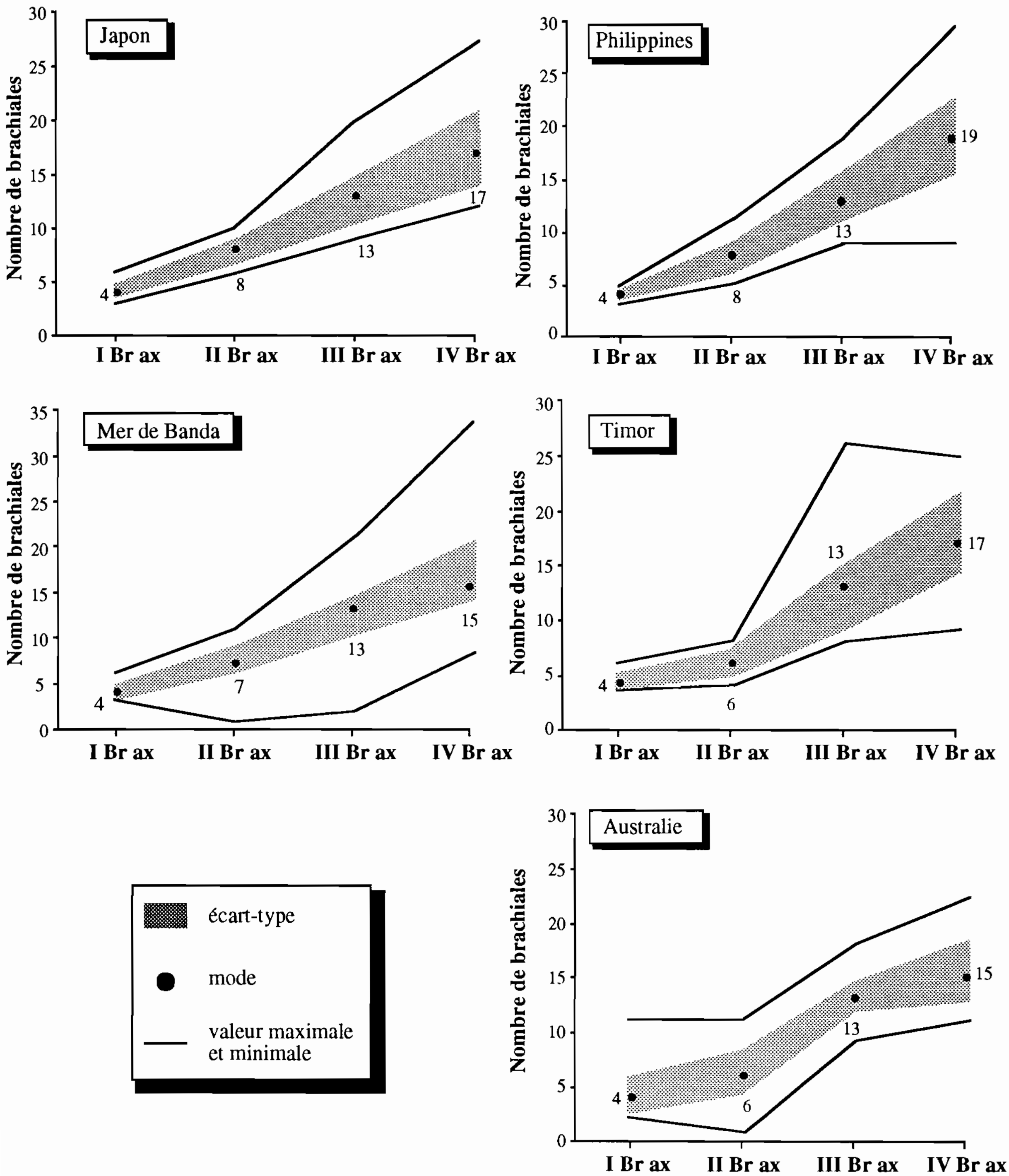

FIG. 5. — Organisation de la couronne de bras chez *Saracrinus angulatus* en fonction de la répartition géographique.
I Br ax, II Br ax, III Br ax et IV Br ax : position la plus fréquente des axillaires de la première, deuxième, troisième et quatrième série brachiale.

La répartition selon les secteurs géographiques de *S. angulatus* montre des différences importantes au niveau des coefficients de variation. Ainsi, les faunes du Japon, des Philippines et de la mer de Banda, présentent la même progression de leurs coefficients de variation ; avec cependant, une grande stabilité pour la faune des

Philippines. En revanche celle de Timor se caractérise par une importante variabilité pour toutes les séries brachiales alors que celle d'Australie a les plus forts coefficients de variation pour les deux premières séries brachiales et les deux plus faibles pour les troisième et quatrième.

Bien qu'irrégulière, la position des dichotomies n'est pas le fait du hasard (AMÉZIANE-COMINARDI, 1991 ; BOURSEAU *et al.*, 1991). Celle-ci pourrait être l'expression d'une organisation plus complexe qui serait significative de l'optimalisation de la fonction "filtration". Ainsi, lorsque la répartition des axillaires des deux premiers troncs est régulière, celle des derniers troncs est irrégulière. En revanche, lorsque la répartition des premiers troncs brachiaux est irrégulière, celle des derniers troncs est régulière. Ainsi, l'importante variabilité de la répartition des I Br ax et II Br ax de la faune australienne se trouve corrélée à une faible variabilité des III Br ax et IV Br ax. Le décalage des dichotomies permet une meilleure répartition des pinnules au sein du cône formé par la couronne déployée.

Pour la faune des Philippines, alors que le diamètre du pédoncule augmente en fonction de la profondeur, le nombre de bras décroît (tabl. 10) ; le maximum de bras se situant vers 210 m. En revanche, à profondeur égale et à diamètre pédonculaire équivalent, le nombre de bras de la faune japonaise est plus faible. À profondeur similaire et diamètre du pédoncule égal, les faunes de la mer de Banda et d'Australie possèdent un nombre de bras plus élevé que celui de la faune des Philippines. Il semble que le créneau bathymétrique le plus propice au développement des *S. angulatus* change suivant le lieu géographique en fonction des paramètres de l'environnement, notamment des courants. Nous constatons que le nombre de bras de la couronne décroît du sud vers le nord.

Localité	Profondeur (en m)	Nombre de bras	Diamètre moyen (en mm)
Japon	188-278	50-60	4,6
Philippines	192-230	60-68	4,2
	320-498	56-60	5,9
	545	51-54	6,5
mer de Banda	219-349	60-80	6,3
mer de Timor	295	80	8,5
Australie	405-426	70-80	6,5

TABLEAU 10. — Nombre de bras chez *Saracrinus angulatus* en fonction de la profondeur du milieu et de la répartition géographique.

CARACTÈRES DES ARTICULATIONS. — Les zones pétaloïdes des symplexies (fig. 12 H-I) du pédoncule se caractérisent par des aréolas lancéolées (en moyenne deux fois plus longues que larges) à très fortement lancéolées (environ trois fois plus longues que larges). Certains spécimens présentent, au sein du réseau de leur aréola, de grosses mailles. Le crénularium interne s'individualise bien. Le nombre de créneaux varie de 12 à 18 (tabl. 11). De plus, ce nombre de créneaux diminue avec la réduction du diamètre du pédoncule. La forme et la largeur des zones interpétaloïdes varient également (tabl. 11). Le périlumen de tous les spécimens se marque fortement. Le canal axial est toujours circulaire.

Les zones pétaloïdes des synostoses du pédoncule (fig. 12 F-G) se caractérisent par des aréolas lancéolées (environ deux fois plus longues que larges) à très fortement lancéolées (en moyenne trois fois plus longues que larges). L'ensemble du crénularium est bien individualisé. Le nombre de créneaux fluctue entre 12 et 15. Le réseau secondaire contenu dans le canal axial est régulier et de densité plus ou moins lâche. La forme du lumen, quant à elle, est pentalobée de façon plus ou moins régulière (tabl. 11). Les synostoses de la partie distale s'ankylosent souvent.

CONCLUSION. — La grande variabilité de *S. angulatus* s'exprime très fortement au niveau des caractères morphologiques externes et plus faiblement au niveau des articulations. Bien que très proches, les diverses populations présentent toutes des différences les unes par rapport aux autres (fig. 6).

La faune d'Australie et celle de la mer de Timor présentent les plus forts pourcentages de variation cumulée alors que la faune des Philippines possède le plus faible. Il est établi que les spécimens considérés comme adultes se différencient des formes plus juvéniles par : de plus gros diamètres, une zone d'extension des pores interarticulaires plus importante, un nombre d'internodales par noditaxis mature plus petit, un nombre de bras plus élevé et un nombre d'ossicules par série brachiale moindre. Pour l'ensemble de ces caractères, les faunes du Japon et des Philippines ont des individus qui correspondent à des formes plus juvéniles. Ces deux populations montrent donc une tendance pédomorphique pour la majorité des caractères morphologiques. Ces tendances évolutives et la grande variabilité intraspécifique pourraient traduire une adaptation phénotypique aux conditions écologiques.

Caractères	Nombre de créneaux par zone pétaloïde		Sillon interradial		Canal axial		Remarques
(1) symplexie (2) synostose	(1)	(2)	(1)	(2)	réseau (2)	lumen (2)	
Sp. 21 (Timor) ø = 9 mm	15 - 17 mode = 16	14 - 16 mode = 15	large, évasé vers l'ext. * = 1,6	large, évasé vers l'ext. * = 1,8	dense régulier	pentalobé irrégulier	présence de quelques grosses mailles
Sp. 18 (Australie) ø = 6,2 mm	14 - 16 mode=15/16	14 - 16 mode = 15	large, évasé vers l'ext. * = 2	étroit, évasé vers l'ext. * = 3	lâche régulier	pentalobé régulier	-
Sp. 56 (mer de Banda) ø = 6,1 mm	12 - 15 mode = 14	flous	étroit, évasé vers l'ext. * = 1,2	étroit, évasé vers l'ext. * = 2,1	dense régulier	pentalobé irrégulier	-
n° 34900 (Philippines) ø = 6,0 mm	13 - 16 mode = 16	12 - 14 mode = 13	large, évasé vers l'ext. * = 1,6	large, évasé vers l'ext. * = 1,5	dense régulier	pentalobé régulier	synostose ankylosée
n° 36134 (Japon) ø = 5,3 mm	14 - 15 mode = 14	flous	étroit, évasé vers l'ext. * = 2,5	étroit, évasé vers l'ext. * = 2,4	dense régulier	pentalobé irrégulier	synostose en cours de comblement

TABLEAU 11. — Principaux caractères des articulations du pédoncule chez *Saracrinus angulatus* (province SW Pacifique). * = rapport de la largeur de la zone pétaloïde sur celle de la zone interpétaloïde ; ø = diamètre ; sp. = spécimen. Les échantillons n° 34900 et 36134 = USNM Washington, le sp. 18 = musée de Sydney, le sp. 21 = musée de Leiden.

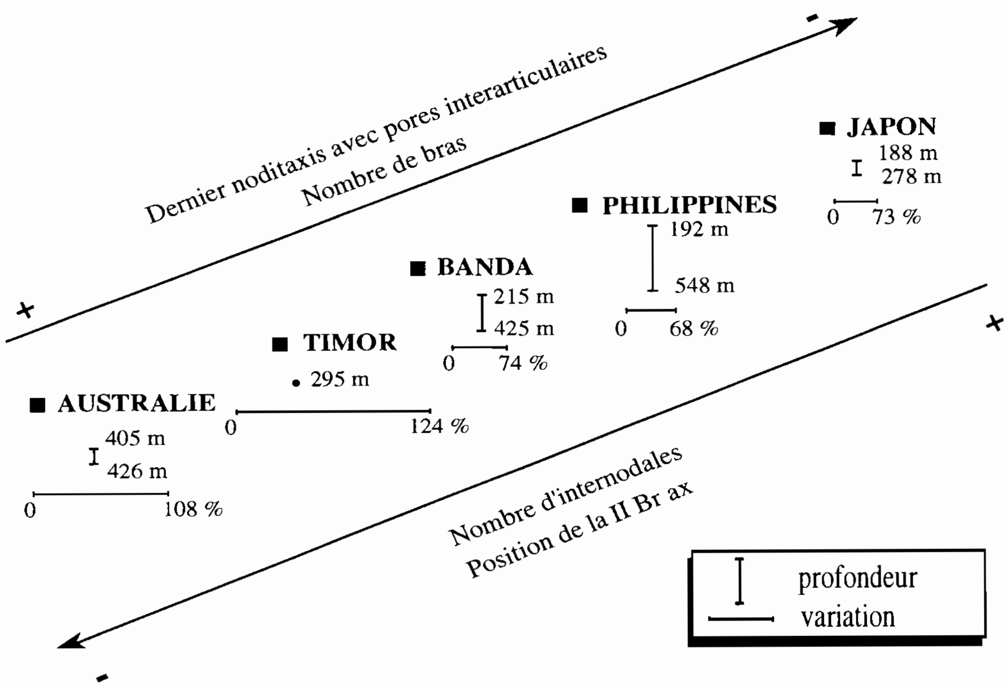

FIG. 6. — Représentation de la variabilité de *Saracrinus angulatus* suivant une ligne géographique virtuelle. Variation : pourcentage de variation cumulée pour les caractères morphologiques utilisés.

N° du spécimen Station	Sp. 1 CP 48	Sp. 2 CP 05	Sp. 3 CP 05	Sp. 4 CP 05	Sp. 5 CP 05	Sp. 6 CP 05	Sp. 7 CP 05	Sp. 8 CP 05	Sp. 9 CP 05
Diamètre proximal	6,4	6,4	6,8	6,5	7,0	6,7	6,1	6,5	6,7
Diamètre distal	7,1	6,0	6,4	5,9	6,2	6,1	5,7	6,0	7,1
Nombre d'internodales*	$10^4;11^9$ 12^{15}	$11^2;12^{10}$ 13^{13}	$11^3;12^9;13^3$	$13^7;14^9$	$12^3;13^{13};14^3$	$12^1;13^9$	$9^5;10^7$ $11^3;12^1$	$13^6;14^5;15^2$	$12^8;13^{13}$
Longueur noditaxis	18,9	19,7	16,7	19,4	17,4	18,4	12,4	17,3	17,6
Epaisseur maximale de l'internodale	2,0	1,4	1,4	1,4	1,3	1,3	1,1	1,5	1,6
Epaisseur maximale de la nodale	2,5	2,2	1,8	1,6	1,9	1,6	1,4	2,0	2,1
Dernier noditaxis avec pores	18	17	15	15	15	17	18	14	19
Longueur des cirres	70,0	52,0	55,7	52,2	60,1	48,6	42,1	50,6	52,8
Nb d'articles/cirre	55	50	48	43	54	58	44	51	49
Longueur couronne	180	121	138	140	-	170	123	160	190
Nombre de bras	>113	> 62	>54	>57	>65	>61	68	>64	78
IBr ax*	$4^4;5^1$	4^5	4^5	4^5	4^5	4^5	4^5	$4^4;8^1$	4^5
IIBr ax*	$5^2;6^6$ $7^1;8^1$	$5^1;6^1$ $7^7;9^1$	$6^5;7^1;9^1$ $10^1;11^1$	$6^2;7^4;9^3$	$7^2;9^6;11^2$	$6^1;7^6;8^1$	$5^1;6^2$ $7^6;9^1$	$6^2;7^9;9^2$ $11^1;13^1$	$7^2;9^8$
IIIBr ax*	$11^4;12^1;13^{20}$ $14^2;15^6;16^1$ 17^1	$8^1;9^4;11^3$ $13^7;14^1;15^2$	$9^2;11^{11};12^1$ $13^2;14^1$	$9^2;10^2$ $11^8;13^3$	$9^4;10^1;11^9$ $12^2;13^4$	$10^1;11^{13}$ 13^2	$11^2;13^9;14^1$ $15^3;16^1;17^3$ 19^1	$9^7;11^8;17^3$	$8^1;9^5;10^1;11^7$ $12^1;13^4;15^1$
IVBr ax*	$13^4;15^{14}$ $16^1;17^8;18^2$ $19^1;23^1$	$13^1;15^7;17^5$ $19^2;21^3;22^1$ $23^2;25^3;27^1$	$12^1;15^3;17^4$ $19^5;21^1;22^1$ $23^1;25^1$	$13^2;15^4;17^7;18^1$ $19^3;20^1;21^1;23^1$ $25^1;26^1$	$11^1;14^1;15^1;17^9$ $19^4;20^1;21^2;22^1$ $23^1;25^3;27^2;29^3$ $31^1;39^1$	$13^2;15^2;17^9$ $18^1;19^3;21^6$ $23^4;49^1$	$13^4;15^8;17^5$ $18^2;19^4;21^1$ $23^3;25^1$	$12^1;13^1;15^8;16^1$ $17^3;18^1;19^3;21^5$ $23^2;25^1$	$13^3;15^9;17^9$ $18^2;19^5;21^4$ $23^1;25^3$
VBr ax*	$13^4;15^{14};17^8$ $18^2;19^1;23^1$	-	-	$22^1;23^1$	-	-	-	17^1	$19^1;25^1$
Largeur IBr	5,9	5,3	5,6	5,4	5,9	5,4	4,5	5,5	5,4
Largeur IIBr	4,6	4,3	4,2	4,5	4,3	4,2	3,6	4,5	4,5
Largeur IIIBr	4,1	2,9	2,9	3,5	3,1	2,7	2,8	2,8	3,6
Longueur de P1	22,4	14,5	-	-	19,1	24,2	-	-	24,6
Nb d'articles/P1	12	11	-	-	17	19	-	-	19
Longueur de PBr	10,3	14,6	-	11,7	18,5	20,7	-	-	20,8
Nb d'articles/PBr	14	16	-	21	23	25	-	-	29

TABLEAU 12. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus nobilis*. Même légende que celle du Tableau 2.

N° du spécimen Station	Sp. 10 CP 05	Sp. 11 CP 05	Sp. 12 CP 05	Sp. 13 CP 16	Sp. 14 CP 06	Sp. 15 CP 06	Sp. 16 CP 46	Sp. 17 CP 46	Sp. 18 CP 46
Diamètre proximal	6,9	6,2	6,6	5,5	6,5	5,8	6,3	7,0	6,3
Diamètre distal	6,1	5,9	5,9	5,0	5,2	5,8	5,7	6,5	5,5
Nombre d'internodales*	13^{12}	$12^1;13^{12}$	$11^2;12^{10};13^7$	$13^{13};14^2$	$13^4;14^2$	$11^3;12^5$ $13^3;14^2$	$13^{12};14^9$	$12^6;13^{13}$	$10^1;12^4$ $13^{15};14^2$
Longueur noditaxis	16,7	17,3	16,8	16,4	18,2	17,1	19,3	17,7	17,3
Epaisseur maximale de l'internodale	1,4	1,3	1,4	1,3	1,1	1,4	1,7	1,5	1,6
Epaisseur maximale de la nodale	2,2	1,7	1,9	1,8	1,4	1,5	2,0	2,1	1,8
Dernier noditaxis avec pores	17	17	16	17	16	-	19	17	-
Longueur des cirres	53,3	52,1	56,9	42,5	-	-	52,8	48,5	50,0
Nb d'articles/cirre	52	50	64	49	-	-	60	45	50
Longueur couronne	155	125	152	-	128	-	185	165	>105
Nombre de bras	>53	>78	>60	>61	>63	-	>82	83	>73
IBr ax*	4^5	4^5	4^5	4^5	4^5	-	4^5	$3^1;4^4$	4^5
IIBr ax*	$7^3;9^6$	$6^1;7^8;9^1$	$6^1;7^7;9^2$	$7^3;9^5$	$6^1;7^9$	-	$8^2;9^6;10^1;11^1$	$5^1;6^2;7^6$	$5^4;6^1;7^5$
IIIBr ax*	$11^2;12^1;13^5$ $15^6;17^4$	$9^2;10^3;11^7$ $12^2;13^4;14^1$	$11^6;12^1;13^9$ $15^3;16^1$	$11^2;13^9$ $15^5;17^1$	$11^5;12^1;13^5$ $15^8;17^1$	-	$9^3;10^1;11^5$ $13^2;15^5;17^4$	$9^6;11^7;13^6$	$8^1;9^2;11^8$ $12^1;13^6$
IVBr ax*	$13^2;15^4;16^4$ $17^1;18^1;19^2$ $21^3;29^1$	$13^4;14^1;15^8$ $17^5;19^8;20^1$ $21^4;23^3;24^1$ 25^1	$15^1;17^3;18^2$ $19^1;21^6;22^1$ $23^2;24^1;25^1$ 27^3	$15^4;17^6;19^5$ $20^1;21^1;22^1$ $24^1;23^2$	$15^4;17^2;18^1$ $19^{11};21^4;23^1$ $24^1;27^1;31^1$ 33^1	-	$11^5;13^6;14^1$ $15^4;17^2;19^5$ $21^1;22^2;23^2$ 27^2	$13^1;14^1;15^6$ $17^{11};19^{10}$ $21^5;34^1$	$11^1;12^1;13^5;14^2$ $15^5;16^1;17^6;18^3$ $19^6;21^1;23^1$
VBr ax*	-	$17^1;23^1$	-	-	-	-	$20^1;21^2;25^2$ $26^1;29^1$	$17^1;21^4;23^1$ $25^2;27^1;29^2$	$19^1;20^1;25^1$
Largeur IBr	5,7	5,5	5,2	4,7	5,5	-	5,2	6,0	6,0
Largeur IIBr	4,5	4,0	4,6	3,3	4,4	-	3,9	4,4	4,8
Largeur IIIBr	3,3	2,4	3,2	2,7	3,1	-	3,4	3,3	3,2
Longueur de P1	18,9	-	-	-	-	-	21,9	17,9	13,2
Nb d'articles/P1	24	-	-	-	-	-	23	18	12
Longueur de PBr	14,7	-	-	13,6	-	-	15,1	-	15,0
Nb d'articles/PBr	22	-	-	29	-	-	21	-	16

TABLEAU 13. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus nobilis* (suite). Même légende que celle du Tableau 2.

Saracrinus nobilis (Carpenter, 1884)

Fig. 7, 13

SYNONYMIE (limitée aux références importantes).
Metacrinus nobilis Carpenter, 1884 : 351. — DÖDERLEIN, 1912 : 31. — GISLEN, 1922 : 147.
Metacrinus murrayi Carpenter, 1884 : 349.
Saracrinus nobilis - A. H. CLARK, 1923 : 9. — ROUX, 1981 : 489. — OJI, 1986 : 355. — BOURSEAU & ROUX, 1989 : 130. — AMÉZIANE-COMINARDI, 1991 : 65. — BOURSEAU *et al.*, 1991 : 254.
Metacrinus superbus Carpenter, 1884 : 435. — DÖDERLEIN, 1907 : 48. — A.H. CLARK, 1908 : 674.
Saracrinus superbus - A.H. CLARK, 1923 : 10. — ROUX, 1981 : 486. — BOURSEAU & ROUX, 1989 : 125.
Metacrinus varians Carpenter, 1884 : 352.
Saracrinus varians - A.H. CLARK, 1923 : 9. — ROUX, 1981 : 489. — BOURSEAU & ROUX, 1989 : 131.

Cette espèce, largement étudiée (AMÉZIANE-COMINARDI, 1991 ; BOURSEAU *et al.*, 1991) possède une large aire de répartition comprise entre le Japon et la Nouvelle-Zélande. *S. nobilis* présente de nombreuses affinités morphologiques avec *S. superbus* et les *S. varians* récoltés dans les milieux profonds. Lors de précédents travaux (AMÉZIANE-COMINARDI, 1991), je signalais que ces trois taxons constituaient un gradient morphologique qui se singularisait par sa vaste répartition géographique. Leur distribution met en évidence un double relais. Le premier est un relais écophénotypique géographique et il affecte seulement les variants de *S. nobilis*. En effet, le nombre d'internodales par noditaxis mature de ces derniers augmente suivant la ligne Sumatra-Timor-Mer de Banda-Nouvelle-Calédonie. Le second relais écophénotypique est bathymétrique. Ainsi, *S. superbus* domine vers 200 m, *S. nobilis* vers 300-500 m et *S. varians* semble inféodé aux milieux profonds (AMÉZIANE-COMINARDI, 1991).

DESCRIPTION DE LA MORPHOLOGIE EXTERNE. — La faune de crinoïdes pédonculés récoltés lors de la mission KARUBAR livre une quarantaine de *Saracrinus nobilis* dont la localisation géographique est précisée dans la liste des stations. L'ensemble des caractères morphologiques des individus est donné dans les tableaux 12 à 15.

N° du spécimen Station	Sp. 19 CP 46	Sp. 20 CP 46	Sp. 21 CP 46	Sp. 22 CP 46	Sp. 23 CP 82	Sp. 24 CP 82	Sp. 25 CP 82	Sp. 26 CP 82	Sp. 27 CP 82
Diamètre proximal	6,9	5,9	6,1	5,5	6,5	6,1	7,0	7,4	7,3
Diamètre distal	6,3	5,2	5,5	5,5	6,5	5,7	6,6	8,2	7,3
Nombre d'internodales*	$8^1;10^5;11^6$ $12^5;13^3$	$12^1;13^3$ $14^9;15^3$	$10^1;12^{10}$	13^5	$11^3;12^{16}$ 13^1	$12^6;13^9$	$11^8;12^6;13^1$	12^{10}	12^{18}
Longueur noditaxis	11,8	16,9	14,3	14,9	21,4	17,9	21,0	21,2	20,0
Epaisseur maximale de l'internodale	1,3	1,5	1,3	1,1	1,7	1,4	1,8	1,9	1,7
Epaisseur maximale de la nodale	1,9	1,7	1,7	1,7	2,1	2,0	2,2	2,3	2,0
Dernier noditaxis avec pores	19	13	17	16	21	16	22	23	26
Longueur des cirres	55,4	47,2	51,4	49,1	58,0	62,0	64,9	63,5	75,0
Nb d'articles/cirre	54	48	50	51	55	58	52	57	65
Longueur couronne	175	-	-	150	-	138	-	-	172
Nombre de bras	>74	>35	>71	>55	>65	>35	>103	-	>91
IBr ax*	4^5	4^5	4^5	4^5	4^5	4^5	$4^4;5^1$	-	4^5
IIBr ax*	$5^1;6^1;7^7;8^2$	$8^1;9^1;10^4$ $11^1;12^1$	$5^3;6^1;7^5;8^1$	$7^6;9^1$	$5^2;6^3;7^5$	$6^1;7^3$	$6^1;7^{10}$	-	7^{10}
IIIBr ax*	$9^4;11^8;12^1$ $13^5;14^1$	$7^1;11^2$ $12^1;15^4$	$9^3;10^1;11^7$ $12^1;15^7;17^1$	$11^5;12^1;13^4$ $14^1;15^2$	$9^7;11^{10}$	$9^1;11^4;13^1$	$7^1;9^8;11^{10}$	-	$9^{11};11^7;12^1$ 13^1
IVBr ax*	$10^1;11^3;12^1;13^6$ $15^2;17^7;18^2;19^5$ $21^2;26^1$	$11^1;17^1;18^1$ $19^3;21^2;24^1$	$11^1;13^2;15^4;17^3$ $18^1;19^7;21^3;22^1$ $23^1;25^1;27^2$	$7^3;11^1;15^5$ $19^3;21^7;23^2$ $24^1;25^1$	$13^2;15^6;17^7$ $19^7;21^4;40^1$	$11^1;13^2;15^2$ $17^2;19^1;20^1$ $21^1;22^1;23^4$	$13^7;15^6;17^{13}$ $18^1;19^1;20^1$ $21^4;22^1;23^2$	-	$15^{11};16^1;17^{12}$ $19^5;21^3;23^3$
VBr ax*	$17^2;19^1;20^1$	-	$21^3;23^1$	-	19^1	$17^1;19^2;23^1$	$19^{13};21^7;22^1$ $23^2;25^1;29^1$ 31^1	-	$15^3;17^2;19^3$ $21^5;23^1;25^1$ 29^1
Largeur IBr	5,5	5,1	5,9	5,9	5,7	5,4	5,6	-	5,6
Largeur IIBr	4,3	4,1	4,3	4,5	4,3	4,1	4,2	-	4,5
Largeur IIIBr	3,1	2,9	3,1	3,0	3,4	3,2	3,4	-	3,3
Longueur de P1	-	-	-	19,6	14,5	31,3	-	-	-
Nb d'articles/P1	-	-	-	17	11	20	-	-	-
Longueur de PBr	-	14,1	-	15,6	19,4	15,3	-	-	-
Nb d'articles/PBr	-	24	-	20	19	18	-	-	-

TABLEAU 14. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus nobilis* (suite). Même légende que celle du tableau 2.

N° du spécimen Station	Sp. 28 CP 82	Sp. 29 CP 82	Sp. 30 CP 82	Sp. 31 CP 82	Sp. 32 CP 82	Sp. 33 CP 83	Sp. 34 CP 86	Sp. 35 CP 86
Diamètre proximal	6,0	4,8	5,6	6,4	5,3	7,0	7,3	7,9
Diamètre distal	5,7	-	5,6	6,3	5,5	6,5	6,9	7,2
Nombre d'internodales*	$11^5;12^7$ $13^5;14^1$	11^2	$11^2;12^9;13^2$	13^{16}	$12^6;13^9$	13^7	$10^9;11^9;12^5$	$9^1;10^3;11^4;12^{11}$
Longueur noditaxis	15,0	14,6	15,7	18,5	17,7	18,0	18,0	18,1
Epaisseur maximale de l'internodale	1,2	1,3	1,4	1,5	1,3	1,2	1,6	1,6
Epaisseur maximale de la nodale	1,8	1,4	1,9	2,2	1,5	1,5	2,0	1,9
Dernier noditaxis avec pores	13	13	16	19	21	16	27	23
Longueur des cirres	48,0	35,0	54,7	58,6	56,4	51,0	60,3	58,3
Nb d'articles/cirre	51	44	54	57	51	55	57	54
Longueur couronne	134	95	145	156	-	-	-	-
Nombre de bras	>48	>34	>63	>60	>36	>59	>96	>80
IBr ax*	4^5	$3^1;4^4$	$4^5;5^1$	4^4	4^5	$4^4;5^1$	4^5	4^5
IIBr ax*	$5^1;7^4;8^2;9^1$	$7^2;8^3;9^4$	$5^3;6^5;7^2$	$6^1;7^4;9^1$	$5^2;6^4;7^3$	$6^1;7^9$	$6^1;7^9$	$5^5;6^2;7^2;9^1$
IIIBr ax*	$9^1;11^6$ $13^4;15^4$	$11^1;13^3;14^1$ $15^8;16^1;17^1$ 19^1	$11^{11};13^2;15^4$ $17^2;19^4;21^5$ 23^2	$9^2;11^4$ $12^1;13^3$	$11^5;13^4$ $14^2;15^1$	$9^4;10^1;11^6$ $12^1;13^3$	$7^1;9^{10};10^1;11^7$	$8^1;9^5;10^1;11^{10}$ $13^1;14^1$
IVBr ax*	$15^2;17^2;19^5$ $21^4;23^2$	-	$21^3;25^2$	$13^2;14^2;15^5$ $17^1;18^1;19^6$ $21^1;23^2$	$15^1;17^1$ $19^2;23^1$	$13^1;15^4;17^2$ $19^3;21^6;22^1$ $23^2;25^3;27^1$	$11^1;12^1;13^6;14^1$ $15^8;17^{10};19^2$ $21^1;23^3;24^1$	$11^3;13^6;14^1;15^5$ $17^1;19^3;21^3;23^2$ $25^1;31^1$
VBr ax*	23^1	-	-	$19^1;23^1$	-	-	$13^2;17^7;18^2;19^5$ $21^7;25^1;29^1$	$15^2;17^2;19^3$ $21^3;23^3$
Largeur IBr	5,6	4,8	5,1	5,5	5,8	5,0	6,1	7,2
Largeur IIBr	4,6	3,9	3,7	3,6	4,3	4,2	5,0	5,5
Largeur IIIBr	3,3	2,8	2,6	2,6	3,1	3,1	4,0	3,9
Longueur de P1	11,4	13,0	16,7	-	16,1	-	-	18,2
Nb d'articles/P1	10	14	15	-	14	-	-	14
Longueur de PBr	20,0	11,1	12,9	-	17,1	13,3	-	14,3
Nb d'articles/PBr	19	17	19	-	18	21	-	21

TABLEAU 15. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus nobilis* (suite). Même légende que celle du tableau 2.

Les individus sont de grande taille (fig. 13 A). En effet leur diamètre varie, en partie proximale, entre 4,8 et 8,2 mm (moyenne = 6,4 mm). La section transversale du pédoncule est toujours étoilée dans sa partie proximale alors qu'elle devient circulaire ou subpentagonale en partie distale. Le pédoncule est très souvent lisse (fig. 13 C) mais quelquefois présente des tubercules plus ou moins marqués. Le nombre d'internodales par noditaxis mature fluctue entre 8 et 15 et se trouve le plus souvent à 13 (tabl. 16). La longueur de la zone d'extension des pores interarticulaires est importante (tabl. 16). Les premiers articles des cirres sont arrondis et peu épais puis deviennent très rapidement subrectangulaires et légèrement arrondis sous la face inférieure de l'article formant ainsi une petite apophyse.

	Valeur minimale	Valeur maximale	Mode	Coefficient de variation (%)	Nombre d'observations
Nombre d'internodales	8	15	13	8,6	550
Dernier noditaxis avec pores	13	27	17	19,4	33
IBr ax	3	8	4	7,6	164
IIBr ax	5	13	7	18,8	304
IIIBr ax	7	19	11	18,4	561
IVBr ax	10	49	17	22,9	809
VBr ax	13	27	19	18,3	190
VIBr ax	20	27	23	10,7	5

TABLEAU 16. — Variabilité de quelques caractères morphologiques chez les *Saracrinus nobilis* récoltés au large des îles Aru, Kai et Tanimbar (Indonésie).

Les basales sont de forme losangique et possèdent une légère apophyse. Elles sont jointives chez la plupart des individus mais les spécimens n° 2, 25, 27 et 34 possèdent des basales non jointives. Le rapport de la largeur sur la hauteur est égal à 1,53. Les basales tendent très fréquemment à être plus hautes que les radiales (fig. 7).

Les radiales de forme rectangulaire et jointives, sont en moyenne trois fois plus larges que hautes (rapport de la largeur sur la hauteur = 3,1). La largeur des radiales tend à augmenter avec l'accroissement du diamètre pédonculaire. De même, quoique moins marquée, cette tendance s'observe pour la hauteur et la largeur des basales. En revanche, pour l'éventail de valeurs actuellement disponibles, la hauteur des radiales n'est pas fortement liée à la taille du pédoncule. Le spécimen n°7 se caractérise par des radiales de petite taille, notamment au niveau de leur largeur. Cette particularité peut résulter d'un problème de régénération. Le spécimen n°1 présente, quant à lui, des radiales exceptionnellement bien développées.

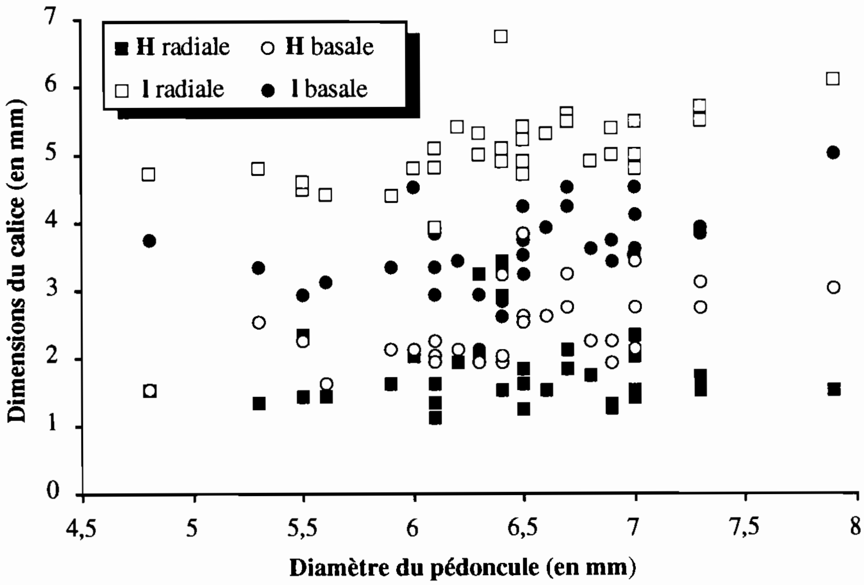

FIG. 7. — Dimensions du calice (hauteur et largeur des basales et des radiales) en fonction du diamètre maximum du pédoncule pour *Saracrinus nobilis* (îles Aru, Kai et Tanimbar).
H : hauteur ; l : largeur.

Le nombre maximum de bras est compris entre 60 et 120, atteignant rarement six dichotomies (fig. 13 B). Des verrues ornent les brachiales de quelques individus leur donnant ainsi un aspect rugueux. Le nombre d'ossicules contenus dans chaque série brachiale augmente régulièrement et progressivement depuis les I Br jusqu'au VI Br. Les pinnules proximales se composent en moyenne de 16 articles pour une longueur de 18,6 mm. Leurs articles proximaux sont massifs et trapézoïdaux, alors que les articles plus distaux sont fins et rectangulaires. Le spécimen n° 24 se particularise par des pinnules proximales anormalement longues, qui peuvent atteindre voire dépasser 31 mm de longueur. Les pinnules médianes, situées sur les II Br et III Br, ont en moyenne 21 articles pour une longueur de 15,4 mm.

Les formes les plus robustes, dont le diamètre pédonculaire est supérieur à 6,5 mm, possèdent les caractéristiques suivantes : leur nombre d'internodales par noditaxis mature se situant très fréquemment à 13, une section transversale du pédoncule arrondie, un nombre de bras important (souvent supérieur à 80). Ces principaux critères ont permis à CARPENTER (1884) de décrire une nouvelle espèce *Saracrinus superbus*. Nous ne pouvons, pour la faune indonésienne, discriminer les *S. nobilis* des *S. superbus,* ce qui corrobore les hypothèses faites auparavant (DÖDERLEIN, 1907 ; BOURSEAU & ROUX, 1989 ; BOURSEAU *et al.*, 1991). *S. superbus* doit donc être mis en synonymie avec *S. nobilis*. *S. superbus* représenterait un morphotype stable, atteignant un stade "sénile", de *S. nobilis*. Ce morphotype stable s'épanouirait dans les milieux peu profonds et abrités, alors que *S. superbus* plus polymorphe (pôle opportuniste) relaie le premier dans un créneau bathymétrique plus profond (300-500 m).

CARACTÈRES DES ARTICULATIONS. — Les zones pétaloïdes des symplexies (fig. 13 F-G) du pédoncule peuvent être de forme lancéolée à bout triangulaire ou piriforme. De grosses mailles sont présentes au sein du réseau des aréolas de certains spécimens. Les aires interpétaloïdes sont en moyenne 1,2 fois moins larges que les zones pétaloïdes et s'évasent vers l'extérieur. Le crénularium interne est peu développé. Le nombre de créneaux est compris entre 12 et 15 (mode à 14). Le périlumen se marque fortement autour du canal axial subcirculaire.

Les synostoses possèdent des aréolas lancéolées et sont en moyenne 1,6 fois plus larges que les zones interpétaloïdes (fig. 13 D-E). Le nombre de créneaux est compris entre 9 et 10 (mode à 10). Le réseau du canal axial est dense et irrégulier. Le lumen, quant à lui, présente une ébauche de lobes.

RAPPORTS ET DIFFÉRENCES. — Les *S. nobilis* de KARUBAR entrent dans le champ de variation des *S. nobilis* du reste de la faune du Pacifique sud-ouest (AMÉZIANE-COMINARDI, 1991) et présentent les particularités suivantes :

- de faibles coefficients de variabilité pour les caractères morphologiques externes tels que le nombre d'internodales par noditaxis mature et la position de l'axillaire de la première série brachiale (I Br ax) ;
- une zone d'extension des pores interarticulaires plus étendue ;
- un nombre de brachiales plus élevé pour les quatrième et cinquième séries brachiales. Ces deux séries, pour le reste de la faune du Sud-Ouest Pacifique, sont constituées d'une quinzaine de pièces ;
- à diamètre pédonculaire égal et à profondeur équivalente, un nombre de bras beaucoup plus important.

La faune indonésienne (îles Aru, Kai et Tanimbar) présente d'une part une plus grande stabilité morphologique et possède d'autre part des caractères beaucoup plus matures que le reste de la faune du Pacifique sud-ouest. Cette faune indonésienne par rapport au reste de la faune se compose de formes que nous pouvons qualifier de "super adultes" (AMÉZIANE-COMINARDI, 1991). Ces caractéristiques pourraient résulter de conditions environnementales, telles que l'hydrodynamisme, l'aspect du substrat et les apports trophiques, qui seraient plus stables pour les sites indonésiens.

Saracrinus moosai sp. nov.

Fig. 8-10, 14-15

SYNONYMIE.
Metacrinus varians Döderlein, 1907 : 41 (non P. H. Carpenter, 1884).

MATÉRIEL EXAMINÉ. — La série-type se constitue de 38 spécimens provenant de la station CP 16, par 315-349 m de fond. Une autre station CP 05, par 296-299 m de fond, a fourni 24 spécimens.

LOCALITÉ-TYPE. — Au large de l'île Kai, Indonésie. Station CP 16 : 24.10.91, 05°17'S-132°50'E, 315-349 m.

ÉTYMOLOGIE. — L'espèce est dédiée au Dr K. MOOSA, chef de mission indonésien de la campagne KARUBAR.

DIAGNOSE DE L'ESPÈCE. — *Saracrinus* de taille très moyenne et de morphologie variable. Pédoncule de section pentagonale et, le plus souvent, dépourvu d'ornementation. La longueur du pédoncule est petite par rapport à celle de la couronne de bras. Le nombre d'internodales par noditaxis mature est généralement de 5 ou 6. Les cirres sont petits, frêles et trois à quatre fois plus longs que les internodes. La surface externe des bras est lisse. Les brachiales prennent souvent un aspect globuleux. L'organisation de la couronne est la suivante : 3 à 8 I Br (mode à 4), 4 à 13 II Br (mode à 9), 7 à 31 III Br (mode à 13). Les articulations du pédoncule et des bras sont différentes de celles de *S. angulatus* et de *S. varians* (les plus profonds), espèces avec lesquelles *S. moosai* présente le plus d'affinités.

DESCRIPTION DE LA MORPHOLOGIE EXTERNE. — L'holotype (spécimen n°45) est un spécimen de taille plutôt moyenne (fig. 14 A). La longueur du pédoncule est de 11 cm pour 26 noditaxis ; son diamètre en partie proximale est de 5 mm et sa section transversale est pentagonale (fig. 14 E). Le pédoncule est de petite taille par rapport à la couronne de bras. Le pédoncule tend à être lisse et présente localement une très faible ornementation qui se traduit par un léger renflement du centre de l'ossicule. Les columnales se caractérisent par une hétérométrie. L'épaisseur des nodales les plus grosses atteint 1,2 mm et celle des internodales 1,0 mm. La hauteur des noditaxis ne dépasse pas 7,2 mm. Les pores interarticulaires s'observent jusqu'au douzième internode. Le nombre total d'internodales par noditaxis mature est de 5 (16 cas) et de 6 (4 cas). Il est atteint dès le douzième internode. La longueur des cirres est d'environ 26 mm pour 46 articles.

N° du spécimen **Station**	Sp. 1 CP 05	Sp. 2 CP 05	Sp. 3 CP 05	Sp. 4 CP 05	Sp. 5 CP 05	Sp. 6 CP 05	Sp. 7 CP 05	Sp. 8 CP 05	Sp. 9 CP 05	Sp. 10 CP 05	Sp. 11 CP 05
Diamètre proximal	4,5	4,5	4,3	4,2	4,4	4,4	4,8	4,9	5,2	5,0	5,2
Diamètre distal	4,1	4,2	4,1	4,6	-	-	4,0	4,5	4,8	4,3	4,6
Nombre d'internodales*	$5^{11};6^{3}$	$4^{7};5^{8}$	5^{16}	$3^{2};4^{1}$ $5^{4};6^{3}$	$5^{5};6^{1}$	-	$5^{8};6^{20}$	$4^{1};5^{7};6^{5}$	$4^{5};5^{4};6^{10}$	$6^{9};7^{1}$	$5^{2};6^{4}$
Longueur noditaxis	6,5	6,6	6,4	5,5	5,6	-	6,5	6,8	6,9	8,9	6,4
Epaisseur maximale de l'internodale	0,8	0,7	0,7	0,8	0,9	-	1,0	1,1	1,0	1,1	1,1
Epaisseur maximale de la nodale	1,0	09	1,1	1,1	1,1	-	1,2	1,4	1,2	1,5	1,5
Dernier noditaxis avec pores	11	11	12	12	9	-	9	9	12	10	9
Longueur des cirres	31,2	29,4	27,5	25,3	-	-	24,4	31,0	31,4	31,9	32,6
Nb d'articles/cirre	38	38	38	43	-	-	35	43	46	37	41
Longueur couronne	110	90	-	-	-	-	109	124	109	104	120
Nombre de bras	45	42	-	-	-	-	>29	40	>32	37	40
IBr ax*	4^{6}	$4^{3};5^{1};6^{1}$	5^{1}	4^{3}	$5^{4};7^{1}$	4^{1}	$4^{3};5^{1}$	4^{5}	4^{5}	$4^{4};5^{1}$	$4^{3};5^{1};6^{1}$
IIBr ax*	$9^{11};10^{1}$	$7^{2};8^{2}$ $9^{4};11^{1}$	$7^{1},9^{1}$	$6^{1};7^{1}$ $8^{2};9^{1}$	-	-	$7^{6};9^{1}$	$7^{5};9^{5}$	$6^{1};7^{5};8^{1}$	$7^{1};8^{3}$ $9^{3};10^{3}$	$4^{1};6^{2}$ $7^{6};8^{1}$
IIIBr ax*	$13^{4};14^{1};15^{4};16^{2}$ $17^{3};18^{1};19^{1};20^{1}$ $21^{1};22^{1};23^{1};31^{1}$	$11^{1};13^{9}$ $15^{8};16^{1}$	13^{2}	-	-	-	$11^{2};13^{4};15^{3}$ $17^{2};21^{2}$	$9^{1};11^{6}$ $13^{9};16^{4}$	$11^{3};13^{5};14^{1}$ $15^{2};16^{3}$	$13^{2};14^{1};15^{3}$ $16^{1};17^{3};18^{4}$ $20^{2};22^{1}$	$11^{1};13^{3}$ $15^{6};17^{6}$ $18^{1};20^{1}$
IVBr ax*	-	$13^{1};15^{1}$	-	-	-	-	-	-	15^{1}	-	-
VBr ax*	-	-	-	-	-	-	-	-	-	-	-
Largeur IBr	4,4	4,8	4,7	5,0	4,7	5,2	4,6	4,7	4,9	4,6	4,9
Largeur IIBr	3,3	3,6	3,7	3,7	3,3	4,1	3,5	3,9	3,7	3,9	3,9
Largeur IIIBr	2,4	2,5	2,7	3,2	-	-	2,8	2,8	2,8	2,8	3,1
Longueur de P1	-	11,4	12,2	11,6	-	13,4	12,4	-	-	-	-
Nb d'articles/P1		10	14	13	-	12	11	-	-	-	-
Longueur de PBr	10,1	10,5	10,4	-	-	-	8,9	12,3	11,8	11,9	-
Nb d'articles/PBr	14	13	15	-	-	-	16	18	17	21	-

TABLEAU 17. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov. Même légende que celle du Tableau 2.

N° du spécimen **Station**	Sp. 12 CP 05	Sp. 13 CP 05	Sp. 14 CP 05	Sp. 15 CP 05	Sp. 16 CP 05	Sp. 17 CP 05	Sp. 18 CP 05	Sp. 19 CP 05	Sp. 20 CP 05	Sp. 21 CP 05	Sp. 22 CP 05
Diamètre proximal	5,2	4,9	4,2	4,6	5,4	-	-	4,7	-	4,9	5,0
Diamètre distal	4,5	4,4	3,9	4,6	-	4,6	-	-	-	-	4,3
Nombre d'internodales*	$4^{9};5^{9};6^{3}$	$3^{1};4^{2}$ $5^{10};6^{13}$	$5^{13};6^{14};7^{1}$	$5^{8};6^{6}$	$5^{3};6^{2}$	6^{16}	-	-	-	5^{2}	$4^{2};5^{8}$ $6^{5};7^{1}$
Longueur noditaxis	6,4	6,9	6,1	6,4	6,2	6,4	-	-	-	-	6,2
Epaisseur maximale de l'internodale	1,1	1,0	1,0	1,0	1,0	1,0	-	-	-	-	1,1
Epaisseur maximale de la nodale	1,4	1,4	1,3	1,3	1,3	1,3	-	--	-	-	1,6
Dernier noditaxis avec pores	9	9	9	10	10	-	-	-	-	-	10
Longueur des cirres	27,0	27,1	27,7	29,5	27,7	28,2	-	-	-	-	28,3
Nb d'articles/cirre	40	37	42	42	45	42	-	-	-	-	39
Longueur couronne	95	-	95	103	-	-	-	-	-	111	105
Nombre de bras	>30	>6	40	>>32	>34	>6	>40	>25	>45	>35	40
IBr ax*	4^{5}	4^{2}	4^{5}	$4^{3};5^{2}$	4^{5}	4^{2}	4^{5}	$4^{3};6^{1}$	4^{5}	4^{5}	$4^{4};5^{1}$
IIBr ax*	$4^{2};6^{2}$ $7^{3};8^{1}$	$7^{1};8^{1}$	$6^{1};7^{1}$ $9^{7};10^{1}$	$6^{1};7^{3};8^{1}$ $9^{1};11^{1}$	$8^{3};9^{3}$ $11^{1};12^{1}$	7^{2}	$7^{5};8^{2};9^{2}$	$6^{2};8^{1}$ $9^{3};11^{1}$	$7^{5};8^{1}$ $9^{3};10^{1}$	$6^{2};7^{2};8^{3}$ $10^{1};11^{1}$	$6^{2};7^{5}$ $8^{1};9^{2}$
IIIBr ax*	$8^{1};10^{1}$ $13^{6};15^{2}$	$13^{2};15^{1}$	$11^{8};13^{9}$ $15^{2};20^{1}$	$9^{1};11^{8};12^{1}$ $13^{3};15^{1}$	$15^{6};16^{1};17^{1}$ $19^{2};20^{3};22^{1}$ 24^{2}	$13^{2};15^{1}$ 18^{1}	$9^{4};10^{1};11^{7}$ $12^{1};13^{1};15^{1}$	$11^{2};13^{2}$ $14^{1};15^{3}$ 16^{1}	$10^{1};11^{5};12^{1}$ $13^{4};14^{4};16^{2}$	$11^{3};12^{1};13^{4}$ $14^{4};15^{1};16^{3}$	$9^{1};11^{1};12^{1}$ $13^{11};15^{4}$ $17^{1};19^{1}$
IVBr ax*	11^{2}	-	-	-	-	-	$11^{1};13^{1};15^{2}$ $16^{1};17^{5};19^{1}$ $20^{1};23^{3};25^{1}$ 29^{1}	-	$13^{1};15^{1};17^{7}$ $19^{5};21^{4};23^{1}$ $24^{1};25^{1}$	-	-
VBr ax*	-	-	-	-	-	-	-	-	-	-	-
Largeur IBr	4,6	4,9	4,3	4,5	5,0	4,8	5,1	5,2	4,8	4,6	4,9
Largeur IIBr	3,9	3,7	3,4	3,6	4,0	3,7	3,2	4,1	3,7	3,6	4,1
Largeur IIIBr	2,8	2,7	2,9	2,8	3,1	2,7	2,8	3,5	2,8	3,0	3,2
Longueur de P1	-	14,9	14,5	-	-	16,1	-	17,9	-	-	-
Nb d'articles/P1	-	15	16	-	-	17	-	16	-	-	-
Longueur de PBr	8,9	12,9	10,8	-	8,3	7,9	-	11,0	-	-	-
Nb d'articles/PBr	19	17	21	-	15	16	-	20	-	-	-

TABLEAU 18. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov. (suite). Même légende que celle du Tableau 2.

N° du spécimen Station	Sp. 23 CP 05	Sp. 24 CP 05	Sp. 25 CP 16	Sp. 26 CP 16	Sp. 27 CP 16	Sp. 28 CP 16	Sp. 29 CP 16	Sp. 30 CP 16	Sp. 31 CP 16	Sp. 32 CP 16
Diamètre proximal	4,8	4,7	3,9	4,4	3,7	2,3	5,0	5,0	4,6	4,0
Diamètre distal	4,8	4,5	3,8	3,9	3,6	1,9	4,7	4,6	4,3	3,2
Nombre d'internodales*	$5^{7};6^{14}$	$4^{5};5^{20}$	$5^{2};6^{12};7^{1}$	6^{16}	$5^{11};6^{10}$	$6^{7};7^{2}$	$5^{17};6^{2}$	$6^{18};7^{7}$	$5^{7};6^{13}$	$6^{11};7^{6}$
Longueur noditaxis	6,0	5,1	6,0	6,4	7,7	5,9	6,5	6,4	7,0	7,1
Epaisseur maximale de l'internodale	1,1	1,1	1,0	1,0	0,9	0,6	0,9	0,9	0,8	0,8
Epaisseur maximale de la nodale	1,5	1,5	1,4	1,2	1,3	0,9	1,2	1,1	1,1	1,1
Dernier noditaxis avec pores	11	11	13	9	11	11	10	11	10	11
Longueur des cirres	27,9	32,3	30,8	26,5	27,7	18,6	23,7	32,9	28,4	28,5
Nb d'articles/cirre	47	38	37	36	39	33	34	40	42	37
Longueur couronne	129	-	105	109	115	60	112	105	102	88
Nombre de bras	40	>8	40	>28	>21	40	37	>32	36	41
IBr ax*	$4^{2};5^{3}$	4^{2}	$4^{3};5^{2}$	$4^{4};5^{1}$	4^{4}	4^{5}	$4^{4};5^{1}$	$3^{1};4^{4}$	4^{5}	$4^{3};5^{1}$
IIBr ax*	$7^{8};8^{1};9^{1}$	10^{1}	$7^{2};8^{1}$ $9^{3};11^{4}$	$7^{3};9^{3}$	9^{4}	$8^{1};9^{9}$	9^{10}	$5^{1};6^{1}$ $7^{5};9^{1}$	$5^{1};7^{2}$ $9^{6};10^{1}$	$7^{2};9^{6}$ $10^{1};11^{1}$
IIIBr ax*	$12^{1};13^{4};14^{1}$ $15^{5};16^{2};17^{3}$ $19^{2};20^{2}$	-	$13^{3};15^{7}$ $16^{2};18^{1}$ $19^{2};20^{5}$	$12^{1};13^{5}$ $15^{2};16^{3}$ 18^{1}	$11^{2};13^{2}$ $19^{1};20^{1}$ 22^{2}	$11^{1};13^{7},15^{1}$ $17^{2};18^{1};19^{4}$ 20^{3}	$9^{1};10^{1};11^{3}$ $13^{5};15^{2}$ $16^{3};20^{2}$ 24^{2}	$11^{4};13^{6};15^{4}$	$11^{1};13^{3};14^{1}$ $15^{5};17^{2};20^{1}$ $21^{2};22^{1}$	$8^{1};13^{5};15^{3}$ $17^{3};19^{5}$ $20^{1};21^{2}$
IVBr ax*	-	-	-	-	-	-	-	-	-	13^{1}
VBr ax*	-	-	-	-	-	-	-	-	-	-
Largeur IBr	5,3	4,8	4,5	4,6	4,5	2,9	4,6	5,0	4,2	3,8
Largeur IIBr	4,1	3,7	3,7	4,0	3,1	1,9	3,6	3,9	3,7	3,0
Largeur IIIBr	3,5	-	2,5	2,6	2,3	1,4	2,0	3,0	2,9	2,2
Longueur de P1	17,4	16,1	10,6	16,3	13,3	-	16,2	11,3	16,3	-
Nb d'articles/P1	17	14	11	14	11	-	12	13	15	-
Longueur de PBr	11,3	-	10,4	9,9	10,0	-	12,4	8,6	9,4	-
Nb d'articles/PBr	19	-	17	17	16	-	19	15	12	-

TABLEAU 19. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov. (suite). Même légende que celle du Tableau 2.

N° du spécimen Station	Sp. 33 CP 16	Sp. 34 CP 16	Sp. 35 CP 16	Sp. 36 CP 16	Sp. 37 CP 16	Sp. 38 CP 16	Sp. 39 CP 16	Sp. 40 CP 16	Sp. 41 CP 16	Sp. 42 CP 16
Diamètre proximal	4,7	4,6	4,4	4,5	5,0	4,9	5,2	4,7	4,7	5,1
Diamètre distal	5,2	4,0	4,0	4,0	4,7	-	4,6	4,4	4,5	-
Nombre d'internodales*	$3^{1};4^{1}$ $5^{15};6^{5}$	$4^{17};5^{3}$	$5^{5};6^{5}$	$5^{3};6^{12}$	$5^{3};6^{13}$	$4^{1};5^{3}$	$4^{2};5^{15}$	$4^{3};5^{17}$	$5^{1};6^{18};7^{1}$	$5^{1};6^{2}$
Longueur noditaxis	5,9	5,1	5,5	6,0	7,9	-	5,8	6,3	8,3	-
Epaisseur maximale de l'internodale	0,8	1,0	0,8	0,9	1,2	-	1,1	1,0	1,1	-
Epaisseur maximale de la nodale	1,0	1,1	1,0	1,0	1,5	-	1,2	1,1	1,4	-
Dernier noditaxis avec pores	13	12	11	12	14	12	13	12	10	11
Longueur des cirres	35,0	27,5	29,0	22,0	-	-	34,0	25,7	-	-
Nb d'articles/cirre	40	35	42	37	-	-	39	39	-	-
Longueur couronne	135	112	103	104	114	140	95	103	115	126
Nombre de bras	>17	>39	40	39	40	>34	>24	41	>34	40
IBr ax*	4^{3}	$3^{1};4^{3};5^{1}$	4^{5}	$4^{3};5^{2}$	4^{5}	4^{5}	4^{4}	4^{5}	$4^{3};5^{2}$	$4^{3};5^{2}$
IIBr ax*	9^{3}	9^{10}	$5^{1};6^{1}$ $7^{7};9^{1}$	$8^{1};9^{8};10^{1}$	$7^{2};9^{1}$ 11^{7}	$7^{1};8^{3};9^{4}$	$6^{1};7^{1};9^{1}$ $10^{1};12^{1}$	$7^{1};8^{1}$ 9^{8}	$6^{1};7^{2}$ 9^{5}	$9^{6};11^{3}$ 13^{1}
IIIBr ax*	$9^{2};11^{2}$ 13^{2}	$13^{6};14^{3};15^{3}$ $20^{2};23^{1};24^{3}$ 26^{1}	$11^{1};13^{10}$ $14^{2};15^{4}$ $16^{2};18^{1}$	$9^{1};11^{5};13^{3}$ $14^{3};15^{1};16^{2}$ $18^{4};20^{2}$	$9^{2};11^{5}$ $13^{7};15^{3}$ 17^{3}	$9^{1};10^{1}$ $11^{9};13^{5}$	$12^{1};13^{2};15^{1}$ $16^{2};17^{2};18^{1}$ 19^{1}	$9^{2};13^{5}$ $15^{5};17^{1}$ $19^{3};20^{4}$	$11^{4};13^{6}$ $14^{1};16^{1}$ 17^{1}	$9^{2};11^{4}$ $12^{1};13^{7}$ $15^{4};17^{2}$
IVBr ax*	-	-	-	-	-	-	-	11^{1}	-	-
VBr ax*	-	-	-	-	-	-	-	-	-	-
Largeur IBr	4,6	4,1	4,7	4,3	5,0	5,0	4,5	4,5	4,8	4,6
Largeur IIBr	3,6	3,6	3,2	3,5	3,7	3,7	3,9	3,5	3,4	3,4
Largeur IIIBr	2,8	2,7	2,3	2,5	2,9	2,9	3,2	2,6	2,7	2,9
Longueur de P1	16,8	11,5	15,2	-	13,0	-	13,1	-	16,4	-
Nb d'articles/P1	15	15	16	-	15	-	14	-	17	-
Longueur de PBr	11,0	9,9	9,0	-	13,5	10,0	9,6	10,0	9,8	11,9
Nb d'articles/PBr	17	20	16	-	15	16	17	16	15	19

TABLEAU 20. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov. (suite). Même légende que celle du Tableau 2.

N° du spécimen **Station**	Sp. 43 CP 16	Sp. 44 CP 16	Sp. 45 CP 16	Sp. 46 CP 16	Sp. 47 CP 16	Sp. 48 CP 16	Sp. 49 CP 16	Sp. 50 CP 16	Sp. 51 CP 16	Sp. 52 CP 16	Sp. 53 CP 16
Diamètre proximal	6,0	6,0	5,0	4,9	4,3	4,9	6,0	4,9	4,8	3,6	4,8
Diamètre distal	-	-	4,5	4,6	4,3	4,5	-	-	4,6	3,2	4,2
Nombre d'internodales*	-	-	$5^{16};6^{4}$	$5^{4};6^{13}$	$5^{10};6^{2}$	5^{15}	-	$5^{2};6^{1}$	$5^{1};6^{5}$	$5^{9};6^{3}$	$5^{14};6^{3}$
Longueur noditaxis	-	-	7,2	6,7	5,7	6,9	-	-	6,4	5,6	7,7
Epaisseur maximale de l'internodale	-	-	1,0	1,1	1,0	1,1	-	-	1,0	1,0	0,9
Epaisseur maximale de la nodale	-	-	1,2	1,5	1,3	1,3	-	-	1,4	1,5	1,3
Dernier noditaxis avec pores	-	-	12	10	10	10	-	-	8	12	9
Longueur des cirres	-	-	26,3	24,1	27,4	32,3	-	-	31,0	21,8	33,4
Nb d'articles/cirre	-	-	36	38	41	36	-	-	39	32	40
Longueur couronne	125	195	121	124	115	114	150	108	109	85	118
Nombre de bras	>71	>45	40	>37	35	>37	>37	>29	>33	35	>38
IBr ax*	4^{5}	4^{5}	$4^{4};5^{1}$	4^{5}	4^{5}	4^{5}	4^{5}	4^{5}	$4^{3};5^{2}$	$4^{2};5^{3}$	$4^{4};6^{1}$
IIBr ax*	$7^{6};8^{3};12^{1}$	$5^{1};6^{3};7^{3}$ $8^{1};9^{1}$	$7^{2};8^{1};9^{7}$	$7^{4};9^{5}$	$7^{4};9^{5}$ 10^{1}	$6^{1};7^{2};9^{6}$	$7^{3};8^{3}$ 9^{2}	9^{7}	$7^{3};8^{1}$ 9^{5}	$9^{9};10^{1}$	$7^{1};8^{3};9^{5}$
IIIBr ax*	$11^{6};12^{1}$ $13^{9};15^{1}$ 17^{1}	$9^{2};11^{9}$ $13^{2};15^{1}$	$11^{6};13^{6}$ $14^{1};15^{3}$ 16^{4}	$9^{1};11^{5};13^{1}$ $14^{3};15^{4};16^{1}$ $17^{2};19^{2}$	$9^{1};11^{7}$ $13^{6};15^{1}$ 16^{1}	$11^{3};13^{2}$ $15^{6};16^{4}$ $17^{2};18^{1}$	$11^{2};13^{5}$	$13^{3};15^{3}$ $17^{1};18^{3}$ $19^{1};20^{1}$	$9^{1};11^{8}$ $13^{5};16^{1}$	$13^{4};15^{2}$ $16^{1};20^{5}$ $22^{1};23^{1}$	$8^{1};9^{8}$ $11^{4};13^{1}$ 14^{1}
IVBr ax*	$13^{3};14^{1};15^{5}$ $16^{7};17^{7};18^{2}$ $19^{5};20^{1};21^{1}$	$9^{1};11^{1};13^{3}$ $15^{2};16^{1};17^{3}$ $19^{1};23^{1}$	-	-	-	-	$11^{1};13^{1}$ $15^{1};17^{3}$ $21^{1};23^{1}$ 25^{3}	-	-	-	13^{1}
VBr ax*	-	-	-	-	-	-	22^{1}	-	-	-	-
Largeur IBr	5,6	5,5	5,3	5,0	4,5	5,1	5,4	4,6	4,7	4,1	5,2
Largeur IIBr	3,7	4,1	4,1	4,0	3,3	3,9	3,9	3,4	3,2	2,9	3,4
Largeur IIIBr	2,7	3,7	3,2	2,7	2,7	2,9	2,7	2,5	2,1	2,2	3,2
Longueur de P1	-	12,7	14,6	17,1	-	14,1	18,9	-	-	-	-
Nb d'articles/P1	-	13	15	12	-	12	17	-	-	-	-
Longueur de PBr	11,3	11,4	12,2	11,2	10,6	11,0	14,4	12,1	-	9,5	11,0
Nb d'articles/PBr	15	16	16	15	18	17	15	16	-	13	14

TABLEAU 21. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov.(suite). Même légende que celle du Tableau 2.

N° du spécimen **Station**	Sp. 54 CP 16	Sp. 55 CP 16	Sp. 56 CP 16	Sp. 57 CP 16	Sp. 58 CP 16	Sp. 59 CP 16	Sp. 60 CP 16	Sp. 61 CP 16	Sp. 62 CP 16
Diamètre proximal	4,5	4,7	4,9	4,7	5,2	4,7	4,2	4,1	5,4
Diamètre distal	4,6	4,3	4,5	4,1	4,4	4,7	4,1	4,3	4,7
Nombre d'internodales*	$5^{5};6^{13};7^{3}$	$5^{3};6^{14}$	$4^{2};5^{10}$ 6^{12}	$5^{1};6^{13};7^{2}$	$5^{7};6^{7};7^{1}$	$5^{7};6^{11}$	$5^{6};6^{7}$	$4^{1};5^{8}$ $6^{6};7^{1}$	$4^{4};5^{12}$
Longueur noditaxis	6,9	5,5	6,1	6,3	6,7	6,4	6,5	7,7	5,4
Epaisseur maximale de l'internodale	1,2	0,9	1,0	1,1	1,2	1,1	1,2	1,2	1,0
Epaisseur maximale de la nodale	1,5	1,2	1,3	1,5	1,5	1,5	1,5	1,5	1,3
Dernier noditaxis avec pores	9	11	9	8	11	11	8	8	9
Longueur des cirres	31,9	28,4	29,5	30,8	34,5	29,1	31,1	-	31,7
Nb d'articles/cirre	38	50	46	41	42	55	45	-	50
Longueur couronne	110	115	145	94	110	111	-	115	117
Nombre de bras	>39	>28	>33	>23	>29	39	>34	>36	>28
IBr ax*	$4^{4};5^{1}$	4^{5}	$4^{3};5^{2}$	$4^{2};5^{1}$	4^{5}	$4^{3};5^{2}$	4^{5}	$4^{4};5^{1}$	$4^{3};8^{1}$
IIBr ax*	9^{10}	$7^{1};9^{5};11^{2}$	$7^{2};9^{3};11^{3}$	$7^{4};9^{1}$	$9^{7};11^{1}$	$7^{4};9^{4};10^{2}$	$5^{1};7^{6};9^{1}$	$5^{1};7^{8}$	$7^{3};8^{1};9^{3}$
IIIBr ax*	$11^{6};13^{2};15^{6}$ $17^{1};19^{3};20^{1}$	$9^{1};13^{6};17^{1}$ $19^{1};21^{2}$	$11^{1};13^{3}$ $15^{4};16^{2}$ 17^{5}	$11^{2};12^{1}$ $13^{4};15^{2}$ 19^{1}	$12^{2};13^{5};14^{1}$ $15^{2};16^{1}$	$13^{8};14^{2}$ $15^{3};16^{3}$ $17^{1};19^{2}$	$9^{1};11^{3};13^{4}$ $14^{2};15^{4};16^{2}$	$11^{3};13^{5};14^{1}$ $15^{3};16^{3};17^{1}$ 18^{1}	$13^{4};14^{1};15^{3}$ $17^{3};18^{1}$
IVBr ax*	-	-	-	-	-	-	-	-	-
VBr ax*	-	-	-	-	-	-	-	-	-
Largeur IBr	4,2	4,8	4,6	4,5	5,1	5,2	4,1	4,7	5,5
Largeur IIBr	3,3	3,8	3,6	3,3	3,6	3,6	3,4	3,5	3,8
Largeur IIIBr	2,4	2,8	2,5	2,5	2,1	3,1	2,5	3,0	2,9
Longueur de P1	-	-	-	15,2	-	-	-	-	-
Nb d'articles/P1	-	-	-	15	-	-	-	-	-
Longueur de PBr	10,9	9,2	-	14,4	11,3	-	9,3	11,6	-
Nb d'articles/PBr	18	16	-	17	19	-	17	22	-

TABLEAU 22. — Principaux caractères morphologiques du pédoncule et de la couronne chez *Saracrinus moosai* sp. nov. (suite). Même légende que celle du Tableau 2.

Les basales, d'aspect trapézoïdal, sont jointives. Les radiales, jointives et de forme rectangulaire, sont deux fois plus larges que hautes. Le nombre de bras est de quarante (fig. 14 B). La hauteur de la couronne est de 121 mm. Son organisation est la suivante : I Br 1+2 (5 cas), 4+5 (1 cas), 4 ax (4 cas), 5 ax (1 cas) ; II Br 3+4 (9 cas), 1+2 (1 cas), 5+6 (1 cas), 7 ax (2 cas), 8 ax (1 cas), 9 ax (7 cas) ; III Br 3+4 (19 cas), 4+5 (1 cas), 11 ax (6 cas), 13 ax (6 cas), 14 ax (1 cas), 15 ax (3 cas), 16 ax (4 cas). Deux troncs brachiaux présentent une régénération ; l'une, au stade final, affecte la septième secondibrachiale et l'autre se localise au niveau de la quatrième série brachiale. Les premières pinnules (P1) présentent une surface externe qui tend parfois à être rugueuse et une section subrectangulaire. Leur longueur atteint 17,1 mm pour environ 15 articles. A partir des II Br, les pinnules deviennent plus petites (12,2 mm pour 16 articles) et leur surface externe perd l'aspect rugueux. L'extrémité des bras est dépourvue de pinnule fonctionnelle sur environ 26 mm. Les brachiales les plus distales portent effectivement des pinnules rudimentaires, constituées de deux ou trois ossicules.

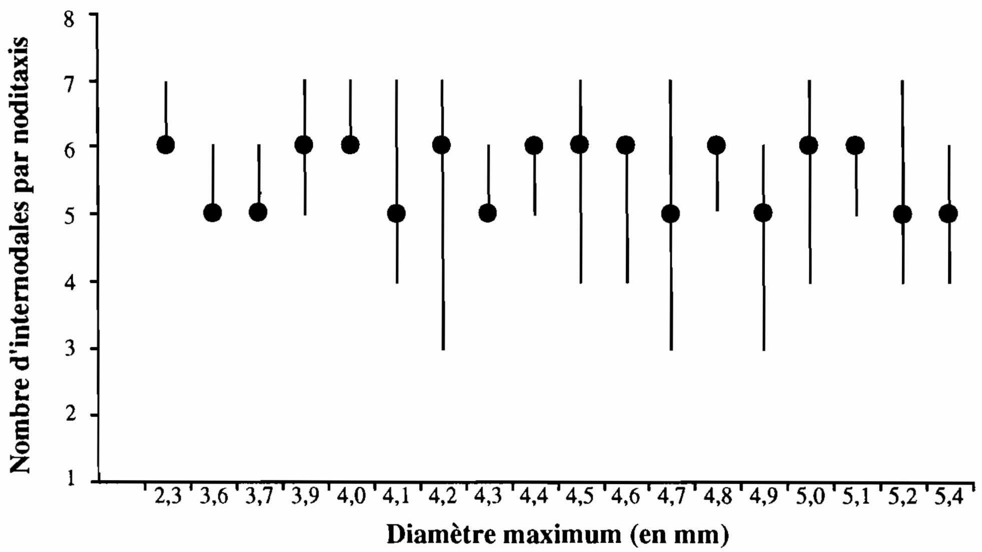

FIG. 8. — Variations du nombre d'internodales par noditaxis mature en fonction du diamètre maximal du pédoncule chez *Saracrinus moosai* sp. nov. (îles Kai, Indonésie).
Le rond noir correspond au mode.

Les Tableaux 17 à 22 regroupent les caractères morphologiques externes de tous les spécimens, y compris ceux de la série-type. Pour l'ensemble de ces individus, la section transversale du pédoncule est pentagonale, parfois une tendance arrondie se développe chez quelques individus. La section transversale des nodales peut tendre vers une forme étoilée. La plupart des spécimens a un pédoncule plutôt gracile par rapport à leur couronne de bras. Les diamètres atteignent exceptionnellement 6,0 mm et varient en partie proximale entre 2,3 mm et 6,0 mm. Le diamètre moyen est de 4,7 mm et 32 individus ont un diamètre compris entre 4,0 et 5,0 mm. Cette population se compose essentiellement d'individus matures. En effet, les jeunes spécimens sont inexistants, à l'exception de l'individu n°28 dont le diamètre varie entre 2,3 mm (en partie proximale) et 1,9 mm (en partie distale). Les columnales sont généralement dépourvues d'ornementation. Cependant, certains spécimens possèdent des ossicules qui peuvent porter un tubercule. Ce dernier peut, sur quelques rares ossicules, évoluer vers une fine carène discontinue. L'épaisseur des columnales varie plus ou moins fortement d'une pièce à l'autre. Cette variation, importante chez certains spécimens, se traduit par l'alternance d'une columnale très épaisse et d'une très mince (2 fois plus petite). Le nombre de columnales est compris entre 3 et 7 ; le premier mode étant à 6 et le second à 5 (tabl. 23, fig. 8). Les pores interarticulaires disparaissent assez rapidement. L'insertion cirrale peut marquer fortement l'infranodale. Chez certains spécimens, cette insertion manque localement (spécimens n°14 et 2). Les cirres sont petits et frêles (en moyenne 29 mm pour 40 articles). Leurs articles proximaux peuvent présenter une apophyse inférieure plus ou moins prononcée.

Les basales sont soit jointives (79 % des cas), soit disjointes (21 % des cas). Elles peuvent parfois posséder une apophyse distale. Le rapport de leur largeur sur leur hauteur est égal à 1,46. Les radiales, jointives, sont en moyenne deux fois et demie plus larges que hautes, et ont ainsi un aspect rectangulaire. Les infrabasales sont également présentes (fig. 14 C-D) et se trouvent à l'intérieur du cercle de basales. La présence des infrabasales, décrite pour d'autres espèces (AMÉZIANE-COMINARDI *et al.*, 1991 ; CLARK, 1908b ; DÖDERLEIN, 1907), semble être une caractéristique des Metacrininae.

	Valeur minimale	Valeur maximale	Mode	Coefficient de variation (%)	Nombre d'observations
Nombre d'internodales	3	7	6	12,9	882
Dernier noditaxis avec pores	8	14	11	13,9	51
IBr ax	3	8	4	12,0	285
IIBr ax	4	13	9	16,4	498
IIIBr ax	7	31	13	21,7	889
IVBr ax	9	29	17	24,1	128

TABLEAU 23. — Variabilité de quelques caractères morphologiques chez *Saracrinus moosai* sp. nov.(îles Kai, Indonésie).

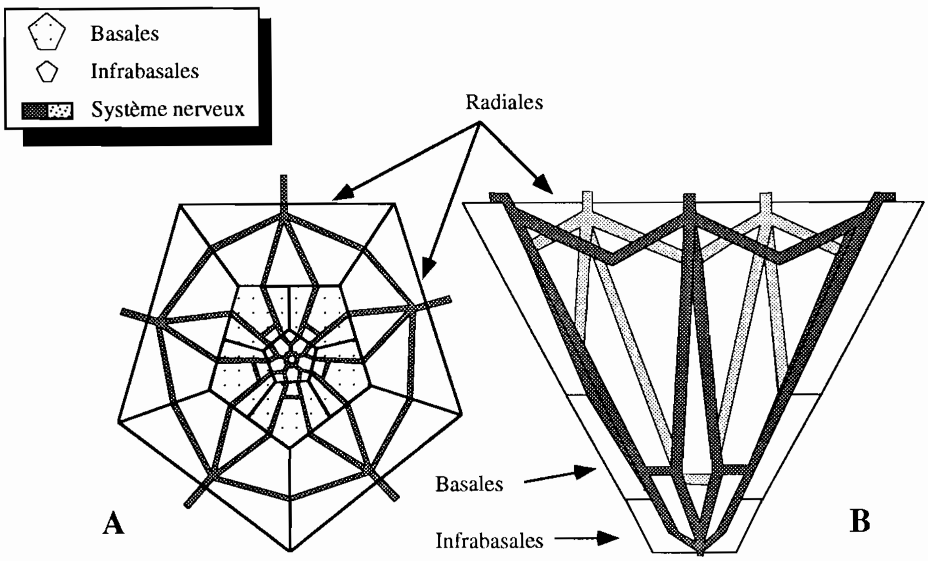

FIG. 9. — Morphologie du système entoneural (système nerveux aboral) dans le calice chez *Saracrinus moosai* sp. nov. (îles Kai, Indonésie).
A : projection horizontale ; B : vue de profil.

L'analyse détaillée des pièces de la coupe dorsale permet de transcrire le parcours, dans le calice, du système nerveux entoneural (fig. 9). De l'organe cloisonné, partent cinq troncs nerveux qui se divisent chacun au niveau des infrabasales. Deux branches nerveuses pénètrent donc dans chaque basale, elles ont pour origine deux infrabasales différentes. Ces branches sont reliées entre elles, vers le tiers postérieur (côté pédoncule), par un troisième cordon nerveux. Ce dernier ne relie entre elles que les branches nerveuses appartenant à la même basale, c'est pourquoi ce cordon nerveux est discontinu. Dans chacune des cinq radiales se trouvent deux ramifications qui proviennent de basales différentes. Au sommet de la partie antérieure (côté couronne de bras), les deux branches se soudent dans la radiale et un cordon nerveux circulaire apparaît également à ce niveau, ce qui permet une meilleure cohésion du cercle de radiales. Par conséquent, une seule branche nerveuse sort de la partie antérieure de la radiale et entre dans la première brachiale. La position des cordons nerveux se révèle semblable à celle de *Neocrinus decorus* et *Metacrinus rotundus* (A.H. CLARK, 1908c).

La couronne brachiale est fréquemment constituée d'une quarantaine de bras. Les dichotomies, au niveau de la quatrième série brachiale, sont rares (tabl. 23) et sont exceptionnelles pour la cinquième série brachiale (1 cas). Le nombre d'ossicules par série brachiale augmente régulièrement et constamment depuis les I Br jusqu'au IV Br (fig. 10). Pour les II Br, un second mode s'exprime au niveau de la septième brachiale (fig. 10). De même, pour les III Br, il existe un second mode au niveau de la onzième et de la treizième brachiale et pour IV Br, ce second mode se trouve aux treizième, quinzième et dix-neuvième brachiales. La répartition du nombre d'ossicules par série brachiale évolue depuis les I Br où il existe un seul mode (82 % des cas), jusqu'au IV Br où s'exprime un mode majeur (24 % des cas) et plusieurs modes secondaires. Ces modes se localisent, à l'exception de la première série brachiale, toujours au niveau d'un nombre impair de pièces. Les brachiales ont souvent un aspect globuleux. La largeur des brachiales varie entre 2,9 mm et 5,6 mm pour les I Br (moyenne = 4,7 mm), entre 1,9 mm et 4,1 mm pour les II Br (moyenne = 3,6 mm) et entre 1,4 mm et 3,7 mm pour les III Br (moyenne = 2,7 mm). La largeur des ossicules, pour chaque série, a été mesurée généralement sur la deuxième brachiale. La largeur des brachiales décroît donc régulièrement depuis les I Br jusqu'au IV Br et elle est en relation avec la taille du diamètre pédonculaire, exception faite des interférences dues à la régénération des ossicules. Les premières pinnules, massives, sont composées en moyenne de 14 articles et ont une longueur d'environ 14,5 mm. Les pinnules médianes (des II Br aux III Br) possèdent en moyenne 17 articles pour une longueur de 10,7 mm.

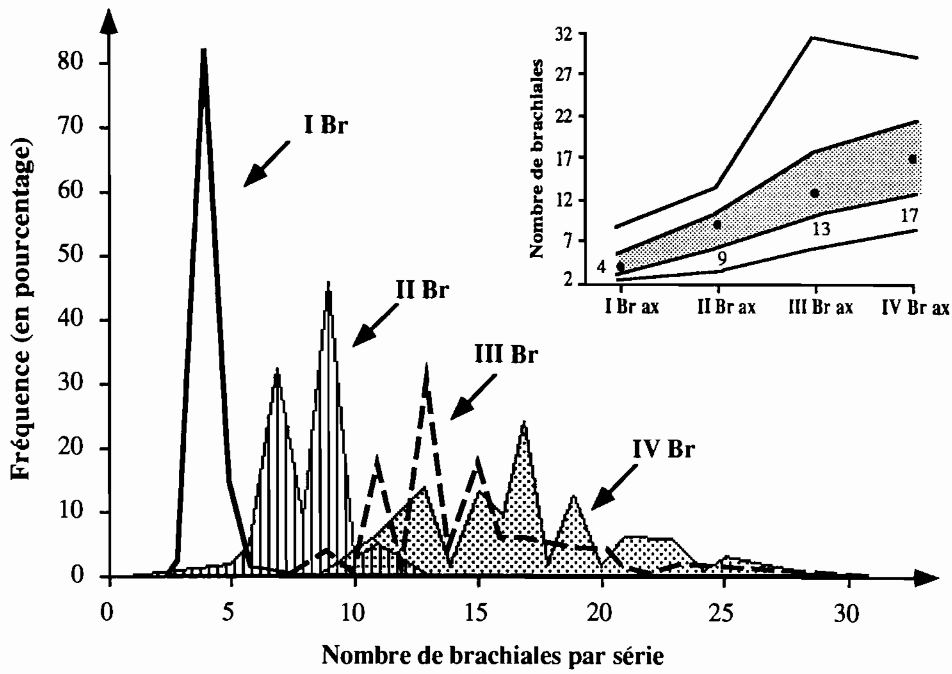

FIG. 10. — Organisation de la couronne de bras chez *Saracrinus moosai* sp. nov. (île Kai, Indonésie). En haut et à droite : mode et écart-type pour chaque série brachiale. Même légende que celle de la figure 5.

L'ensemble des caractères morphologiques présente une importante variabilité (tabl. 23). Si nous comparons la variabilité des trois espèces de *Saracrinus* d'Indonésie, nous constatons que *S. moosai* sp. nov. présente la plus importante variabilité pour le nombre d'internodales par noditaxis mature et la position de l'axillaire de la première et de la troisième série brachiale (I Br, III Br). En revanche, pour le caractère "dernier noditaxis avec pores", *S. moosai* sp. nov. possède le plus faible coefficient de variation.

CARACTÈRES DES ARTICULATIONS. — Les symplexies du pédoncule (fig. 14 G-H ; fig. 15 A) présentent des aréolas lancéolées (en moyenne 2 fois plus longues que larges), entourées d'un crénularium régulier. Le nombre de créneaux varie entre 10 et 13 (mode à 12). Le crénularium interne est peu développé. Les zones pétaloïdes peuvent être ouvertes ou fermées sur l'extérieur. La zone interpétaloïde s'individualise bien et va en s'évasant vers l'extérieur de la pièce (en moyenne 1,5 fois moins larges que la zone pétaloïde). Le périlumen s'exprime très fortement. Le canal axial est de forme circulaire.

Les zones pétaloïdes des synostoses du pédoncule sont également lancéolées (fig. 15 B-C). Ces zones sont également soit ouvertes vers l'extérieur, soit fermées. Le nombre de créneaux varie entre 8 et 10 (mode à 10). Les zones interpétaloïdes sont bien différenciées (en moyenne 1,75 fois moins large que la zone pétaloïde). Ces zones interpétaloïdes sont beaucoup plus larges au niveau des synostoses distales. Le réseau secondaire qui remplit le canal axial est de forme pentagonale, lâche et régulier. Le lumen secondaire est irrégulier et pentalobé.

Les synarthries des bras ont une crête fulcrale qui est nettement oblique et bien en relief (fig. 15 E, G). Le sillon interne, qui sépare les aires musculaires, est étroit. La zone ligamentaire externe est non seulement bien développée mais est également fortement évidée. Les aires ligamentaires internes présentent une limite franche avec les aires musculaires. Ces dernières sont bien développées et leurs zones de croissance sont très apparentes. L'insertion pinnulaire provoque une dissymétrie des aires musculaires. Une évolution de la microstructure des synarthries existe depuis les brachiales proximales jusqu'aux brachiales distales (fig. 15 E, G, H, J). En effet, le périlumen qui entoure le canal axial est bien individualisé et a une forme trapézoïdale pour les ossicules proximaux, alors qu'il est pratiquement inexistant pour les ossicules distaux. Les zones musculaires deviennent de plus en plus restreintes et sont pratiquement inexistantes en partie distale. L'évidement de l'aire ligamentaire externe est de plus en plus faible, de même que la crête fulcrale se différencie de moins en moins, au fur et à mesure que les brachiales apparaissent en position distale.

Les synostoses des bras sont généralement planes (fig. 15 D, I). Le sillon médian est bien marqué. Les synostoses proximales (fig. 15 D) présentent, dès la partie médiane de l'articulation, des épaississements concentriques de réseau syzygial. Ces épaississements sont absents des synostoses distales (fig. 15 I).

Pour les deux types d'articulation, le canal axial évolue depuis des formes rectangulaires pour des brachiales proximales jusqu'à des formes circulaires en partie distale.

Les premiers ossicules des pinnules proximales ou médianes possèdent des synarthries qui sont beaucoup plus évoluées que celles des brachiales les plus distales (fig. 15 K, M). Leurs crêtes fulcrales, bien que peu différenciées au niveau microstructure, sont nettement individualisées. De même, les aires musculaires sont visibles. En revanche, les ossicules plus distaux des pinnules proximales ou médianes sont très peu différenciés (fig. 15 L).

RAPPORTS ET DIFFÉRENCES. — *Saracrinus moosai* est associé avec *S. nobilis* et *S. angulatus*. *S. moosai* sp. nov. est très différent de *S. nobilis*, alors que certains spécimens ont un aspect général qui présente parfois quelques analogies avec *S. angulatus*. Cependant l'étude détaillée des caractères morphologiques permet de séparer les deux espèces. En effet, même si quelques noditaxis matures du pédoncule de certains *S. moosai* sp. nov. se composent parfois de 7 columnales, la majorité d'entre eux possèdent 5 à 6 ossicules. De plus, la zone d'extension des pores interarticulaires est beaucoup plus restreinte chez *S. moosai* sp. nov. En revanche, différencier *S. moosai* sp. nov. de *S. angulatus* seulement avec la couronne de bras se révèle difficile. Toutefois, il semble que *S. moosai* sp. nov. possède plus d'ossicules au niveau de la deuxième série brachiale. Au niveau des articulations du pédoncule, *S. moosai* sp. nov. présente par rapport à *S. angulatus* les différences suivantes : des zones pétaloïdes des symplexies et des synostoses beaucoup moins lancéolées ; un nombre de créneaux plus faible ; un crénularium interne peu développé et un périlumen moins large. Les principales différences au niveau de l'articulation des bras se situent essentiellement au niveau de l'obliquité de la crête fulcrale (plus forte chez *S. moosai*) et la présence, chez *S. angulatus*, d'apophyses calcitiques sur les bords internes de l'aire ligamentaire.

S. moosai sp. nov. tend également à présenter de très fortes affinités avec trois des cinq *S. varians* décrits par L. DÖDERLEIN (1907). Ces individus ont été récoltés à la station 253 de l'expédition de la *"Siboga"*. Cette station se trouve à proximité de la station CP 05 de KARUBAR et à une profondeur similaire. Les spécimens décrits par L. DÖDERLEIN présentent non seulement la même allure générale mais également des caractéristiques morphologiques identiques. Ce sont donc bien des *S. moosai*. Le nombre limité de *S. varians* et la faible connaissance sur l'importante variabilité inhérente à chaque espèce a masqué cette nouvelle espèce. Les deux autres *S. varians*, prélevés entre 500 et 600 m, sont des morphotypes profonds de *S. nobilis* (AMÉZIANE-COMINARDI, 1991).

CAS DE RÉGÉNÉRATIONS

Les crinoïdes pédonculés ont une grande capacité à se régénérer (BOURSEAU *et al.*, 1991 ; OJI, 1986) et peuvent le faire plusieurs fois au cours de leur existence. Une taille plus petite et une couleur différente, souvent plus claire, indiquent que l'individu est en cours de régénération. La régénération traduit un instant *t* qui ici est le moment du prélèvement. En effet, un spécimen peut s'être déjà régénéré plusieurs fois et ne porter aucune trace significative de cette régénération lors de sa récolte, car il se trouve dans une phase de "non-régénération". La fréquence de régénération sur l'ensemble d'une population récoltée dans une même station reflétera les perturbations subies par les individus. Théoriquement, toutes les parties de l'organisme présentent la possibilité de se régénérer. Mais la présence des basales (AMÉZIANE-COMINARDI, 1991 ; AMEMIYA & OJI, 1992) et de la partie proximale du pédoncule se révèle indispensable pour que la régénération s'effectue. En effet, le centre nerveux aboral contenu dans ces éléments est nécessaire pour que le processus se déclenche. Les résultats d'expérimentation (AMEMIYA & OJI, 1992) montrent également qu'une résorption de la partie proximale du pédoncule se manifeste lorsque l'ensemble de la couronne de bras est en cours de régénération. Cette particularité a été observée chez un *Metacrinus levii* (BOURSEAU *et al.*, 1991), un *M. wyvillei* et un *M. serratus* (BOURSEAU & ROUX, 1989).

Le pédoncule. — L'observation du pédoncule en cours de régénération est rare. Aucun des individus récoltés lors de la mission KARUBAR ne présente de régénération visible du pédoncule.

Le calice. — Un seul spécimen (*Saracrinus moosai*, spécimen n°1) montre une anomalie au niveau du calice. En effet cet individu possède six radiales ; l'une d'entre-elles étant plus petite et surélevée par rapport aux autres. Chacune de ces six radiales porte un tronc brachial. Cette anomalie peut résulter soit d'un problème lors d'une régénération, soit d'un défaut de naissance.

La couronne de bras. — La régénération des bras, quant à elle, est fréquente et les cassures s'effectuent généralement au niveau des synostoses. Une aberration particulière, due certainement à un problème de régénération, est observé pour la première fois chez un *S. angulatus* (spécimen n°2). Au niveau de la quatrième primibrachiale (I Br 4), où normalement se situe la division brachiale, se trouve une axillaire avortée (fig. 11). En effet, cette pièce a l'allure générale d'une axillaire par sa forme losangique, accentuée par un bec central. A l'endroit où se localise habituellement la pinnule, apparaissent deux brachiales singulières : la première (I Br 5), très petite, se niche dans le creux de la I Br 4 lui conférant ainsi une vocation d'axillaire ; la seconde (I Br 6) recouvre non seulement la I Br 5 mais également une partie de la I Br 4. De cette situation, il résulte une dissymétrie de la I Br 6 qui est bien développée du côté où se trouve I Br 5, mais qui est très fine sur le côté opposé. La fonction de cette pièce serait de corriger l'anomalie induite par I Br 4. Pour ce tronc brachial, l'axillaire se localise, en fait, au niveau de la huitième brachiale (I Br 8 ax).

		S. nobilis	*S. angulatus*	*S. moosai*
I Br	t	1,8	-	2,1
	j	0,8		0
II Br	t	19,3	9,8	12,8
	j	4,6	5,5	15,3
III Br	t	22,5	15,8	24,9
	j	16,8	29,9	11,6
IV Br	t	6,7	4,0	2,5
	j	39,0	41,1	31,3
V Br	t	0,7	0,53	-
	j	100	63,6	

TABLEAU 24. — Fréquence de régénérations, exprimée en pourcentage, le long des divers troncs brachiaux pour les trois espèces de *Saracrinus* récoltées en Indonésie.

t : pourcentage total des régénérations observées (stades très jeunes et terminal) dans la série brachiale ; j : pourcentage de très jeunes régénérations observées dans la série brachiale (bras constitué de 2 ou 3 ossicules) par rapport au pourcentage total ; - : pas de régénération observée.

Les fréquences de régénérations s'obtiennent à partir du nombre total de régénérations observées sur une même série brachiale comparé au nombre total de troncs brachiaux de tous les individus (régénérés ou non) pour cette même série brachiale. Sur l'ensemble des bras, *S. nobilis* présente les plus forts pourcentages de régénérations et *S. angulatus* les plus faibles (tabl. 24). Pour les trois espèces, ce sont au niveau des II Br et III Br que s'observent le plus grand nombre de régénérations, alors qu'elles sont les plus rares au niveau des I Br et V Br. Toutes les fréquences de très jeunes régénérations augmentent depuis les II Br jusqu'au V Br, à l'exception des III Br de *S. moosai* sp. nov. Il semble que les parties distales, plus fragiles, se régénèrent plus souvent. Si nous comparons ces données avec celles obtenues dans le SW Pacifique (AMÉZIANE-COMINARDI, 1991), nous constatons que les *S. angulatus* indonésiens (îles Kai et Tanimbar) se caractérisent par un taux de régénération plus faible que celui observé chez ceux récoltés dans le reste du SW Pacifique. Les *S. nobilis* d'Indonésie (îles Aru, Kai et Tanimbar), quant à eux, montrent un taux de régénération plus important pour les trois premières séries brachiales que celui obtenu chez les individus récoltés dans le reste du SW Pacifique. Les *S. nobilis* indonésiens se caractérisent également par une plus forte variabilité de leurs caractères morphologiques.

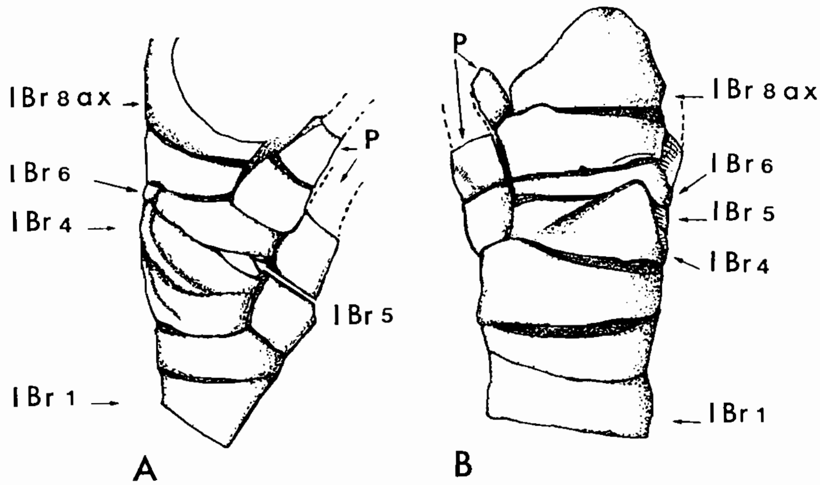

FIG. 11. — Schéma représentant l'anomalie de la première série brachiale (I Br) du spécimen *Saracrinus angulatus* n°2 (îles Kai, Indonésie).
A : vue du côté latéral ; **B**: vue du côté dorsal.
I Br 1, I Br 4, I Br 5 et I Br 6 = première, quatrième, cinquième et sixième primibrachiale ; I Br 8 ax = huitième primibrachiale axillaire ; P = pinnule.

La relation qui existe entre les fortes fréquences de régénération et les forts coefficients de variation chez de nombreuses espèces (BOURSEAU *et al.*, 1991) se vérifie de nouveau. Les mysostomes ont été invoqués, de même que la prédation et l'action des courants (A.H. CLARK, 1921 ; CONAN *et al.*, 1981 ; OJI, 1986), pour expliquer la cassure des bras. Aucun mysostome n'a été trouvé chez *S. moosai.* En revanche, chez certains spécimens de *S. angulatus* et *S. nobilis*, un certain nombre de mysostomes sont présents. Ces organismes affectent aussi bien les brachiales que les pinnules. Un individu peut être infesté par de très nombreux mysostomes ; par exemple, quatorze individus parasitent le *S. nobilis* n°19 et douze parasitent le n°21.

CONCLUSIONS

L'étude du matériel recueilli par la campagne KARUBAR confirme qu'il existe une grande variabilité intraspécifique chez les Metacrininae et que de nombreuses espèces sont, en fait, des écophénotypes qui sont susceptibles de traduire les variations du milieu environnant. Sur les huit espèces de Metacrininae récoltées aux abords des îles Kai lors de précédentes campagnes (*"Challenger"*, *"Siboga"*, expédition danoise), trois espèces seulement sont indiscutablement présentes dans cette région. Ainsi, *Saracrinus acutus*, *S. cingulatus*, *S. tuberosus* deviennent synonymes de *S. angulatus*, de même que *S. superbus*, *S. murrayi*, *S. varians* (certains spécimens) sont synonymes de *S. nobilis*. Les *S. varians,* décrits par L. DÖDERLEIN, ont été mal identifiés et correspondent à des *S. moosai* sp. nov.

Lors des diverses campagnes, passées ou récentes, les spécimens prélevés dans une même station appartiennent souvent à des espèces et à des genres différents. Quelquefois, *S. nobilis* et *S. angulatus* sont associés dans un même site, mais là encore la faune de KARUBAR se singularise par la présence simultanée de trois espèces appartenant au même genre.

La faune récoltée lors de la campagne KARUBAR se caractérise par des populations homogènes dépourvues de juvéniles. En effet, les *Saracrinus nobilis* et *angulatus*, par rapport au reste de la faune SW Pacifique, ont de fortes tailles. De même, *S. moosai*, espèce plus gracile que les deux précédentes, semble se situer à un pôle maximal de croissance. Plusieurs hypothèses peuvent être envisagées pour tenter d'expliquer cette situation :

- il peut exister un problème au niveau de l'échantillonnage. Les techniques de prélèvements utilisées sont les mêmes que celles employées lors des campagnes effectuées au large de la Nouvelle-Calédonie, région où de nombreux juvéniles ont été récoltés alors que le nombre total d'individus prélevés est moindre que celui de la campagne KARUBAR. Cette première hypothèse semble donc peu vraisemblable ;
- les larves des *Saracrinus* des îles Kai se déplacent, de façon active ou passive (action des courants), et s'installent ailleurs ;
- enfin, ces populations ont des vitesses de renouvellement faunistique lentes car leur environnement est stable.

Lors des campagnes effectuées auparavant au large des îles Kai, *Democrinus weberi* et un *Rhizocrinus* (stations 56 et 58 de l'expédition danoise, MORTENSEN, 1923) ont été prélevés en même temps que des *Saracrinus*. GISLEN (1925) décrit un *Democrinus globularis* et un *Porphyrocrinus verrucosus* (station 56 de la *"Siboga"*). Des prélèvements ont été faits aux mêmes endroits et à des profondeurs similaires, mais malheureusement aucune de ces espèces n'a été récoltée.

De nombreuses autres espèces sont potentiellement présentes dans ces eaux. Au sein des Pentacrinidae, les diverses récoltes passées ont permis d'identifier *Metacrinus serratus* (mer de Sulu), *M. wyvillei* (Célèbes), *M. costatus* (Célèbes), *Diplocrinus sibogae* (mer de Timor), *Hypalocrinus naresianus* (Célèbes). L'absence de *Metacrinus* est surprenante car ce genre se trouve très fréquemment et plus régulièrement que *Saracrinus* dans tout le SW Pacifique. Enfin, parmi les *Bathycrinus*, *B. minimus* (Célèbes), *B. nodipes* (Célèbes et Banda) et *B. poculum* (Banda) ont été prélevés lors du passage de la *"Siboga"*. Parmi la quinzaine de stations de KARUBAR effectuées à des profondeurs où se développent généralement de telles espèces, aucune n'a fourni de crinoïdes pédonculés. Deux hypothèses peuvent expliquer l'absence de ces organismes : soit ces formes sont effectivement présentes aux abords des îles Kai et n'ont pas été récoltées pour des raisons diverses telles que : zones de développement très restreintes, déplacement des organismes, problème d'échantillonnage ; soit alors ces espèces ne vivent pas dans ce secteur. Nous constatons que la faune des diverses mers qui séparent les îles (Timor, Célèbes, Banda..) diffère suivant les secteurs (espèces rencontrées qu'à un seul endroit ; cf. *Diplocrinus sibogae*) et de plus, elle présente des variations morphologiques importantes pour des espèces déjà connues (cf. *Saracrinus nobilis* et *S. angulatus*). Ainsi, les crinoïdes pédonculés pourraient être caractéristiques de chacune de ces régions, mais en l'état actuel de nos connaissances ceci reste une simple supposition.

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PHOTOGRAPHIES

FIGURE 12

Saracrinus angulatus (Carpenter, 1884)

A. — Spécimen n°9, station CP 05. Vue générale (x 0,6).

B. — Spécimen n°9, station CP 05. Vue de détail montrant le calice et l'organisation de la base de la couronne de bras. Les premières pièces axillaires sont les quatrièmes primibrachiales (x 1,4).

C. — Spécimen n°29, station CP 16. Vue générale de la pinnule bifide (x 4).

D. — Spécimen n°29, station CP 16. Vue de détail de la pinnule bifide. La pièce où se localise la division se comporte comme une axillaire (x 7).

E. — Spécimen n°9, station CP 05. Vue de détail montrant l'organisation du pédoncule et l'ornementation des columnales. Le nombre d'internodales par noditaxis mature est de 7 sur les noditaxis complets (x 1,4).

F. — Spécimen n°34900 (collection de l'USNM à Washington), station 5623, *"Albatross"*. Vue générale au microscope électronique à balayage d'une synostose de nodale distale (x 7,5).

G. — Spécimen n°34900 (collection de l'USNM à Washington), station 5623, *"Albatross"*. Vue de détail de la figure précédente. Vue du canal axial de la synostose (x 60).

H. — Spécimen n°56, station CP 82. Vue générale au microscope électronique à balayage d'une symplexie d'une nodale distale (x 5,6).

I. — Spécimen n°56, station CP 82. Vue générale au microscope électronique à balayage d'une symplexie d'internodale distale (x 6).

Les vues au microscope électronique ont été effectuées au C.I.M.E., département M.E.B., Paris VI.

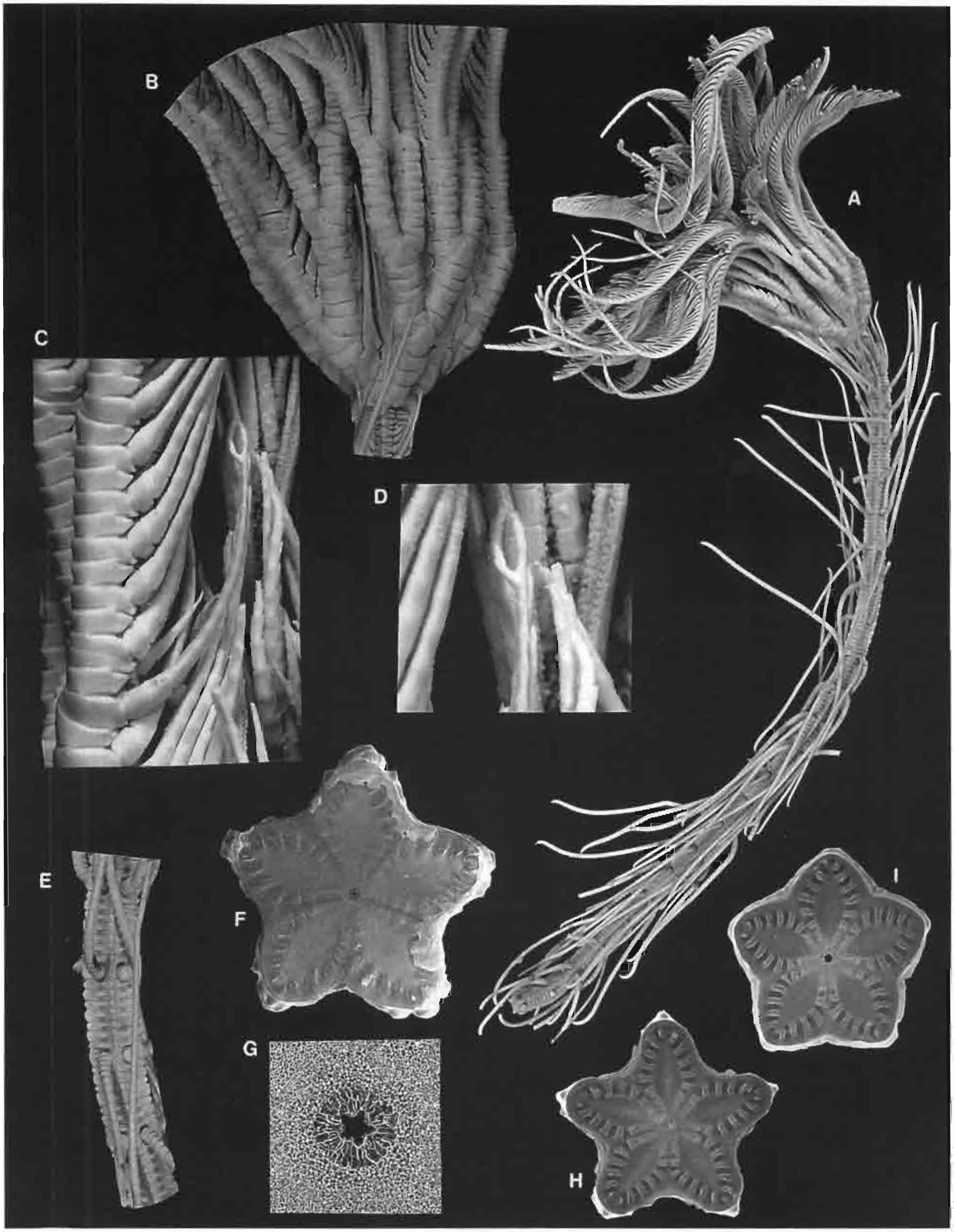
A
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FIGURE 13

Saracrinus nobilis (Carpenter, 1884)

A. — Spécimen n°27, station CP 82. Vue générale (x 0,6).

B. — Spécimen n°27, station CP 82. Vue de détail montrant le calice et l'organisation de la base de la couronne de bras. Les premières pièces axillaires sont les quatrièmes primibrachiales (x 1,4).

C. — Spécimen n°27, station CP 82. Vue de détail montrant l'organisation du pédoncule et l'ornementation des columnales. Le nombre d'internodales par noditaxis mature est de 12 sur les noditaxis complets (x 1,4).

D. — Spécimen n°16, station CP 46. Vue générale au microscope électronique à balayage d'une synostose de nodale distale (x 7).

E. — Spécimen n°16, station CP 46. Vue de détail de la figure précédente. Vue du canal axial de la synostose (x 115).

F. — Spécimen n°1, station CP 48. Vue générale au microscope électronique à balayage d'une symplexie d'une nodale distale (x 6,5).

G. — Spécimen n°1, station CP 48. Vue générale au microscope électronique à balayage d'une symplexie d'internodale distale (x 6,5).

Les vues au microscope électronique ont été effectuées au C.I.M.E., département M.E.B., Paris VI.

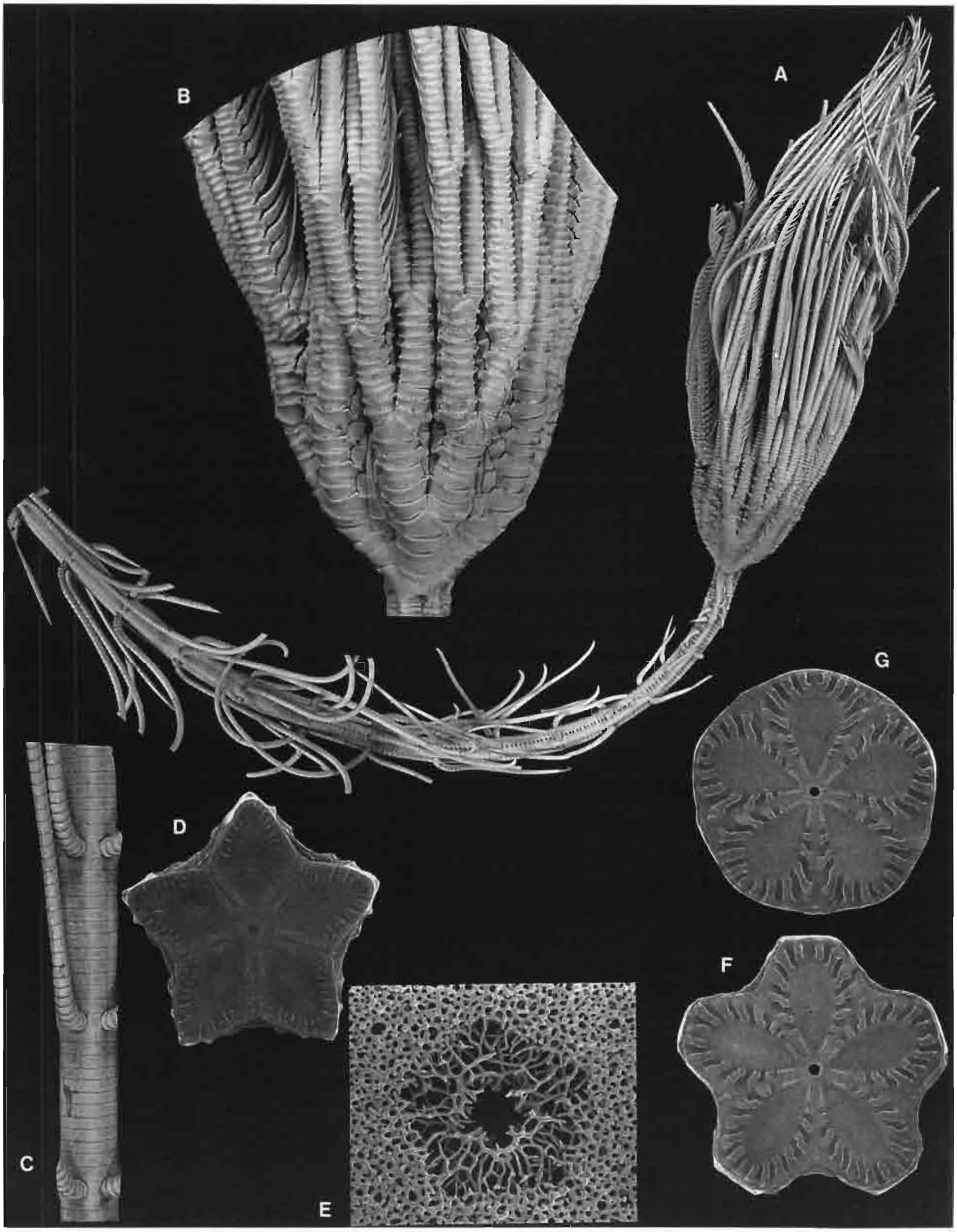
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FIGURE 14

Saracrinus moosai sp. nov.

A. — Holotype (spécimen n°45), station CP 16. Vue générale (x 0,8).

B. — Holotype (spécimen n°45), station CP 16. Vue de détail montrant le calice et l'organisation de la base de la couronne de bras. Les premières pièces axillaires sont les quatrièmes primibrachiales (x 1,4).

C. — Spécimen n°15, station CP 05. Vue générale au microscope électronique à balayage du calice (x 7). R = radiales ; B = basales ; I = infrabasales ; C = premières columnales.

D. — Spécimen n°6, station CP 05. Vue de détail au microscope électronique à balayage des infrabasales (x 35).

E. — Holotype (spécimen n°45), station CP 16. Vue de détail montrant l'organisation du pédoncule et l'ornementation des columnales. Le nombre d'internodales par noditaxis mature est de 5 (7 cas), 6 (1 cas) sur les noditaxis complets (x 1,4).

F. — Spécimen n°15, station CP 05. Vue générale au microscope électronique à balayage d'une jeune columnale proximale (x 30).

G. — Spécimen n°1, station CP 05. Vue générale au microscope électronique à balayage de la symplexie d'une internodale distale (x 8,5).

H. — Spécimen n°15, station CP 05. Vue de détail de la figure précédente. Vue du canal axial et du périlumen (x 45).

Les vues au microscope électronique ont été effectuées au C.I.M.E., département M.E.B., Paris VI.

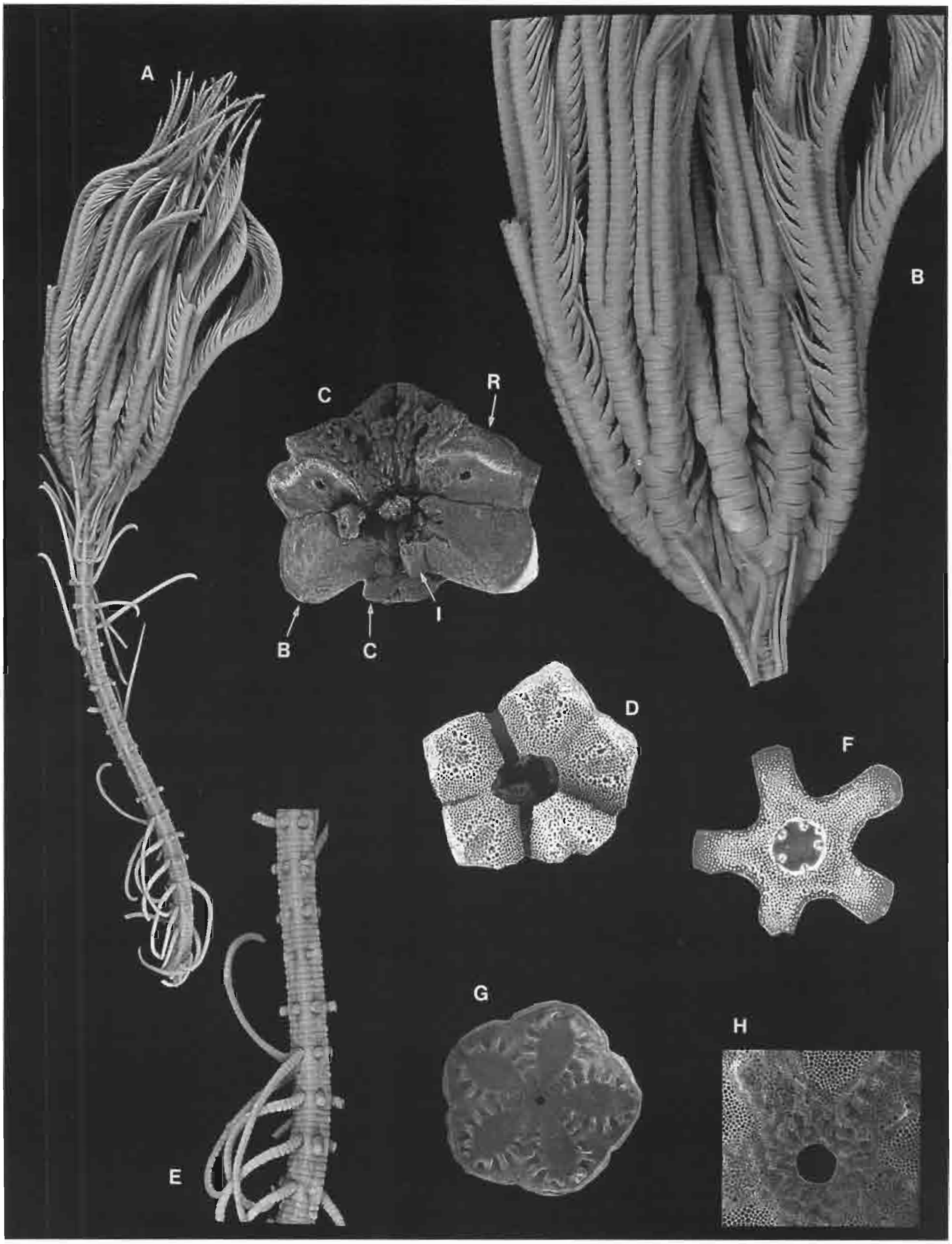
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FIGURE 15

Saracrinus moosai sp. nov.

A. — Spécimen n°15, station CP 05. Symplexie d'une internodale distale (x 8,5).

B. — Spécimen n°15, station CP 05. Synostose d'une infranodale distale (x 8,5).

C. — Spécimen n°15, station CP 05. Vue de détail de la figure précédente. Vue du canal axial de la synostose (x 110).

D. — Spécimen n°15, station CP 05. Vue générale de la synostose de la deuxième primibrachiale, I Br 2, (x 11).

E. — Spécimen n°15, station CP 05. Vue générale de la synarthrie de la troisième primibrachiale, I Br 3, (x 10).

F. — Spécimen n°15, station CP 05. Synarthrie de la quatrième primibrachiale axillaire, I Br 4, (x 9).

G. — Spécimen n°15, station CP 05. Synarthrie d'une brachiale distale appartenant à la troisième série brachiale, III Br, (x 20).

H. — Spécimen n°15, station CP 05. Synarthrie d'une brachiale distale (x 35).

I. — Spécimen n°15, station CP 05. Synostose d'une brachiale distale (x 35).

J. — Spécimen n°15, station CP 05. Synarthrie d'une brachiale terminale qui porte une pinnule non fonctionnelle (x 40).

K. — Spécimen n°15, station CP 05. Vue ventrale d'un élément proximal appartenant à une pinnule proximale (x 20).

L. — Spécimen n°15, station CP 05. Articulation d'un élément distal d'une pinnule proximale (x 45).

M. — Spécimen n°15, station CP 05. Articulation d'un élément proximal d'une pinnule distale (x 45).

N. — Spécimen n°15, station CP 05. Vue ventrale d'un ossicule d'une pinnule distale non fonctionnelle (x 100).

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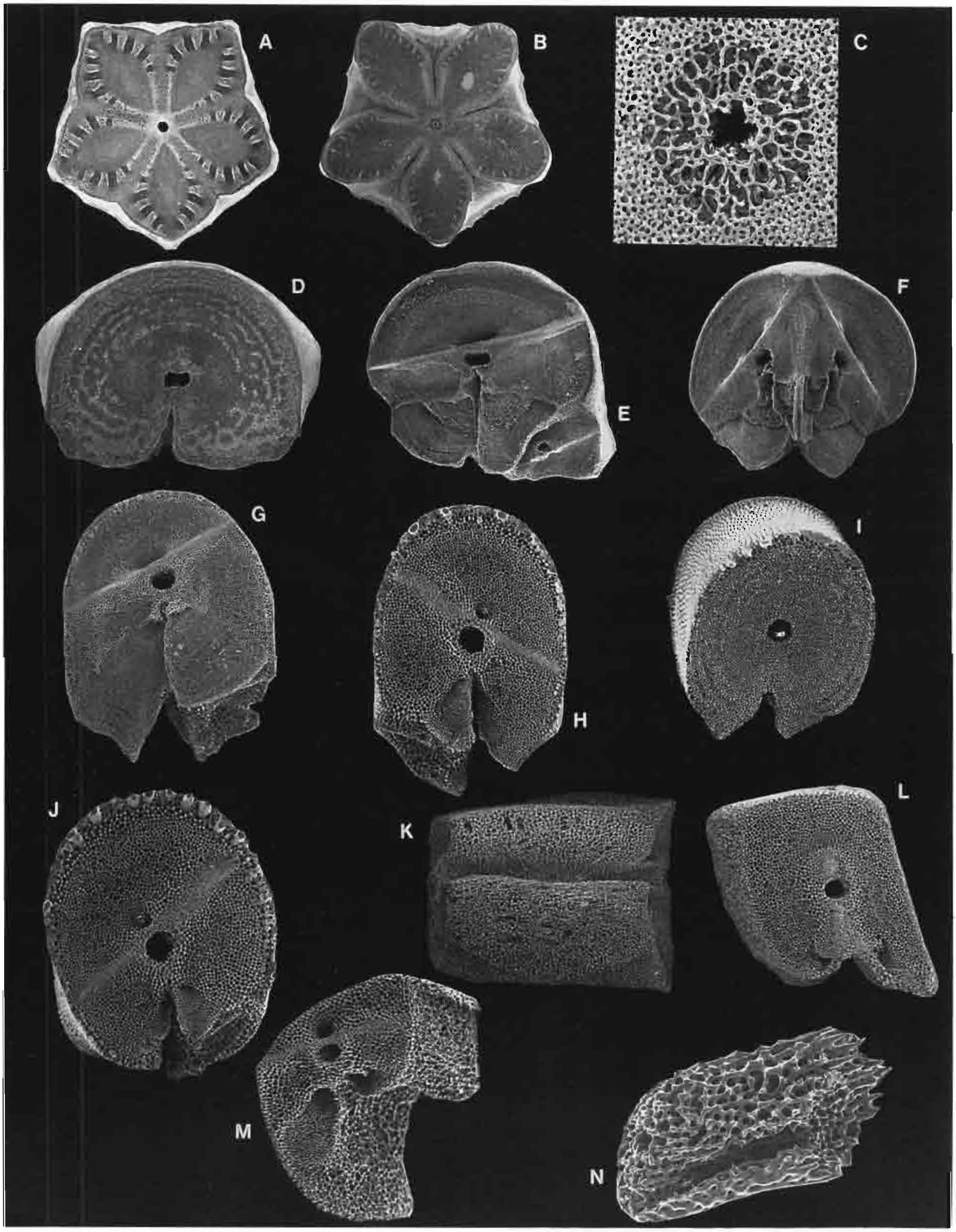
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Ever since the explorations of the Danish Expedition to the Kei Islands, led by the famous zoologist Th. MORTENSEN in 1922, the eastern seas of Indonesia have been renowned as a hotspot of marine biodiversity. In 1991, the French-Indonesian KARUBAR cruise took place on board R.V. *Baruna Jaya I* in the Banda and Arafura Seas, off the Kai and Tanimbar Islands (Eastern Indonesia). The expedition, which had a dual zoological and fisheries goal, collected a rich material of deep-sea benthos between 200 and 1200 m. Scattered faunistic results have already been published elsewhere, but the present volume is the first consolidated report, consisting of a narrative and 13 contributed articles on the systematics and biogeography of Scleractinia (1 paper), Mollusca (5 papers), Crustacea Decapoda (6 papers) and Crinoidea (1 paper). Among the more remarkable results is a review of the highly diverse azooxanthellate coral fauna from the Philippines and Indonesia, and a description of a major new hermit crab assemblage.

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