4

Scaphopoda of the tropical Pacific and Indian Oceans, with description of 3 new genera and 42 new species

Victor SCARABINO

Muséum national d'Histoire naturelle
55 rue de Buffon
75005 Paris, France

ABSTRACT

New data on the scaphopod fauna of the Indo-West Pacific are presented, based on new material from recent oceanographic expeditions, mostly in the SW Indian Ocean, SE Asia and the New Caledonia region. Over 780 stations yielded a total of 139 species. Of 81 species of Dentaliida and 58 Gadilida, 42 species (16 Dentaliida and 26 Gadilida), as well as 3 gadilid genera, are described as new. Many range extensions are documented, and new synonymies are established. With 73 recorded species, New Caledonia is currently the geographic area with the highest documented scaphopod diversity. Their bathymetric distribution shows a peak in species numbers in deep water around 800 m, with a second, minor peak for Gadilida at around 2,000 m. Including genera not represented in the Indo-Pacific, 44 Recent scaphopod genera are recognized. The radula of 42 of these is described, and an update of the general classification of the class Scaphopoda is proposed.

RÉSUMÉ

Scaphopodes des régions tropicales de l'océan Indien et du Pacifique, avec la description de 3 nouveaux genres et 42 espèces nouvelles.

La faune de Scaphopodes de l'Indo-Pacifique est étudiée sur la base du matériel récolté par diverses campagnes océanographiques récentes, en particulier dans le Sud-Ouest de l'océan Indien, l'Asie du Sud-Est et la région néo-calédonienne. Au total, plus de 780 stations ont livré 139 espèces. Sur 81 espèces de Dentaliida et 58 Gadilida, 42 espèces (16 Dentaliida et 26 Gadilida), de même que 3 genres de Gadilida, sont décrits comme nouveaux. L'aire de distribution connue de nombreuses espèces se trouve étendue, et de nouvelles synonymies sont établies. Soixante-treize espèces sont recensées en Nouvelle-Calédonie, ce qui en fait le secteur de l'Indo-Pacifique avec la faune de Scaphopodes la plus diversifiée. La distribution bathymétrique de cette faune montre un maximum de diversité autour de 800 m, et un deuxième maximum, plus atténué, pour les Gadilida autour de 2000 m. En comprenant les genres non représentés dans l'Indo-Pacifique, 44 genres actuels de Scaphopodes sont reconnus. La radula de 42 d'entre eux est décrite, et la classification de la classe est mise à jour.

SCARABINO, V., 1995. — Scaphopoda of the tropical Pacific and Indian Oceans, with description of 3 new genera and 42 new species. *In*: P. BOUCHET (ed.), Résultats des Campagnes MUSORSTOM, Volume 14. *Mém. Mus. natn. Hist. nat.*, **167**: 189-379. Paris ISBN 2-85653-217-9.

Published 29th December 1995.

INTRODUCTION

The present paper is based essentially on the collections made over the last 20 years in the Indo-Pacific by MNHN staff and other French scientists, notably from ORSTOM. It covers parts of the Western Pacific, with emphasis on the Philippines, Indonesia and New Caledonia, and parts of the Indian Ocean, with emphasis on its southwestern portion around Madagascar and the Mascarenes. Much of the material was collected aboard R.V. *"Vauban"*, *"Coriolis"* , and *"Alis"* during the six MUSORSTOM expeditions to the Philippines (1976-1985; for narratives and station lists, see FOREST, 1981, 1986) and New Caledonia (1985-1989; for narratives of these, and other, cruises in the New Caledonia area, together with station lists, see RICHER DE FORGES, 1990 and 1991). There is also a substantial amount of material from a dozen other expeditions on French research vessels, among others Cruise 32 of R.V. *"Marion-Dufresne"* (Réunion island; see GUILLE, 1982), CORINDON (R.V. *"Coriolis"*, Makassar Channel, 1980) and BENTHEDI (R.V. *"Suroit"*, Mozambique Channel, 1977).

Beside the material in MNHN, I have also studied the Scaphopoda taken during the *"Snellius"* I (1929-1930; see BOSCHMA, 1936) and *"Snellius"* II Expeditions (1984; see ANONYMOUS) in Indonesia (RMNH), the *"Galathea"* Expedition (1950-52; see BRUUN, 1959) (ZMC) and the *"Meiring Naudé"* cruises (1976 and 1979; see LOUW, 1977, 1980) off South Africa (SAM). Whenever possible and necessary, I have examined relevant type material and other reference material, as listed under each species.

There has been no recent review of the scaphopod fauna of the Indo-Pacific. Many species descriptions are scattered in the reports of major expeditions such as those of the *"Challenger"* (WATSON, 1879), *"Investigator"* (SMITH, 1894 to 1906), *"Siboga"* (BOISSEVAIN, 1906), *"Valdivia"* (PLATE, 1908a, JAECKEL, 1932), and *"John Murray"* (LUDBROOK, 1954). Part of the extensive Japanese literature concerns directly the tropical Indo-Pacific, and CHISTIKOV (1979 to 1983) studied the material from several Russian expeditions in the Indian and Pacific Oceans. In parallel with the present report, the scaphopod fauna of Australia is being revised by Dr J. HEALY and Mr K. LAMPRELL, and it is anticipated that the two papers combined will hopefully lay new foundations for the taxonomy and biogeography of Indo-Pacific Scaphopoda. As a help for further revisionary work, I have given under each genus a list of valid Indo-Pacific taxa not critically examined by me for this paper, complete with type locality and literature references.

ABBREVIATIONS AND TEXT CONVENTIONS

For shells, usage of terms such as small, medium, long refers to the approximate mean length for specimens considered adults. Known lengths range from 9 to 180 mm in Dentaliida, and from 2 to 50 mm in Gadilida. All measurements are in mm. L = length; W = maximum diameter; m = diameter at aperture (this is not always the maximum diameter); w = minimum diameter (apex); arc = the distance of maximum concavity of the dorsal side from a line between apex and mouth. Shell terminology follows Figs 1-2.

Illustrations: in drawings of apical and oral sections, the specimens are placed dorsal side up.

Charts: distribution maps are given for all species. The star notes the type locality; in the case of questionable type locality, a question mark has been added, see text for comments. Filled circles represent locality records checked for the present paper, open circles represent records taken from the literature. Circles may represent several neighbouring localities. In the case of records in Japanese waters, I have not tried to map the distribution there in detail, since the present monograph only marginally covers that country.

Radula illustrated teeth have been taken on the middle part of the radular ribbon, avoiding both juvenile rows and rows showing wear. Radula terminology follows Figs 3-4.

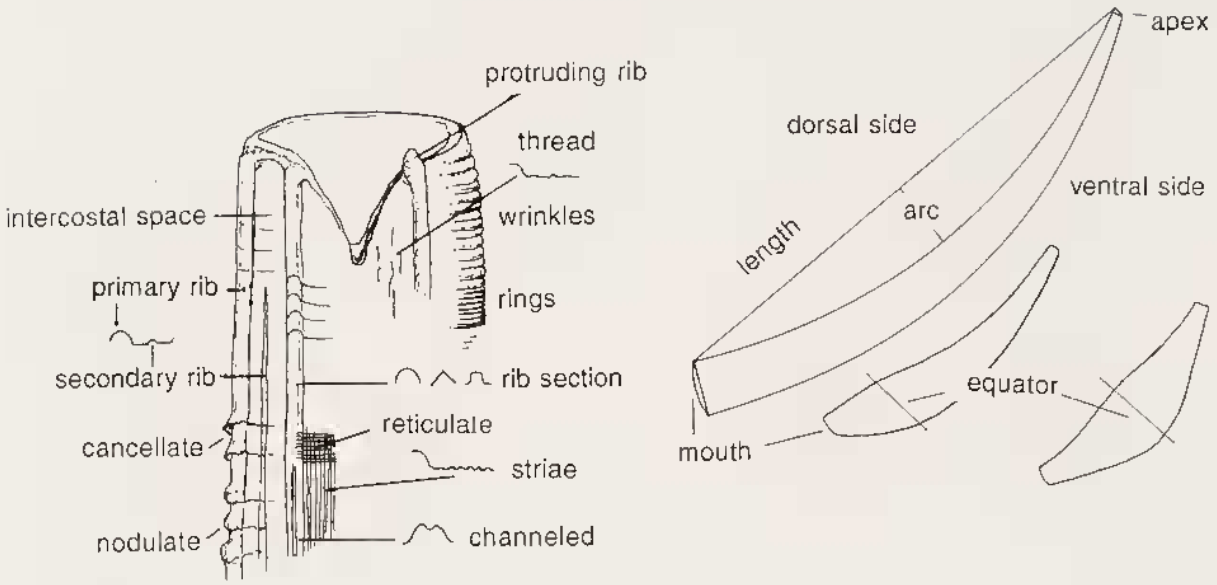


FIG. 1. — Illustrated glossary of shell structures and descriptive terms used in this publication: general shape and sculpture.

Repositories

AMNH : American Museum of Natural History, New York
AMS : Australian Musem, Sydney
ANSP : Academy of Natural Sciences of Philadelphia, Philadelphia
BMNH : The Natural History Museum, London
CNRS : Centre National de la Recherche Scientifique
IOAS : Institute of Oceanology, Academia Sinica
MHNG : Muséum d'Histoire Naturelle, Genève
MNHN : Musèum national d'Histoire naturelle, Paris
NMP : Natal Museum, Pietermaritzburg
RMNH : Nationaal Natuurhistorisches Museum, Leiden
NMNZ : Muscum of New Zealand, Wellington
NSMT : National Science Museum, Tokyo
ORSTOM : Institut Français de Recherche Scientifique pour le Développement en Coopération
SAM : South African Museum, Cape Town
USNM : National Museum of Natural History, Washington, DC
ZIN : Zoological Institute, Russian Academy of Sciences, St Petersburg
ZMB : Zoologisches Museum der Humboldt-Universität, Berlin
ZMC : Zoologisk Museum, Copenhagen

Station data

CC : Shrimp trawl
CH : Otter trawl
CP : Beam trawl
DC : Charcot dredge
DG : Boillot geological dredge
DR : Rectangular dredge (1.20 × 0.50 m)
DS : Sanders epibenthic sledge
DW : Waren dredge

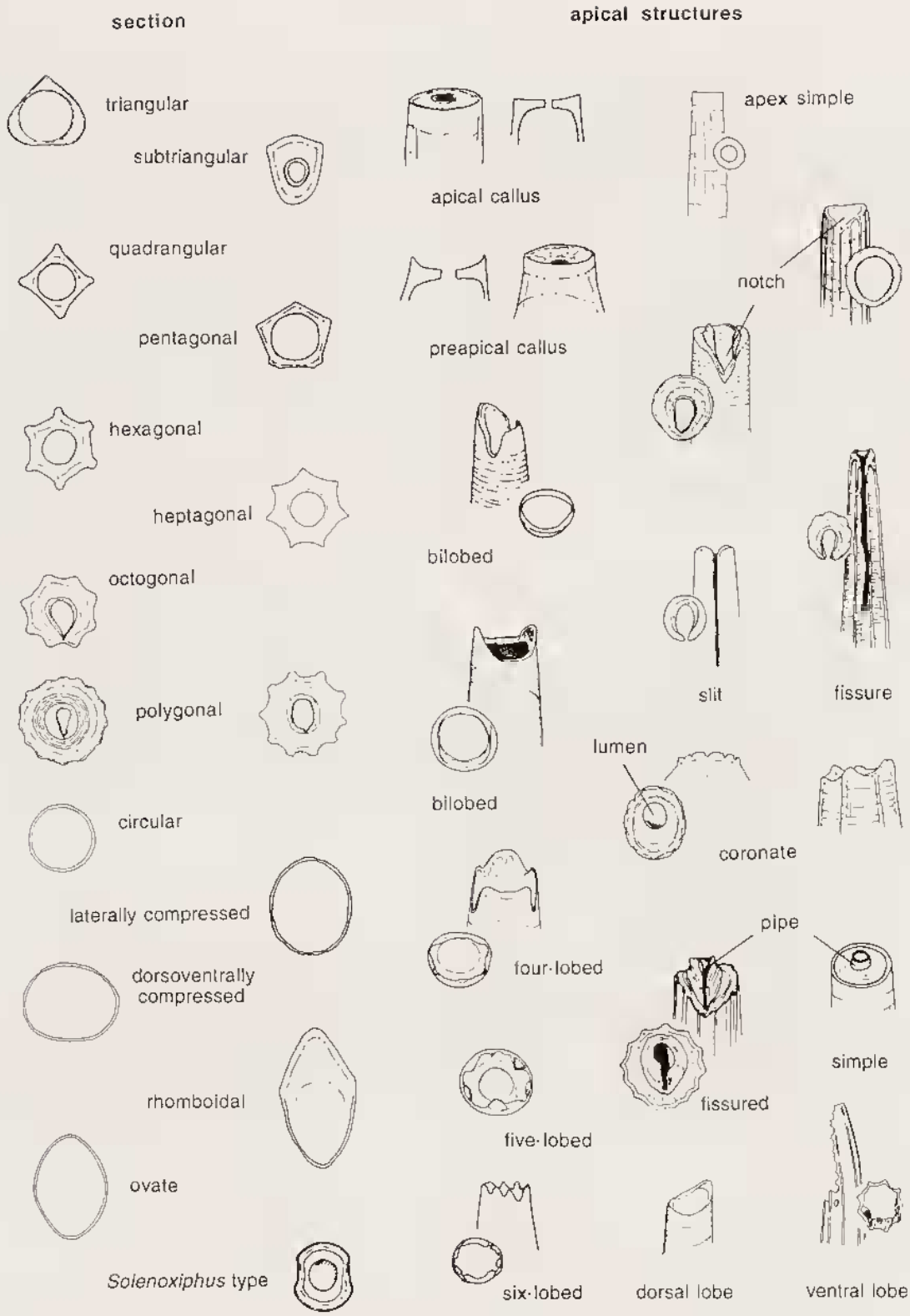


FIG. 2. — Illustrated glossary of shell structures and descriptive terms used in this publication: sections and apical structures.

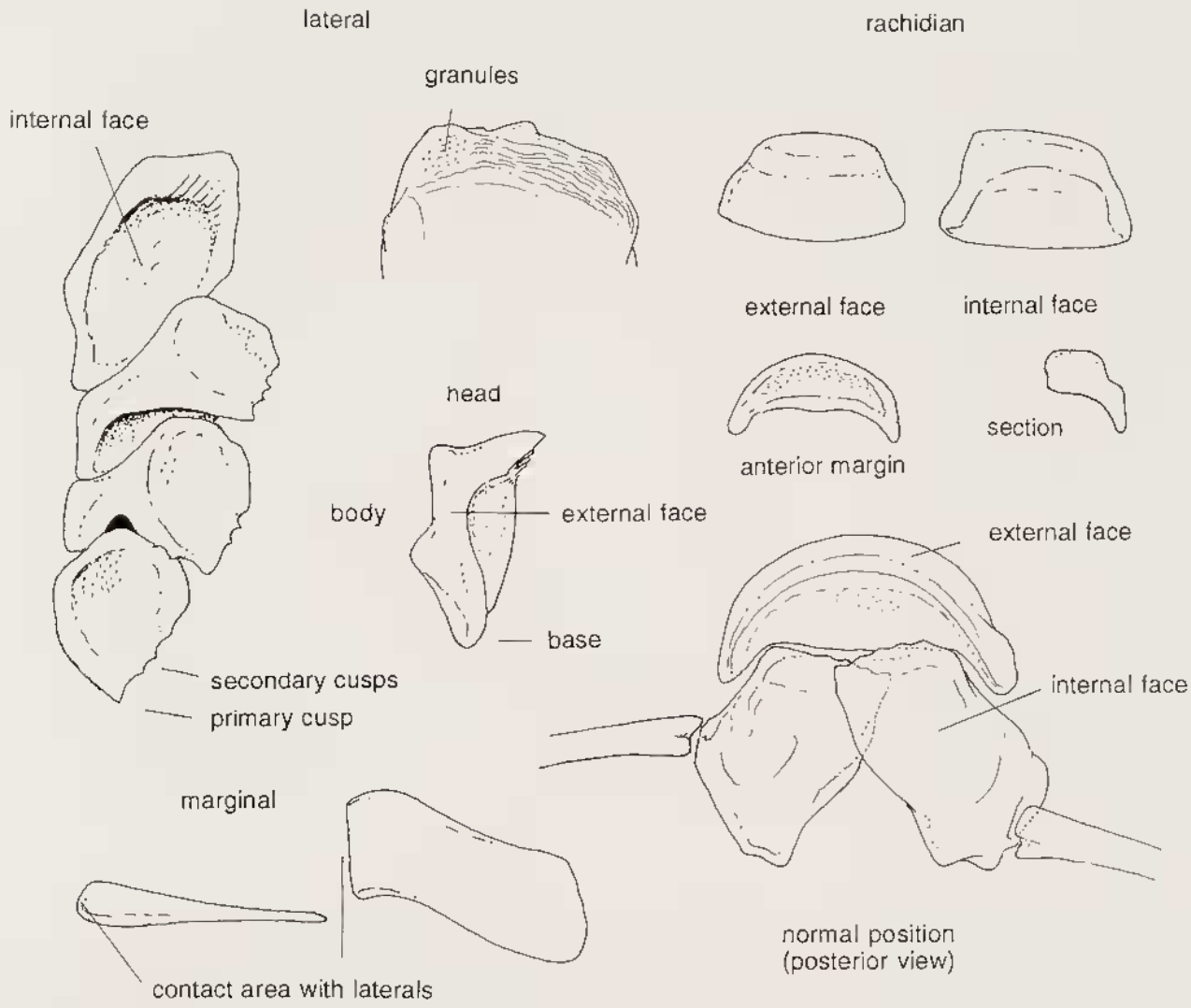


FIG. 3. — Radular nomenclature used in this publication: Dentaliida.

F : Faubert [a group of old cotton nets towed on the bottom, especially on steep hard bottoms]
KG : Usnel Box-Corer
B : Okean dredge
S : SCUBA operated air lift
stn : Station
T : Troika dredge

Other abbreviations

Coll. : eollection of
coll. : collected by
lv : live-taken specimens
dd : empty shells
OD : Original designation
SD : Subsequent designation.

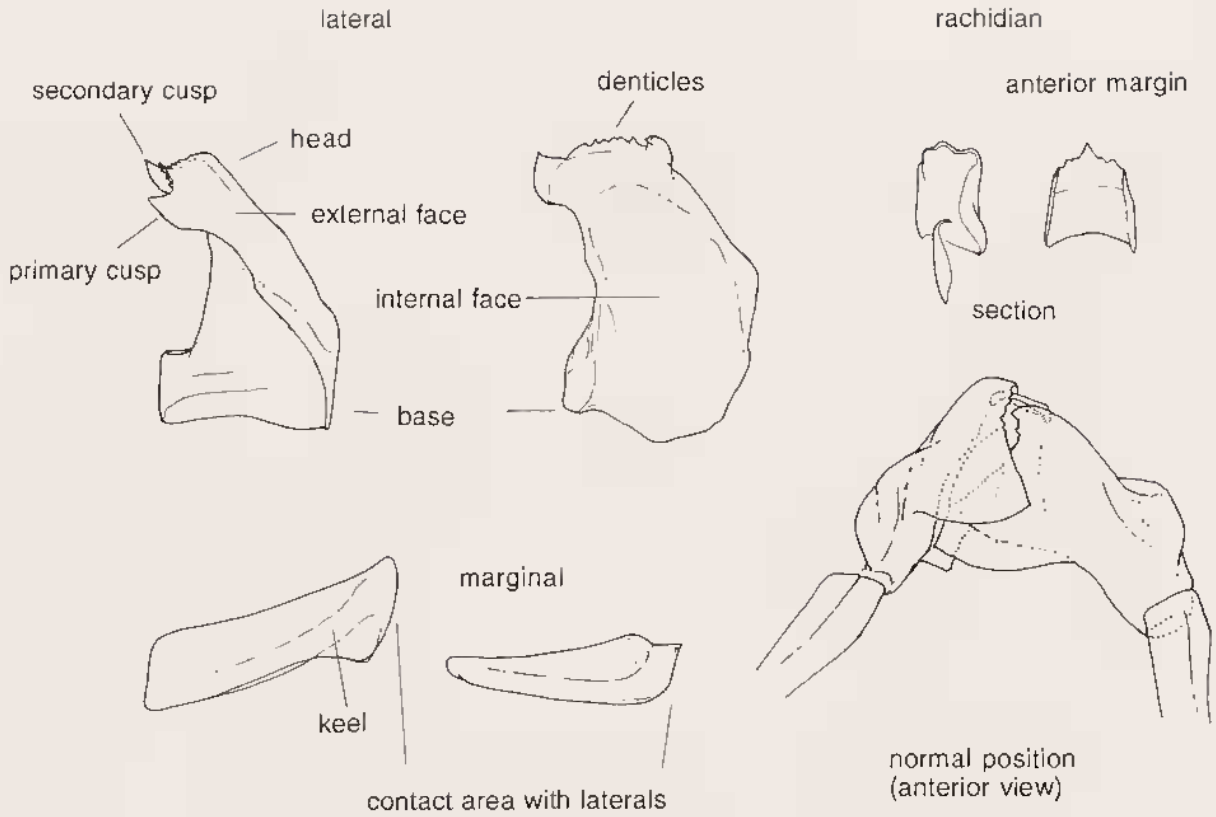


FIG. 4. — Radular nomenclature used in this publication: Gadilida.

SYSTEMATIC ACCOUNT

This paper follows, with some modifications based on unpublished information, the classification proposed by STEINER (1992b), which is currently the best approach to a biologically based ordination for the class (Table 1). Modifications proposed here are supported by radular and shell characters. For historical reviews of former classifications see EMERSON (1978) and STEINER (1992b). This latter paper as well as those of STEINER (1991 and 1992a) are recent and provide descriptions of the anatomy of representatives of genera, therefore I will here discuss only shell and radular characters, based on new, unpublished observations. (Exceptions are *Sagamicadulus* and *Eudentalium*, for which I have not had access to live-taken material). For general information about scaphopod radula, I refer to IVANOV & CHISTIKOV (1990).

Table 1. — Synopsis of the classification of Indo-Pacific Scaphopoda used in the present paper.

Class SCAPHOPODA Bronn, 1862
Order DENTALIIDA da Costa, 1776
Family DENTALIIDAE Gray, 1847
Genus *Dentalium* Linné, 1758 = *Lentigodentalium* Habe, 1963
Genus *Paradentalium* Cotton & Godfrey, 1933
Genus *Tesseracme* Pilsbry & Sharp, 1897
Genus *Eudentalium* Cotton & Godfrey, 1933
Genus *Antalis* H. & A. Adams, 1854

Genus *Plagioglypta* Pilsbry *in* Pilsbry & Sharp, 1897
Genus *Striodentalium* Habe, 1964
Genus *Graptacme* Pilsbry & Sharp, 1897
Genus *Fissidentalium* Fischer, 1885
Genus *Schizodentalium* Sowerby, 1894
Genus *Compressidentalium* Habe, 1963
Genus *Coccodentalium* Sacco, 1896
Genus *Pictodentalium* Palmer, 1974

Family CALLIODENTALIIDAE Chistikov, 1975
Genus *Calliodentaliuni* Habe, 1964

Family FUSTIARIIDAE Steiner, 1991
Genus *Fustiaria* Stoliczka, 1868

Family GADILINIDAE Chistikov, 1975
Subfamily GADILININAE Chistikov, 1975
Genus *Gadilina* Foresti, 1895

Subfamily EPISIPHONINAE Chistikov, 1975
Genus *Episiphon* Pilsbry & Sharp, 1897

Subfamily ANULIDENTALIINAE Chistikov, 1975
Genus *Anulidentalium* Chistikov, 1975

Family LAEVIDENTALIIDAE Palmer, 1974
Genus *Laevidentalium* Cossmann, 1888

Family OMNIGLYPTIDAE Chistikov, 1975
Genus *Omniglypta* Kuroda & Habe *in* Habe, 1953

Family RHABDIDAE Chistikov, 1975
Genus *Rhabdus* Pilbry & Sharp, 1897

Order GADILIDA Starobogatov, 1974
Suborder ENTALIMORPHA Steiner, 1992
Family ENTALINIDAE Chistikov, 1979
Subfamily ENTALININAE Chistikov, 1979
Genus *Entalina* Monterosato, 1872

Subfamily HETEROSCHISMOIDINAE Chistikov, 1982
Genus *Heteroschismoides* Ludbrook, 1960
Genus *Costentalina* Chistikov, 1982
Genus *Entalinopsis* Habe, 1957
Genus *Spadentalina* Habe, 1963
Genus *Pertusiconcha* Chistikov, 1982

Subfamily BATHOXIPHINAE Chistikov, 1983
Genus *Bathoxiphus* Pilsbry & Sharp, 1897
Genus *Rhomboxiphus* Chistikov, 1983
Genus *Solenoxiphus* Chistikov, 1983

Suborder GADILIMORPHA Steiner, 1992
Family PULSELLIDAE Scarabino *in* Boss, 1982
Genus *Pulsellum* Stoliczka, 1868
Genus *Annulipulsellum* Scarabino, 1986
Genus *Striopulsellum* gen. nov.

Family WEMERSONIELLIDAE Scarabino, 1986
Genus *Wemersoniella* Scarabino, 1986
Genus *Chistikovia* gen. nov.

Family GADILIDAE Stoliczka, 1868
Subfamily SIPHONODENTALIINAE Simroth, 1894
Genus *Siphonodentalium* M. Sars, 1859
Genus *Sagamicadulus* Sakurai & Shimazu, 1963
Genus *Striocadulus* Emerson, 1962
Genus *Polyschides* Pilsbry & Sharp, 1898
Genus *Dischides* Jeffreys, 1867

Subfamily GADILINAE Stoliczka, 1868
Genus *Cadulus* Philippi, 1844
Genus *Bathycadulus* gen. nov.
Genus *Gadila* Gray, 1847 = *Platyschides* Henderson, 1920

Families ***incertae sedis***
Genus *Megaentalina* Habe, 1963
Genus *Compressidens* Pilsbry & Sharp, 1897

In the present study, 400 species-level taxa, including synonyms, are listed or discussed: they represent 237 valid species (141 Dentaliida and 96 Gadilida), of which 139 (81 Dentaliida and 58 Gadilida) have been taken during the different expeditions here reported on. Forty-two are described as new (16 Dentaliida and 26 Gadilida), and three new genera are erected in the Order Gadilida. Of the other 97 species (65 Dentaliida and 32 Gadilida) cited from the Indo-Pacific in the literature, I have examined the type material of many in their respective repositories.

Order DENTALIIDA Da Costa, 1776

Family DENTALIIDAE Gray, 1847

Genus *DENTALIUM* Linné, 1758

Type species (SD by MONTFORT, 1810): *D. elephantinum* Linnè, 1758.

Synonym: *Lentigodentalium* Habe, 1963. Type species (OD): *Dentalium variabile* Deshayes, 1825.

DIAGNOSIS. — *Shell* medium to large, generally well curved and strong, usually polished. White to yellow, orange, red, or green. Longitudinally sculptured by 8 to 12 primary ribs of varying strength, simple or channeled. Secondary ribs variable in number, smooth or sculptured. Intercostal spaces concave or convex, smooth or sculptured by longitudinal or transversal striae, or both. Apex generally with a flat V-shaped notch on the ventral side. Apical callous, lumen circular and pipe are common. Transversal section polygonal at the apex, usually circular at the mouth.

Radula rachidian very regular, well curved in section, anterior margin smooth or granulous; lateral solid with primary cusp sharp and secundary shorts; marginal short and slightly sinusoidal.

DISTRIBUTION. — Cretaceous-Recent, worldwide; temperate to tropical; sublittoral-shelf-bathyal.

Dentalium elephantinum Linné, 1758

Figs 5, 16 a

Dentalium elephantinum Linné, 1758: 785.

Synonyms:

Dentalium arcuatum Gmelin, 1791: 3738 (after Gualtieri, 1757: pl. 10, figs G, I).
Dentalium viridis Perry, 1811: pl. 52, fig. 3.

Other references:

Dentalium elephantinum — Martini, 1769: 31, pl. 1, fig. 5a (first illustration of a live specimen). — Lister, 1770: pl. 547, fig. 1 (*pars*). — Gmelin, 1791: 3736. — Lamarck, 1801: 326. — Deshayes, 1825: 347, pl. 3, fig. 7. — Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 4; 1873: pl. 1, fig. 5. — Pilsbry & Sharp, 1897: 1, pl. 1, figs 1-7. — Boissevain, 1906: 7, pl. 1, fig. 1. — Oostingh, 1925: 228. — Habe, 1962: 106, pl. 47, fig. 16; 1963: 253, pl. 37, fig. 3; 1964a: 6, pl. 1, fig. 3. — Emerson, 1962: 468, pl. 77, figs 1a-c. — Habe & Kosuge, 1964: 1. — Springsteen & Leobrera, 1985: 286, pl. 82, fig. 1. — Higo & Goto, 1993: 685.

Type material. — Syntypes, Uppsala University Zoological Museum (*fide* Wallin, 1992; not seen), and Linnean Society of London, no. 612 (*fide* Wheeler, 1993, not seen).

Type locality. — *D. elephantinum*: Amboina [Ambon], Indonesia. — *D. arcuatum*: unknown. — *D. viridis*: "South Seas".

Material examined. — **Papua New Guinea**. Manokwari, Coll. Staadt, 2 dd. — Port Dorey, Raffray coll., 4 dd (both MNHN).
Indonesia. Moluccas, Coll. Jousseaume, 3 dd (MNHN).
Philippines. Davao, Coll. Staadt, 2 dd. — Philippines, 1 dd (both MNHN).
Northern Indian Ocean. India, Coll. Denis, 1 dd. — Malabar, 2 dd (both MNHN).

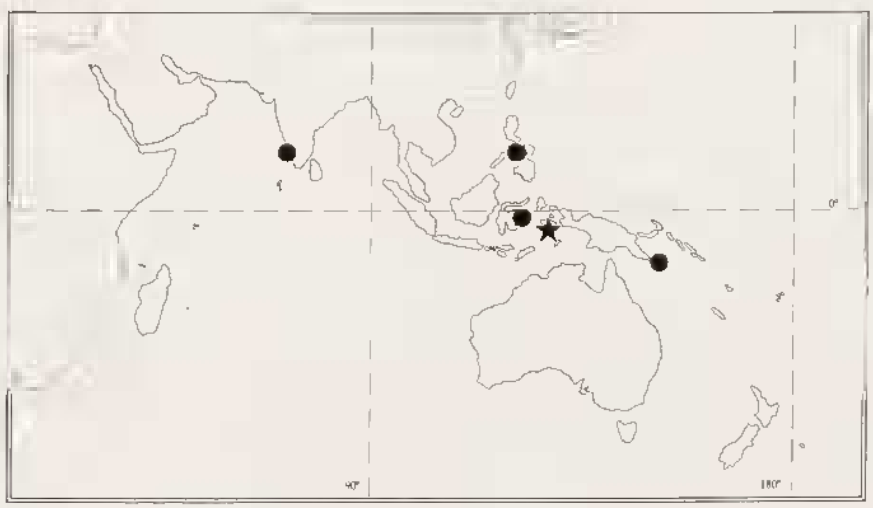


Fig. 5. — Distribution of *Dentalium elephantinum*.

Distribution. — The Philippines, Indonesia, New Guinea, Northern Indian Ocean (present paper), 5-40 m (Habe, 1964a).

Dentalium aprinum Linnè, 1767

Figs 6, 16 b

Deutaliuu aprinum Linnè, 1767: 1263.

Synonyms:

Dentalium striatulum Gmelin, 1791: 3738 (after LISTER, 1770: pl. 574, fig. 1) (*pars*).
Dentalium interstriatum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 7.
Dentalium aprinum incolor Boissevain, 1906: 9, pl. 4, figs 3-6.
Dentaliuu aprinum taiwanum Kuroda, 1941: 149.

Other references:

Dentalium aprinum – LISTER, 1770: pl. 547, fig. 1 (*pars*). — SOWERBY, 1860: 102, pl. 223 (*Dentalium* 1), figs 5-6; 1873: pl. 1, figs 2a-b. — MARTENS, 1880: 311. — CLESSIN, 1896: 12, pl. 3, figs 1-2. — BOISSEVAIN, 1906: 9, pl. 1, fig. 3, pl. 4, fig. 2. — DAUTZENBERG, 1929: 553. — DAWYDOFF, 1952: 144. — HABE, 1963: 253, pl. 37, fig. 6; 1977: 330. — HABE & KOSUGE, 1964: 1; 1966: 117, figs 24-25. — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 2. — DHARMA, 1992: 79, fig. 14. — HIGO & GOTO, 1993: 685.
Dentaliuu aparinum (*sic*) – CHERIYAN, 1968: 126. — SAYTAMURTI, 1956: 4, pl. 1 figs 2 a-b.
Dentaliuu apricum (*sic*) – PAETEL, 1873: 78.
Dentalium aprinum taiwanum – HABE, 1962: 106, pl. 47, fig. 15.
Dentalium interstriatum – CLESSIN, 1896: 13, pl. 3, fig. 8. — PILSBRY & SHARP, 1897: 4, pl. 1, fig. 15.

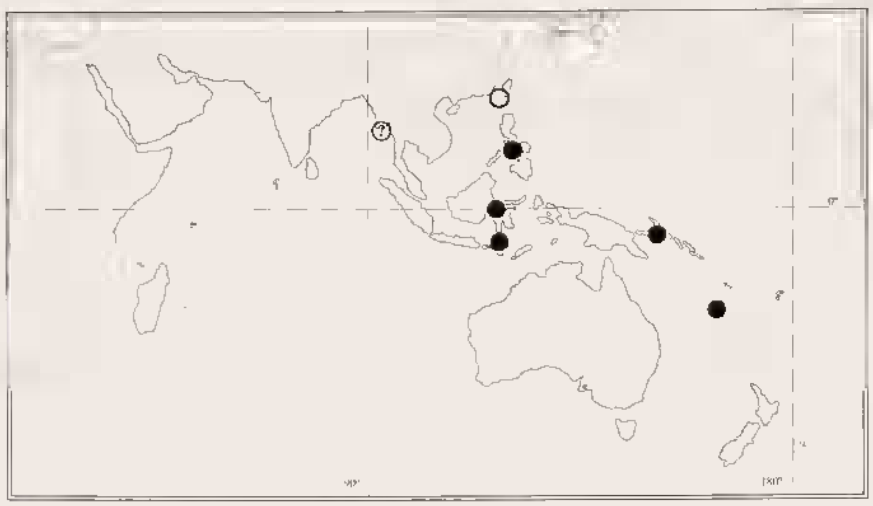


FIG. 6. — Distribution of *Deutaliuu aprinum*.

TYPE MATERIAL. — *D. aprinum*: syntypes in the Linnean Society of London, no. 611 (not seen). — *Dentalium aprinum incolor*: lectotype (here designated) ZMA 3.06.055 and paralectotypes ZMA 3.06.066-007. — *D. interstriatum*: syntypes (3 dd) BMNH 1950.11.28.42-44.

TYPE LOCALITY. — *D. aprinum*: Indian Ocean. — *D. aprinum incolor*: Indonesia, anchorage off Lirung, Silababu Island, *"Siboga"*, stn 133. — *D. aprinum taiwanum*: Taiwan, Takao. — *D. interstriatum*: Philippines, Bohol Island. — *D. striatulum*: unknown.

MATERIAL EXAMINED. — Type material of *D. aprinum incolor* and *D. interstriatum*.
New Caledonia. MUSORSTOM 4: stn DW 150, 19°07′ S, 163°22′ E, 110 m, 1 lv, 20 dd.
Papua New Guinea. New Britain, 3 dd (MNHN).

Indonesia. CORINDON: stn CH 206, 01°06′ S, 117°45′ E, 85 m, 1 dd. — Stn DR 216, 00°40′ N, 117°51′ E, 94 m, 26 dd. — Stn B 256, 01°56′ S, 119°174′ E, 24 m, 3 dd.
"Snellius" I: Timor, 123 m, 1 dd (RMNH).
Philippines. Philippines, no further data, 24 dd (MNHN).

DISTRIBUTION. — From Southern Japan, 5-40 m (HABE & KOSUGE, 1964) through Taiwan, the Philippines and Sulu Sea, to Indonesia and Papua New Guinea. Now extended to New Caledonia, alive in 110 m.

Dentalium octangulatum Donovan, 1804

Figs 7, 16 c

Dentalium octangulatum Donovan, 1804: pl. 162.

Synonyms:

Dentalium octogonum Lamarck, 1818: 344.
Dentalium yokohamense Watson, 1879: 517; 1886: 11, pl. 2, fig. 1.
Dentalium japonicum Dunker, 1882: 153, pl. 5, fig. 2.

Other references:

Dentalium octangulatum – PILSBRY & SHARP, 1898: 16, pl. 2, figs 16-18, 22. — BOISSEVAIN, 1906: 17, pl. 1, fig. 8, pl. 4, fig. 8-9. — DAUTZENBERG & FISCHER, 1906: 209. — TOKUNAGA, 1907: 10. — WINCKWORTH, 1927: 167, pl. 14, fig. 4. — KURODA & KIKUCHI, 1933: 7. — NOMURA, 1938: 155. — DAWYDOFF, 1952: 144. — SAYTAMURTI, 1956: 126. — AHMED, 1975: 29, fig. 32. — HABE, 1977: 330. — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 3. — QI & MA, 1989: 112, fig. 2. — IEYAMA, 1993: 245, figs 1-3.
Dentalium (*Paradentalium*) *octangulatum* – HABE, 1963: 254, pl. 37, figs 1-2; 1971: 486 (Japanese text), 305 (English text), pl. 65, figs 10-11. — HABE & KOSUGE, 1964: 1. — KIRA, 1955: 80, pl. 40, fig. 8. — HIGO & GOTO, 1993: 685.
Dentalium (*Dentalium*) *octangulatum* – HIRASE, 1931: 133, figs 1-4. — LUDBROOK, 1954: 96, fig. 1. — KIRA, 1962: 116, pl. 41, fig. 8.
Dentalium octogonum – DESHAYES, 1825: 352, pl. 16, figs 5-6. — DELESSERT, 1841: pl. 1, figs 1-1a-b. — CHENU, 1843: 4, pl. 1, figs 21-23. — REEVE, 1842b: 130, pl. 130, fig. 8. — SOWERBY, 1860: 102, pl. 223, fig. 9; 1873: pl. 2, fig. 12. — MARTENS, 1874: 102. — LISCHKE, 1874: 75, pl. 5, figs 1-3. — SMITH, 1875: 25. — BRAZIER, 1877: 55. — ANGAS, 1878: 868. — DUNKER, 1882: 153. — PILSBRY, 1895: 116. — CLESSIN, 1896: 10, pl. 1, fig. 6. — HALL & STANDEN, 1907: 65.
Dentalium octagonum – STEARNS, 1891: 13.
Dentalium (*Paradentalium*) *octangulum* – FUKUDA, 1992: 81, fig. 421.

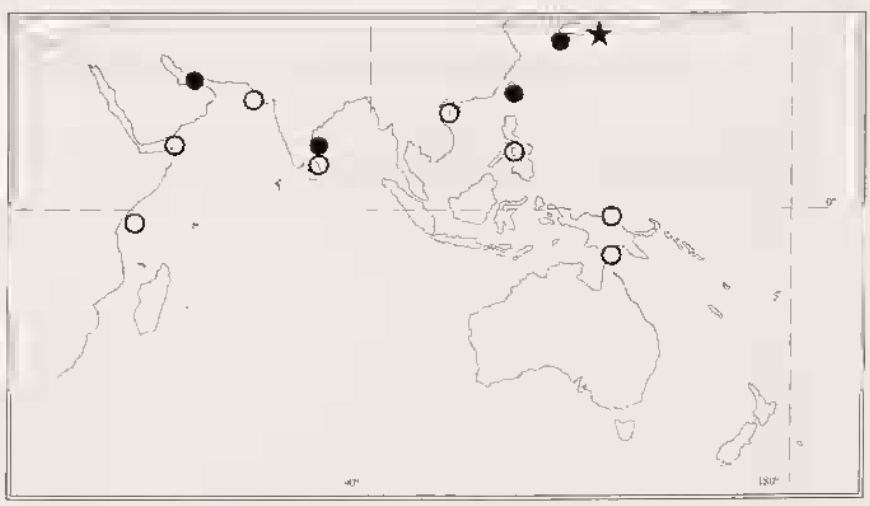


FIG. 7. — Distribution of *Dentalium octangulatum*.

TYPE MATERIAL. — *D. octangulatum*: neotype, designated by LUDBROOK (1954), BMNH 1952.2.23.1. — *D. octogonum*: syntypes (2 dd) MNHN (one of which figured by DELESSERT, 1841). — *D. yokohamense*: syntypes (3 dd) BMNH 1887.2.9.45-47. — *D. japonicum*: holotype ZMB 101995 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *D. octangulatum*: LUDBROOK (1954) designated Japan as type locality, while DONOVAN's original was China Seas. — *D. octogonum*: "Mers de la Chine". — *D. yokohamense*: Japan, Yokohama, *"Challenger"*, stn 233, 34°39′ N, 135°14′ E, 8 fms [15 m]. — *D. japonicum*: Japan.

MATERIAL EXAMINED. — The type material of *D. octangulatum*, *D. octogonum* and *D. yokohamense*.
Japan. No further data, Coll. JOUSSEAUME, 2 dd (MNHN).
China. No further data, 6 dd (MNHN).
Northern Indian Ocean. Karikal, Bay of Bengal, 4 dd (MNHN). — Persian Gulf, Dubay'ah, S. Pras coll., 20 dd (MNHN). — Jebel Dana and Abu Dhabi, 10 dd (BMNH). — Oman, Salalah, shore, 32 dd (BMNH).

DISTRIBUTION. — Japan, China Seas, Philippines, Northern Indian Ocean, Persian Gulf, shells in 0-100 m (HABE & KOSUGE, 1964).

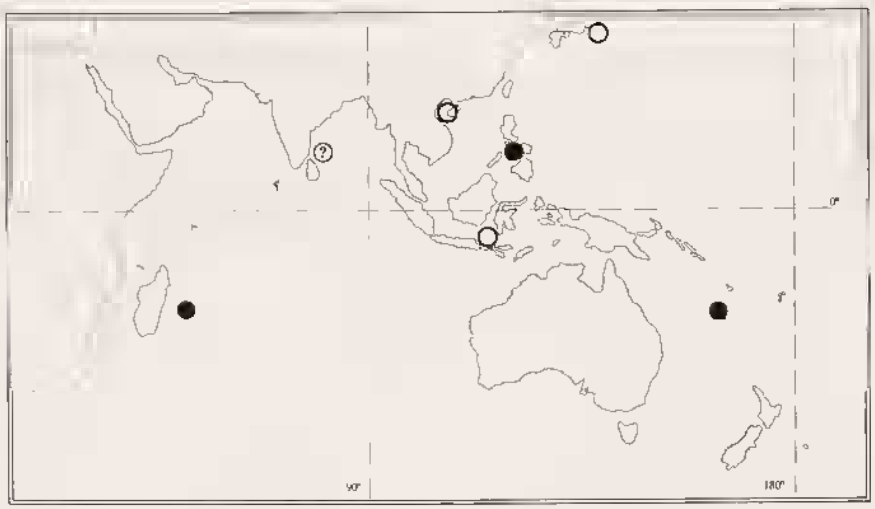


FIG. 8. — Distribution of *Dentalium elephantinum*.

Dentalium variabile Deshayes, 1825

Figs 8, 16 d-e

Dentalium variabile Deshayes, 1825: 352, pl. 2, fig. 30.

Synonyms:

Dentalium multistriatum Deshayes, 1825: 358, pl. 4, fig. 11 (**Syn. nov.**).
Dentalium belcheri Sowerby, 1860: 101, pl. 24 (*Dentalium* 2), figs 28-29 (**Syn. nov.**).

Other references:

Dentalium variabile – SOWERBY, 1860: 101, pl. 224 (*Dentalium* 2), fig. 30; 1873: pl. 4, fig. 26. – MARTENS 1887: 200. — BOISSEVAIN, 1906: 36, pl. 1, fig. 17. — CLESSIN, 1896: 14, pl. 4, fig. 1. — PILSBRY & SHARP, 1897: 60, pl. 14, figs 26-28.
Lentigodentalium variabile – HABE, 1977: 332. — HABE *et al.*, 1986: 24. — CHISTIKOV, 1979b: 112. — HIGO & GOTO, 1993: 686.
Dentalium (*Lentigodentalium*) *variabile* – HABE, 1963: 258, figs 53-54. — HABE & KOSUGE, 1964: 2.
Dentalium belcheri – SOWERBY, 1873: pl. 1, figs 1a-b. — PILSBRY & SHARP, 1897: 60, pl. 14, figs 29-30. — BOISSEVAIN, 1906: 35, pl. 1, fig. 18. — SMITH, 1906b: 58.

TYPE MATERIAL. — *D. variabile*: lectotype (here designated) (L 22.5, W 2.4, w 1.4) from 164 syntypes (MNHN). — *D. multistriatum*: lectotype (here designated) (L 18.8, W 2, w 1) from 14 syntypes (MNHN). — *D. belcheri*: lectotype (here designated) the largest (25 mm) of the 3 syntypes BMNH.

TYPE LOCALITY. — *D. variabile*: "could be from India". — *D. multistriatum*: "presumably from India" (DESHAYES 1825). — *D. belcheri*: East Indian Archipelago [= Indonesia].

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CHALCAL 1: stn DC 40, 20°32′ S, 158°51′ E, 65 m, 1 dd.
New Caledonia. LAGON: stn 7, 22°24′ S, 166°20′ E, 14 m, 7 dd. — Stn 8, 22°23′ S, 166°18′ E, 15 m, 1 dd. — Stn 21, 22°23′ S, 166°23′ E, 10 m, 1 dd. — Stn 50, 22°17′ S, 166°12′ E, 12 m, 1 lv, 2 dd. — Stn 64, 22°28′ S, 166°25′ E, 15 m, 2 lv. — Stn 98, 22°36′ S, 166°32′ E, 15 m, 1 lv. — Stn 162, 22°13′ S, 166°09′ E, 10 m, 4 lv. — Stn 212, 21°56′ S, 165°53′ E, 10 m, 2 lv, 1 dd. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 4 dd. — Stn 293, 22°42′ S, 166°41′ E, 20 m, 1 lv. — Stn 867, 20°39′ S, 165°01′ E, 25 m, 1 dd.
Philippines. No further data, 11 dd. — *ibid.*, Coll. JOUSSEAUME, 73 dd, (all MNHN).
West Indian Ocean. MD 32 Réunion: stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 60 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 7 dd.

DISTRIBUTION. — Japan, China Seas, the Philippines, Indonesia and India (?), now extended to New Caledonia and Réunion Island, alive in 10-75 m (present paper).

Dentalium strigatum Gould, 1859

Figs 9, 16 f

Dentalium strigatum Gould, 1859: 166.

Synonym:

Dentalium agulhasense Plate, 1908a: 349, pl. 30, figs 21-23 (**Syn. nov.**).

Other references:

Dentalium strigatum — SMITH, 1903: 393. — BARTSCH, 1915: 180, pl. 44, fig. 5. — TOMLIN, 1931: 337. — JAECKEL, 1932: 303. — BARNARD, 1963b: 345; 1974: 742. — JOHNSON, 1964: 153.

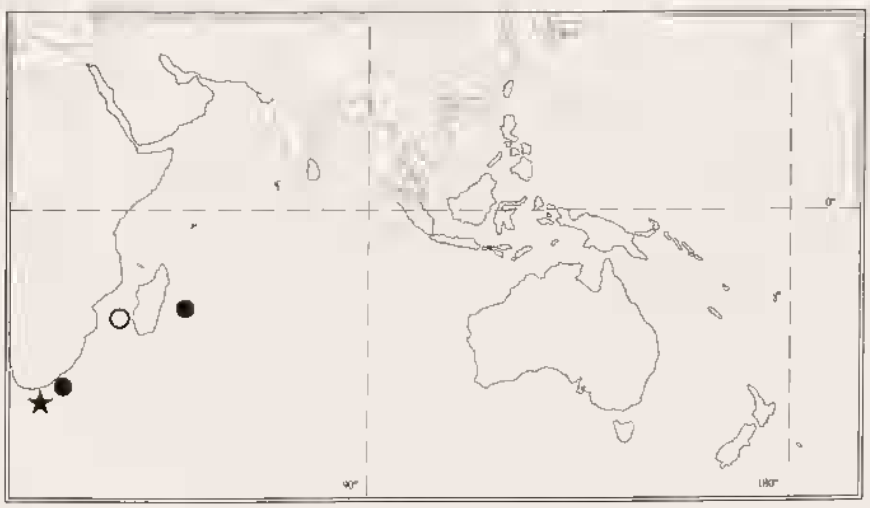


FIG. 9. — Distribution of *Dentalium strigatum*.

TYPE MATERIAL. — *D. strigatum*: lectotype (designated by JOHNSON, 1964) USNM 159, paralectotypes MCZ 169382. — *D. agulhasense*: lectotype, designated by KILIAS (1995), ZMB 61087a.

TYPE LOCALITY. — *D. strigatum*: False Bay, Cape of Good Hope, 20-80 m. — *D. agulhasense*: South Africa, off Cape Agulhas, *"Valdivia"*, stn 95, 34°51′ S, 19°38′ E, 80 m.

MATERIAL EXAMINED. — The type material of *D. strigatum*.
West Indian Ocean. MD 32 Réunion: stn CP 172, 20°52′ S, 55°38′ E, 105-120 m, 1 dd.
"Meiring Naudé": stn SM 180, 33°29′ S, 27°21′ E, 80 m, 2 dd (SAM).

DISTRIBUTION. — South Africa, Mozambique Channel (BARNARD, 1963b); now extended to Réunion Island; shells in 80-120 m.

Dentalium bisexangulatum Sowerby, 1860

Figs 10, 16 j

Dentalium bisexangulatum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 8.

Other references:

Dentalium bisexangulatum – SOWERBY, 1873: pl. 3, fig. 15. — BRAZIER, 1877: 57. — COOKE, 1885: 273. — PILSBRY & SHARP, 1897: 15, pl. 2, fig. 25. — BOISSEVAIN, 1906: 22, pl. 1, fig. 7.
Dentalium (Dentalium) bisexangulatum – LUDBROOK, 1954: 92. — HIGO & GOTO, 1993: 685.
D. (P.) bisexangulatum – HABE & KOSUGE, 1964: 2.

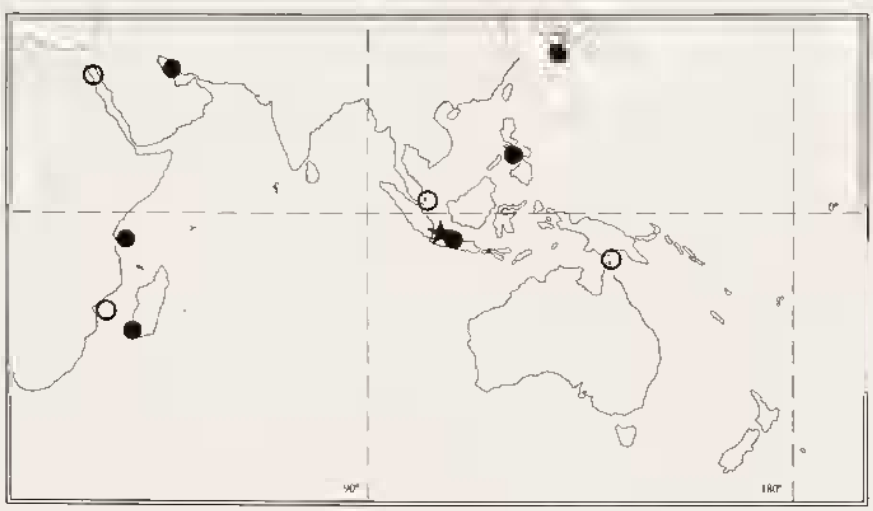


FIG. 10. — Distribution of *Dentalium bisexangulatum*.

TYPE MATERIAL. — 3 syntypes dd, BMNH no reg. no.

TYPE LOCALITY. — Java.

MATERIAL EXAMINED. — The type material.
Indonesia. Java, Coll. JOUSSEAUME, 1 dd (MNHN).
Philippines. Philippines, Coll. JOUSSEAUME, 1 dd (MNHN).
Japan. Booshu, Coll. DENIS, 1945, 2 dd (MNHN).

Northwestern Indian Ocean. Persian Gulf, shore of Iran, 26°35′ N, 54°00′ E, 35 m, 2 dd, *"Calypso"* 1954 (MNHN).
West Indian Ocean. Madagascar, Tuléar, N of jetty, shore, 10 dd. — Tuléar, Grand Récif, 1 m, 4 dd, R. v. Cosel coll. 1986. — Zanzibar, Coll. CLOUÉ, 1850, 5 dd (MNHN).

DISTRIBUTION. — Japan, Singapore, Java, Torres Strait, Gulf of Suez, Mozambique (14-55 m) (LUDBROOK, 1954); Philippines, Persian Gulf, Zanzibar (present paper). No data about living depth range.

Dentalium javanum Sowerby, 1860

Figs 11, 16 i

Dentalium javanum Sowerby, 1860: 102, pl. 223 (*Dentalium* 1), fig. 12.

Other references:

Dentalium javanum – SOWERBY, 1873: pl. 3, fig. 14. — SMITH, 1884: 77. — PILSBRY & SHARP, 1897: 4, pl. 4, fig. 49. — MELVILL & STANDEN, 1899: 181. — BOISSEVAIN, 1906: 18, pl. 1, fig. 6; pl. 4, fig. 7. textfig. 13. — HABE, 1977: 331.
Dentalium (*Paradentalium*) *javanum* – HABE, 1963: 254, pl. 37, figs 7-8; 1964a: 9, pl. 1, figs 7-8.
Dentalium (*Paradentalium*) *javanicum* – HIGO & GOTO, 1993: 685.

TYPE MATERIAL. — Not found in BMNH.

TYPE LOCALITY. — Java, Malacca.

MATERIAL EXAMINED. — **Indonesia**. "Java, Malacca", Coll. WRIGHT 1869, 2 dd. — Java, Coll. JOUSSEAUME, 1 dd (both MNHN).

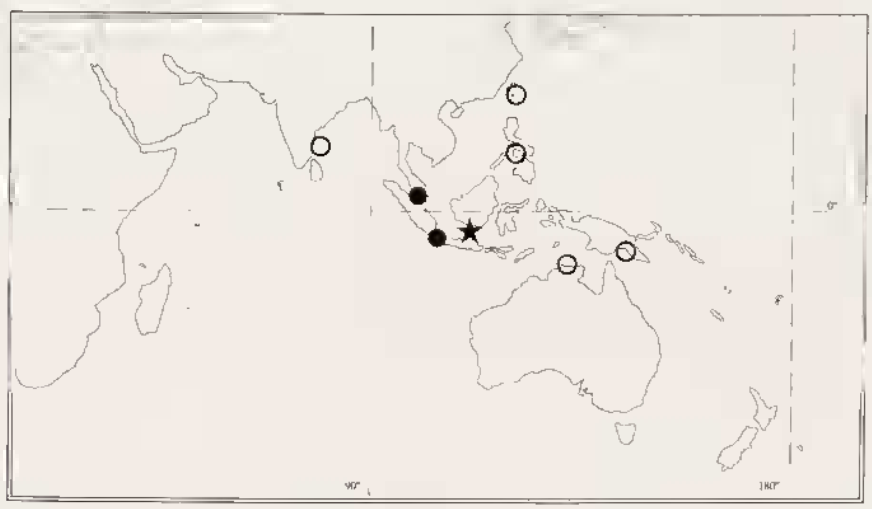


FIG. 11. — Distribution of *Dentalium javanum*.

DISTRIBUTION. — Taiwan, Philippines, Indonesia, New Guinea, North Australia, India, 5-50 m (HABE, 1964b).

Dentalium reevei Fischer, 1871

Figs 12, 16 g-h

Dentalium reevei Fischer (*ex* Deshayes, MS), 1871: 212.

Synonyms:

Dentalium aratorum Cooke, 1885: 273.
Dentalium lineolatum Cooke, 1885: 274.
Dentalium clavus Cooke, 1885: 275.
Dentalium langieri Jousseaume, 1894: 103.
Dentalium macandrewi Boissevain, 1906: 25, pl. 5, figs 25-34.

Other references:

Dentalium reevei – Boissevain, 1906: 27. — Moazzo, 1939: 221.
Dentalium (Dentalium) reevei – Ludbrook, 1954: 98.
Dentalium aratorum – Pilsbry & Sharp, 1897: 10. — Boissevain, 1906: 27, pl. 5, figs 31-34. — Franc, 1956: 49.
Dentalium lineolatum – Pilsbry & Sharp, 1897: 11. — Boissevain, 1906: 26. pl. 5, figs 25-27. — Lamy, 1910: 334; 1938: 88. — Dautzenberg, 1929: 554.
Dentalium laugieri – Pilsbry & Sharp, 1897: 12. — Boissevain, 1906: 25.
Dentalium clavus – Boissevain, 1906: 27, pl. 5, figs 28-30.

Fig. 12. — Distribution of *Dentalium reevei*.

Type material. — *D. reevei*: lectotype (here designated), the only remaining syntype, MNHN. — *D. laugieri*: 10 syntypes dd MNHN. — *D. macandrewi*: lectotype (here designated), the specimen figured in Boissevain, 1906, pl. 5, fig. 29 (ZMA). — *D. aratorum*, *D. lineolatum* and *D. clavus*: not located.

Type locality. — *D. reevei*: Suez. — *D. aratorum*, *D. lineolatum* and *D. clavus*: Gulf of Suez. — *D. laugieri*: Aden, Suez. — *D. macandrewi*: Gulf of Suez.

Material examined. — The type material listed.
Northwestern Indian Ocean. Red Sea: Saudi Arabia, 24°12′ N, 37°55′ E, Marioni coll., 2 dd. — Port Sudan, harbour, 1 m, Reid coll., 9 lv, 1 dd (both BMNH). — Souakin, Sudan, 1 dd. — Aden, 2 dd (both Coll. Jousseaume, MNHN).
West Indian Ocean. BENTHEDI: stn S 18, 12°45′ S, 45°16′ E, 15 m, 1 lv, 6 dd. — Stn S 23, 12°46′ S,

45°15′ E, 6 m, 1 lv, 1 dd. — Stn S 32, 12°45′ S, 45°18′ E, 15-20 m, 1 dd. — Stn S 36, 12°52′ S, 45°16′ E, 30 m, 2 dd.
Shimoni, Kenya, 2 lv, 5 dd. — 1 mile E Nyango, W Zanzibar, 18 fms [33 m], 1 dd (both BMNH). — Kiloa, Zanzibar, 3 dd. — Tuléar, Madagascar, 2 dd. — Tuléar, S beach, Thomassin coll., 1 dd (all MNHN). — Nosy Bé Island, NW Madagascar, 5 m, 2 lv, Plante coll. (BMNH).

DISTRIBUTION. — Red Sea and the Gulf of Aden; now extended to East Africa and Madagascar, alive in 6-32 m.

REMARKS. — Although BOISSEVAIN (1906) introduced the name *D. macandrewi* as a *nomen novum* for *D. aratorum*, *D. lineolatum* and *D. clavus*, none of the Cooke's names is preoccupied. *D. macandrewi* is to be treated as a nominally different species, with its own type material. *D. reevei* is extremely variable in shape (W/w ratio 3.5-1.5) and colour (white to green). The ribs can be simple to deeply channeled longitudinally, smooth to slightly sculptured transversally. The apex is also variable in width, probably due to reabsorption.

Dentalium oryx Boissevain, 1906

Figs 13, 16 k, 71 d

Dentalium oryx Boissevain, 1906: 20, pl. 6, fig. 24.

Synonym:

Dentalium paucicontortum Boissevain, 1906: 28, pl. 6, figs 25-28 (**Syn. nov.**).

Other references:

Entalinopsis (*Entalinospsis*) *oryx* — HABE & KOSUGE, 1964: 9.
Dentalium (*Paradentalium*) *paucicontortum* — HABE, 1963: 255.

TYPE MATERIAL. — *D. oryx*: lectotype (here designated) ZMA 3.06.014, paralectotypes ZMA 3.06.015. — *D. paucicontortum*: lectotype (here designated) ZMA 3.06.022, paralectotypes ZMA 3.06.023.024.

TYPE LOCALITY. — *D. oryx*: *"Siboga"*, stn 302, 10°28′ S, 123°29′ E, 216 m, South of Sunda Island. — *D. paucicontortum*: Indonesia, Sulu Archipelago, *"Siboga"*, stn 95, 05°44′ N, 119°40′ E, 522 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 lv, 1 dd. — Stn DW 340, 19°49′ S, 158°41′ E, 675-680 m, 1 dd. — Stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 1 lv, 1 dd. — Stn DW 357, 19°37′ S, 158°46′ E, 630 m, 6 dd. — Stn DW 358, 19°39′ S, 158°47′ E, 680-700 m, 1 dd. — Stn DC 361, 19°53′ S, 158°38′ E, 400 m, 1 dd. — Stn DC 362, 19°53′ S, 158°40′ E, 410 m, 1 lv. — Stn DC 381, 19°38′ S, 158°47′ E, 620 m, 1 dd. — Stn DC 382, 19°37′ S, 158°43′ E, 580 m, 1 dd.
New Caledonia. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 28 dd.
BIOCAL: stn DW 36, 23°09′ S, 167°11′ E, 650-680 m, 1 dd. — Stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 4 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 3 lv, 4 dd. — Stn DW 70, 23°25′ S, 167°53′ E, 965 m, 1 lv.
MUSORSTOM 4: stn DW 226, 22°47′ S, 167°22′ E, 390 m, 1 dd.
CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 2 lv.
LAGON: stn 993, 20°15′ S, 163°53′ E, 375-400 m, 2 dd.
Passe de Boulari, 400 m, B. Richer/ORSTOM coll., 6 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 397, 20°47′ S, 167°05′ E, 380 m, 1 dd. — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 416, 20°42′ S, 167°00′ E, 343 m, 1 dd. — Stn DW 418,

20°42′ S, 167°03′ E, 283 m, 1 dd. — Stn DW 425, 20°24′ S, 166°25′ E, 594 m, 3 dd. — Stn DW 439, 20°46′ S, 167°17′ E, 288 m, 3 dd. — Stn DW 440, 20°49′ S, 167°17′ E, 288 m, 2 dd. — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 3 dd. — Stn DW 452, 21°00′ S, 167°25′ E, 300 m, 1 dd. — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 3 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 2 dd. — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 2 dd. — Stn DW 488, 20°49′ S, 167°06′ E, 800 m, 1 lv, 1 dd.

Indonesia. CORINDON: stn B 248, 00°54′ S, 119°29′ E, 170 m, 3 dd.

"Snellius" II: stn 4.166, 06°26′ S, 120°27′ E, 300 m, 5 dd.

Philippines. MUSORSTOM 3: stn DR 126, 11°49′ N, 121°22′ E, 266 m, 1 dd.

West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 3 lv, 2 dd. — Stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 dd. — Stn F 49, 12°55′ S, 44°59′ E, 300-450 m, 1 lv. — Stn DR 34, 12°54′ S, 45° 16′ E, 500 m, 1 lv. — Stn 37, 12°54'S, 45°16′ E, 520-830 m, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 3 lv. — Stn DR 104, 11°26′ S, 47°22′ E, 330-530 m, 2 lv, 1 dd. — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 2 dd.

MD 32 Réunion: stn DR 62, 21°09′ S, 55°12′ E, 630-710 m, 46 dd.

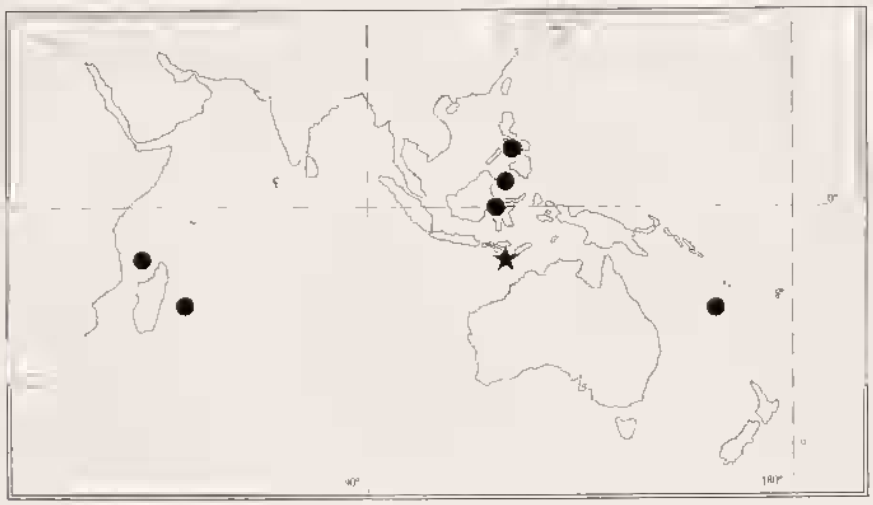


FIG. 13. — Distribution of *Dentalium oryx*.

DISTRIBUTION. — Indonesia; now extended to the Philippines, New Caledonia, and SW Indian Ocean; alive in 216-965 m.

Dentalium leucoryx Boissevain, 1906

Figs 14, 16 I

Dentalium leucoryx Boissevain, 1906: 20, pl. 6, fig. 23.

Synonym:

Dentalium sinuosum Boissevain, 1906: 28, pl. 6, fig. 22 (**Syn. nov.**).

Other references:

Dentalium leucoryx — HABE & KOSUGE, 1964: 2.
Dentalium sinuosum — HABE & KOSUGE, 1964: 2. — QI & MA, 1989: 112, fig. 1.
Paradentalium sinuosum — CHISTIKOV, 1979b: 109.

TYPE MATERIAL. — *D. leucoryx*: lectotype (here designated) ZMA 3.06.016, paralectotypes ZMA 3.06.017. — *D. sinuosum*: lectotype (here designated) ZMA 3.06.021, paralectotypes ZMA 3.06.018-020.

TYPE LOCALITY. — *D. leucoryx*: Indonesia, off Sunda Island, *"Siboga"*, stn 285, 08°39′ S, 127°04′ E, 34 m. — *D. sinuosum*: Indonesia, Timor Sea, *"Siboga"*, stn 294, 10°12′ S, 124°27′ E, 73 m.

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 207, 00°15′ S, 117°52′ E, 150 m, 8 dd. — Stn CH 208, 00°15′ S, 117°52′ E, 150 m, 1 lv. — Stn CH 214, 00°31′ N, 117°50 E, 595 m, 2 dd. — Stn B 251, 00°54′ S, 119°30′ E, 65 m, 2 dd.
"Snellius" I: stn 123, 10°29′ S, 126°44′ E, 250 m, 1 dd.
"Snellius" II: stn 4.045, 05°57′ S, 123°49′ E, 250-300 m, 3 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 600-800 m, 1 dd.

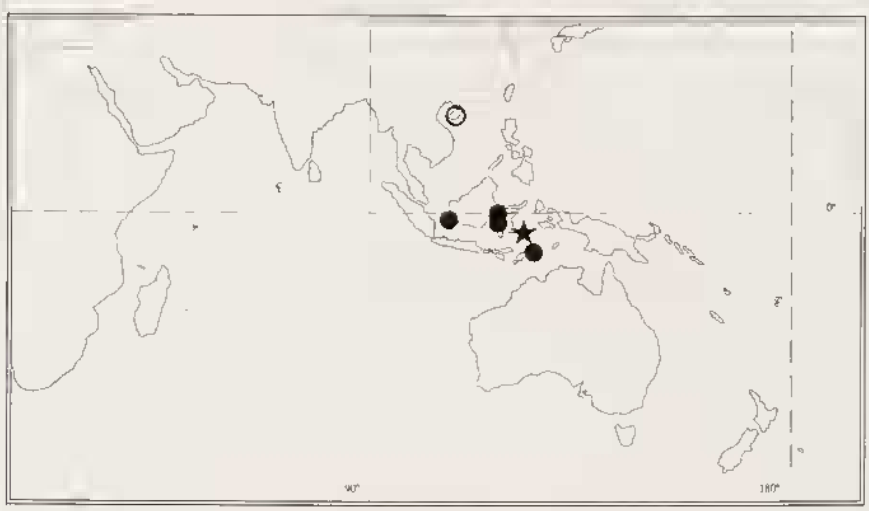


FIG. 14. — Distribution of *Dentalium leucoryx*.

DISTRIBUTION. — South China Seas to Indonesia, alive in 150-157 m, shells from 34 m (BOISSEVAIN, 1906) to 800 m (present paper; possibly washed down).

Dentalium pluricostatum Boissevain, 1906

Figs 15, 16 m, 28 k

Dentalium pluricostatum Boissevain, 1906: 30, pl. 6, figs 6-7.

Other reference:
D. pleuricostatum (*sic*) — HABE & KOSUGE, 1964: 2.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.027, paralectotypes ZMA 3.06.025-026.

TYPE LOCALITY. — Indonesia, Buton Strait, *"Siboga"*, stn 204, 04°20′ S, 122°58′ E, 75-94 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 69, 22°23′ S, 166°32′ E, 13 m, 4 lv, 8 dd. — Stn 131, 22°28′ S, 166°50′ E, 38 m, 1 lv, 2 dd. — Stn 133, 22°24′ S, 166°52′ E, 59-62 m, 1 dd. — Stn 146, 22°24′ S, 166°55′ E, 40-

52 m, 2 lv, 3 dd. — Stn 147, 22°26′ S, 166°54′ E, 50-60 m, 5 dd. — Stn 149, 22°29′ S, 166°51′ E, 48 m, 2 lv, 4 dd. — Stn 234, 22°33′ S, 166°51′ E, 56 m, 6 lv, 12 dd. — Stn 234bis, 22°33′ S, 166°51′ E, 60 m, 2 dd. — Stn 235, 22°31′ S, 166°52′ E, 70 m, 1 lv, 3 dd. — Stn 236, 22°29′ S, 166°54′ E, 67 m, 2 lv, 3 dd. — Stn 237, 22°27′ S, 166°55′ E, 62 m, 1 dd. — Stn 238, 22°26′ S, 166°56′ E, 50 m, 1 lv. — Stn 240, 22°23′ S, 166°59′ E, 42 m, 2 dd. — Stn 245, 22°27′ S, 166°58′ E, 62 m, 3 lv, 5 dd. — Stn 257, 22°22′ S, 166°20′ E, 9 m, 1 lv. — Stn 301, 22°35′ S, 166°52′ E, 46 m, 1 lv. — Stn 317, 22°33′ S, 166°53′ E, 66 m, 1 lv, 2 dd. — Stn 318, 22°34′ S, 166°55′ E, 71 m, 1 lv, 3 dd. — Stn 319, 22°32′ S, 166°57′ E, 75 m, 3 lv, 3 dd. — Stn 320, 22°32′ S, 166°54′ E, 70 m, 1 lv, 2 dd. — Stn 321, 22°30′ S, 166°56′ E, 70 m, 1 lv. — Stn 322, 22°30′ S, 166°58′ E, 71 m, 1 lv, 20 dd. — Stn 323, 22°29′ S, 166°59′ E, 80 m, 1 dd. — Stn 325, 22°27′ S, 167°01′ E, 75 m, 4 lv, 2 dd. — Stn 326, 22°26′ S, 167°02′ E, 67 m, 4 lv, 18 dd. — Stn 328, 22°27′ S, 167°03′ E, 72 m, 3 lv, 2 dd. — Stn 329, 22°29′ S, 167°02′ E, 80 m, 7 lv, 4 dd. — Stn 330, 22°31′ S, 167°00′ E, 82 m, 1 lv, 3 dd. — Stn 331, 22°33′ S, 166°59′ E, 79 m, 3 lv, 3 dd. — Stn 332, 22°34′ S, 166°57′ E, 80 m, 3 lv, 1 dd. — Stn 333, 22°37′ S, 166°56′ E, 71 m, 7 lv. — Stn 350, 22°39′ S, 166°57′ E, 67 m, 4 lv, 6 dd. — Stn 352, 22°35′ S, 166°60′ E, 82 m, 3 lv, 7 dd. — Stn 354, 22°32′ S, 167°02′ E, 78 m, 7 lv, 3 dd. — Stn 355, 22°30′ S, 167°04′ E, 82 m, 5 lv, 1 dd. — Stn 356, 22°29′ S, 167°05′ E, 78 m, 4 lv, 3 dd. — Stn 357, 22°30′ S, 167°07′ E, 77 m, 3 lv, 5 dd. — Stn 359, 22°33′ S, 167°04′ E, 74 m, 3 lv. — Stn 361, 22°36′ S, 167°02′ E, 78 m, 1 lv. — Stn 362, 22°38′ S, 167°00′ E, 83 m, 1 dd. — Stn 376, 22°34′ S, 167°06′ E, 75-76 m, 1 lv, 11 dd. — Stn 386, 22°37′ S, 167°09′ E, 128 m, 1 lv. — Stn 429, 22°40′ S, 167°15′ E, 95 m, 6 lv. — Stn 537, 19°07′ S, 163°22′ E, 200 m, 3 dd. — Stn 538, 19°07′ S, 163°21′ E, 195 m, 1 lv, 7 dd. — Stn 539, 19°05′ S, 163°17′ E, 240 m, 2 lv, 2 dd. — Stn 603, 22°16′ S, 167°05′ E, 78-80 m, 1 lv, 6 dd. — Stn 604, 22°14′ S, 167°04′ E, 80 m, 10 lv, 10 dd. — Stn 605, 22°15′ S, 167°02′ E, 65-70 m, 4 lv. — Stn 606, 22°13′ S, 167°01′ E, 46-48 m, 1 lv. — Stn 611, 22°09′ S, 166°59′ E, 56-57 m, 1 dd. — Stn 615, 22°07′ S, 166°57′ E, 56-60 m, 3 lv. — Stn 618, 22°05′ S, 166°56′ E, 53-58 m, 1 dd. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 lv. — Stn 622, 22°02′ S, 166°53′ E, 67 m, 3 lv, 5 dd. — Stn 628, 22°00′ S, 166°49′ E, 55-56 m, 1 lv, 1 dd. — Stn 630, 21°59′ S, 166°46′ E, 60-68 m, 2 lv, 1 dd. — Stn 638, 21°56′ S, 166°40′ E, 56-58 m, 2 lv. — Stn 643, 21°53′ S, 166°40′ E, 56-66 m, 3 lv, 8 dd. — Stn 646, 21°52′ S, 166°38′ E, 66-70 m, 5 lv, 4 dd. — Stn 647, 21°54′ S, 166°37′ E, 50-52 m, 3 lv, 3 dd. — Stn 648, 21°53′ S, 166°35′ E, 22-25 m, 1 dd. — Stn 649, 21°51′ S, 166°37′ E, 64-65 m, 3 lv, 7 dd. — Stn 652, 21°50′ S, 166°35′ E, 55-62 m, 6 dd. — Stn 655, 21°48′ S, 166°31′ E, 35-40 m, 2 lv. — Stn 656, 21°49′ S, 166°33′ E, 30-40 m, 1 lv. — Stn 660, 21°47′ S, 166°33′ E, 48-52 m, 1 dd. — Stn 665, 21°45′ S, 166°28′ E, 40-42 m, 1 lv, 1 dd. — Stn 674, 21°38′ S, 166°23′ E, 48 m, 1 dd. — Stn 692, 21°32′ S, 166°12′ E, 44-48 m, 1 dd. — Stn 694, 21°32′ S, 166°10′ E, 45-47 m, 2 lv. — Stn 695, 21°31′ S, 166°11′ E, 54-55 m, 1 lv, 1 dd. — Stn 699, 21°31′ S, 166°08′ E, 50-52 m, 1 dd. — Stn 712, 21°25′ S, 166°00′ E, 47-49 m, 2 lv. — Stn 728, 21°21′ S, 165°52′ E, 43-47 m, 2 lv, 2 dd. — Stn 737, 22°08′ S, 166°59′ E, 49-50 m, 1 lv. — Stn 738, 22°10′ S, 167°00′ E, 59-61 m, 1 lv. — Stn 749, 21°18′ S, 165°18′ E, 49 m, 1 dd. — Stn 768, 21°14′ S, 165°39′ E, 28 m, 1 dd. — Stn 785, 21°08′ S, 165°33′ E, 37 m, 1 dd. — Stn 791, 21°07′ S, 165°31′ E, 33 m, 1 dd. — Stn 809, 20°56′ S, 165°28′ E, 34 m, 1 dd. — Stn 813, 22°51′ S, 165°25′ E, 47 m, 1 lv. — Stn 814, 21°56′ S, 165°26′ E, 38-50 m, 1 lv, 1 dd. — Stn 815, 21°54′ S, 165°27′ E, 32 m, 2 lv. — Stn 821, 20°52′ S, 165°23′ E, 32 m, 1 dd. — Stn 827, 20°52′ S, 165°18′ E, 53 m, 1 dd. — Stn 831, 20°50′ S, 165°18′ E, 73 m, 1 dd. — Stn 832, 20°51′ S, 165°13′ E, 32 m, 1 lv. — Stn 833, 20°50′ S, 165°18′ E, 52-70 m, 2 lv, 2 dd. — Stn 834, 20°48′ S, 165°16′ E, 58 m, 1 dd. — Stn 878, 20°32′ S, 164°48′ E, 54 m, 2 dd. — Stn 901, 20°13′ S, 164°22′ E, 22-40 m, 1 lv.

MUSORSTOM 4: stn DW 149, 19°08′ S, 163°23′ E, 155 m, 3 lv, 70 dd. — Stn DW 150, 19°07′ S, 163°23′ E, 110 m, 6 lv, 18 dd. — Stn DW 151, 19°07′ S, 163°22′ E, 200 m, 1 lv, 10 dd. — Stn DW 186, 19°07′ S, 163°30′ E, 190 m, 1 dd. — Stn DW 203, 22°36′ S, 167°05′ E, 105-110 m, 1 lv. — Stn DW 232, 22°29′ S, 167°05′ E, 77 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 441, 20°54′ S, 167°17′ E, 80 m, 1 dd. — Stn DW 442, 20°54′ S, 167°17′ E, 200 m, 1 lv, 10 dd.

Philippines. MUSORSTOM 2: stn DG 32, 13°40′ N, 120°54′ E, 192-220 m, 1 dd.

MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 14 dd.

West Indian Ocean. BENTHEDI: stn DR 38, 12°55′ S, 45°16′ E, 200-500 m, 1 dd. — Stn F 49, 12°55′ S, 44°57′ E, 300-450 m, 1 dd.

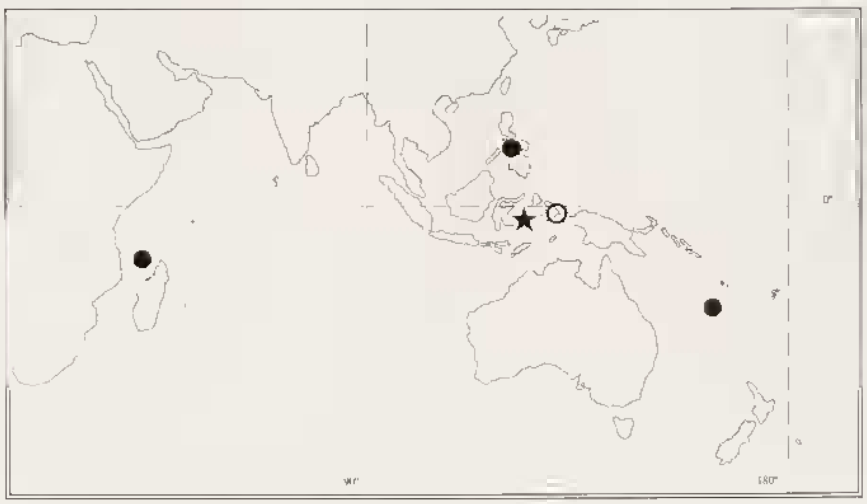


FIG. 15. — Distribution of *Dentalium pluricostatum*.

DISTRIBUTION. — The Philippines and Indonesia, now extended to New Caledonia and NW Madagascar; living from 9 to 240 m, shells down to 500 m (present paper).

Dentalium caledonicum sp. nov.

Figs 17, 28 a, 71 c

TYPE MATERIAL. — Holotype and 2 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Northern Norfolk Ridge, CHALCAL 2, stn DW 74, 24°40′ S, 168°38′ E, 650 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m. 1 lv (paratype). — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 lv (holotype). — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 1 lv (paratype).

DISTRIBUTION. — SE New Caledonia, alive in 573-650 m.

DESCRIPTION. — *Shell* to 30 mm long, nearly straight, shiny white, solid, 15 primary ribs with rounded edges. Secondary ribs present on the dorsal side or with only vestigal undulations reaching the fragile, circular oral aperture. Apex simple, truncate, with a shallow V-shaped notch in the ventral side. Lumen circular, suboval at the end of a short projecting pipe fissured on dorsal side.

Measurements: holotype L 26.4, W 3.5, w 2.1, arc 0.8; paratypes L 30.1, W 3.4, w 2.2, arc 0.5; L 27.5, W 3.5, w 2.1, arc 0.6. W/w ratio 1.54-1.67.

ETYMOLOGY. — From New Caledonia.

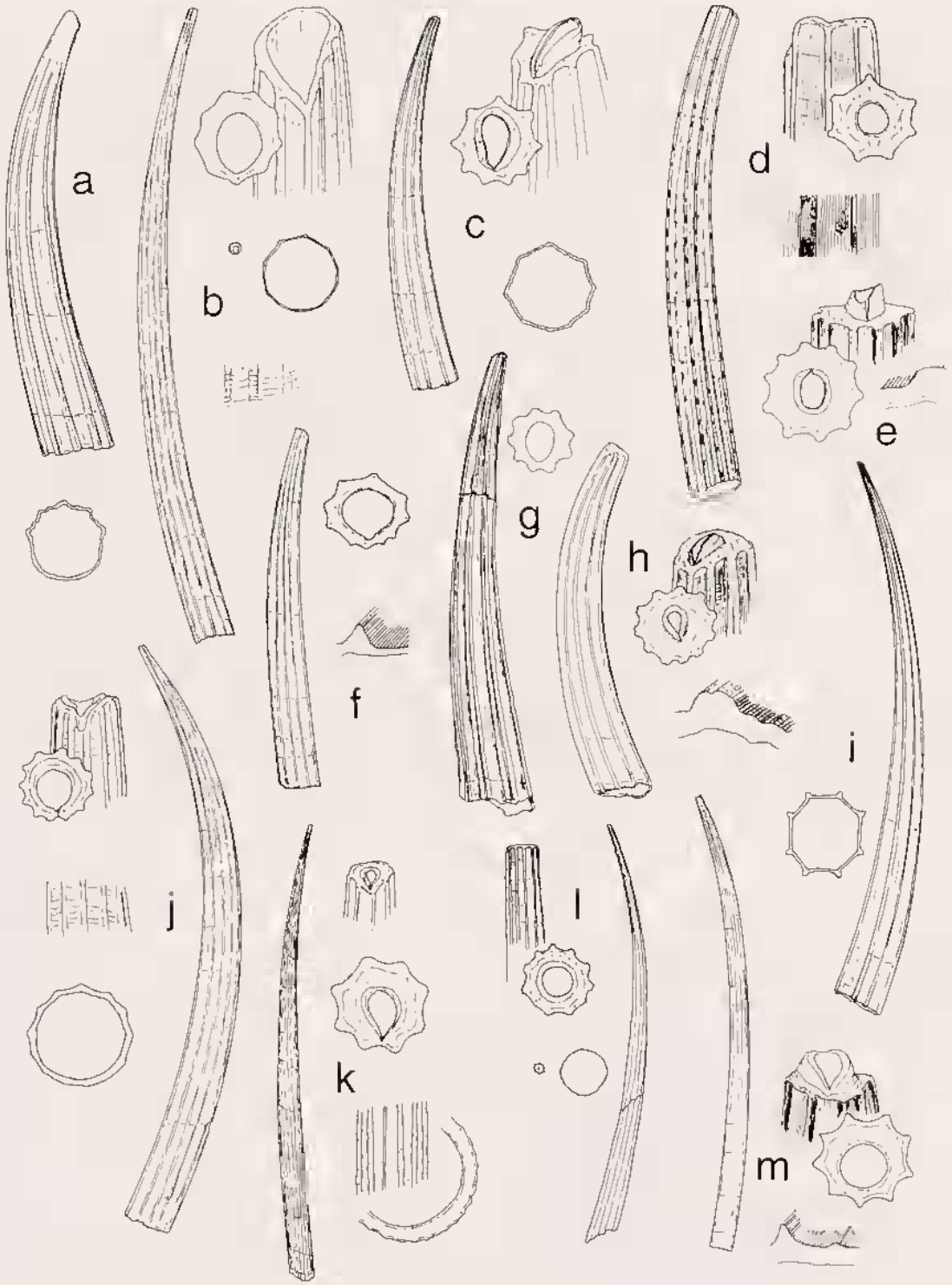


FIG. 16. — **a**, *Dentalium elephantinum*, shell (72 mm) and oral section, India (MNHN). — **b**, *Dentalium aprinum*, shell (75 mm), apex, apical and oral sections, detail of the sculpture, Papua New Guinea (MNHN). — **c**, *Dentalium octangulatum*, shell (40 mm), apex, apical and oral sections. — **d**, *Dentalium variabile*, lectotype (22.5 mm), apex and apical section, detail of the sculpture. — **e**, *Dentalium variabile*, apex and apical section (1.7 mm), detail of rib and sculpture, New Caledonia, LAGON: stn 7. — **f**, *Dentalium strigatum*, shell (18 mm), apical section, detail of the sculpture, MD 32 Réunion: stn CP 172. — **g**, *Dentalium reevei*, lectotype (29.8 mm), shell and apical section. — **h**, *Dentalium reevei*, shell (23 mm), apex, apical section, detail of the sculpture, Tuléar (MNHN). — **i**, *Dentalium javanum*, shell (55 mm) and oral section. Java, Malacca (MNHN). — **j**, *Dentalium bisexangulatum*, shell (72 mm), apex and apical section, detail of the sculpture and oral section, Tuléar (MNHN). — **k**, *Dentalium oryx*, shell (32 mm), apex, apical and oral sections, detail of sculpture, BENTHEDI: stn DR 08. — **l**, *Dentalium leucoryx*, shell (47 mm), apex, apical and oral sections, CORINDON: stn CH 208. — **m**, *Dentalium pluricostatum*, shell (49 mm), apex, apical section and detail of the sculpture, MUSORSTOM 4: stn DW 149.

FIG. 17. — Distribution of *Dentalium caledonicum*.

Dentalium crosnieri sp. nov.

Figs 18, 28 b

TYPE MATERIAL. — Holotype and 7 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Loyalty Islands, MUSORSTOM 6, stn DW 428, 20°24′ S, 166°13′ E, 420 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn DW 292, 20°28′ S, 166°48′ E, 465-470 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 428, 20°24′ S, 166°13′ E, 420 m, 2 lv, 1 dd (holotype lv and paratypes). — Stn DW 459, 21°01′ S, 167°31′ E, 425 m, 11 dd (2 paratypes). — Stn DW 487, 21°23′ S, 167°46′ E, 500 m, 1 lv, 1 dd (paratypes).

DISTRIBUTION. — New Caledonia and Loyalty Islands, alive in 420-500 m.

FIG. 18. — Distribution of *Dentalium crosnieri*.

DESCRIPTION. — *Shell* to 32 mm long, needle-like, almost straight, solid, white, shiny, with 15-17 primary ribs with rounded edges. Secondary ribs less prominent, but more so towards oral aperture. Intercostal spaces with coarse growth lines only. Oral aperture circular. Apex simple, truncate, circular to slightly flattened dorso-ventrally, lumen circular.

Measurements: holotype L 30.7, W 1.5, w 0.7, arc 0.9; paratypes L 31.5, W 1.6, w 0.9, arc 0.9; L 30.5, W 1.7, w 1.3, arc 0.8; L 23.5, W 1.4, w 0.6, arc 0.8. W/w ratio 1.31-2.34.

REMARKS. — The slight curvature and W/w ratio are the main distinguishing characters of this species. *D. oryx*, its closest relative, differs in apical section and W/w ratio (range 3.6-5.8 in 10 specimens).

ETYMOLOGY. — Named for Alain CROSNIER, ORSTOM, without whom there would have been no MUSORSTOM expeditions. In addition to making possible and participating himself in seven cruises at sea between 1976 and 1992, A. CROSNIER has edited most of the report volumes in the series where the present paper is published.

Dentalium flavum sp. nov.

Figs 19, 28 c, e

TYPE MATERIAL. — Holotype MNHN. Paratypes: 10 MNHN, 1 AMS C201722, 1 NMNZ M268960.

TYPE LOCALITY. — Chesterfield Islands, MUSORSTOM 5, stn DW 301, 22°07′ S, 159°25′ E, 487-610 m.

FIG. 19. — Distribution of *Dentalium flavum*.

MATERIAL EXAMINED. — **Chesterfield Islands.** MUSORSTOM 5: stn DW 301, 22°07′ S, 159°25′ E, 487-610 m, 2 lv (holotype and paratype). — Stn DW 306, 22°08′ S, 159°21′ E, 375-415 m, 1 lv (paratype).
New Caledonia. LAGON: stn 444, 18°15′ S, 162°59′ E, 300-350 m, 1 lv (paratype).
CHALCAL 2: stn DW 72, 24°54′ S, 168°22′ E, 527 m, 2 dd (paratypes).
BIOCAL: stn DW 38, 23°00′ S, 167°15′ E, 360 m, 1 dd (paratype).
SMIB 3: stn DW 01, 24°56′ S, 168°22′ E, 500 m, 1 dd (paratype). — Stn DW 05, 24°55′ S, 168°22′ E, 502-512 m, 1 dd (paratype).

Loyalty Islands. MUSORSTOM 6: stn DW 478, 21°09′ S, 167°54′ E, 400 m, 1 dd (paratype). — Stn DW 479, 21°09′ S, 167°55′ E, 310 m, 3 dd (paratypes: MNHN, AMS, NMNZ).

DISTRIBUTION. — Coral Sea, New Caledonia and Loyalty Islands, alive in 300-610 m.

DESCRIPTION. — *Shell* to 42 mm long, solid, shiny, slightly curved, white with alternating yellow bands. Sculpture consisting of 13-14 rounded primary ribs, secondary ribs appearing below apex, fading by the anterior quarter. Intercostal spaces smooth, except for growth lines and occasional vestigial longitudinal lines. Oral aperture thin, subcircular, slightly depressed on ventral side. Apex truncated, round and wide in cross section, with a projecting pipe fissured at dorsal side.

Measurements: holotype L 36.4, W 3.6, w 1.2, arc 1.5; paratype: L 23.4, W 3.1, w 1.4, arc 1. W/w ratio 2.2-3.0.

ETYMOLOGY. — From the Latin *flavus* (yellow).

Dentalium deforgesi sp. nov.

Figs 20, 28 d, 71 a-b

TYPE MATERIAL. — Holotype and 6 paratypes, MNHN.

TYPE LOCALITY. — New Caledonia, Northern Norfolk Ridge, CHALCAL 2, stn DW 73, 24°40′ S, 168°38′ E, 573 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m, 3 lv (holotype and 2 paratypes).
LAGON: stn 1146, 19°08′ S, 163°31′ E, 185 m, 4 lv (paratypes).

FIG. 20. — Distribution of *Dentalium deforgesi*.

DISTRIBUTION. — New Caledonia, alive in 185-575 m.

DESCRIPTION. — *Shell* to 42 mm long, solid, regularly curved, shiny, cream-white. Sculpture of 11-13 primary ribs, secondary ribs beginning at apex. Ribs decreasing in strength shortly below apex on ventral side, later on dorsal side. Shell smooth for first quarter of length except for growth lines, circular in section, aperture thin, straight. Apex truncate with terminal callus and a deep V-shaped notch on ventral side. Lumen protected by pseudo-pipe fissured on the ventral side; lumen oval, laterally compressed.

Measurements: holotype L 36.3, W 4, w 1.4, arc 2; paratypes L 41.5, W 3.8, w 2.1, arc 1.8; L 37.8, W 3.8, w 1, arc 2; L 35.7, W 2.7, w 1.4, arc 2.2; L 27.1, W 2.8, w 1, arc 1.6. W/w ratio 1.81-3.8.

REMARKS. — This species is similar to *D. obtusum* Qi & Ma, 1989, an intertidal species from China Seas, which differs in having 0-12 primary ribs, and lacking secondary ribs. In *D. deforgesi* the ribs encircle the oral aperture, thus producing an irregular outline.

ETYMOLOGY. — Named for Dr Bertrand RICHER DE FORGES (ORSTOM, Nouméa), organizer of many dredging expeditions in New Caledonia and collector of numerous novelties in every group of marine animals.

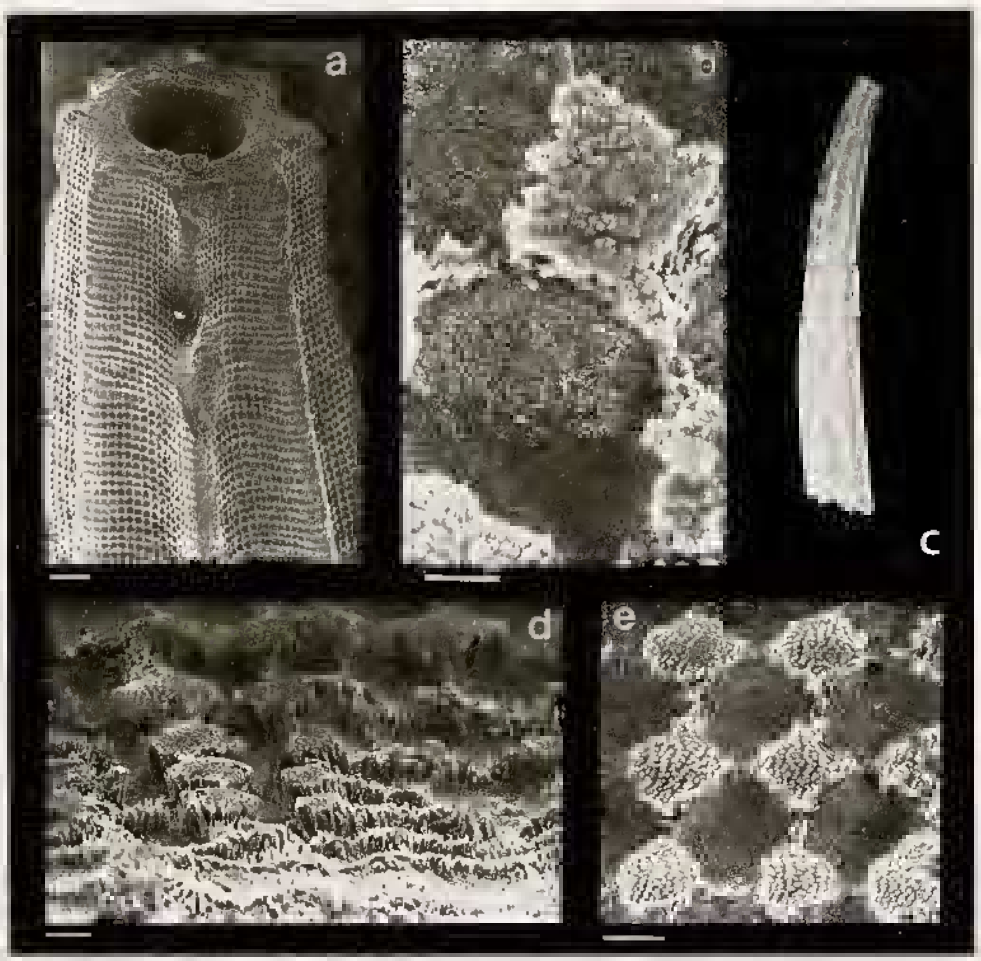


FIG. 21. — *Dentalium tessellatum* sp. nov., holotype. — **a**, apex area. — **c**, lateral view (9.6 mm). — **b**, **d-e**, details of the sculpture. Scale bars: 100 µm (a), 10 µm (b, d, e).

Dentalium tessellatum sp. nov.

Figs 21 a-e, 22

TYPE MATERIAL. — Holotype and 3 paratypes dd, MNHN.

TYPE LOCALITY. — Philippines. MUSORSTOM 3, stn DR 140, 11°43' N, 122°34' E, 93-99 m.

MATERIAL EXAMINED. — Only known from the type material.

FIG. 22. — Distribution of *Dentalium tessellatum*.

DISTRIBUTION. — The Philippines. Only known from the type locality, in 93-99 m, not recorded alive.

DESCRIPTION. — *Shell* to 16 mm long, solid, opaque, cream, slightly curved, with 8 high, rounded primary ribs, lacking secondary ribs. At SEM magnification the entire surface has a mosaic sculpture which appears finely reticulated under an optical microscope. Apex simple or with apical callus, lumen circular.

Measurements: holotype L 9.6, W 1.5, w 0.5, a 0.6; paratypes L 15.1, W 1.6, w 0.6, a 0.6; L 10.1, W 1.6, w 0.5, a 0.4. W/w ratio 2.67-3.2.

REMARKS. — The absence of secondary ribs and the fine sculpture characterize this new species.

ETYMOLOGY. — From the Latin *tessellatus* (mosaic).

Other Indo-Pacific species of *Dentalium* cited in the literature

Dentalium aciculum Gould, 1859: 165. Hong Kong. Holotype USNM 24149.

Dentalium adenense Ludbrook, 1954: 97, fig. 2. Gulf of Aden, *"John Murray"*, stn 28, 12°00′ N, 50°38′ E, 201 m. Holotype BMNH 1952.3.25.124.

Dentalium buccinulum Gould, 1859: 166. Kagoshima, Japan. Holotype USNM 24160.

Dentalium cancellatum Sowerby, 1860: 101, pl. 224 (*Dentalium* 2), fig. 36. China. Type material apparently missing.

Dentalium cheverti Pilsbry & Sharp, 1897: 9. Evans Bay, Cape York, N. Australia, 11 m. ANSP.

Dentalium cookei Pilsbry & Sharp, 1897: 29. Gulf of Suez. ANSP.

Dentalium decemcostatum Brazier, 1877: 55. Katow, New Guinea. 2 syntypes dd AMS A90.

Dentalium duodecemcostatum Brazier, 1877: 56. New Guinea. Holotype AMS A91.

Dentalium laseroni Colman, 1958: 143, fig. 7. Broken Bay, New South Wales. Holotype AMS C62221.

Dentalium lessoni Deshayes, 1825: 357, pl. 2, fig. 13. New Guinea. Lectotype (here designated) 20.3 mm MNHN.

Dentalium letsonae Pilsbry & Sharp, 1897: 4, pl. 1, fig. 13; pl. 5, figs 66-68. Island of Bohol, Philippines. ANSP.

Dentalium nannarense Winckworth, 1927: 167, fig. 4. Nannar Island, Sri Lanka, 6 m. 7 syntypes lv BMNH 1952.3.21.6-12, and NMW (*fide* OLIVER, 1984).

Dentalium obtusum Qi & Ma, 1989: 69. Zhejiang Province, China.
Dentalium regulare Smith, 1903: 393, pl. 15, fig. 2. Port Shepstone, South Africa. 6 syntypes dd BMNH 1903.9.9.24-24a and 1904.7.26.29-32.
Dentalium robustum Brazier, 1877: 56. Katow, New Guinea. Syntype, labelled "lectotype", but designation apparently never published, AMS A95.
Dentalium tignum Colman, 1958: 141, fig. 1. 35 miles East of Sydney, New South Wales, 1463 m. Holotype AMS C24485.
Dentalium townlini Melvill, 1918: 155, pl. 5, fig. 31. Karachi, Pakistan. 5 syntypes dd BMNH 1921.1.28.36-40.
Dentalium woolacottae Colman, 1958: 142, fig. 4. Middle Harbour, Sydney, New South Wales. Holotype AMS C21230.

Genus *PARADENTALIUM* Cotton & Godfrey, 1933

Type species (OD): *D. intercalatum* Gould, 1859.

DIAGNOSIS. — *Shell* medium to large, moderately curved, solid, shiny, polished; translucent, white or yellow. Longitudinally sculptured with 6 primary ribs, the most prominent dorsal, 1 ventral and 4 latero-ventral. Secondary ribs present, variable number. Ribs round, flat or angled in cross section, intercostal spaces generally smooth and straigth on dorsal side and convex on ventral side. Apex simple, truncate, lumen circular, frequently with short terminal pipe. Section hexagonal at apex, subcircular at mouth. Oral aperture generally thin and translucent in fresh specimens.
Radula similar to *Dentalium*.

DISTRIBUTION. — Recent, worldwide, temperate and tropical regions. Sublittoral to bathyal.

Paradentalium pseudosexagonum (Deshayes, 1825)

Figs 23, 28 f

Dentalium pseudosexagonum Deshayes, 1825: 358, pl. 2, figs 14-16.

Other references:

Dentalium pseudo-sexagonum – SOWERBY, 1860: 103, pl. 224 (*Dentalium* 2), fig. 34; 1873: pl. 4, fig. 23. — BRAZIER, 1877: 56. — PILSBRY & SHARP, 1897: 23, pl. 4, figs 47-48. — MELVILL & STANDEN, 1899: 181. — BOISSEVAIN, 1906: 14, pl. 1, fig. 10. — MELVILL, 1909: 120. — LUDBROOK, 1954: 97, fig. 3.
Dentalium (Paradentalium) pseudohexagonum (*sic*) – HABE & KOSUGE, 1964: 1.

TYPE MATERIAL. — 6 syntypes dd, MNHN.

TYPE LOCALITY. — "Unknown" (DESHAYES 1825).

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 210, 00°13′ S, 117°53′ E, 338 m, 1 dd.
"Snellius" II: stn 4.181, 06°21′ S, 120°26′ E, 34 m, 1 dd (RMNH).
Philippines. Philippines, Coll. JOUSSEAUME, 6 dd (MNHN).
China. Hong Kong, Coll. JOUSSEAUME, 1 dd (MNHN).

DISTRIBUTION. — China Sea, the Philippines to Indonesia, Northern Australia, Seychelles and the Gulf of Aden. Probably a shallow-water species, shells down to 499 m (LUDBROOK, 1954).

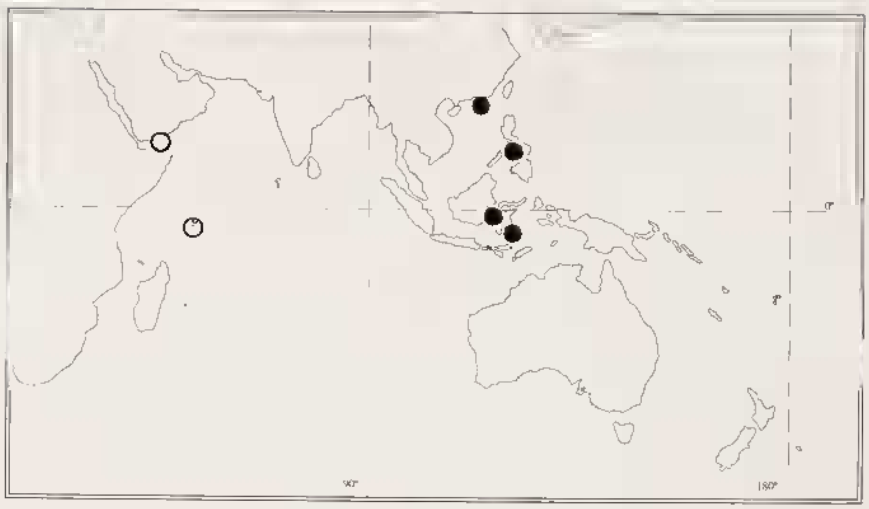


FIG. 23. — Distribution of *Paradentalium pseudosexagonum*.

Paradentalium intercalatum (Gould, 1859)

Figs 24, 28 g

Dentalium intercalatum Gould, 1859: 106.

Other references:

Dentalium intercalatum — SOWERBY, 1873: pl. 7, fig. 45. — BOISSEVAIN, 1906: 22, pl. 1, fig. 9. — PILSBRY & SHARP, 1897: 23, pl. 11, figs 88-89. — HABE, 1977: 330. — JOHNSON, 1964: 93.
Dentalium (Paradentalium) intercalatum — HABE & KOSUGE, 1964: 1.

TYPE MATERIAL. — Holotype USNM 24183.

TYPE LOCALITY. — China Seas.

MATERIAL EXAMINED. — The type material.

Philippines. MUSORSTOM 3: stn DR 137, 12°03′ N, 122°06′ E, 56 m, 1 dd.

DISTRIBUTION. — China Sea, now extended to the Philippines; no living records.

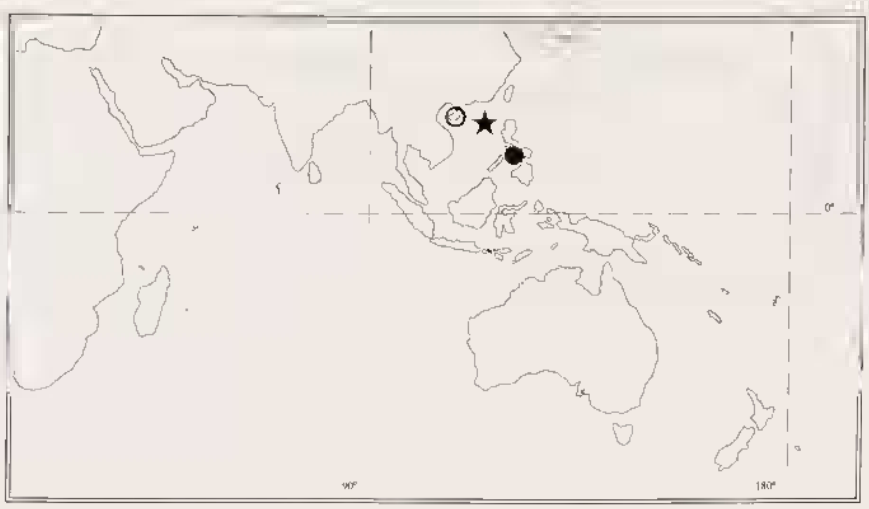


FIG. 24. — Distribution of *Paradentalium intercalatum*.

Paradentalium hexagonum (Gould, 1859)

Figs 25, 28 h

Dentalium hexagonum Gould, 1859: 166.

Synonyms:

Dentalium sexcostatum Sowerby, 1860: 103, pl. 223 (*Dentalium* 1), fig. 44.
Dentalium minus Boissevain, 1906: 14, pl. 6, fig. 3 (**Syn. nov.**).

Other references:

Dentalium hexagonum – Sowerby, 1860: 103, pl. 223 (*Dentalium* 1), fig. 10; 1873: pl. 2, fig. 6. — Clessin, 1896: 14, pl. 24, fig. 2. — Pilsbry & Sharp, 1897: 18, pl. 2, figs 20-21, 23-24. — Boissevain, 1906: 12, pl. 1, fig. 14, pl. 6, fig. 1. — Hirase, 1931: 133, pl. 3, fig. 2. — Johnson, 1964: 88, pl. 22, fig. 4.
Dentalium hexagonum var. *sexcostatum* – Pilsbry & Sharp, 1897: 19, pl. 2, figs 27-28. — Boissevain, 1906: 13, pl. 6, fig. 2.
Paradentalium hexagonum sexcostatum – Chistikov, 1979b: 109.
Dentalium (*Paradentalium*) *hexagonum* – Kira, 1955: 80, pl. 40, fig. 7.
Dentalium sexcostatum – Smith, 1875: 25.
Paradentalium minus – Habe & Kosuge, 1964: 2. – Chistikov, 1979b: 109.

Type material. — *D. hexagonum*: holotype USNM 2053. — *D. sexcostatum*: not located. — *D. minus*: lectotype (here designated) ZMA 3.06.008, paralectotypes ZMA 3.06.009.

Type locality. — *D. hexagonum*: Hong Kong, China. — *D. sexcostatum*: China. — *D. minus*: Indonesia, Java Sea, *"Siboga"*, stn 319, 06°17′ S, 114°37′ E, 82 m.

Material examined. — The type material of *D. hexagonum* and *D. minus*.
Indonesia. CORINDON: stn B 202, 01°10′ S, 117°06′ E, 21 m, 1 lv. — Stn CH 203, 01°09′ S, 117°08′ E, 25 m, 1 dd. — Stn CH 204, 01°09′ S, 117°19′ E, 49 m, 2 dd.

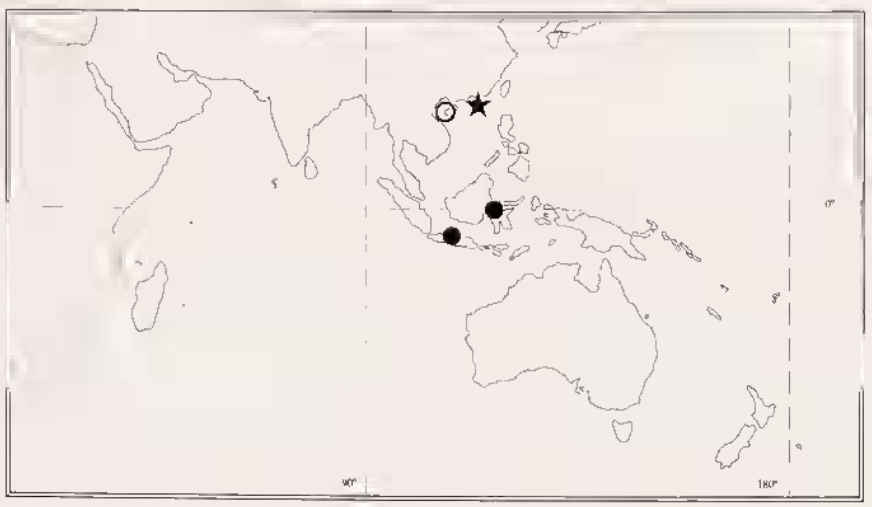


Fig. 25. — Distribution of *Paradentalium hexagonum*.

Distribution. — China Sea to Indonesia; alive in 15-29 m (Chistikov, 1979b and present paper).

Remarks. — Nomura (1938) synonymized *P. hexagonum* with *Dentalium octangulatum* based on rib count in 1500 specimens of *D. octangulatum*, of which 33 shells were found to have 6 ribs. The

material identifed by us as *P. hexagonum* presents 6 ribs, no secondary rib, and intercostal spaces are smooth or with traces of longitudinal threads. *D. octangulatum* has secondary ribs that, although they never reach the size of the primary ones, obscure the octangular section at the mouth. Variation in the number of ribs is observed in several species and I consider the presence of six ribs in occasional specimens of *D. octangulatum* insufficient to support the synonymy established by NOMURA. In specimens of *P. hexagonum* I have studied, characters were constant.

Paradentalium natalensis (Barnard, 1963)

Figs 26, 28 i

Dentalium natalensis Barnard, 1963b: 350, fig. 30 e; 1974: 742.

TYPE MATERIAL. — 49 syntypes (*fide* BARNARD) SAM A9364, 6 syntypes dd BMNH 1964.2.57.

TYPE LOCALITY. — South Africa, off Cape Natal, Durban, 85 fms [156 m].

MATERIAL EXAMINED. — The type material in BMNH.
West Indian Ocean. Madagascar, Nosy Bé Island, 50 m, Plante coll., 2 lv, 4 dd (BMNH).
South Africa. *"Meiring Naudé"*: stn SM 94, 28°16′ S, 32°29′ E, 670 m, 1 dd (SAM).

FIG. 26. — Distribution of *Paradentalium natalensis*.

DISTRIBUTION. — South Africa, from off East London to Madagascar. Alive in 50 m, shells from 70 to 670 m.

Paradentalium rudoi sp. nov.

Figs 27, 28 j, l

TYPE MATERIAL. — Holotype MNHN. Paratypes: 9 MNHN, 1 NMP.

TYPE LOCALITY. — Western Indian Ocean. NE Madagascar, 12°39′ S, 48°17′ E, 240 m.

MATERIAL EXAMINED. — **West Indian Ocean**. NW Madagascar, *"Vauban"*: 12°39′ S, 48°17′ E, 240 m, A. Crosnier coll. 1974, 13 dd (holotype and 6 paratypes MNHN, 1 paratype NMP). BENTHEDI: stn DS 72, 12°31′ S, 45°02′ E, 300-350 m, 2 lv, 1 dd (paratypes).

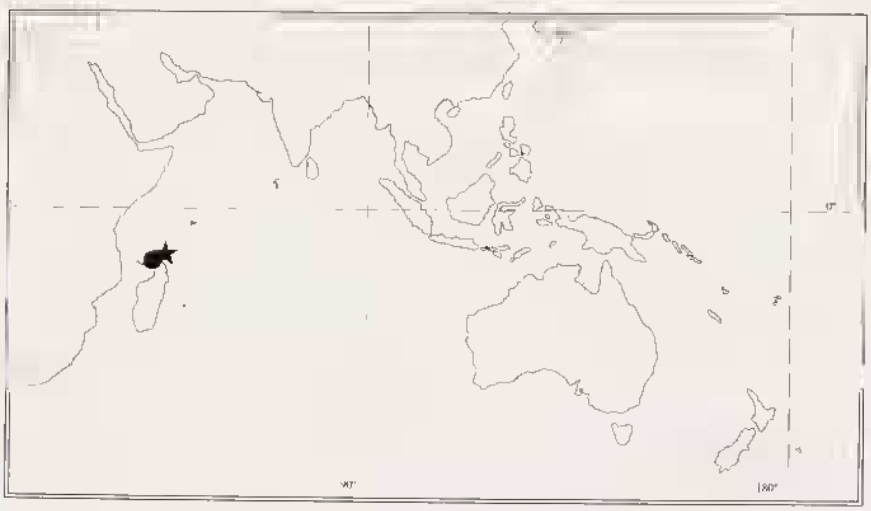


FIG. 27. — Distribution of *Paradentalium rudoi*.

DISTRIBUTION. — Off North Madagascar, alive in 300-350 m.

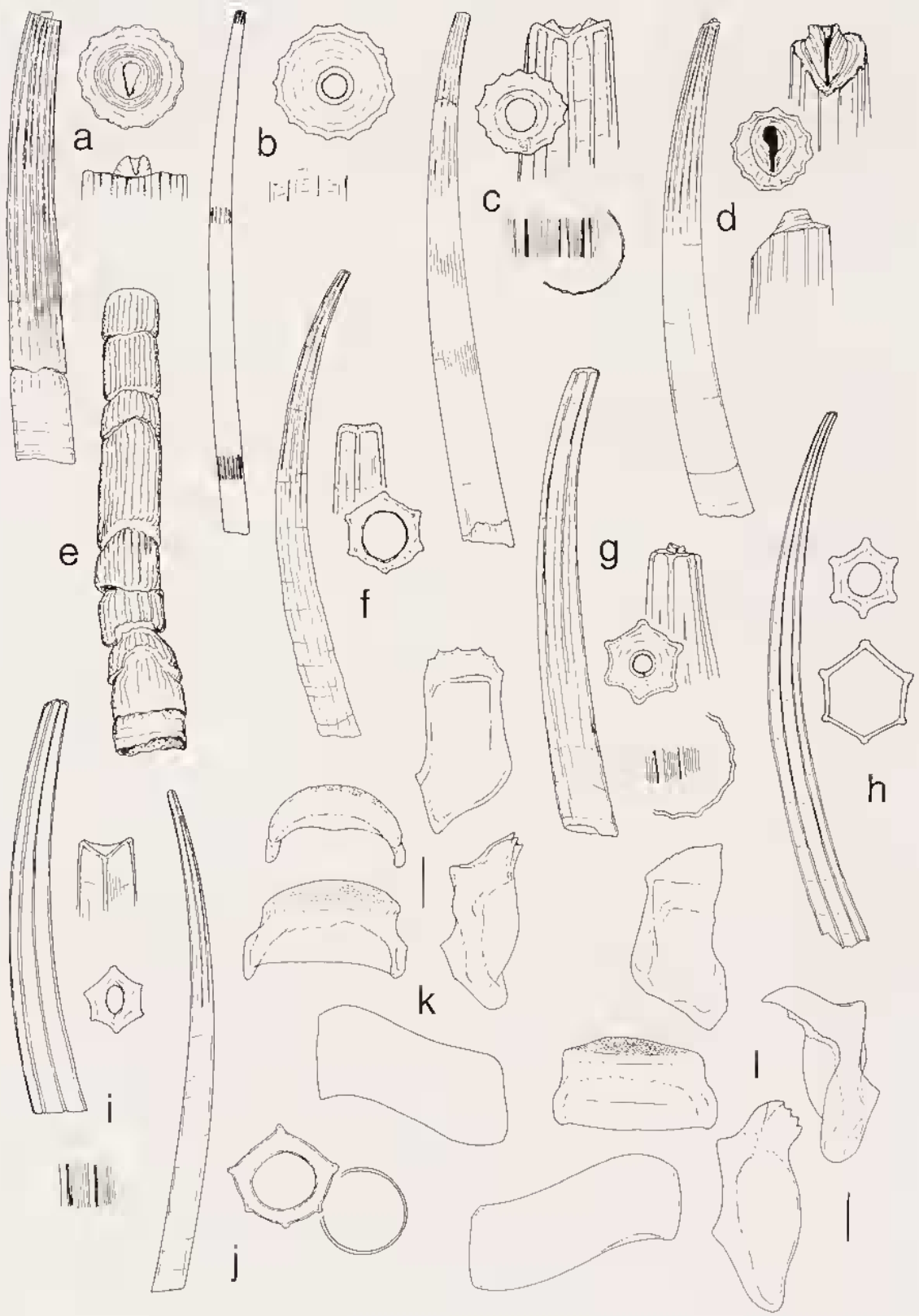
DESCRIPTION. — *Shell* to 60 mm long, solid, polished, yellow, regularly curved. Six primary angle-edged ribs distributed one on the dorsal side, one on each side and 3 on the ventral side. Secondary ribs appear at the posterior third of the shell, fading at the aperture. Intercostal spaces with fine longitudinal and transverse lines, which give the apical area a reticulate appearance. Apex simple, lumen slightly irregularly compressed dorsoventrally.

Measurements: holotype L 52.8, W 3.8, w 1.2, arc 2.8; paratypes L 60.2, W 3.9, w 1.5, arc 4.2; L 51, W 3.5, w 1, arc 3.5; L 47.5, W 3.4, w 1, arc 2.1; L 45.2, W 3, w 0.9, arc 2; L 50.9, W 3.5, w 1.1, arc 2.1. W/w ratio 2.6-3.5.

REMARKS. — *P. pseudosexagonum* is a related species from which *P. rudoi* differs in having sculptured intercostal spaces, a longer and more slender shell with differently placed ribs and different brightness and color.

ETYMOLOGY. — Named after Rudo VON COSEL, MNHN, who has contributed to our knowledge of the Madagascar fauna by collecting remarkable and spectacular mollusc species during a survey of shrimp resources conducted in 1989.

FIG. 28. — **a**, *Dentalium caledonicum* sp. nov., holotype, shell (26.4 mm), apex and apical section. — **b**, *Dentalium crosnieri* sp. nov., holotype, shell (30.7 mm), apical section and detail of the sculpture. — **c**, *Dentalium flavum* sp. nov., holotype, shell (36.4 mm), apex, apical and oral sections, detail of the sculpture. — **d**, *Dentalium defforgesi* sp. nov., holotype, shell (36.3 mm), apex and apical section. — **e**, *Dentalium flavum* sp. nov., extremely damaged and repaired shell (33 mm). — **f**, *Paradentalium pseudosexagonum*, shell (38 mm), apex and apical section, CORINDON: stn B 210. — **g**, *Paradentalium intercalatum*, shell (20 mm), apex, apical and oral sections, detail of the sculpture, MUSORSTOM 3: stn DR 137. — **h**, *Paradentalium hexagonum*, shell (35 mm), apical and oral sections, CORINDON: stn CH 203. — **i**, *Paradentalium natalensis*, shell (22 mm), apex and apical section, detail of the sculpture. — **j**. *Paradentalium rudoi* sp. nov., holotype, shell (52.8 mm), apical and oral sections. — **k**, *Dentalium* type radula (*D. pluricostatum*). — **l**, *Paradentalium* type radula (*P. rudoi* sp. nov.). Scale lines: 100 µm.



Other Indo-Pacific species of *Paradentalium* cited in the literature

Paradentalium angustistriatum Chistikov, 1979b: 110, fig. 2. Tonking Bay, Viet Nam, 47 m. ZIN.
Paradentalium gradile Chistikov, 1979b: 109, fig. 1. Tonking Bay, Viet Nam, 60 m. ZIN.
Paradentalium katowense (Brazier, 1877): 56. Katow, New Guinea, 15 m. Holotype AMS A92.
Paradentalium pistis (Winckworth, 1940b): 43, fig. 6. Madras, India. Holotype BMNH 1940.7.227.

Genus *Tesseracme* Pilsbry & Sharp, 1897

Type species (SD by WOODRING, 1925): *Dentalium quadrapicale* Sowerby, 1860.

DIAGNOSIS. — *Shell* medium to large, moderately curved, solid, generally polished; white, cream to orange-yellow at apical area. Longitudinally sculptured with 4 primary ribs, prominent at the apex, simple or bifurcated, one ventral, one dorsal and two lateral. Secondary ribs present, variable in number. Intercostal spaces straight or concave, smooth or with longitudinal striae. Apex simple, truncate, lumen circular; frequently with short terminal pipe. Transverse section quadrangular at apex, subquadrangular to subcircular at mouth; oral aperture generally thin and translucent in fresh specimens. *Radula* similar to *Dentalium*.

DISTRIBUTION. — Eocene-Recent. Pacific and Indian Oceans, absent in the Atlantic Ocean; sublittoral to shelf in temperate and warm waters.

Tesseracme quadrapicalis (Hanley, 1860)

Figs 29, 33 a

Dentalium quadrapicale Hanley *in* Sowerby, 1860: 103, pl. 225 (*Dentalium* 3), fig. 61.

Synonyms:

Dentalium conspicuum Melvill, 1897: 21, pl. 7, fig. 28 (**Syn. nov.**).
Dentalium dipsycha Pilsbry & Sharp, 1897: 33, pl. 4, figs 57-60 (**Syn. nov.**).

Other references:

Dentalium quadrapicale — SOWERBY, 1873: pl. 7, fig. 46. — SMITH, 1896: 371. — PILSBRY & SHARP, 1897: 34, pl. 4, fig. 50. BOISSEVAIN, 1906: 42, pl. 1, fig. 13. — WINCKWORTH, 1940b: 25. — AHMED, 1975: 29, fig. 33.
Tesseracme quadrapicale — HABE & KOSUGE, 1964: 5.
Dentalium (*Tesseracme*) *quadrapicale* — PLATE, 1908a: 350, pl. 30, fig. 53. — LUDBROOK, 1954: 102, fig. 5.
Dentalium quadripicale (*sic*) — CLESSIN, 1896: 13, pl. 3, fig. 6.
Dentalium conspicuum — PILSBRY & SHARP, 1898: 248, pl. 33, fig. 60. — BOISSEVAIN, 1906: 42, pl. 2, fig. 26. DINAMANI, 1964: 1.
Dentalium dipsycha — BOISSEVAIN, 1906: 42, pl. 2, figs 24-25.

TYPE MATERIAL. — *D. quadrapicale*: holotype BMNH 1907.10.28.147, paratypes BMNH 1907.10.28.148-149. — *D. conspicuum*: 2 syntypes dd BMHN 1897.30.80-81. — *D. dipsycha*: syntype ANSP.

TYPE LOCALITY. — *D. quadrapicale*: Cochin, Malabar, India. — *D. conspicuum*: Karachi. — *D. dipsycha*: unknown.

MATERIAL EXAMINED. — The type material.
West Indian Ocean. Malabar, 28 dd. — "Côtes de Malabar", 60 dd. — Karachi, Coll. JOUSSEAUME, 1 lv. — Karachi, Coll. DENIS, 2 dd (all MNHN).

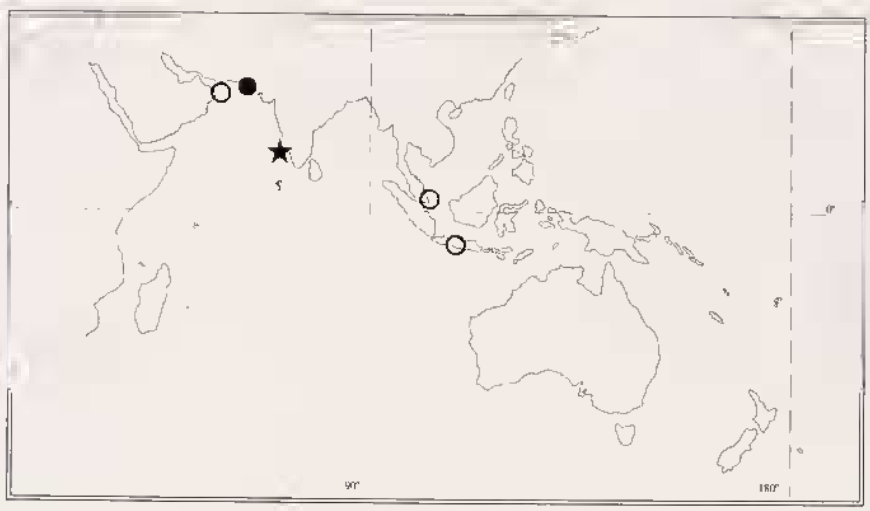


FIG. 29. — Distribution of *Tesseracme quadrapicalis*.

DISTRIBUTION. — Malaya (HABE & KOSUGE, 1964), Indonesia (BOISSEVAIN, 1906), S of India in 742 m (SMITH, 1896), Gulf of Oman (LUDBROOK, 1954). Living depth range unknown, apparently a shallow water species, shells cited from 9 m to 742 m .

REMARKS. — The syntypes of *Dentalium conspicuum* are gerontic specimens with the apex wide by reabsorption, 8-ribbed in section but the 4 primary ribs clearly noticed indicate its generic position. *Tesseracme* are variable in shell shape, curvature, width of the apex and starting point of the secondary ribs. I have observed this in specimens of *T. quadrapicalis* and specially in a large number of specimens of *T. tetrapleura*, and which allows me to ascertain the present synonymy.

Tesseracme dispar (Sowerby, 1860)

Figs 30, 33 b

Dentalium dispar Sowerby, 1860: 103, pl. 224 (*Dentalium* 2), fig. 37.

Other references:

Dentalium dispar — SOWERBY, 1873: pl. 4, fig. 25. — BRAZIER, 1877: 58. — CLESSIN:, 1896 11, pl. 2, fig. 4. — PILSBRY & SHARP, 1897: 32, pl. 4, figs 52-56. — BOISSEVAIN, 1906: 39, pl. 2, figs 22-23.
Tesseracme dispar — HABE & KOSUGE, 1964: 5.

TYPE MATERIAL. — Four specimens from the Island of Samar, 4 fms [7 m] in BMNH, could belong to the type series, but this is far from certain.

TYPE LOCALITY. — Singapore and Samar, the Philippines.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 253, 00°54′ S, 119°30′ E, 17 m, 2 dd. **China**. Hong Kong, Coll. JOUSSEAUME, 1 dd (MNHN).

DISTRIBUTION. — Philippines and China to Indonesia and North Australia, 0-54 m (HABE & KOSUGE, 1964).

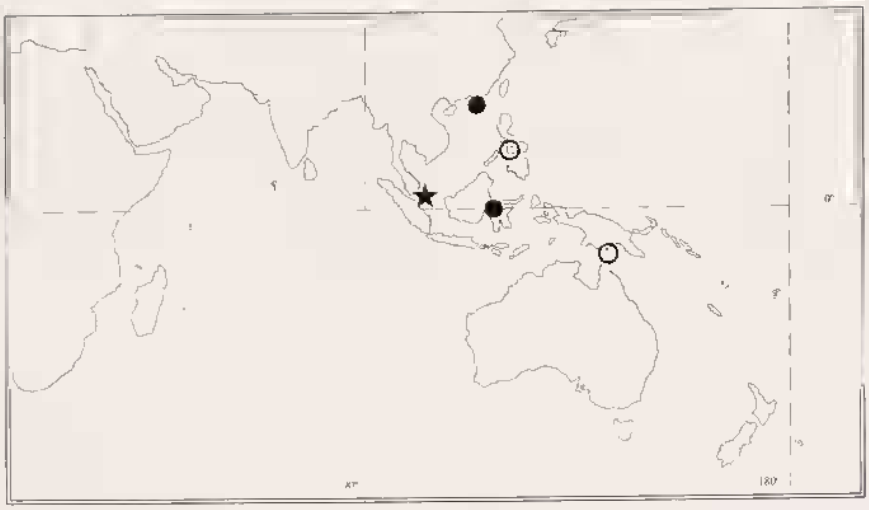


FIG. 30. — Distribution of *Tesseracme dispar*.

Tesseracme tetrapleura (Boissevain, 1906)

Figs 31, 33 c-d

Dentalium tetrapleurum Boissevain, 1906: 41, pl. 6, fig. 37.

Other reference:
Dentalium tetrapleurum — HABE & KOSUGE, 1964: 5 (as a synonym of *Tesseracme quadrapicale*).

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.49, paralectotype ZMA 3.06.50.

TYPE LOCALITY. — *"Siboga"*, stn 4, 07°42′ S, 114°13′ E, 9 m, anchorage off Djankar, Java.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 41, 22°19′ S, 166°16′ E, 28-46 m, 1 dd. — Stn 58, 22°09′ S, 166°13′ E, 22 m, 1 dd. — Stn 63, 22°26′ S, 166°26′ E, 20 m, 1 lv. — Stn 65, 22°29′ S, 166°26′ E, 24 m, 1 lv. — Stn 80, 22°31′ S, 166°28′ E, 33 m, 5 lv, 12 dd. — Stn 83, 22°32′ S, 166°30′ E, 22 m, 2 lv, 1 dd. — Stn 170, 22°09′ S, 166°07′ E, 22 m, 2 dd. — Stn 171, 22°11′ S, 166°06′ E, 32 m, 1 dd. — Stn 192, 22°01′ S, 166°00′ E, 18 m, 2 lv. — Stn 201, 22°00′ S, 165°59′ E, 17 m, 1 lv. — Stn 202, 21°59′ S, 165°57′ E, 13 m, 1 lv. — Stn 211, 21°55′ S, 165°52′ E, 12 m, 1 dd. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 1 lv, 1 dd. — Stn 216, 21°53′ S, 165°49′ E, 14 m, 1 dd. — Stn 226, 22°38′ S, 166°39′ E, 28 m, 1 lv, 1 dd. — Stn 239, 22°24′ S, 166°58′ E, 43 m, 2 dd. — Stn 244, 22°25′ S, 167°00′ E, 37 m, 1 lv, 1 dd. — Stn 290, 22°16′ S, 166°32′ E, 11 m, 1 dd. — Stn 311, 22°44′ S, 166°47′ E, 36 m, 2 lv, 2 dd. — Stn 348, 22°42′ S, 166°55′ E, 45 m, 1 dd. — Stn 353, 22°34′ S, 167°01′ E, 70 m, 1 dd. — Stn 360, 22°35′ S, 167°03′ E, 60 m, 1 lv, 1 dd. — Stn 470, 18°28′ S, 163°09′ E, 41 m, 1 dd. — Stn 473, 18°24′ S, 163°03′ E, 50 m, 2 dd. — Stn 517, 19°09′ S, 163°35′ E, 42 m, 2 dd. — Stn 541, 19°06′ S, 163°13′ E, 45 m, 2 lv, 3 dd. — Stn 601, 22°18′ S, 167°03′ E, 47-48 m, 1 lv, 2 dd. — Stn 602, 22°16′ S, 167°03′ E, 43-48 m, 4 dd. — Stn 607, 22°12′ S, 167°03′ E, 48-54 m, 2 lv. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 dd. — Stn 632, 21°57′ S, 166°50′ E, 44-45 m, 2 lv, 4 dd. — Stn 633, 21°56′ S, 166°48′ E, 50 m, 1 dd. — Stn 667, 21°42′ S, 166°28′ E, 33-37 m, 2 lv, 2 dd. — Stn 676, 21°35′ S, 166°23′ E, 41 m, 1 dd. — Stn 682, 21°34′ S, 166°19′ E, 36-37 m, 2 lv. — Stn 687, 21°33′ S, 166°17′ E, 37-40 m, 1 lv. — Stn 688, 21°31′ S, 166°15′ E, 36-40 m, 1 lv. — Stn 696, 21°29′ S, 166°12′ E, 41-57 m, 1 lv, 4 dd. — Stn 697, 21°28′ S, 166°10′ E, 35-36 m, 1 dd. — Stn 701, 21°28′ S, 166°07′ E, 36-39 m, 1 lv, 1 dd. — Stn 702, 21°27′ S, 166°08′ E, 37 m, 1 lv. — Stn 703, 21°25′ S, 166°07′ E, 38-40 m, 5 lv, 1 dd. — Stn 704, 21°27′ S, 166°06′ E, 46-58 m, 1 lv. — Stn 707, 21°25′ S, 166°04′ E, 24-38 m, 1 lv, 1 dd. —

Stn 716, 21°22′ S, 165°59′ E, 30 m, 1 lv. — Stn 726, 21°20′ S, 165°55′ E, 50-51 m, 1 dd. — Stn 729, 21°19′ S, 165°54′ E, 42-45 m, 4 lv, 4 dd. — Stn 730, 21°07′ S, 165°55′ E, 40-43 m, 1 lv, 3 dd. — Stn 747, 21°15′ S, 165°51′ E, 31-34 m, 1 lv. — Stn 749, 21°18′ S, 165°18′ E, 49 m, 1 dd. — Stn 754, 21°13′ S, 165°49′ E, 36 m, 1 lv, 1 dd. — Stn 762, 21°12′ S, 165°46′ E, 43 m, 1 dd. — Stn 772, 21°08′ S, 165°41′ E, 30 m, 1 dd. — Stn 781, 21°05′ S, 165°38′ E, 36 m, 3 dd. — Stn 787, 21°04′ S, 165°36′ E, 39 m, 1 lv. — Stn 801, 21°02′ S, 165°29′ E, 29 m, 2 lv, 1 dd. — Stn 822, 20°51′ S, 165°21′ E, 33 m, 1 dd. — Stn 856, 20°37′ S, 165°11′ E, 30 m, 2 lv. — Stn 865, 20°39′ S, 165°04′ E, 24 m, 1 lv. — Stn 866, 20°38′ S, 165°03′ E, 26 m, 1 dd. — Stn 867, 20°39′ S, 165°01′ E, 25 m, 1 dd. — Stn 898, 20°14′ S, 167°27′ E, 22 m, 5 dd. — Stn 913, 20°58′ S, 164°32′ E, 10-13 m, 1 dd. — Stn 916, 20°56′ S, 164°28′ E, 13 m, 1 lv, 2 dd. — Stn 931, 20°45′ S, 164°17′ E, 28-29 m, 1 lv, 1 dd. — Stn 932, 20°46′ S, 164°17′ E, 23 m, 3 lv, 1 dd. — Stn 972, 20°25′ S, 163°58′ E, 27 m, 1 dd. — Stn 995, 20°15′ S, 163°55′ E, 35-36 m, 1 lv, 2 dd. — Stn 1007, 20°12′ S, 163°52′ E, 23-24 m, 1 lv. — Stn 1015, 20°10′ S, 163°52′ E, 25 m, 1 lv. — Stn 1025, 20°07′ S, 163°49′ E, 25-28 m, 9 lv, 9 dd. — Stn 1063, 20°03′ S, 163°47′ E, 31 m, 1 dd. — Stn 1126, 19°33′ S, 163°46′ E, 41 m, 1 dd. — Stn 1168, 19°16′ S, 163°09′ E, 50 m, 2 dd. — Stn 1182, 19°27′ S, 163°16′ E, 48 m, 1 lv. — Stn 1205, 19°42′ S, 163°26′ E, 38 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 435, 20°21′ S, 166°08′ E, 32 m, 1 dd.

Indonesia. CORINDON: stn B 251, 00°54′ S, 119°30′ E, 95 m, 1 dd.

"Snellius" II: stn 4.025, 05°57′ S, 123°49′ E, 250-300 m, 2 dd (RMNH).

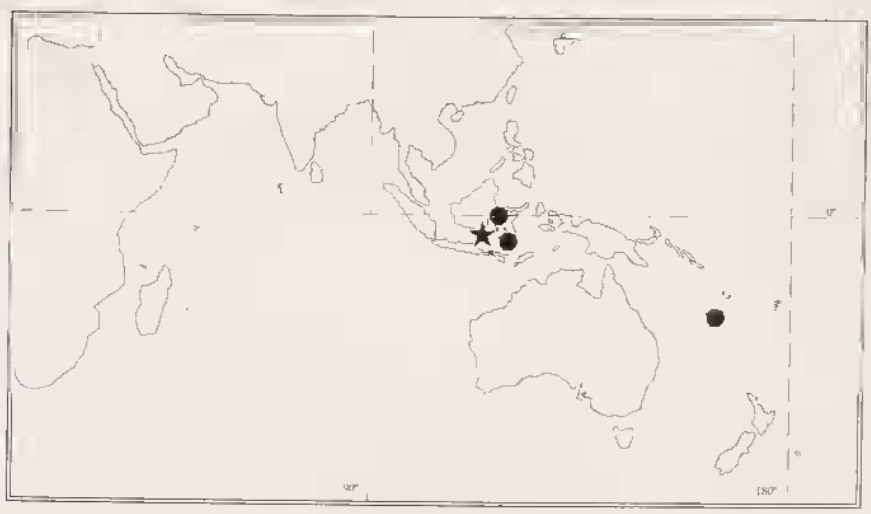


FIG. 31. — Distribution of *Tesseracme tetrapleura*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia. Alive in 10-70 m (present paper).

Genus *EUDENTALIUM* Cotton & Godfrey, 1933

Type species (OD): *Dentalium quadricostatum* Brazier, 1877.

DIAGNOSIS. — *Shell* small to medium with four ribs, intercostal spaces smooth and straight. Apical callus prominent, lumen circular, pipe present. Ribs simple, high, with rounded section, irregular due to growth lines.

Radula unknown, assumed to be similar to *Tesseracme*.

DISTRIBUTION. — Recent. Eastern Australian waters, New Guinea, sublittoral-shelf.

Eudentalium quadricostatum (Brazier, 1877)

Figs 32, 33 e

Dentalium quadricostatum Brazier, 1877: 58.

Other references:
Dentalium quadricostatum – Pilsbry & Sharp, 1897: 33. — Cotton & Godfrey, 1933: 140.

Type material. — 5 syntypes dd, ams A94.

Type locality. — Northeastern Australia, Princess Charlotte Bay, 13 fms [24 m].

Material examined. — The syntypes.
Northeastern Australia. Off Pioneer Bay, Orpheus Island, 26 m, Reid coll., 1 dd (bmnh).

Fig. 32. — Distribution of *Eudentalium quadricostatum.*

Distribution. — East Australia, Papua New Guinea (Brazier, 1877), shells in 15-24 m.

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

Type species (SD by Pilsbry & Sharp, 1897): *Dentalium entalis* Linné, 1758. Recent, Europe.

Diagnosis. — *Shell* medium to large, moderately to well curved; general aspect variable, solid to thin and fragile, generally polished; white, cream, and/or orange-yellow at the apex. Longitudinally sculptured, primary ribs variable in number, and strength; secondary ribs present, also variable in number and can equal primary ribs in size at the oral area. Ribs generally round in section, occasionally flat or angled; smooth or sculptured. Intercostal spaces concave or convex, smooth or sculptured by longitudinal or transverse striae. Apex simple, truncate, with a V-shaped notch or irregular slit on ventral side; lumen circular, commonly with short terminal pipe. Section "polygonal" at apex, circular, subcircular dorsoventrally compressed, or subpolygonal at mouth; generally thin and translucent in fresh specimens.

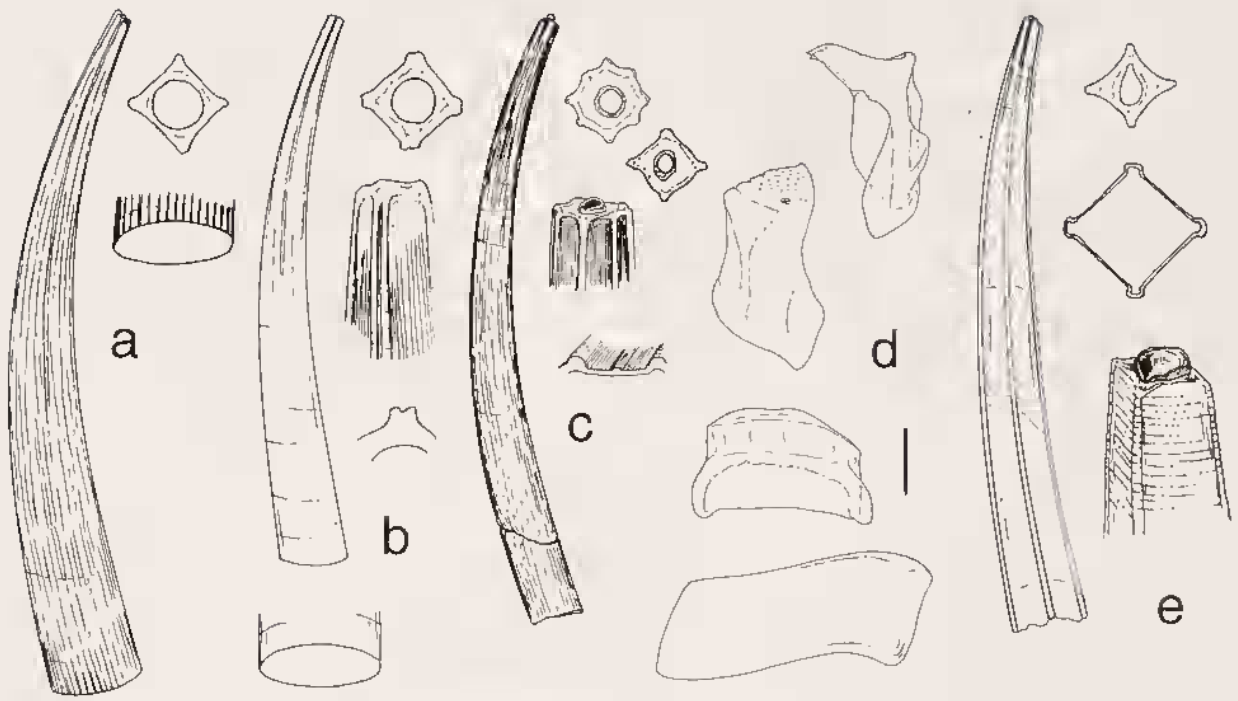


FIG. 33. — **a**, *Tesseracme quadrapicalis*, shell (42 mm), apical section, detail of the sculpture at the mouth, Karachi, MNHN. — **b**, *Tesseracme dispar*, shell (30 mm), apex, apical section, section of a rib, sculpture at the mouth, CORINDON; stn B 253. — **c**, *Tesseracme tetrapleura*, shell (35 mm), apical sections, apex, detail of the sculpture, New Caledonia LAGON: stn 83. — **d**, *Tesseracme* type radula (*T. tetrapleura*). Scale line: 100 µm. — **e**, *Eudentalium quadricostatum*, shell (22 mm), apex, apical and oral sections, Orpheus Isl. (BMNH).

Radula rachidian similar to *Dentalium*, anterior margin with granulae; laterals well armed, head area granulose.

DISTRIBUTION. — Triassic-Recent, worldwide. Sublittoral to abyssal.

Antalis longitrorsum (Reeve, 1842)

Figs 34, 45 a

Dentalium longitrorsum Reeve, 1842a: 197; 1842b: 6, pl. 130, fig. 6.

Synonym:

Dentalium lamarcki Chenu, 1843: 2, pl. 6, figs 15-15a.

Other references:

Dentalium longitrorsum – REEVE, 1842b: 6, pl. 130, fig. 6. — SOWERBY, 1860: 98, pl. 225 (*Dentalium* 3), figs 59-60; 1873: pl. 2, figs 9a-b. — BRAZIER, 1877: 59. — WATSON, 1879: 515; 1886: 9. — COOKE, 1885: 273. — MELVILLE & ABERCROMBIE, 1893: 41. — CLESSIN, 1896: 23, pl. 1, fig. 2. — PILSBRY & SHARP, 1897: 111, pl. 20, figs 35-36. — SMITH, 1903: 393; 1906b: 58. — BOISSEVAIN, 1906: 52, pl. 2, figs 33-33a. — LAMY, 1938: 88. — MOAZZO, 1939: 222. — DAWIDOFF, 1952: 114. — KURODA & HABE, 1952: 36. — DHARMA, 1992: 78, fig. 14.
Dentalium (Laevidentalium) longitrorsum – LUDBROOK, 1954: 104.
Laevidentalium longitrorsum – MATSUKUMA et al., 1991: 183. — HABE & KOSUGE, 1964: 7.
Dentalium longirostrum – PAETEL, 1873: 79. — MASTALLER, 1978: 136.
Antalis longitrorsum – KILBURN & RIPPEY, 1982: 148, pl. 34, fig. 5.
Laevidentalium longitorsum (*sic*) – HIGO & GOTO, 1993: 687.

TYPE MATERIAL. — *D. longitrorsum*: holotype BMNH 1887.3.4.21. — *D. lamarcki*: probably in MHNG.

TYPE LOCALITY. — *D. longitrorsum*: Zanzibar. — *D. lamarcki*: China Seas.

MATERIAL EXAMINED. — The holotype of *D. longitrorsum*.
West Indian Ocean. Madagascar, Tuléar. Harbour, 0-3 m, 1 lv, 86 dd. — N harbour, 2-4 m, 5 dd. — Pointe Anosy, 0.5-2 m, 1 dd. — N of jetty, tidal flat, fine sand at low tide, 28 dd. — NW of jetty, tidal flat, fine sand at low tide, 33 dd. — S of jetty, low tide, 16 dd (all R. von Cosel coll., MNHN). — Lagoon, 0-13 m, 6 dd. — Grand Récif, shore, 15 dd. — Foly, 7 m, 1 lv, 2 dd. — Nosy Bé Island, NW Madagascar, coll. Plante, 5 dd (all BMNH).
"*Meiring Naudé*": stn SM 114, 29°11′ S, 31°43′ E, 40 m, 1 dd (SAM).

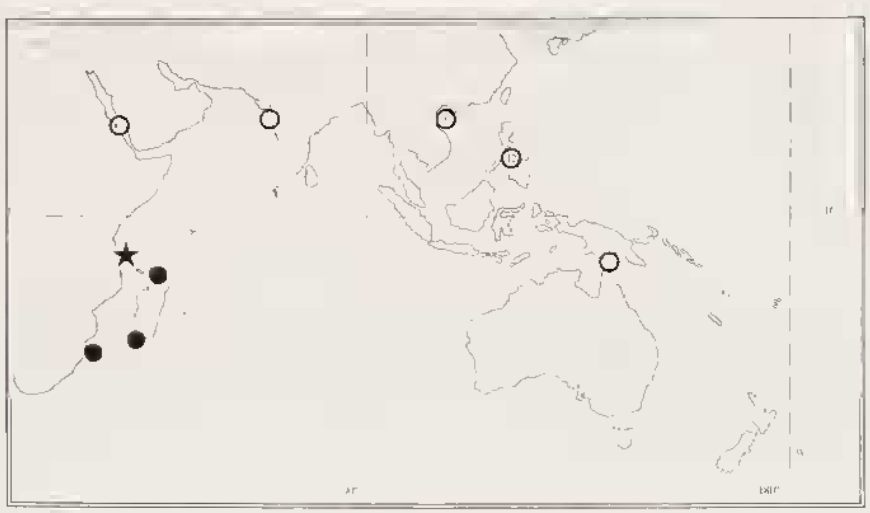


FIG. 34. — Distribution of *Antalis longitrorsum*.

DISTRIBUTION. — China, the Philippines, New Guinea, Northern Australia, India, Red Sea, Zanzibar and Natal, 65-68 m (LUDBROOK, 1954); Madagascar, alive in 0-3 m (present paper).

Antalis porcatum (Gould, 1859)

Figs 35, 45 b

Dentalium porcatum Gould, 1859: 166.

Other references:

Dentalium porcatum — SOWERBY, 1873: pl. 7, fig. 47. — CLESSIN, 1896: 20, pl. 6, fig. 3. — PILSBRY & SHARP, 1897: 15, pl. 6, fig. 80. — BOISSEVAIN, 1906: 15, pl. 1, fig. 15. — HABE & KOSUGE, 1964: 2. — JOHNSON, 1964: 130, pl. 18, fig. 5.

TYPE MATERIAL. — Holotype MCZ 169304 (*fide* JOHNSON, 1964), paratype USNM 24142.

TYPE LOCALITY. — Hong Kong Harbour, China.

MATERIAL EXAMINED. — The paratype.
West Indian Ocean. MD 32 Réunion: stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 2 lv, 8 dd.

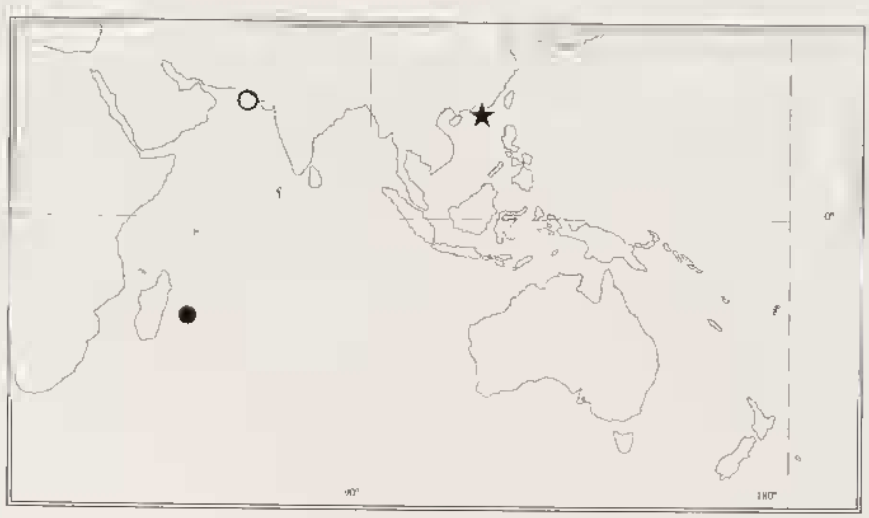


FIG. 35. — Distribution of *Antalis porcatum*.

DISTRIBUTION. — China, Karachi (BOISSEVAIN, 1906). Now extended to Réunion Island, alive in 75-90 m.

Antalis weinkauffi (Dunker, 1877)

Figs 36, 45 c

Dentalium weinkauffi Dunker, 1877: 68; 1882: 153, pl. 5, fig. 1.

Synonym:

Antalis septentrionalis Kuroda & Habe *in* Habe, 1963: 262, pl. 38, fig. 34, textfigs 15-17 (**Syn. nov.**).

Other references:

Dentalium weinkauffi – PILSBRY, 1895: 116. — PILSBRY & SHARP, 1897: 40, pl. 2, fig. 26. — HIRASE, 1931: 135, pl. 3, fig. 4. — HABE, 1957: 128, fig. 7. — HABE *et al.*, 1986: 24.
Dentalium (Dentale) weinkauffi – KIRA, 1955: 80, pl. 40, fig. 6.
Antalis weinkauffi – HABE, 1963: 261, pl. 38, fig. 30. textfig. 27; 1971: 488 (Japanese text): 307, (English). pl. 65, figs 12-13; 1977: 333, pl. 70, figs 1-4. — HABE & KOSUGE, 1964: 5. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 7. — QI & MA, 1989: 118. — HIGO & GOTO, 1993: 686.
Antalis weinkauffi weinkauffi – HABE & KOSUGE, 1964: 5.

TYPE MATERIAL. — *D. weinkauffi*: holotype ZMB 101996 (*fide* KILIAS, 1995). — *A. septentrionalis*: NSMT (*fide* HABE, 1963).

TYPE LOCALITY. — *D. weinkauffi*: Japan. — *A. septentrionalis*: Japan, off Hachinoe, Honshu, 30 m.

MATERIAL EXAMINED. — **Japan**. Coll. JOUSSEAUME, 2 dd. — Kadena, Okinawa, Coll. STAADT, 1 dd. — Kii, Japan, Coll. STAADT, 1 dd (all MNHN).
New Caledonia. MUSORSTOM 4: stn CP 189, 19°07′ S, 163°29′ E, 210 m, 1 dd.
LAGON: stn 267, 22°16′ S, 166°17′ E, 26 m, 1 dd.
West Indian Ocean. MD 32 Réunion: stn CP 41, 21°21′ S, 55°27′ E, 75 m, 4 dd. — Stn DC 43, 21°21′ S, 55°27′ E, 73-77 m, 5 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 2 lv, 3 dd. — Stn DC 126, 20°52′ S, 55°38′ E, 110 m, 1 dd.

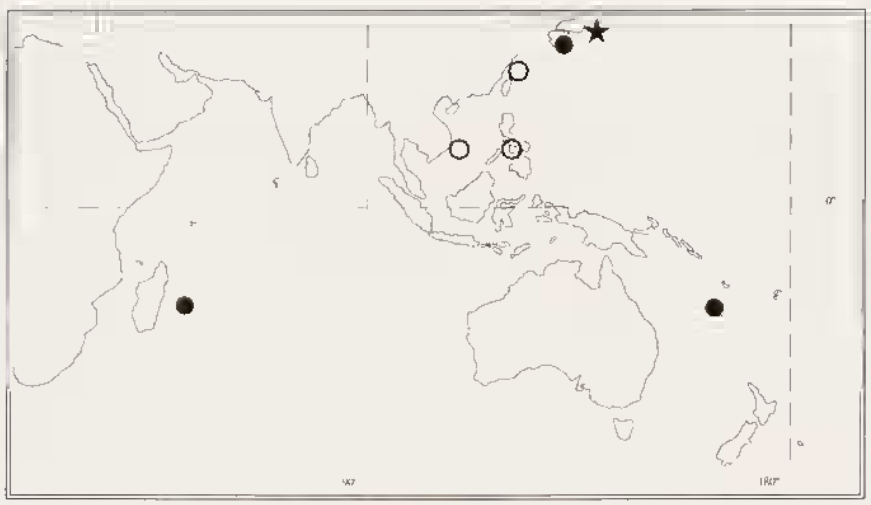


FIG. 36. — Distribution of *Antalis weinkauffi*.

DISTRIBUTION. — Japan, 30-500 m (HABE & KOSUGE, 1964); East and South China Seas, 67-195 m (QI & MA, 1989); the Philippines (SPRINGSTEEN & LEOBRERA, 1985). Now extended to New Caledonia and Réunion Island, alive in 75-90 m.

Antalis usitatum (Smith, 1894)

Figs 37, 45 d

Dentalium usitatum Smith, 1894: 168, pl. 4, fig. 16.

Other references:

Dentalium usitatum – SMITH, 1906a: 250. — PILSBRY & SHARP, 1897: 29, pl. 10, figs 68-69. — WINCKWORTH, 1940a: 25.
Graptacme usitatum – HABE & KOSUGE, 1964: 5.
Dentalium (Antalis) usitatum – LUDBROOK, 1954: 99, fig. 4.

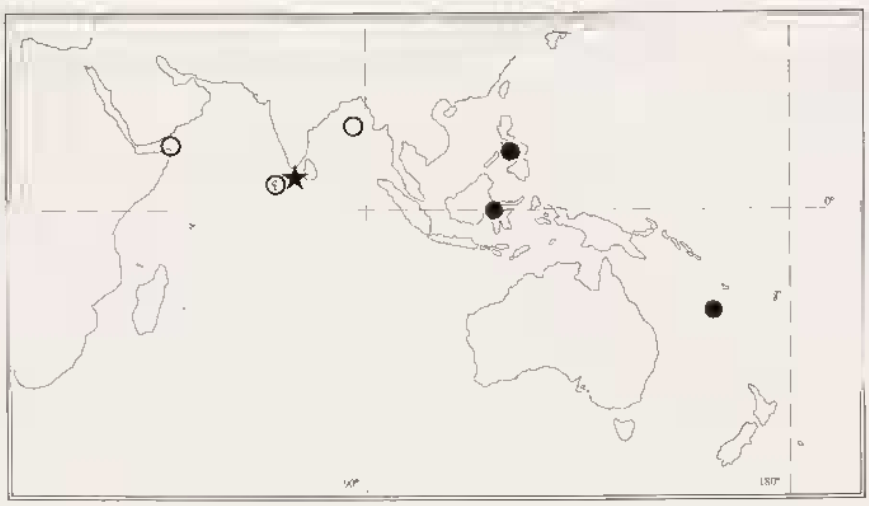


FIG. 37. — Distribution of *Antalis usitatum*.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India (not seen); paratype BMNH 1894.9.11.8, Gulf of Bengal, 1094 m.

TYPE LOCALITY. — Off Colombo, *"Investigator"*, 06°32′ N, 79°37′ E, 675 fms [1542 m].

MATERIAL EXAMINED. — Paratype in BMNH.
New Caledonia. BIOCAL: stn CP 57, 23°44′ S, 166°58′ E, 1490-1620 m, 1 dd.
Indonesia. CORINDON: stn B 244, 00°57′ S, 119°22′ E, 970 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 lv.

DISTRIBUTION. — Indonesia to the Bay of Bengal, the Maldives and the Gulf of Aden, in 183-1542 m (LUDBROOK, 1954), now extended to the Philippines and New Caledonia; living in 865 m (present paper).

Antalis tibanum (Nomura, 1940)

Figs 38, 45 e

Dentalium (Antalis) tibanum Nomura, 1940: 101, pl. 1, figs 11-11a.

Synonyms:

Dentalium entalis var. *indicum* Boissevain, 1906: 44, pl. 6, fig. 15 (*non Dentalium indicum* Chenu, 1843).
Antalis boissevainae Palmer, 1974b: 124. *Nom. nov. pro Dentalium entalis* var. *indicum* Boissevain, 1906 *non* Chenu, 1843 (**Syn. nov.**).

Other references:

Dentalium pretiosum — HIRASE, 1931: 136, pl. 3, fig. 6.
Dentalium lubricatum — HIRASE, 1931: 138, pl. 3, fig. 9.
Antalis tibanum — HABE, 1963: 262, pl. 38, fig. 14; 1971: 488 (Japanese text), 307 (English text), pl. 65, figs 6-7.
Antalis indicum — HABE & KOSUGE, 1964: 4.
Antalis indicum tibanum — HABE & KOSUGE, 1964: 4.
Antalis tibana — HABE 1977: 333. — SPRINGSTEEN & LEOBRERA:, 1985: 287, pl. 82, fig. 10. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 686.

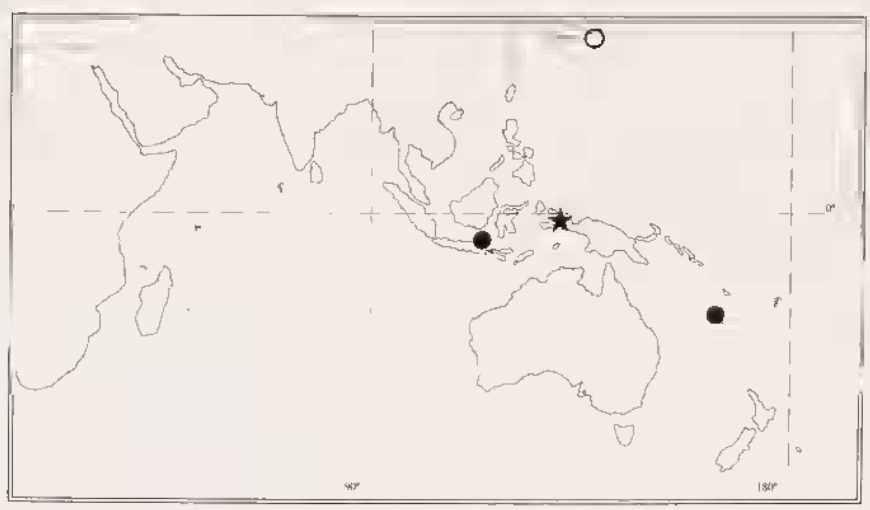


FIG. 38. — Distribution of *Antalis tibanum*.

TYPE MATERIAL. — *D. entalis* var. *indicum*: lectotype (here designated) ZMA.

TYPE LOCALITY. — *D. entalis* var. *indicum*: Indonesia, *"Siboga"*, stn 159, 00°59'1 S, 129°48.8' E, 411 m. — *D. tibanum*: Japan, off Boso Peninsula.

MATERIAL EXAMINED. — The type material of *D. entalis* var. *indicum*.
New Hebrides Arc. VOLSMAR: stn DW30, 22°17′ S, 171°18′ E, 450-550 m, 8 dd.
Indonesia. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 lv, 2 dd (RMNH).

DISTRIBUTION. — From Japan, 0-200 m (HABE & KOSUGE, 1964) to Indonesia. Now extended to New Hebrides Arc, alive in 700-835 m (present paper).

Antalis gardineri (Melvill, 1909)

Figs 39, 45 f

Dentalium gardineri Melvill, 1909: 120, pl. 5, fig. 9.

Other reference:
Dentalium (Antalis) gardineri – LUDBROOK, 1954: 93.

TYPE MATERIAL. — Holotype BMNH 1910.3.17.12.

TYPE LOCALITY. — Indian Ocean, Amirantes Is., 293-383 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. *"Vauban"* 1978-79: stn 22, 22°59′ S, 167°17′ E, 540-545 m, 1 dd. — Stn 33, 22°33′ S, 166°25′ E, 290-350 m, 4 dd.
SMIB 2: stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 1 dd. — Stn DW 23, 22°31′ S, 167°37′ E, 410-420 m, 1 dd.
CHALCAL 2: stn DW 73, 24°40′ S, 168°38′ E, 573 m, 1 dd. — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 2 dd. — Stn DW 75, 24°39′ S, 168°40′ E, 600 m, 1 dd.
BIOGEOCAL: stn DW 308, 20°40′ S, 166°58′ E, 510-590 m, 1 lv, 3 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 410, 20°38′ S, 167°07′ E, 490 m, 1 lv, 2 dd.
New Hebrides Arc. GEMINI: stn DW 51, 20°59′ S, 170°03′ E, 450 m, 4 lv, 14 dd.
West Indian Ocean. BENTHEDI: stn DR 28, 12°42′ S, 45°20′ E, 705 m, 1 dd.

FIG. 39. — Distribution of *Antalis gardineri*.

DISTRIBUTION. — Seychelles. Now extended to NW Madagascar and New Caledonia, live records in 450-590 m.

Antalis perinvolutum (Ludbrook, 1954)

Figs 40, 45 g

Dentalium (Fissidentalium) perinvolutum Ludbrook, 1954: 101, fig. 7.

Other references:
Dentalium (Graptacme) usitatum – Boissevain, 1906: 44, pl. 4, figs 6-8.

Type material. — Holotype BMNH 1952.3.25.65.

Type locality. — *"John Murray"*, stn 185, 13°48′ N, 49°16′ E, 2000 m, Gulf of Aden.

Material examined. — The type material. Specimens identified by Boissevain (1906) as *D. usitatum* in ZMA.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 1080 m, 1 lv, 1 dd.

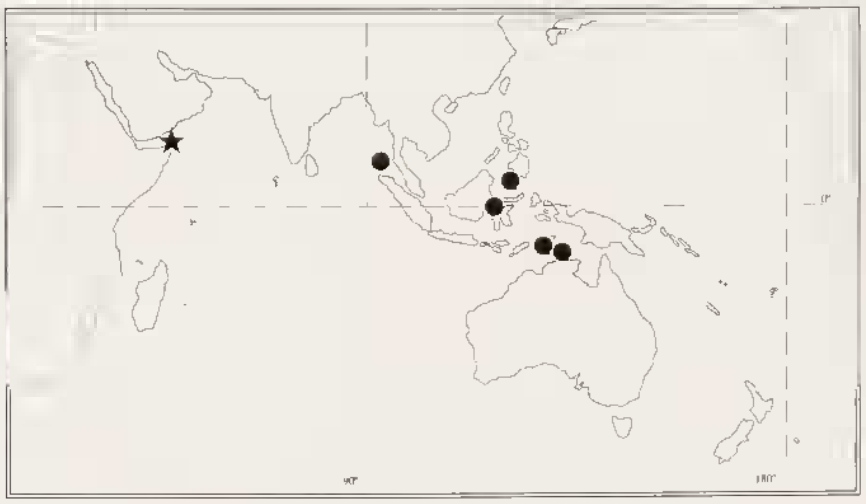


Fig. 40. — Distribution of *Antalis perinvolutum*.

Distribution. — Indonesia, Andaman Sea and Gulf of Aden, 918-2000 m. Alive in 918-1080 m.

Antalis phaneum (Dall, 1895)

Figs 41, 45 i

Dentalium phaneum Dall, 1895: 686, pl. 26, fig. 1.

Other references:
Dentalium phaneum – Boss *et al.*, 1968: 253. — Kay, 1979: 586, fig. 193F.

Type material. — Holotype USNM 107025, paratypes USNM 107026.

Type locality. — *"Albatross"*, stn 3476, near Sandwich [Hawaii] Is., 298 fms [545 m].

Material examined. — The type material.

New Caledonia. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 23 lv.
BIOCAL: stn DW 56, 23°35′ S, 167°12′ E, 695-705 m, 1 lv. — Stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 8 lv. — Stn DW 106, 21°36′ S, 166°29′ E, 625-650 m, 1 dd.
SMIB 2: stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 7 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 488, 20°49′ S, 167°06′ E, 800 m, 1 dd.
French Polynesia. 11°22′ S, 139°43′ W, 614 m, J. Poupin-SMCB coll., 3 lv (MNHN).

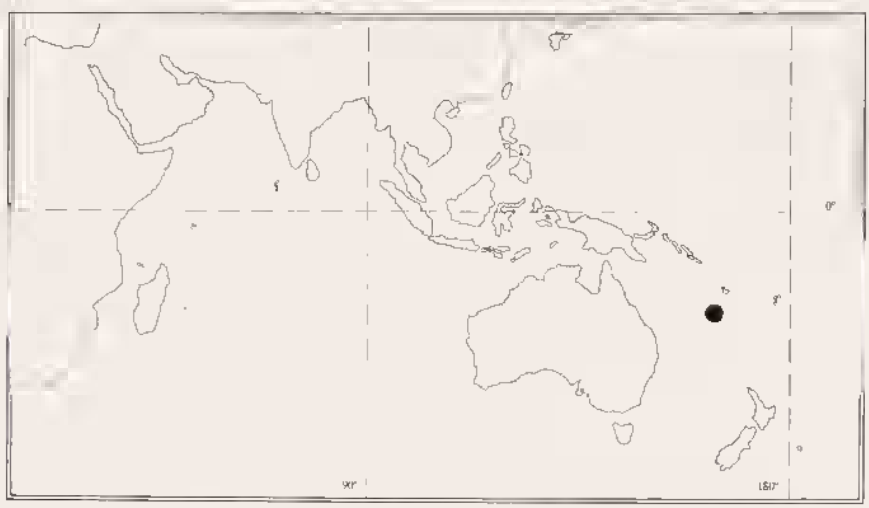


FIG. 41. — Distribution of *Antalis phaneum*.

DISTRIBUTION. — Central and South Western Pacific from Hawaii to French Polynesia and New Caledonia, live records in 614-860 m.

Antalis boucheti sp. nov.

Figs 42, 45 h, j, 73 g

TYPE MATERIAL. — Holotype MNHN. Paratypes: 12 MNHN, 1 AMS C201723, 1 NMNZ M268959, 1 USNM.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn 428, 20°24′ S, 166°13′ E, 420 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn CC 175, 18°59′ S, 163°17′ E, 355 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 397, 20°47′ S, 167°05′ E, 380 m, 4 dd (2 paratypes: 1 MNHN, 1 USNM). — Stn DW 398, 20°47′ S, 167°06′ E, 370 m, 1 dd. — Stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 dd (paratype). — Stn DW 411, 20°40′ S, 167°03′ E, 424 m, 1 lv, 1 dd (paratypes). — Stn DW 413, 20°40′ S, 167°03′ E, 463 m, 1 dd. — Stn DW 428, 20°24′ S, 166°13′ E, 420 m, 3 lv (holotype and paratypes), 3 dd (paratypes: 1 MNHN, 1 AMS, 1 NMNZ). — Stn DW 444, 20°54′ S, 167°18′ E, 300 m, 2 dd. — Stn DW 446, 20°54′ S, 167°19′ E, 360 m, 1 lv, 2 dd (1 paratype lv, 1 paratype dd). — Stn DW 451, 20°59′ S, 167°25′ E, 330 m, 5 dd (1 paratype). — Stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 lv (paratype), 4 dd.
Philippines. MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd.

DISTRIBUTION. — New Caledonia and the Philippines. Alive from 360 to 424 m, shells down to 842 m.

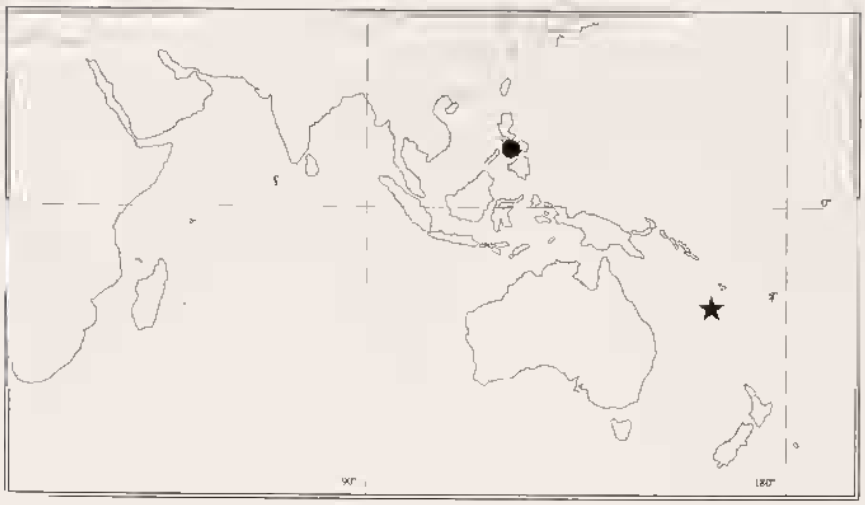


FIG. 42. — Distribution of *Antalis boucheti*.

DESCRIPTION. — *Shell* to 50 mm long, white to yellow, solid, polished, very slightly curved, rapidly tapering to apex, 16 to 18 rounded primary angled ribs. Secondary ribs begin near the apex, 58 in number at mouth. Transversal sculpture of fine and dense subequal striae, round in section. Under magnification, the longitudinal and transverse sculpture give this species a reticulate appearance. Apex fine with a deep fissure in fresh specimens, but this is usually missing due to breakage or wear.

Measurements: holotype L 42, W 4.4, w 0.7, a 1; mean of 8 paratypes L 32.2, W 3.71, w 0.67, arc 0.66. W/w ratio 3.9-6.3.

ETYMOLOGY. — Named after Dr Philippe BOUCHET, who contributed to this monograph all the way from collecting the material in the field to reviewing and editing my manuscript.

Antalis guillei sp. nov.

Figs 43, 45 k

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DC 136, 20°46′ S, 55°36′ E, 915-922 m.

MATERIAL EXAMINED. — **West Indian Ocean.** MD 32 Réunion: stn FA 40, 21°21′ S, 55°27′ E, 150 m, 4 dd. — Stn DR 47, 21°23′ S, 55°37′ E, 205-215 m, 7 dd. — Stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 8 dd (7 paratypes MNHN, 1 paratype NMP). — Stn DC 136, 20°46′ S, 55°36′ E, 915-922 m, 5 dd (holotype and 4 paratypes).

DISTRIBUTION. — Réunion Island. Shells only in 150-915 m.

DESCRIPTION. — *Shell* to 9 mm long, well arched, translucent. Sculpture of 10 primary ribs. Secondary ones begin equal in strength to, but less prominent than the primary ribs near the anterior aperture where both are present. Conspicuous growth lines also present. Apex simple, straight, lacking callus. Mouth thin, slightly depressed ventrally.

Measurements: holotype L 8.7, W 0.9, w 0.3, arc 0.8; paratypes L 7.5, W 0.7, w 0.3, arc 0.7; L 8.6, W 0.9, w 0.4, arc 0.8; L 9, W 0.9, w 0.4, arc 0.9; L 8.7, W 0.8, w 0.3, arc 0.6; L 8.5, W 0.8, w 0.3, arc 0.8. W/w ratio 2.3-3.

REMARKS. — Despite the small size, specimens appear to be mature.

ETYMOLOGY. — Named for Dr Alain GUILLE, now at Laboratoire Arago, Banyuls, formerly curator of Echinoderms at MNHN and senior scientist of Marion-Dufresne cruise MD 32.

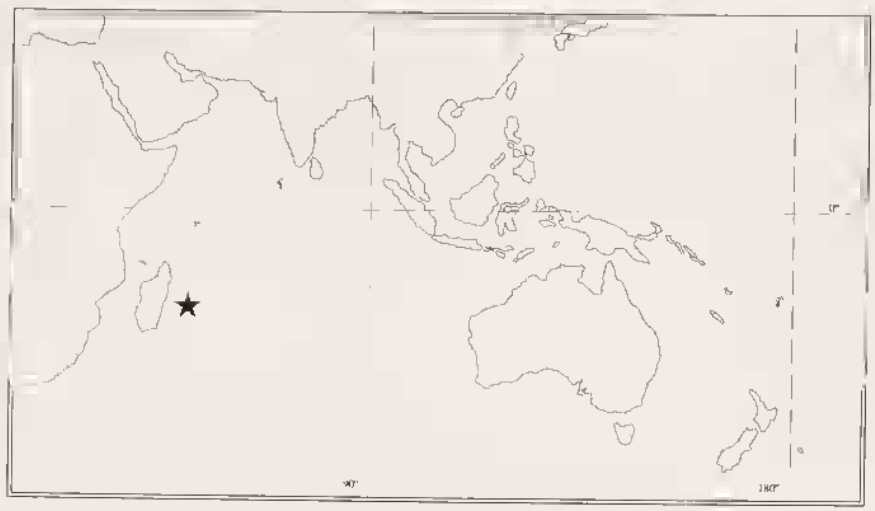


FIG. 43. — Distribution of *Antalis guillei*.

Other Indo-Pacific species of *Antalis* cited in the literature

Antalis diarrhox (Watson, 1879): 511. *"Challenger"*, stn 169, 37°34′ S, 178°22′ E, 700 fms [1280 m], New Zealand. Holotype BMNH 1887.2.9.65.

Antalis glaucarena (Dell, 1953): 48. Chatham Rise, New Zealand, 200-300 fms [366-548 m]. NMNZ.

Antalis inflexum (Sowerby, 1903): 224, pl. 5, fig. 11. South Africa, Natal, Tugela River mouth, 14 fms [26 m]. Paratype SAM A9364.

Antalis marukawai (Otuka, 1933): 159, textfig. 1a-f. Off Koshikizima, Satuma, Japan, 200 m. Central Fisheries Experimental Station, Japan.

Antalis suteri (Emerson, 1954): 185, *nom. nov. pro D. arenarium* Suter, 1907. Stewart Island, New Zealand, 18 fms [33 m]. New Zealand Geological Survey, Wellington (*fide* DANCE, 1986); paratype South Australian Museum D16001 (*fide* ZEIDLER & MACPHAIL, 1978).

Antalis tosaensis (Habe, 1963): 23, pl. 2, fig. 2. Tosa Bay, Shikoku, 200 m. NSMT.

Genus *PLAGIOGLYPTA* Pilsbry *in* Pilsbry & Sharp, 1897

Type species (OD): *Dentalium undulatum* Münster, 1844. Carboniferous.

DIAGNOSIS. — *Shell* medium to large, almost straight, solid, polished, shiny, white. Sculptured at apex by close-set, fine, encircled wrinkles; prominent, oblique growth lines over the entire shell. Apex simple or with a flat V-shaped notch. Subcircular in section, slightly compressed dorsoventrally. *Radula* rachidian similar to *Dentalium*, but with smooth anterior margin; lateral with large primary cusp; marginal short, sinusoidal.

DISTRIBUTION. — Ordovician (*fide* EMERSON, 1962)-Recent. SW Pacific and Indian Ocean in temperate and cold water, absent in the Atlantic Ocean; shelf-bathyal.

Plagioglypta pertracheata (Plate, 1908)

Figs 44, 45 l-m

Dentalium (Plagioglypta) pertracheatum Plate, 1908a: 357, pl. 30, figs 45-46.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 61099a (not seen).

TYPE LOCALITY. — *"Valdivia"*, stn 185, 03°41′ S, 100°59′ E, 614 m, SW Sumatra.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 lv, 6 dd.
BIOGEOCAL: stn CP 214, 22°43′ S, 166°28′ E, 1590-1665 m, 4 dd.
West Indian Ocean. BENTHEDI: stn DS 42, 13°05′ S, 45°08′ E, 400-520 m, 1 lv. — Stn F 49, 12°55′ S, 44°57′ E, 300-450 m, 2 dd. — Stn F 61, 12°46′ S, 44°58′ E, 475-510 m, 2 lv, 5 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 dd. — Stn F 68, 12°30′ S, 45°02′ E, 400-460 m, 1 dd. — Stn DS 71, 12°30′ S, 45°02′ E, 450 m, 1 lv, 4 dd.
MD 32 Réunion: stn CP 60, 21°03′ S, 55°10′ E, 460-490 m, 1 lv. — Stn DC 58, 21°03′ S, 55°10′ E, 450 m, 4 lv, 6 dd. — Stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 3 lv, 7 dd.

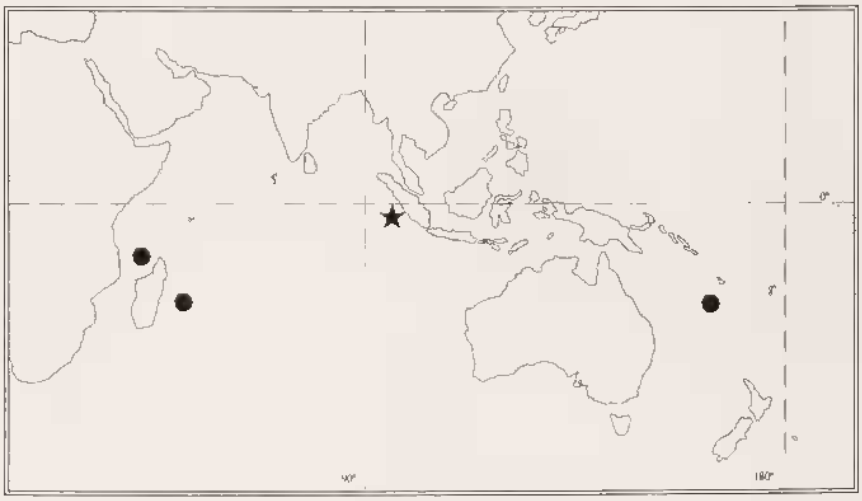


FIG. 44. — Distribution of *Plagioglypta pertracheata*.

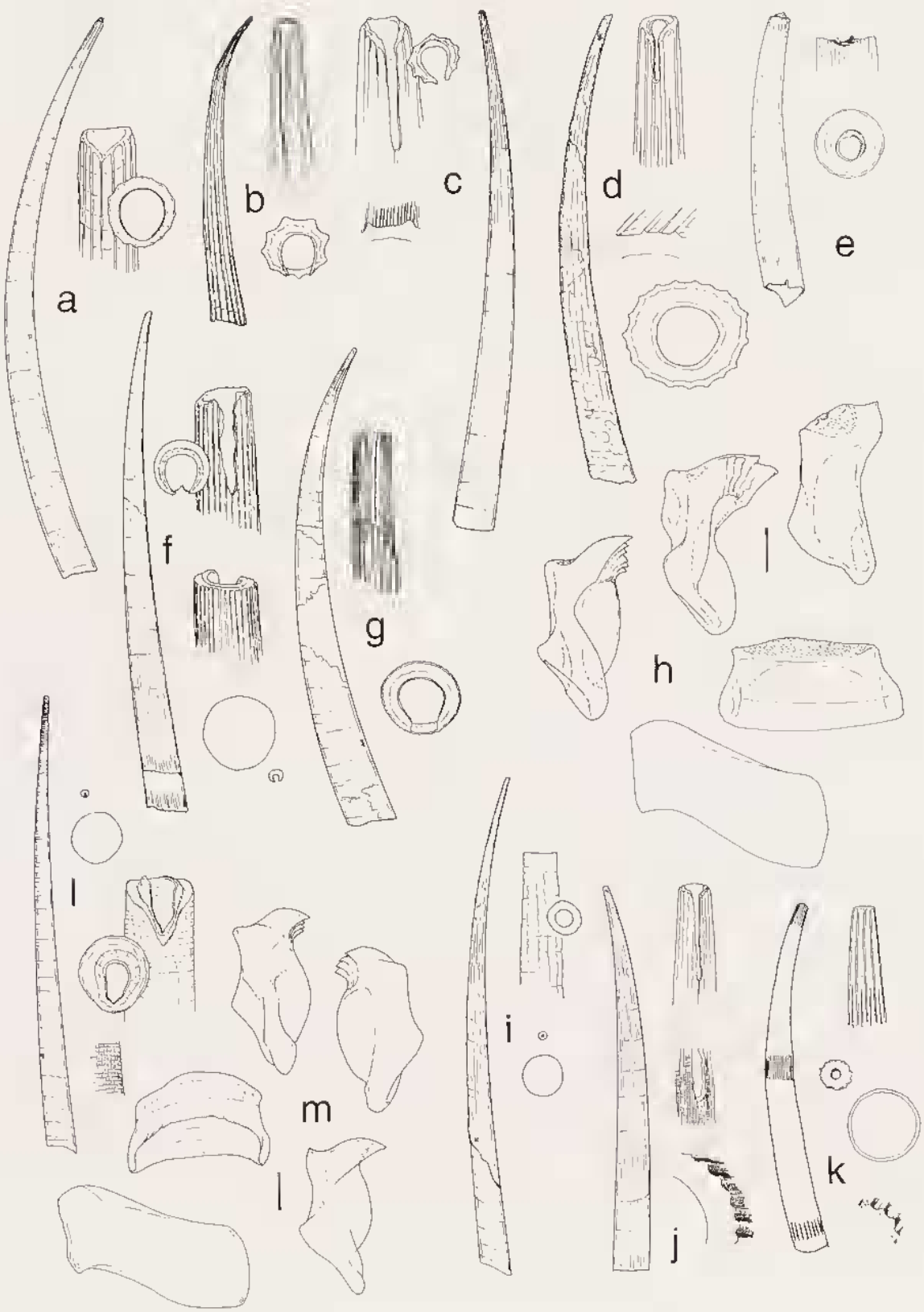
DISTRIBUTION. — W Indonesia, now extended to New Caledonia, Réunion Island and NW Madagascar, live records in 460-1740 m.

Genus *STRIODENTALIUM* Habe, 1964a

Type species (OD): *Dentalium rhabdotum* Pilsbry, 1905. Recent.

DIAGNOSIS. — *Shell* medium to large, slightly curved to almost straight, solid, opaque, light brown. Longitudinal sculpture of 7-8 primary ribs; secondary ribs present, variable in number. Rib section angled, smooth or sculptured. Intercostal spaces concave, smooth or sculptured with longitudinal striae. Apex simple, section starlike at apex, starlike to polygonal at mouth.
Radula rachidian with the granulose anterior border; lateral with prominent primary cusp, head granulose; marginal sinusoidal.

DISTRIBUTION. — Recent, Pacific and Indian Oceans, temperate and cold waters. Absent in the Atlantic Ocean. Shelf to bathyal.



Source : MNHN, Paris

Striodentalium thetidis (Hedley, 1903)

Figs 46, 52 b

Dentalium thetidis Hedley, 1903: 327, fig. 61.

Other references:

Dentalium thetidis – Hedley, 1918: 112.
Entalinopsis (Entalinopsis) thetidis – Habe & Kosuge, 1964: 8.

Type material. — 2 syntypes dd AMS C16212.

Type locality. — Off Port Kembla, New South Wales, Australia, 115-137 m.

Material examined. — The type material.
Philippines. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 2 dd.

Fig. 46. — Distribution of *Striodentalium tethidis*.

Distribution. — Southeastern Australia, now extended to the Philippines; shells in 115-214 m.

Fig. 45. — a, *Antalis longitrorsum*, shell (80 mm), apex and apical section, Tuléar, (MNHN). — **b**, *Antalis porcatum*, shell (18 mm), apex and apical section, MD 32 Réunion: stn DC 86. — **c**, *Antalis weinkauffi*, shell (68 mm), apex, apical section, detail of the sculpture, New Caledonia LAGON: stn 267. — **d**, *Antalis usitatum*, shell (45.5 mm), apex, detail of the sculpture, CORINDON: stn B 244. — **e**, *Antalis tibanum*, shell (21 mm), apex and apical section, VOLSMAR: stn DW 30. — **f**, *Antalis gardineri*, shell (63 mm), apex, apical and oral sections, GEMINI: stn DW 51. — **g**, *Antalis perinvolutum*, shell (68 mm), apex, and apical section, CORINDON: stn DR 231. — **h**, *Antalis* type radula (*A. boucheti* sp. nov.). — **i**, *Antalis phaneum*, shell (37 mm), apex, apical and oral sections, BIOGEOCAL: stn CP 232. — **j**, *Antalis boucheti* sp. nov., holotype, shell (42 mm), apex and detail of the sculpture. — **k**, *Antalis guillei* sp. nov., holotype, shell (8.7 mm), apex, apical and oral sections, section of the ribs and detail of sculpture. — **l**, *Plagioglypta pertracheata*, shell (60 mm), apex, apical and oral sections, detail of the sculpture, BENTHEDI: stn F 61. — **m**, *Plagioglypta* type radula (*P. pertracheata*). Scale lines: 100 µm (h, m).

Striodentalium rhabdotum (Pilsbry, 1905)

Figs 47, 52 a, d

Dentalium rhabdotum Pilsbry, 1905: 116, pl. 5, figs 45-47.

Other references:

Dentalium (Antalis) rhabdotum – Kuroda & Kikuchi, 1933: 8, pl. 1, figs 1-2.
Dentalium (Dentale) rhabdotum – Habe, 1953: 294; 1957: 129, fig. 11.
Antalis rhabdotum – Habe, 1962: 106, pl. 47, fig. 12; 1963: 263, pl. 38, figs 17-18. — Habe & Kosuge, 1964: 5. — Okutani, 1964: 73.
Striodentalium rhabdotum – Okutani, 1966: 12. — Habe, 1964a: 22, pl. 2, figs 17-18; 1971: 489 (Japanese text), 307 (English text), pl. 65, figs 4-5. — Habe, 1977: 334, pl. 72, fig. 5. — Habe *et al.*, 1986: 24, pl. 1, figs 11-12. — Qi & Ma, 1989: 118, figs 10a-b. — Higo & Goto, 1993: 687.

Type material. — Holotype ANSP 88319.

Type locality. — Heda, Izu, Japan, 306 m.

Material examined. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 3 dd.
Indonesia. *"Snellius"* II: stn 4.135, 06°29′ S, 121°09′ E, 495 m, 2 lv, 3 dd. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 1 dd.
Philippines. MUSORSTOM 1: stn CP 44, 13°47′ N, 120°30′ E, 592-610 m, 8 dd.
MUSORSTOM 2: stn CP 82, 13°46′ N, 120°28′ E, 550 m, 5 lv.
MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 6 lv, 60 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 lv, 3 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 219-220 m, 2 dd.

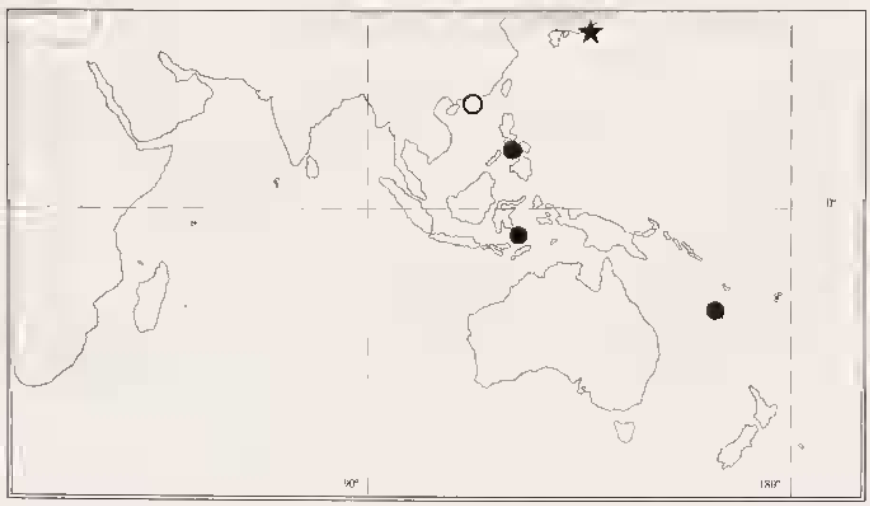


Fig. 47. — Distribution of *Striodentalium rhabdotum*.

Distribution. — Japan, from 61 m to 1350 m (Habe, 1957 and Okutani, 1964); East and South China Seas, 300-550 m (Qi & Ma, 1989). Now extended to the Philippines and New Caledonia. Live records in 448-668 m.

Striodentalium kanakorum sp. nov.

Figs 48, 52 c

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, Coral Sea, CHALCAL 2, stn DW 74, 24°40′ S, 168°38′ E, 650 m.

MATERIAL EXAMINED. — **New Caledonia**. CHALCAL 2: stn DW 72, 24°55′ S, 168°22′ E, 527 m, 1 lv (paratype). — Stn DW 73, 24°40′ S, 168°38′ E, 573 m, 1 dd (paratype). — Stn DW 74, 24°40′ S, 168°38′ E, 650 m, 1 lv (holotype).
MUSORSTOM 4: stn DW 197, 18°51′ S, 163°21′ E, 550 m, 1 dd (paratype).

FIG. 48. — Distribution of *Striodentalium kanakorum*.

DISTRIBUTION. — New Caledonia, alive in 527-650 m.

DESCRIPTION. — *Shell* to 32 mm long, solid, regularly curved, white, shiny. Seven primary high, angulate and irregular ribs and one secondary rib at each intercostal concave space. Apex truncate with important callus, wide on dorsal side, lumen drop-like shape. Cross section laterally compressed throughout, mouth thin.

Measurements: holotype L 21, W 2.8, w 1.4, arc 1.3; paratypes L 18.5, W 2.7, w 1.4, arc 1; L 27.6, W 3.1, w 1.4, arc 1.4; L 32, W 3.1, w 1.5, arc 1.5. W/w ratio 2.2-2.

REMARKS. — *S. kanakorum* is shorter, more curved and shiny than the other species of the genus, except *S. thetidis*, but in the latter species the intercostal spaces are finely striated.

ETYMOLOGY. — After Kanak, name of the people of New Caledonia and Vanuatu Islands.

Other Indo-Pacific species of *Striodentalium* cited in the literature

Striodentalium chinensis Qi & Ma, 1986: 69, fig. 1. East China Sea.
Striodentalium concretum (Colman, 1958): 141, fig. 2. E of Sydney, NSW, Australia, 548 m. AMS.
Striodentalium hosoi Habe, 1963: 263, fig. 46. Off Tosa Bay, Shikoku, Japan. NSMT.
Striodentalium polycostatum Qi & Ma, 1986: 69. East China Sea, 184 m.

Genus *Graptacme* Pilsbry & Sharp, 1897

Type species (SD by Woodring, 1925): *Dentalium eboreum* Conrad, 1846. Recent, Tampa Bay, Florida, USA.

Diagnosis. — *Shell* medium to large, slightly to well curved, generally fragile, polished to shiny, except for apical portion; translucent white and salmon near the apex in some species. Sculptured by close, fine, longitudinal striae, prominent near apex; anterior half of shell usually smooth. Apex simple, truncate with apical callus and lumen variable in shape, or with deep irregular slit on dorsum or side in some species. Circular in section, oral aperture generally thin and translucent.
Radula similar to *Dentalium*.

Distribution. — Paleocene-Recent, worldwide; sublittoral of temperate and tropical regions to abyssal.

Graptacme lactea (Deshayes, 1825)

Figs 49, 52 e-f, 71 f, 73 i

Dentalium lacteum Deshayes, 1825: 362, pl. 2, fig. 27.

Other references:

Dentalium lacteum — Sowerby, 1860: 98, pl. 225 (*Dentalium* 3), fig. 48; 1873: pl. 6, fig. 37. — Pilsbry & Sharp, 1897: 99, pl. 19, fig. 1. — Boissevain, 1906: 54, pl. 1, fig. 21, pl. 6, fig. 35.
Eboreidens lacteum — Chistikov, 1975: 19; 1979: 113, fig. 5.

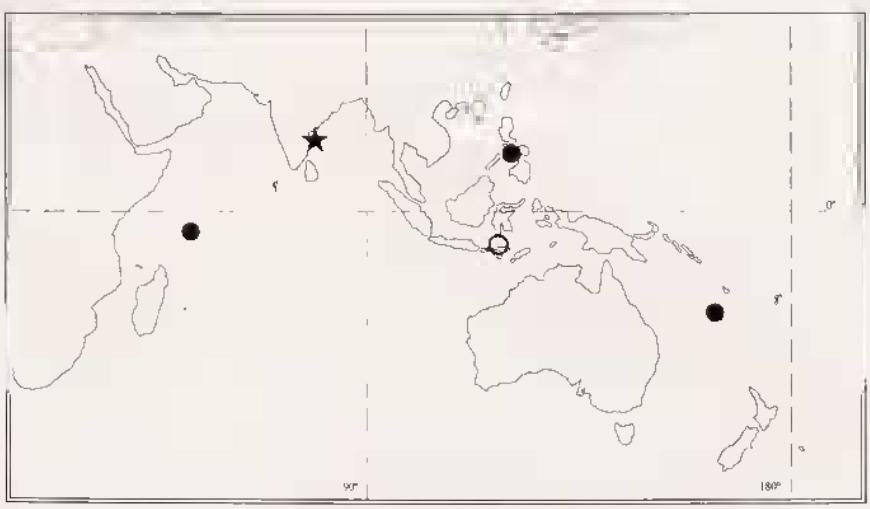


Fig. 49. — Distribution of *Graptacme lactea*.

Type material. — Lectotype (here designated; L 29, W 2.8, w 0.9) and paralectotype, MNHN.

Type locality. — India.

Material examined. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 72, 19°15′ S, 158°21′ E, 32 m, 2 dd. — Stn DW 100, 19°06′ S, 158°27′ E, 40 m, 1 lv. — Stn DW 122, 19°28′ S, 158°17′ E, 32 m, 2 dd. — Stn DW 155, 19°49′ S,

158°25′ E, 42 m, 1 dd. — Stn DW 158, 19°46′ S, 158°17′ E, 28 m, 1 dd. — Stn DW 160, 19°46′ S, 158°23′ E, 35-41 m, 1 lv.
Philippines. Coll. JOUSSEAUME, 3 dd (MNHN).
West Indian Ocean. Seychelles, 2 dd (MNHN).

DISTRIBUTION. — Philippines and China Seas to Indonesia and the Indian Ocean, now extended to the Coral Sea, alive in 32 to 42 m.

REMARKS. — The type specimens are very worn but show typical *Graptacme* sculpture, as noted by BOISSEVAIN (1906: 54). CHISTIKOV (1975) proposed the genus *Eboreidens* and the family Eboreidentidae using *G. lactea* as type species, but giving a description not corresponding to the characteristics of *G. lactea*. I have not seen CHISTIKOV's specimens, but they do not appear to be the present species. Examination of the figure of the radula (CHISTIKOV, 1979b: fig. 5) indicates that CHISTIKOV's species is *Calliodentalium crocinum*. If this is correct, *Eboreidens* and Eboreidentidae are synonyms of *Calliodentalium* and Calliodentaliidae respectively.

Graptacme acutissima (Watson, 1879)

Figs 50, 52 g

Dentalium acutissimum Watson, 1879: 514; 1886: 8, pl. 1, fig. 8.

Other references:

Dentalium acutissimum – PILSBRY & SHARP, 1897: 94, pl. 20, fig. 26. — BOISSEVAIN, 1906: 45, pl. 2, fig. 39, pl. 5, figs 9-12.
D. (Graptacme) acutissimum – PLATE, 1908a: 351.
Graptacme acutissimum – HABE & KOSUGE, 1964: 5. — OKUTANI, 1974: 34.
Graptacme acutissima – HIGO & GOTO, 1993: 687.

TYPE MATERIAL. — Three syntypes BMNH 1887.2.9.31-33. The specimen BMNH 1887.2.9.31 is the figured syntype and will be designated lectotype by LAMPRELL & HEALY (in press). The paralectotype BMNH 1887.2.9.33 belongs to a different species.

TYPE LOCALITY. — Putative lectotype and paralectotype from *"Challenger"* stn 218, 02°33′ S, 144°04′ E, 1070 fms [1956 m], N off Papua New Guinea. Non-conspecific paralectotype from stn 246, 36°10′ N, 178°00′ E, East of Japan, 3758 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 lv. — Stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 2 lv, 6 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 11 dd. — Stn CP 23, 22°46′ S, 166°20′ E, 2040 m, 3 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 3 lv, 13 dd. — Stn CP 74, 22°14′ S, 167°29′ E, 1300-1475 m, 1 dd. — Stn DW 79, 20°40′ S, 166°52′ E, 1320-1380 m, 1 dd. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 1 lv, 2 dd. — Stn KG 95, 21°22′ S, 166°33′ E, 2365 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 2 lv, 1 dd. — Stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 2 lv, 3 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 lv, 8 dd. — Stn CP 266, 21°05′ S, 166°57′ E, 1990-2100 m, 2 dd. — Stn KG 269, 21°02′ S, 166°58′ E, 1810 m, 1 lv, 1 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 1 dd. — Stn CP 341, 21°30′ S, 166°47′ E, 2334 m, 1 dd.
Indonesia. CORINDON: stn CH 231, 00°05′ N, 119° 48′ E, 980-1080 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 lv, 1 dd.
West Indian Ocean. MD 32 Réunion: stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 1 lv, 1 dd.

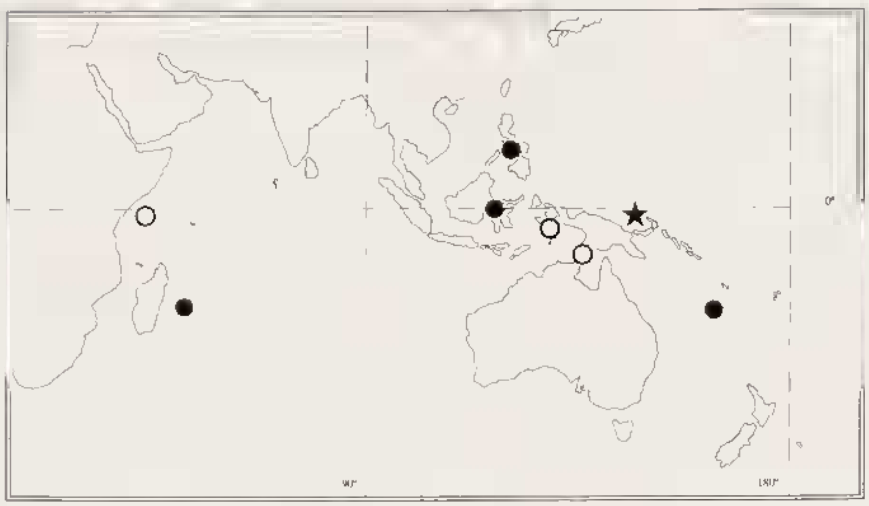


FIG. 50. — Distribution of *Graptacme acutissima*.

DISTRIBUTION. — The Philippines, Indonesia, N of Papua New Guinea and East Africa (PLATE, 1908a). Now extended to New Caledonia and Réunion Island. Living records from 1050 to 2350 m, mostly below 1800 m, shells known from 865 m (present paper).

Graptacme africana (Sowerby, 1903)

Figs 51, 52 h

Dentalium africanum Sowerby, 1903: 224, pl. 5, fig. 10.

Other references:
Dentalium africanum – SMITH, 1906b: 58. — BARNARD, 1963b: 351; 1974: 742.

TYPE MATERIAL. — Holotype BMNH 1903.7.27.54, paratype SAM A5491.

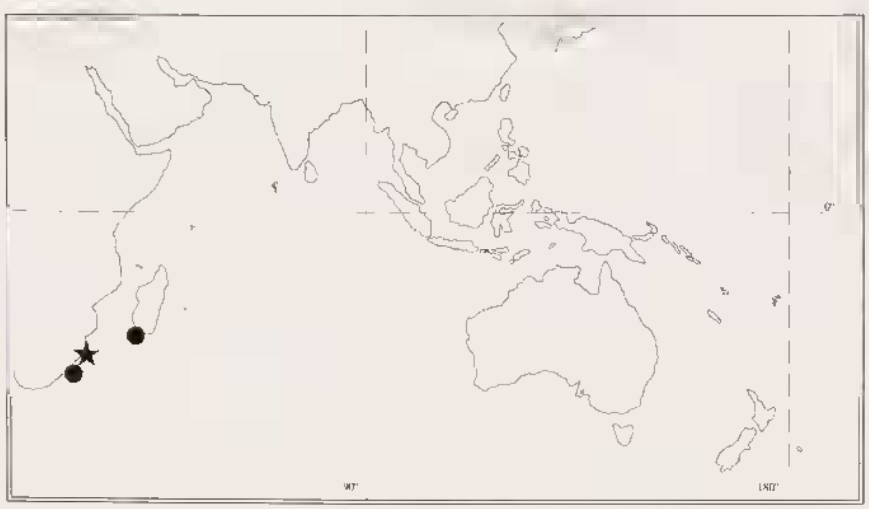


FIG. 51. — Distribution of *Graptacme africana*.

TYPE LOCALITY. — North of Untwalumi river, Natal, South Africa, 25 fms [45 m].

MATERIAL EXAMINED. — The type material.
West Indian Ocean. Tuléar, Madagascar, Thomassin coll., 1 dd (BMNH).
South Africa. *"Meiring Naudé"*: stn SM 16, 27°33′ S, 32°35′ E, 384 m, 1 dd.

DISTRIBUTION. — South Africa, now extended to Madagascar, shells from 45 to 384 m.

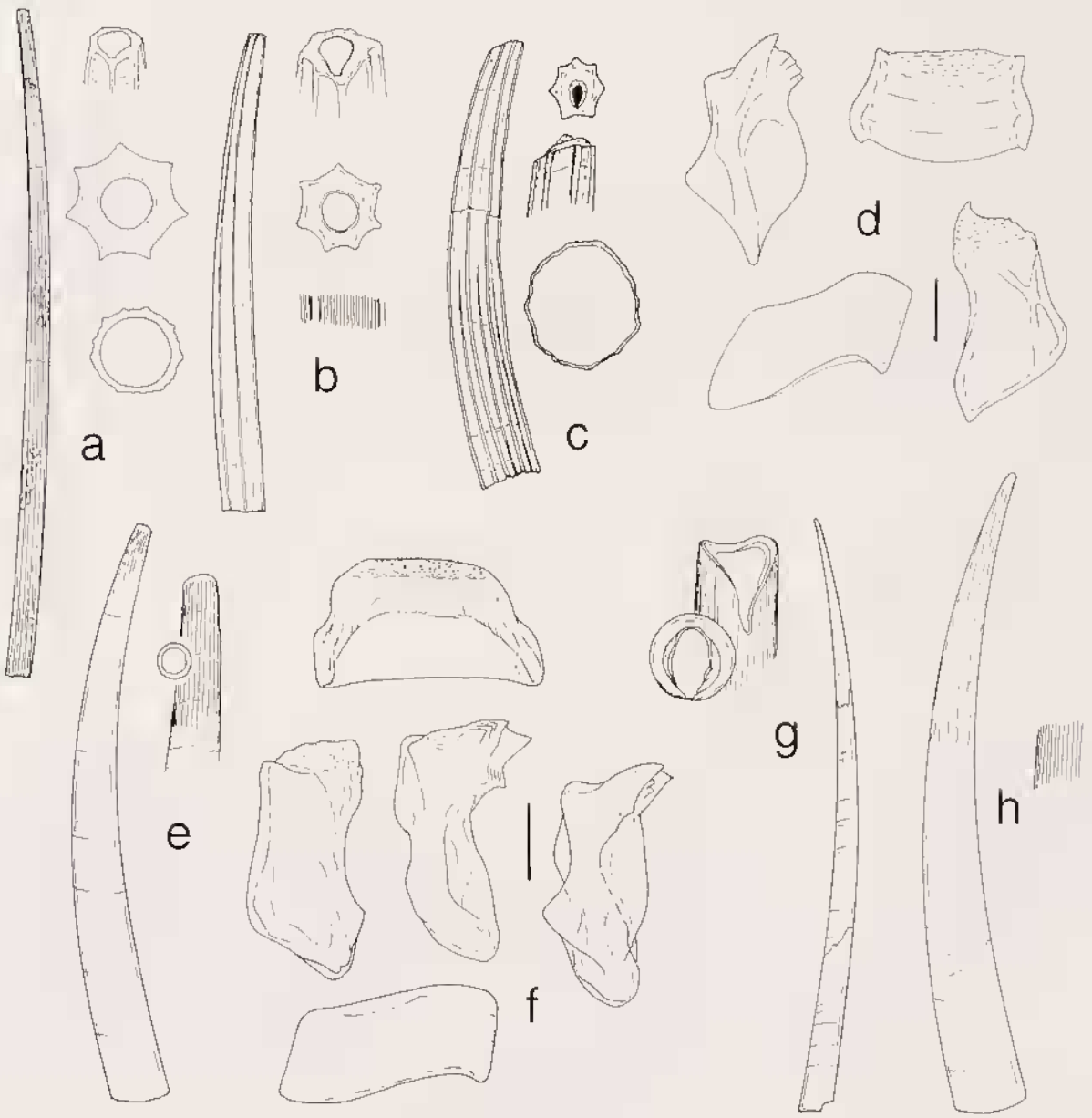


FIG. 52. — **a**, *Striodentalium rhabdotum*, shell (91 mm), apex, apical and oral sections, MUSORSTOM 3: stn CP 106. — **b**, *Striodentalium tethidis*, shell (22 mm), apex and apical section, detail of the sculpture, MNHN, MUSORSTOM 3: stn CP 143. — **c**, *Striodentalium kanakorum* sp. nov., holotype, shell (21 mm), apex, apical and oral sections. — **d**, *Striodentalium* type radula (*S. rhabdotum*). — **e**, *Graptacme lactea*, shell (23 mm), apex and apical section, CORAIL 2: stn CP 160. — **f**, *Graptacme* type radula (*G. lactea*). — **g**, *Graptacme acutissima*, shell (47 mm), apex and apical section, BIOCAL: stn DW 79. — **h**, *Graptacme africana*, shell (44 mm), detail of the sculpture, Tuléar (BMNH). Scale lines: 100 µm (d, f).

Other Indo-Pacific species of *Graptacme* cited in the literature

Graptacme acuticostata (Plate, 1908): 352, pl. 30, fig. 37. Off Dar-es-Salaam, Tanzania, *"Valdivia"*, stn 247, 05°56′ S, 39°1′ E, 50 m. Holotype ZMB 61082 (*fide* KILIAS, 1995).

Graptacme elpis (Winckworth, 1927): 168, pl. 14, figs 6-7. West side of Nannar, Ceylon, 5 m. 2 syntypes BMNH 1952.3.21.13-14.

Genus *Fissidentalium* Fischer, 1885

Type species (by monotypy): *D. ergasticum* Fischer, 1885 (= *D. capillosum* Jeffreys, 1877). Recent, Atlantic Ocean, 1900 m.

DIAGNOSIS. — *Shell* generally very large, moderately curved, solid, opaque or polished, white, cream or light brown, usually with dark-brown markings. Longitudinal sculpture faint with primary ribs variable in number; secondary ribs present, originating near the apex, variable in number and in some species reaching the strength of the primary ribs at the oral area. Rib section round, flat or angled, striated, cancellated or serrated. Intercostal spaces concave or convex, smooth or with longitudinal or transverse striae, generally less prominent than ribs. Apex with a deep irregular slit on ventral side, frequently broken or worn. Section polygonal at apex, circular or subcircular slightly dorsoventrally compressed at oral aperture.
Radula: rachidian strong, well curved with barely granulose anterior margin; lateral strong with short but strong cusps or irregular grooves, anterior part of head usually granulose; marginal large and sinusoidal.

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf to abyssal.

Fissidentalium profundorum (Smith, 1894)

Figs 53, 62 f, l, 70 a

Dentalium profundorum Smith, 1894: 167, pl. 4, fig. 18.

Other references:

Dentalium profundorum – PILSBRY & SHARP, 1897: 79, pl. 6, fig. 82. — SMITH, 1906a: 249. — BOISSEVAIN, 1906: 37, pl. 4, figs 14-16. — WINCKWORTH, 1940a: 25.
Fissidentalium (*Fissidentalium*) *profundorum* – HABE, 1964a: 13, pl. 1, fig. 15, pl. 5, fig. 59.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1894.9.11.11.

TYPE LOCALITY. — Off Sri Lanka, *"Investigator"*, 06°32′ N, 79°37′ E, 675 fms [1235 m].

MATERIAL EXAMINED. — The paratype.
New Caledonia. BIOCAL: stn CP 57, 23°44′ S, 166°58′ E, 1490-1620 m, 1 dd. — Stn CP 62, 24°19′ S, 167°49′ E, 1395-1410 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 10 dd.
Indonesia. CORINDON: stn DR 229, 00°02′ N, 119°50′ E, 411-445 m, 1 lv, 1 dd.
West indian Ocean *"Galathea"*: stn 217, 14°20′ S, 45°09′ E, 3560 m, 2 dd (ZMC).

DISTRIBUTION. — Indian Ocean, Indonesia, Japan, now extended to New Caledonia. Live records in 441-445 m and shells down to 3560 m (present paper).

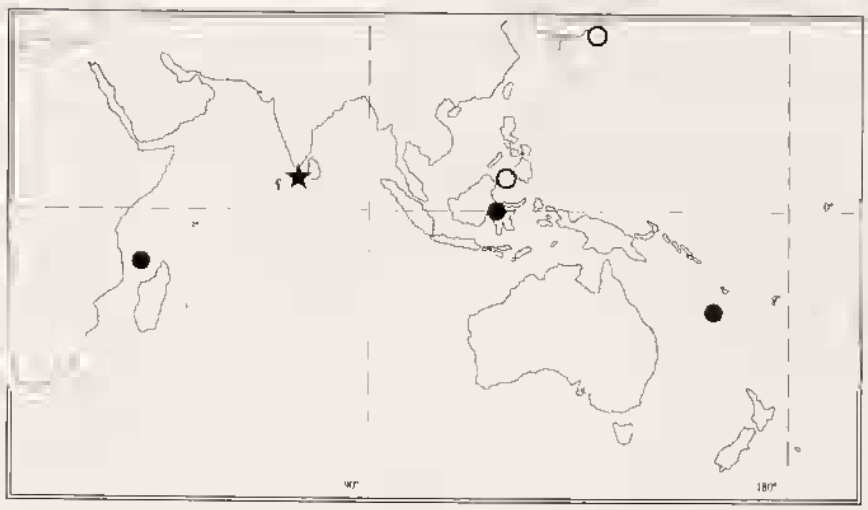


FIG. 53. — Distribution of *Fissidentalium profundorum*.

Fissidentalium magnificum (Smith, 1896)

Figs 54, 62 b, i, 78 a

Dentalium magnificum Smith, 1896: 371.

Other references:

Dentalium magnificum — PILSBRY & SHARP, 1897: 78, 251. — ALCOCK & ANDERSON, 1898: pl. 7, figs 5-5a. — SMITH, 1904: 7; 1906a: 248; 1906b: pl. 7, figs 5-5a. — BOISSEVAIN, 1906: 37, pl. 2, figs 32-32a. — WINCKWORTH, 1940a: 25.
Fissidentalium (*Fissidentalium*) *magnificum* — HABE & KOSUGE, 1964: 3.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1895.12.13.1.

TYPE LOCALITY. — Off Trincomalee, East coast of Sri Lanka, *"Investigator"*, 08°40' N, 81°27' E, 637-800 fms [1165-1465 m].

MATERIAL EXAMINED. — Paratype in BMNH.
Chesterfield Islands. MUSORSTOM 5: stn CP 323, 21°19' S, 157°58' E, 970 m, 1 lv, 3 dd. — Stn CP 324, 21°15' S, 157°51' E, 970 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 426, 20°25' S, 166°23' E, 610 m, 2 lv. — Stn DW 489, 20°48' S, 167°06' E, 700 m, 1 lv.
Indonesia. CORINDON: stn CH 214, 00°31' N, 117°50' E, 595 m, 1 dd. — Stn CH 240, 00°38' S, 119°34' E, 675 m, 2 lv.
"Snellius" II: stn 4.127, 08°19' S, 118°18' E, 500-550 m, 1 dd. — Stn 4.128, 08°18' S, 118°16' E, 700-835 m, 2 lv, 6 dd. — Stn stn 4.130, 08°18' S, 118°18' E, 700-730 m, 1 lv, 5 dd. — Stn 4.267, 08°18' S, 118°21' E, 650 m, 10 lv, 21 dd. (RMNH).
Philippines. MUSORSTOM 1: stn CP 47, 13°41' N, 120°30' E, 685-757 m, 2 lv, 7 dd.
MUSORSTOM 2: stn CP 24, 13°37' N, 120°42' E, 640-647 m, 1 dd. — Stn CP 25, 13°39' N, 120°43' E, 520-550 m, 1 lv. — Stn CP 55, 13°54' N, 119°58' E, 865 m, 8 lv, 8 dd.
MUSORSTOM 3: stn DR 95, 13°56' N, 119°59' E, 865 m, 13 dd. — Stn DR 102, 14°01' N, 120°18' E, 192 m, 1 dd. — Stn CP 106, 13°47' N, 120°30' E, 640-668 m, 2 dd. — Stn CP 133, 11°58' N, 121°52' E, 334-390 m, 1 dd.
West Indian Ocean. *"Galathea"*: stn 314, 15°54' N, 90°17' E, 2600 m, 2 lv (ZMC).
MD 32 Réunion: stn CP103, 20°42' S, 54°57' E, 2950-2970 m, 2 dd.

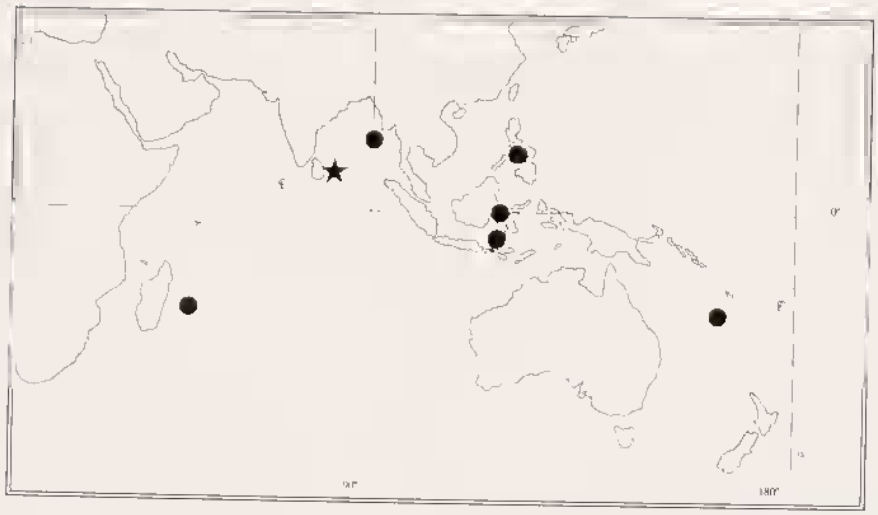


FIG. 54. — Distribution of *Fissilentalium magnificum*.

DISTRIBUTION. — Indian Ocean, now extended to the Philippines, Indonesia and New Caledonia, live records in 520-2600 m (present paper).

Fissidentalium shoplandi (Jousseaume, 1894)

Figs 55, 73 a-d

Dentalium shoplandi Jousseaume, 1894: 102.

Synonyms:

Dentalium transversostriatum Boissevain, 1906: 32, pl. 4, fig. 23 (**Syn. nov.**).
Dentalium (*Fissilentalium*) *chuni* Plate, 1908a: 341, pl. 30, figs 1-9 (**Syn. nov.**).

Other references:

Dentalium shophndi – PILSBRY & SHARP, 1897: 28, pl. 12, fig. 100. — SHOPLAND, 1902: 176. — SMITH, 1904: 7. — BOISSEVAIN, 1906: 31, pl. 1, fig. 12. — (?) MELVILL & STANDEN, 1907: 123. — WINCKWORTH, 1940a: 25.
Fissidentalium (*F.*) *shoplandi* – HABE & KOSUGE, 1964: 3.
Dentalium (*F.*) *shoplandi* – LUDBROOK, 1954: 99.
Dentalium (*F.*) *chuni* – JAECKEL, 1932: 305.

TYPE MATERIAL. — *D. shoplandi*: holotype MNHN. — *D. transversostriatum*: syntypes ZMA 3.06.028-029. — *D. chuni*: lectotype, designated by KILIAS (1995), ZMB 63824.

TYPE LOCALITY. — *F. shoplandi*: 50 miles of Aden, 1243 m. — *F. transversostriatum*: Indonesia, off Selayer, *"Siboga"*, stn 212, 05°55′ S, 120°19′ E, 462 m. — *F. chuni*: *"Valdivia"*, stn 251, 01°41′ S, 41°47′ W, 693 m.

MATERIAL EXAMINED. — The type material of *F. shoplandi* and *F. transversostriatum*.
Loyalty Islands. MUSORSTOM 6: stn DW 425, 20°24′ S, 166°25′ E, 594 m, 2 dd.
Philippines. MUSORSTOM 2: stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 lv. — Stn CP 39, 13°03′ N, 122°36′ E, 1030-1190 m, 2 lv, 4 dd. — Stn CP 82, 13°47′ N, 120°29′ E, 550 m, 1 lv.
MUSORSTOM 3: stn CP 123, 12°11′ N, 121°45′ E, 700-702 m, 1 dd. — Stn CP 127, 11°48′ N, 121°30′ E, 464-475 m, 1 dd. — Stn CP 128, 11°50′ N, 121°42′ E, 815-821 m, 1 lv, 1 dd.

DISTRIBUTION. — Indian Ocean, Indonesia and the Philippines, now extended to New Caledonia, live records in 520-1190 m (present paper).

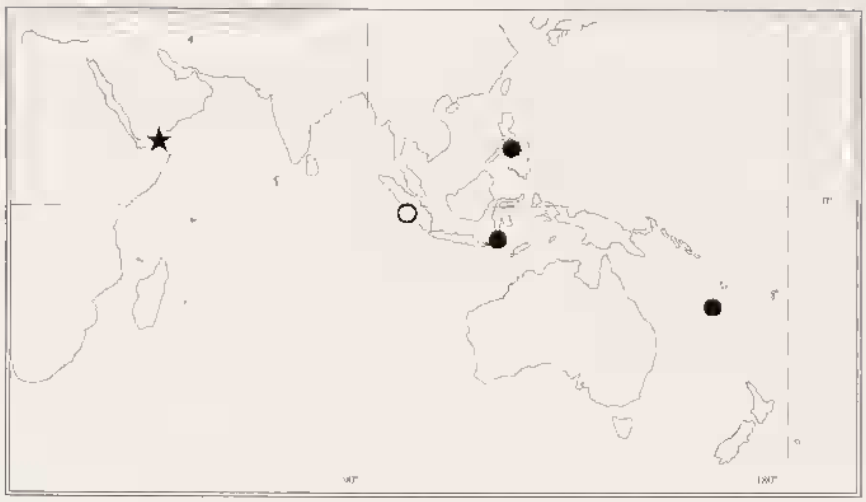


FIG. 55. Distribution of *Fissidentalium shoplandi*.

REMARKS. — The type material of *D. chuni* was not examined but the detailed original description allows us to synonymize it.

Fissidentalium cornubovis (Smith, 1906)

Figs 56, 62 h

Dentalium cornubovis Smith, 1906a: 249.

Other references:

Dentalium cornubovis – ANNANDALE & STEWART, 1909: pl. 23, figs 2-2a. WINCKWORTH, 1940a: 25.
Dentalium ceras – SMITH, 1906a: 248.

TYPE MATERIAL. — Lectotype (here designated) the largest (63 mm) of the 3 syntypes BMNH 1906.10.12.142-144.

TYPE LOCALITY. — Indian Ocean, 1154 fms [2109 m], *"Investigator"*.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn CP 13, 20°20′ S, 167°19′ E, 3690-3740 m, 1 lv, 1 dd. — Stn CP 17, 20°35′ S, 167°25′ E, 3680 m, 1 lv, 2 dd.
West Indian Ocean. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 2 lv.
MD 32 Réunion: stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m, 2 lv.
"Galathea": stn 234, 05°25′ S, 47°09′ E, 4830 m, 3 dd. — Stn 238, 03°23′ S, 44°04′ E, 3960 m, 2 lv, 1 dd (ZMC).
East Indian Ocean. SAFARI 2: stn CP 10, 01°43′ N, 87°08′ E, 4350 m, 1 lv. — Stn CP 12, 02°54′ S, 89°43′ E, 3344 m, 1 lv.
"Galathea": Stn 280, 01°66′ N, 77°09′ E, 4350 m, 1 lv, 8 dd. — Stn 314, 15°54′ N, 90°17′ E, 2600 m, 1 lv (ZMC).

DISTRIBUTION. — Widely distributed throughout the Indian Ocean, now extended to New Caledonia, recorded alive from 2600 to 4350 m.

REMARKS. — The three syntypes of *F. cornubovis* are gerontic individuals, and their ribs fade near the half of the shell. The specimens identified as *Dentalium ceras* by SMITH, 1906 (S of Sri-Lanka, BMNH 1906.10.12.1-2) are adults but not gerontic, and are ribbed throughout.

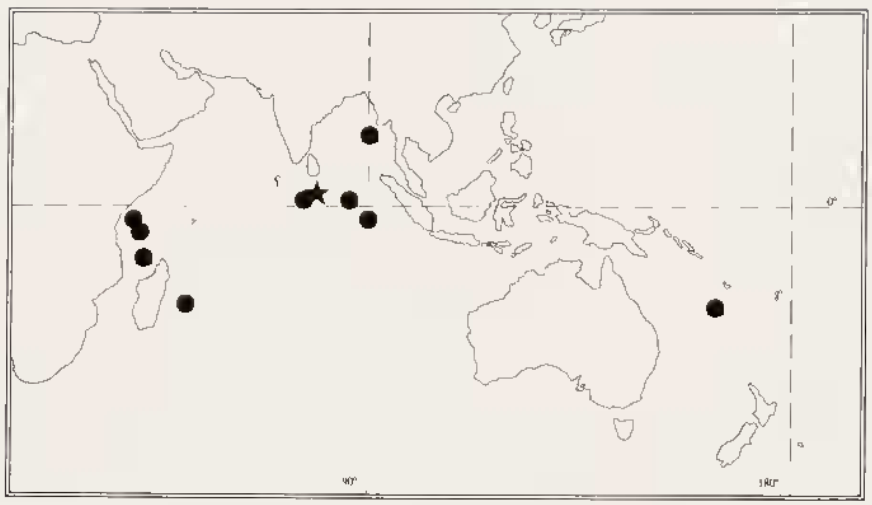


FIG. 56. — Distribution of *Fissidentalium cornubovis*.

Fissidentalium ceras (Watson, 1879), from *"Challenger"* stations 246, 36°10′ N, 178°00′ E, Mid Pacific Ocean E of Japan, 2050 fms [3690 m] and 299, 33°31′ S, 74°43′ W, W of Valparaiso, 2160 fms [3948 m], is here considered a senior synonym of *Fissidentalium megathyris* Dall, 1889, from *"Albatross"*, stn 2807, 00°24′ S, 89°06′ E, 812 fms [1485 m], near Galapagos Islands (holotype USNM 594262). This abyssal species is widely distributed throughout the East Pacific, from Chile to Northern California and the Central Pacific.

Fissidentalium serrulatum (Smith, 1906)

Figs 57, 70 b

Dentalium serrulatum Smith, 1906a: 249.

Other reference:

Dentalium serrulatum — WINCKWORTH, 1940a: 25.

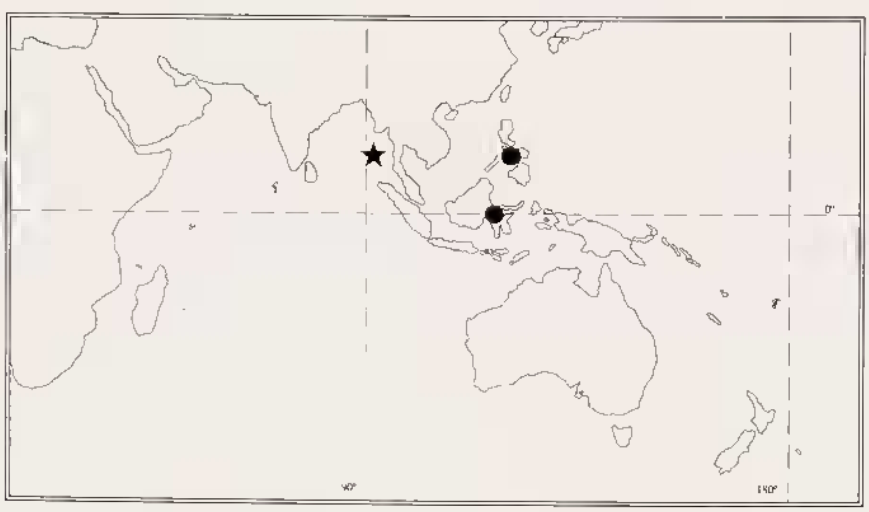


FIG. 57. — Distribution of *Fissidentalium serrulatum*.

TYPE MATERIAL. — Holotype presumably in the Zoological Survey of India; paratype BMNH 1906.10.12.4.

TYPE LOCALITY. — Andaman Is., Gulf of Bengal, 60 fms [110 m].

MATERIAL EXAMINED. — Paratype in BMNH.
Indonesia. CORINDON: stn DR 216, 00°40′ N, 117°51′ E, 96 m, 2 dd.
Philippines. MUSORSTOM 2: stn CP 72, 14°00′ N, 120°18′ E, 182-197 m, 1 dd.

DISTRIBUTION. — Gulf of Bengal, now extended to Indonesia and the Philippines. No records of living material, shells from 96 to 182 m (present paper).

Fissidentalium malayanum (Boissevain, 1906)

Figs 58, 62 d, j

Dentalium malayanum Boissevain, 1906: 32, pl. 5, fig. 45.

Other reference:
Fissidentalium (*F.*) *malayanum* – HABE & KOSUGE, 1964: 3.

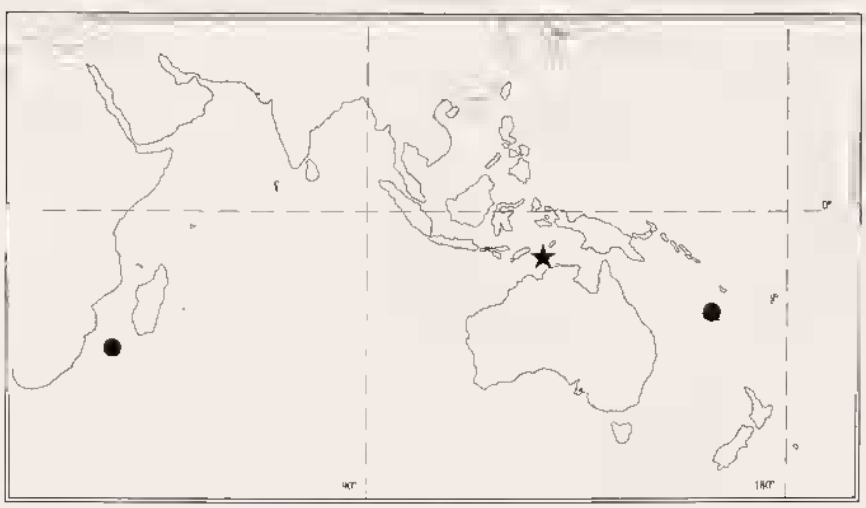


FIG. 58. — Distribution of *Fissidentalium malayanum*.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.033, paralectotypes ZMA 3.06.030-032.

TYPE LOCALITY. — *"Siboga"*, stn 300, 10°49′ S, 123°23′ E, 918 m, Timor Sea.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 2 lv, 30 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 42 lv, 4 dd. — Stn DS 98, 21°14′ S, 166°30′ E, 2365-2470 m, 3 dd.
BIOGEOCAL: stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 42 dd. — Stn CP 266, 21°05′ S, 166°57′14′ E, 1990-2100 m, 2 dd. — Stn CP 283, 21°22′ S, 166°31′ E, 2370-2375 m, 11 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 37 dd. — Stn CP

329, 21°09′ S, 166°40′ E, 2315-2310 m, 19 dd. — Stn CP 336, 21°12′ S, 166°22′ E, 2370-2380 m, 11 dd. — Stn CP 341, 21°30′ S, 166°47′ E, 2334 m, 25 dd.
West Indian Ocean. *"Galathea"*: stn 190, 29°42′ S, 39°19′ E, 2760 m, 1 lv, 1 dd (ZMC).

DISTRIBUTION. — Indonesia, now extended to southern Madagascar and New Caledonia. Living from 2100 to 2760 m; shells from 918 m.

Fissidentalium vicdani Kosuge, 1981

Figs 59, 62 c

Fissidentalium vicdani Kosuge, 1981: 114, pl. 39, figs 5-7.

Other reference:
Fissidentalium (F.) vicdani — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 4.

TYPE MATERIAL. — Holotype, Institute of Malacology, Tokyo IMT 81-36 (not seen).

TYPE LOCALITY. — Bohol, Philippines.

MATERIAL EXAMINED. — **Philippines**. MUSORSTOM 3: stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 dd.

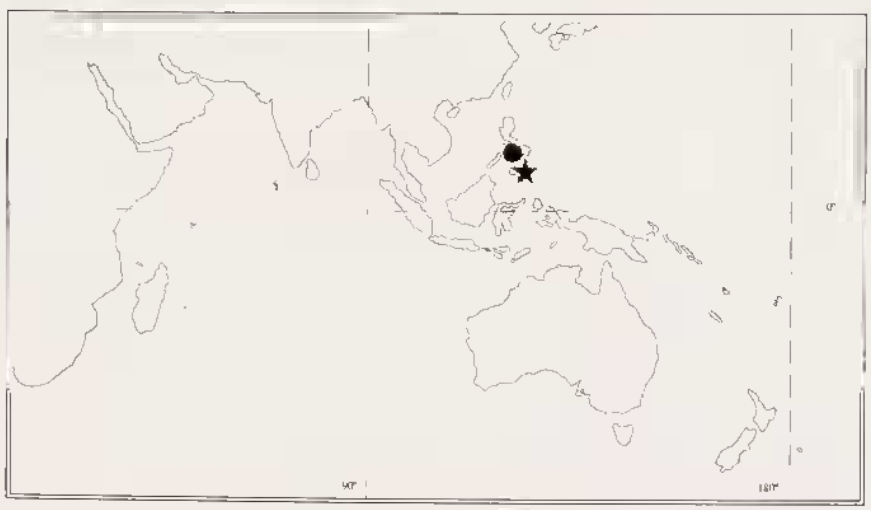


FIG. 59. — Distribution of *Fissidentalium vicdani*.

DISTRIBUTION. — Only known from the Philippines, shell in 448-466 m.

Fissidentalium levii sp. nov.

Figs 60, 70 c

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201724, 1 NMNZ M268957.

TYPE LOCALITY. — North of New Caledonia, MUSORSTOM 4, stn DW 160, 18°42′ S, 163°13′ E, 668 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 341, 19°46′ S, 158°43′ E, 620-630 m, 1 dd (paratype). — Stn DC 358, 19°39′ S, 158°47′ E, 680-700 m, 1 dd (paratype).
New Caledonia. BIOCAL: stn DW 33, 23°10′ S, 167°10′ E, 675-680 m, 1 lv (paratype). — Stn DW 39, 22°55′ S, 167°23′ E, 650 m, 1 dd (paratype AMS). — Stn CP 40, 22°55′ S, 167°24′ E, 650 m, 3 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 1 dd. — Stn DW 48, 23°00′ S, 167°29′ E, 775 m, 2 dd.
MUSORSTOM 4: stn DW 160, 18°42′ S, 163°13′ E, 668 m, 3 lv (holotype and 2 paratypes).
SMIB 2: stn DW 20, 22°44′ S, 167°42′ E, 415-470 m, 2 dd. — Stn DW 21, 22°40′ S, 167°41′ E, 460-500 m, 3 dd.
SMIB 3: stn DW 21, 22°59′ S, 167°19′ E, 525 m, 5 dd (1 paratype).
"Vauban" 1976: Pointe du Grand Récif Sud, 200 m, 1 dd (1 paratype).
"Vauban" 1978-79: stn 14, 22°16′ S, 167°17′ E, 465-495 m, 1 dd. — Stn 22, 22°59′ S, 167°17′ E, 540-545 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 396, 20°48′ S, 167°01′ E, 1400 m, 1 dd (paratype NMNZ).
New Hebrides Arc. GEMINI: stn DW 55, 20°59′ S, 170°02′ E, 710 m, 1 dd (paratype).

FIG. 60. — Distribution of *Fissidentalium levii*.

DISTRIBUTION. — New Caledonia, alive in 668-680 m, shells from 200 to 1400 m.

DESCRIPTION. — *Shell* to 70 mm long, strong, white, shiny, slightly curved, regularly tapering. Sculptured by numerous close riblets often fading near the oral aperture. Apex with a narrow, irregular slit in ventral side in well preserved specimens, slightly compressed dorsally. Mouth fragile, translucent, subcircular in section.

Measurements: holotype L 51.7, W 5.1, w 1.6, arc 1.5; paratypes L 61.5, W 6.5, w 1, arc 2; L 50.7, W 5, w 1.2, arc 1.5; L 44.9, W 5, w 1, arc 1.5., W/w ratio 3.18-6.5.

REMARKS. — This species can be compared with some growth stages of *Antalis gardineri*, but the latter species has better defined and regularly spaced ribs and transverse sculpture.

ETYMOLOGY. - Named for Prof. Claude LÉVI, MNHN, senior scientist of the BIOCAL Expedition, and former head of Marine Invertebrates in MNHN.

Fissidentalium metivieri sp. nov.

Figs 61, 62 a, 70 d-e

TYPE MATERIAL. — Holotype MNHN. Paratypes 10 MNHN, 1 NMP, 1 USNM, 2 BMNH 1994.4041.

TYPE LOCALITY. — West Indian Ocean, SW Madagascar, *"Mascareignes III"*, stn 106, 22°24′ S, 43°03′ E, 600 m.

MATERIAL EXAMINED. — **West Indian Ocean**. SW Madagascar, *"Mascareignes III"*: stn 65, 22°26′ S, 43°05′ E, 520 m, 1 lv (paratype). — Stn 67, 22°26′ S, 43°06′ E, 530 m, 1 dd. — Stn 74, 22°26′ S, 43°03′ E, 540 m, 1 lv, 1 dd. — Stn 76, 22°22′ S, 43°04′ E, 530 m, 2 lv (1 paratype). — Stn 82, 22°11′ S, 43°03′ E, 520 m, 1 lv. — Stn 84, 22°21′ S, 43°04′ E, 535 m, 4 lv (1 paratype). — Stn 88, 22°13′ S, 43°04′ E, 525 m, 2 dd (2 paratypes). — Stn 91, 22°25′ S, 43°04′ E, 535 m, 1 lv. — Stn 95, 22°12′ S, 43°03′ E, 590 m, 4 lv (1 paratype MNHN, 1 paratype NMP). — Stn 97, 22°24′ S, 43°04′ E, 600 m, 3 lv. — Stn 100, 22°23′ S, 43°03′ E, 600 m, 2 lv. — Stn 104, 22°22′ S, 43°03′ E, 610 m, 1 lv (paratype USNM). — Stn 106, 22°24′ S, 43°03′ E, 600 m, 3 lv (holotype and 1 paratype). — Stn 111, 22°17′ S, 43°02′ E, 610 m, 2 lv. — Stn 113, 22°11′ S, 43°02′ E, 650 m, 1 dd. — Stn 122, 22°17′ S, 43°03′ E, 600 m, 1 lv, 4 dd. — Stn 126, 22°18′ S, 43°02′ E, 590 m, 10 lv (2 paratypes), 4 dd. — Stn 127, 22°21′ S, 43°02′ E, 610 m, 8 lv, 2 dd.
Madagasgar. *"Vauban"* Crosnier coll. 1973: stn CH 46, 15°19′ S, 46°12′ E, 400 m, 3 dd. — Stn CH 48, 15°18′ S, 46°12′ E, 480-510 m, 1 dd. — Stn CH 49, 15°18′ S, 46°10′ E, 500-550 m, 2 lv, 10 dd (1 paratype). — Stn CH 50, 15°19′ S, 46°12′ E, 405 m, 1 lv, 1 dd. — Stn CH 88, 18°54′ S, 43°55′ E, 280-310 m, 1 dd. — Stn CH 91, 21°26′ S, 43°15′ E, 425-550 m, 1 dd. — Stn CH 102, 22°30′ S, 42°59′ E, 995-1020 m, 2 dd (paratypes BMNH).

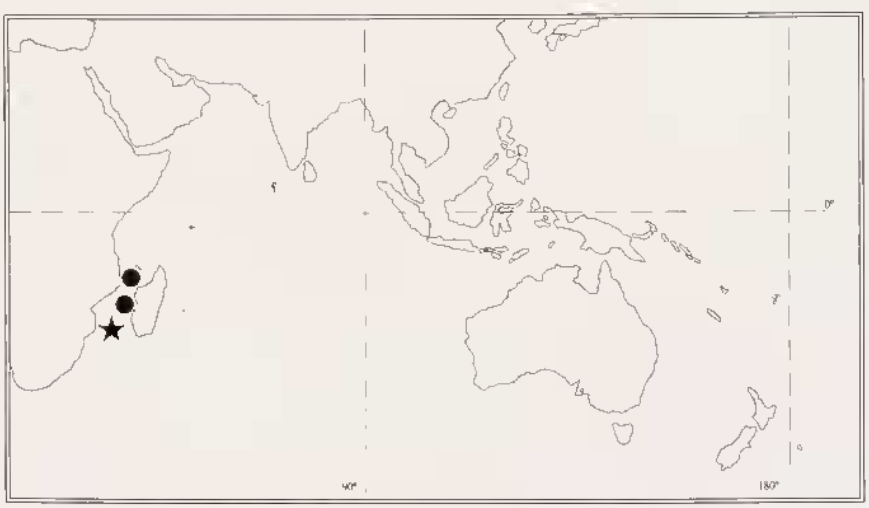


FIG. 61. — Distribution of *Fissidentalium metivieri*.

DISTRIBUTION. — SW Madagascar, Mozambique Channel, alive in 310-650 m, shells to 1020 m.

DESCRIPTION. — *Shell* to 180 mm long, solid, opaque, light brown. Anterior half of shell straight and regularly curved to posterior end, rapidly tapering to apex. Eight primary ribs, of which two latero-dorsal are larger, prominent to mouth. Secondary ribs begin earlier on dorsal than on ventral side, never reaching the strength of the primary ribs. Transverse sculpture cancellate over entire length of shell. Apex with long irregular slit. Mouth straight, section oval dorsoventrally.

Measurements: holotype L 130.9, W 19.6, w 2.4, arc 0.5. W/w ratio 7.1.

REMARKS. — *Fissidentalium metivieri* can be compared to *F. magnificum*, which is more regularly curved, with circular to slightly flattened section, with ribs equal in size and different W/w ratio 5.3/1. *Fissidentalium metivieri* also resembles the fossil *F. rectum* (Linné) in shape, but that species has fine longitudinal striae over the entire surface. *F. exasperatum* is less curved and more sculptured transversally and also has longitudinal striae throughout. *F. metivieri* is the largest known living scaphopod species.

ETYMOLOGY. — Named for Bernard MÉTIVIER, MNHN, who participated in several of the expeditions on which the present report is based, and who assisted in many ways during my visits to Paris.

Other Indo-Pacific species of *Fissidentaliun* cited in the literature

Fissidentalium ceras (Watson, 1879): 510. *"Challenger"* stn 246, 36°10′ N, 178°00′ E, 2050 fms [3747 m]. Mid Pacific E of Japan. Syntypes BMNH 1887.2.9.10-11.

Fissidentalium complexum (Dall, 1895): 687, pl. 26, fig. 3. *"Albatross"*, stn 3472, 256-280 fms [468-512 m], Near Hawaii Is. Holotype USNM 107023.

Fissidentalium eualdes (Barnard, 1963a): 444. Off South Africa, 33°36′ S, 16°15′ E, 2778-2870 m. Syntypes SAM *(fide* BARNARD, 1963b, not seen) and BMNH (1 dd, no registration number).

Fissidentalium exasperatum (Sowerby, 1903): 225, pl. 5, fig. 12. South Africa, Umhloti river mouth, 49 m. 3 syntypes dd BMNH 1903.7.27.57-59.

Fissidentalium lima Kuroda & Habe *in* Habe, 1963: 260, pl. 37, fig. 15. Japan, Okinoshima, Shikoku, 40 m. NSMT.

Fissidentalium horikoshii Okutani, 1982: 1, figs 1-5. E of Japan, 38°22′ N, 143°26′ E, 2930-3020 m. NSMT.

Fissidentalium kawamurai Kuroda & Habe *in* Habe,1962: 106, pl. 47, fig. 14. Ashizurimisaki, Kochi Prefecture, Japan. NSMT.

Fissidentalium laterischismum Shikama & Habe, 1963: 249, textfig. 1-2. Okhotsk Sea, off Monbetsu, Hokkaido, Japan.

Fissidentalium platypleurum (Tomlin, 1931): 339. South Africa, off Itongazi River, Natal, 46 m. SAM.

Fissidentalium salpinx (Tomlin, 1931): 338, fig. 1. Off South Africa, "Cape Point NE 3/4°E 40 miles, 1280-1462 m". SAM.

Fissidentalium tenuicostatum Qi & Ma, 1986: 69. South China Seas.

Fissidentalium yokoyamai (Makiyama, 1931): 44, pl. 1, fig. 1. Yokosuka City, Honshu, Japan.

Fissidentalium zelandicum (Sowerby, 1860): 101, pl. 223 (*Dentalium* 1), fig. 13. New Zealand. BMNH (not seen).

Genus *SCHIZODENTALIUM* Sowerby, 1894

Type species (by monotypy): *Schizodentalium plurifissuratum* Sowerby, 1894.

DIAGNOSIS. — *Shell* long, moderately curved, solid, opaque, cream to light brown. Longitudinally hardly sculptured with primary ribs; secondary ribs present, starting near the apex and reaching almost the size of the primary ones at the oral area. Rib section angled; cancellated. Intercostal spaces concave, sculptured. Apex a fissure furnished with a series of 3-5 elongated holes on the ventral side. Section polygonal.
Radula as in *Fissidentalium*.

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf to abyssal.

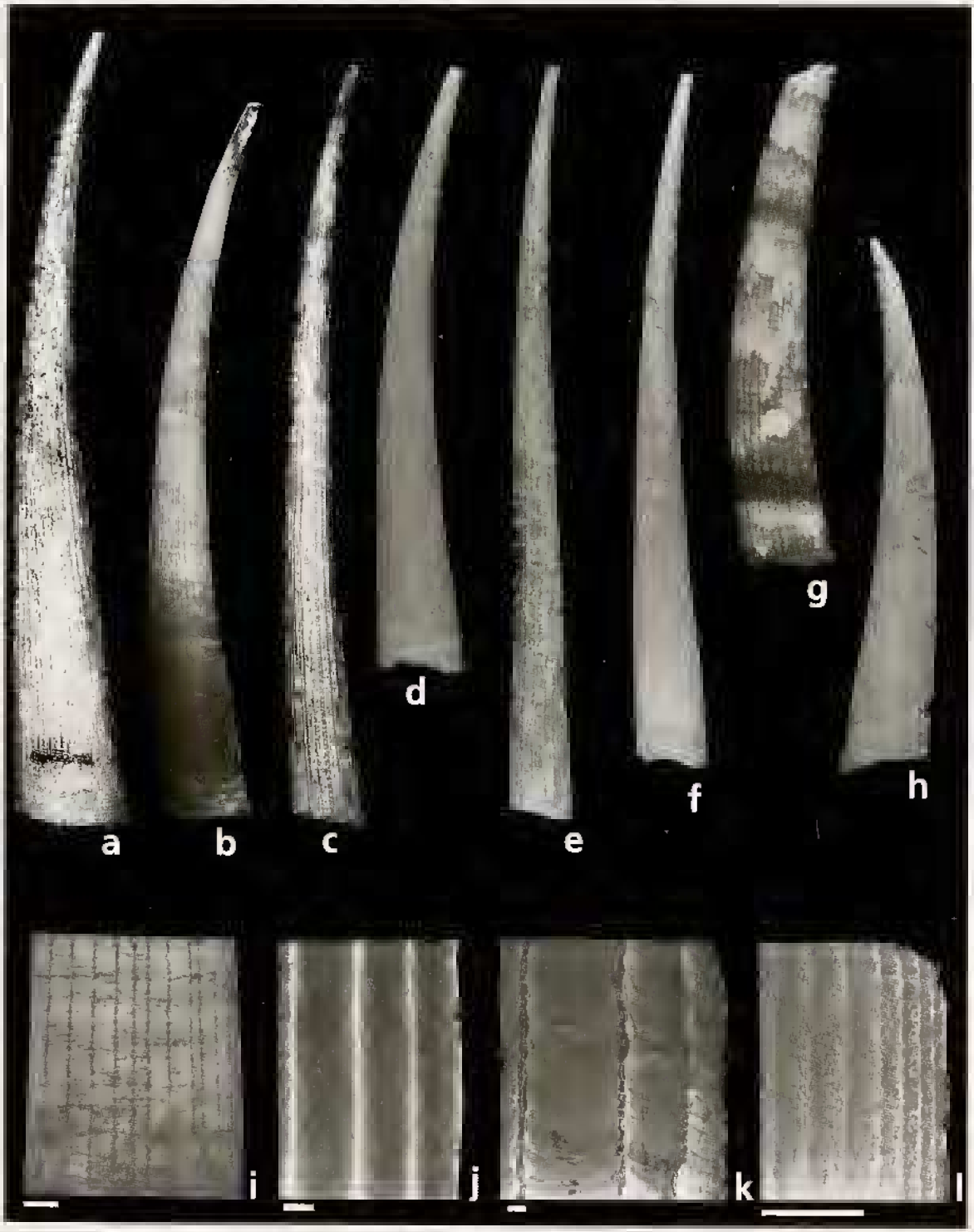


FIG. 62. — **a**. *Fissidentalium metivieri*, holotype (130.9 mm). — **b**, *Fissidentalium magnificum* (115 mm), MUSORSTOM 2: stn CP 25. — **c**, *Fissidentalium vicdani* (114 mm), MUSORSTOM 3: stn CP 118. — **d**, *Fissidentalium malayanum* (55 mm), BIOGEOCAL: stn CP 250. — **e**, *Compressidentalium subcurvatum* (78 mm), CORINDON: stn DR 231. — **f**, *Fissidentalium profundorum* (71 mm), CORINDON: stn DR 229. — **g**. *Pictodentalium festivum* (50 mm), New Caledonia LAGON: stn 424. — **h**, *Fissidentalium cornubovis* (56 mm), BENTHEDI: stn CH 87. — **i**, *F. magnificum*, detail of the sculpture. — **j**, *F. malayanum*, detail of the sculpture. — **k**, *C. subcurvatum*, detail of the sculpture. — **l**. *F. profundorum*, detail of the sculpture. Scale lines: 100 µm (i, j, k), 1 mm (b).

Schizodentalium plurifissuratum Sowerby, 1894

Figs 63, 70 f

Schizodentalium plurifissuratum Sowerby, 1894: 158, pl. 12, fig. 24.

Other references:

Dentalium plurifissuratum – Pilsbry & Sharp, 1897: 82, pl. 6, figs 87-89. — Sowerby, 1903: 231. — Smith, 1906b: 57. — Plate, 1908a: 344, pl. 30. figs 12-16. — Bartsch, 1915: 181. — Barnard, 1963b: 347.
Dentalium multistriatum – Plate, 1908: 437. — Jaeckel, 1932: 304.

Type material. — Holotype BMNH 95.4.29.179, paratypes BMNH 95.4.29.80-81.

Type locality. — Said to be from Hong Kong (erroneous).

Material examined. — **South Africa**. *"Meiring Naudé"*: stn SM 184, 33°39′ S, 27°12′ E, 86 m, 1 dd. — Stn SM 185, 33°39′ S, 27°11′ E, 90 m, 1 dd (SAM).

Fig. 63. — Distribution of *Schizodentalium plurifissuratum*.

Distribution. — Apparently endemic to South Africa and Agulhas Bank (Sowerby, 1903). No information on living depth range; shells from 86 m (present paper) to 564 m (Barnard, 1963b).

Genus *Compressidentalium* Habe, 1963

Type species (OD): *Dentalium hungerfordi* Pilsbry & Sharp, 1897.

Diagnosis. — *Shell* medium to large, slightly curved to almost straight, usually curved only at apical portion. Solid, polished, white to red. Longitudinal sculpture of more than 14 strong primary ribs; secondary ribs present, reaching the oral area. Rib section flat at top, round, smooth. Intercostal spaces concave, smooth or with longitudinal striae. Apex with flat, V-shaped notch on ventral side, apical callus with terminal pipe or irregular slit. Section strongly compressed dorsoventrally. Oral aperture oval or subtriangular.
Radula similar to that of *Antalis*.

DISTRIBUTION. — Pacific and Indian Oceans. Absent in the Atlantic Ocean. Temperate-tropical, shelf to abyssal.

Compressidentalium hungerfordi (Pilsbry & Sharp, 1897)

Figs 64, 70 g

Dentalium hungerfordi Pilsbry & Sharp, 1897: 84, pl. 6, fig. 86 (*nom. nov. pro Deutalium compressum* Sowerby, 1888: 569, pl. 28, fig. 18, *non* Watson, 1879).

Other references:

Dentalium (*Fissidentalium*) *hungerfordi* — BOISSEVAIN, 1906: 38, pl. 2, fig. 30. — HIRASE, 1931: 293, figs 749-750. — KIRA, 1955: 80, pl. 40, fig. 10.
Fissidentalium (*Compressidentalium*) *hungerfordi* — HABE, 1963: 260, pl. 37, fig. 14, textfigs 25-26; 1964a: 17, pl. 1, fig. 14, pl. 4, figs 25-26; 1971: 487 (Japanese text), 306 (English text), pl. 65, figs 2-3. — HABE, 1977: 332. — HIGO & GOTO, 1993: 686.

TYPE MATERIAL. — Holotype BMNH 1881.2.1.1.

TYPE LOCALITY. — Hong Kong.

MATERIAL EXAMINED. — **Japan**. Tosa Bay, Shikoku, 100 fms [183 m], Coll. STAADT, 1 dd (MNHN).

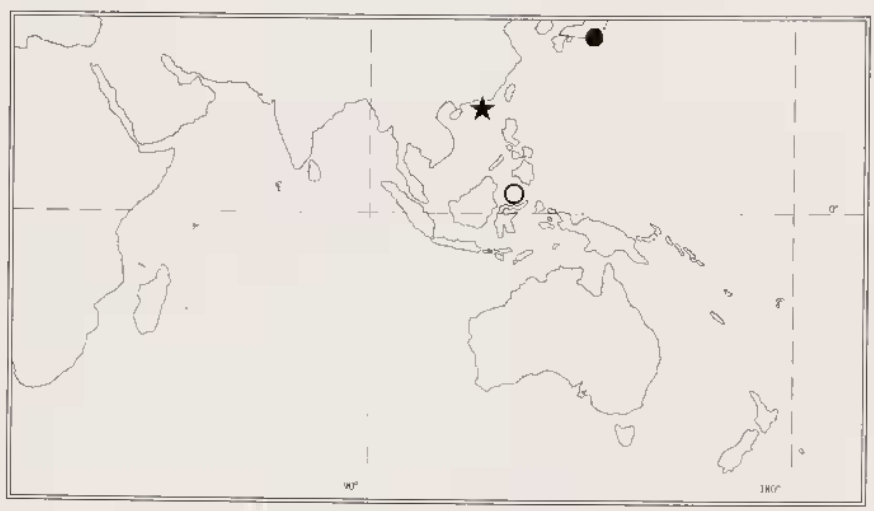


FIG. 64. — Distribution of *Compressidentalium hungerfordi*.

DISTRIBUTION. — Indonesia, China, Japan, 50-1570 m.

Compressidentalium compressiusculum (Boissevain, 1906)

Figs 65, 70 h, 73 h

Dentalium compressiusculum Boissevain, 1906: 33, pl. 6, fig. 12.

Other reference:

Fissidentalium (*Compressidentalium*) *compressiusculum* — HABE & KOSUGE, 1964: 4.

TYPE MATERIAL. — Holotype ZMA 3.06.044.

TYPE LOCALITY. — *"Siboga"*, stn 241, 04°24′ S, 129°49′ E, 1570 m, Banda Sea.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. CORAIL 2: stn DW 172, 18°26′ S, 155°12′ E, 1100 m, 5 dd.
New Caledonia. BIOCAL: stn KG 95, 21°22′ S, 166°33′ E, 2365 m, 1 dd.
BIOGEOCAL: stn KG 248, 21°15′ S, 166°29′ E, 2340 m, 1 dd. — Stn DW 296, 20°38′ S, 167°10′ E, 1230-1270 m, 4 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 1080 m, 1 lv.
"Galathea": stn 490, 05°25′ S, 117°03′ E, 585 m, 2 dd (ZMC).
Philippines. MUSORSTOM 2: stn CP 50, 13°37′ N, 120°34′ E, 810-820 m, 2 lv. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 12 lv, 28 dd. — Stn CP 79, 13°44′ N, 120°32′ E, 682-770 m, 1 dd. — Stn CP 81, 13°34′ N, 120°31′ E, 856-884 m, 2 lv.
MUSORSTOM 3: stn DR 93, 13°49′ N, 120°02′ E, 540 m, 8 lv, 12 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 5 lv, 25 dd.
ESTASE 2: stn CP 6, 04°38′ N, 119°49′ E, 2570 m, 4 lv, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 64, 12°41′ S, 44°57′ E, 860-770 m, 1 dd.
MD 32 Réunion: stn DC 18, 21°19′ S, 55°16′ E, 3150-3225 m, 1 dd. — Stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 4 dd. — Stn DR 106, 20°48′ S, 55°05′ E, 1710-1730 m, 2 dd.

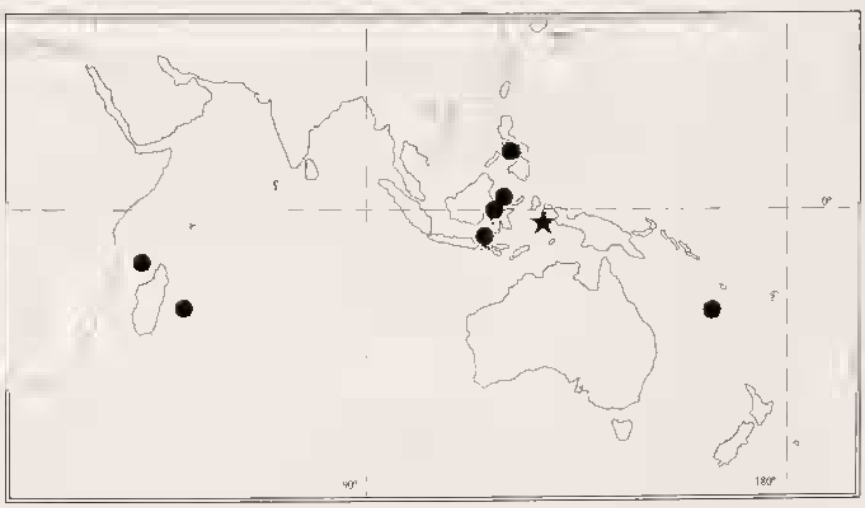


FIG. 65. — Distribution of *Compressidentalium compressiusculum*.

DISTRIBUTION. — Indonesia, now extended to the Philippines, New Caledonia and the Western Indian Ocean; live records from 540 to 2570 m, mostly between 540 and 700 m (present paper).

Compressidentalium sedecimcostatum (Boissevain, 1906)

Figs 66, 70 j

Dentalium sedecimcostatum Boissevain, 1906: 33, pl. 6, figs 8-11.

Other references:

Dentalium sedecimcostatum — PLATE, 1908: 347.
Fissidentalium (Compressidentaliun?) sedecimcostatum — HABE & KOSUGE, 1964: 4.
Striodentalium sedecimcostatum — QI & MA, 1989: 118, figs 10a-b.

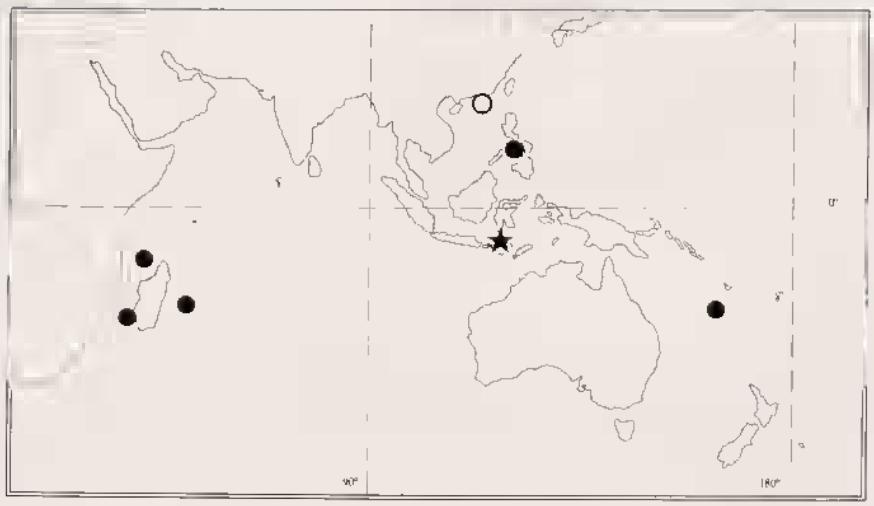


FIG. 66. — Distribution of *Compressidentalium sedecimcostatum*.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.035, paralectotypes ZMA 3.06.036-043.

TYPE LOCALITY. — *"Siboga"*, stn 52, 09°03′ S, 119°57′ E, 959 m, Banda Sea.

MATERIAL EXAMINED. — The type material.

Chesterfield Islands. MUSORSTOM 5: stn DC 321, 21°20′ S, 158°02′ E, 1000 m, 2 dd. — Stn CP 324, 21°15′ S, 157°51′ E, 970 m, 1 lv.

New Caledonia. *"Vauban"* 1978-79: stn 32, 22°32′ S, 166°25′ E, 430-500 m, 1 lv. — Stn 33, 22°33′ S, 166°25′ E, 290-350 m, 2 lv, 7 dd. — Stn 34, 22°32′ S, 166°26′ E, 350-420 m, 2 lv, 6 dd. — Stn 35, 22°32′ S, 166°26′ E, 250-375 m, 1 dd. — Stn 39, 22°29′ S, 166°23′ E, 375-550 m, 1 dd. — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 8 lv, 47 dd.

BIOCAL: stn CP 29, 23°08′ S, 166°40′ E, 1100 m, 1 dd. — Stn CP 30, 23°09′ S, 166°41′ E, 1140 m, 1 dd. — Stn CP 55, 23°20′ S, 167°30′ E, 1160-1175 m, 1 lv, 3 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 2 lv, 4 dd. — Stn CP 69, 23°52′ S, 167°58′ E, 1220-1225 m, 1 dd. — Stn DW 104, 21°31′ S, 166°21′ E, 375-450 m, 3 dd.

LAGON: stn 872, 20°37′ S, 165°58′ E, 105 m, 1 dd.

Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 2 lv, 7 dd.

BIOGEOCAL: stn KG 219, 22°39′ S, 166°34′ E, 570 m, 1 dd. — Stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 2 dd. — Stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 4 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 2 lv, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 2 dd.

MUSORSTOM 4: stn DC 168, 18°48′ S, 163°11′ E, 720 m, 1 dd. — Stn DW 220, 22°58′ S, 167°38′ E, 505-550 m, 1 lv. — Stn CP 242, 22°06′ S, 167°10′ E, 500-550 m, 1 lv.

Loyalty Islands. MUSORSTOM 6: stn DW 394, 20°49′ S, 167°09′ E, 570 m, 3 lv, 6 dd. — Stn DW 424, 20°24′ S, 166°25′ E, 599 m, 1 lv, 1 dd. — Stn DW 425, 20°24′ S, 166°25′ E, 594 m, 4 dd. — Stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd. — Stn DW 483, 21°20′ S, 167°48′ E, 600 m, 1 lv, 1 dd.

Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 1 lv.

MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 3 lv, 1 dd.

West Indian Ocean. BENTHEDI: stn DR 33, 12°54′ S, 45°16′ E, 275-400 m, 3 lv, 14 dd. — Stn DR 38, 12°55′ S, 45°16′ E, 200-500 m, 7 lv, 6 dd. — Stn DS 42, 13°05′ S, 45°08′ E, 400-520 m, 3 lv. — Stn F 61, 12°46′ S, 44°58′ E, 475-510 m, 2 lv, 7 dd. — Stn DS 62, 12°46′ S, 44°58′ E, 530-535 m, 1 dd.

MD 32 Réunion: stn DC 10, 21°13′ S, 55°52′ E, 930-980 m, 2 dd. — Stn DC 58, 21°03′ S, 55°10′ E, 450 m, 5 lv, 14 dd. — Stn DC 64, 21°12′ S, 55°04′ E, 1150-1180 m, 1 lv, 3 dd. — Stn DC 112, 20°53′ S, 55°09′ E, 740-780 m, 1 dd. — Stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 4 lv, 2 dd.

"Mascareignes III": R. von Cosel coll. 1986: stn 97, 22°24′ S, 43°04′ E, 600 m, 1 dd.

DISTRIBUTION. — Indonesia, East China Seas, 550 m (QI & MA, 1989) to East Africa, 1143 m (PLATE, 1908). Now extended to New Caledonia; live records from 250 to 2050 m (present paper).

Compressidentalium subcurvatum (Smith, 1906)

Figs 62 e, k, 67, 71 g

Dentalium subcurvatum Smith, 1906a [October]: 251.

Synonym:

Dentalium martensi Boissevain, 1906 [December]: 34, pl. 4, fig. 19 (**Syn. nov.**).

Other references:

Dentalium subcurvatum – ANNANDALE & STEWART, 1909: pl. 23, fig. 3. — WINCKWORTH, 1940a: 25.
Dentalium martensi – LUDBROOK, 1954: 93.
Fissidentalium martensi – KOSUGE, 1985: 59, pl. 23, fig. 4.

TYPE MATERIAL. — *D. subcurvatum*: holotype BMNH. — *D. martensi*: lectotype (here designated) ZMA 3.06.045, paralectotypes ZMA 3.06.046.047.

TYPE LOCALITY. — *D. subcurvatum*: Indian Ocean, SW Cape Comorin, *"Investigator"* stn 275, 08°27′ N, 75°35′ E, 731-771 fms [1336-1409 m]. — *D. martensi*: Indonesia, *"Siboga"*, stn 88, 00°35′ N, 119°09′ E, 1301 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. MUSORSTOM 4: stn DC 168, 18°48′ S, 163°11′ E, 720 m, 1 lv.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 980-1080 m, 1 lv.
"Snellius" II: stn 4.164, 06°24′ S, 120°21′ E (no depth data), 5 dd (RMNH).
Philippines. MUSORSTOM 1: stn CP 47, 13°41′ N, 120°30′ E, 685-757 m, 1 dd.
MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 91 lv, 181 dd. — Stn CP 55, 13°54′ N, 119°59′ E, 865-866 m, 10 lv, 12 dd. — Stn CP 81, 13°34′ N, 121°31′ E, 856-884 m, 4 lv, 3 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn DR 95, 13°56′ N, 119°59′ E, 865 m, 2 lv, 11 dd. — Stn CP 114, 13°34′ N, 120°29′ E, 1000-1040 m, 1 lv.
West Indian Ocean. NW Madagascar, Crosnier coll. 1975: stn CH 142, 13°46′ S, 47°34′ E, 1250-1300 m, 5 dd.

FIG. 67. — Distribution of *Compressidentalium subcurvatum*.

DISTRIBUTION. — Indian Ocean and Indonesia, now extended to the Philippines and New Caledonia; live records from 685 to 1090 m (present paper) and shells from 142 to 1411 m.

REMARKS. — *Fissidentalium clathratum* Martens, 1881, from Northeastern Australia, could be a senior synonym of *C. subcurvatum*, but until type material of that species is examined, it appears best to consider *C. subcurvatum* the valid name of the present species.

Compressidentalium zanzibarense (Plate, 1908)

Figs 68, 70 i

Dentalium zanzibarense Plate, 1908a: 384, pl. 3, figs 35-36.

Other reference:
Dentalium zanzibarense – LUDBROOK, 1954: 93.

TYPE MATERIAL. — Holotype ZMB 61092 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *"Valdivia"*, stn 245, 05°28′ S, 39°18′ E, 463 m, Zanzibar Channel.

MATERIAL EXAMINED. — **West Indian Ocean.** BENTHEDI: stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv, 1 dd.
MD32 Réunion: stn CP 105, 20°47′ S, 55°04′ E, 1740-1850 m, 9 lv, 14 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 lv. — Stn DC 138, 24°41′ S, 55°36′ E, 1500-1590 m, 4 dd.
"Meiring Naudé": stn SM 53, 26°51′ S, 33°13′ E, 720 m, 1 dd. — Stn SM 78, 27°32′ S, 32°50′ E, 750 m, 1 lv, 3 dd. — Stn SM 86, 28°00′ S, 32°41′ E, 550 m, 1 dd. — Stn SM 94, 28°16′ S, 32°39′ E, 670 m, 1 dd. — Stn SM 117, 30°18′ S, 31°10′ E, 820 m, 3 dd. — Stn SM 121, 30°32′ S, 30°53′ E, 625-900 m, 1 dd. — Stn SM 123, 30°33′ S, 30°49′ E, 690 m, 1 lv. — Stn SM 129, 30°53′ S, 30°31′ E, 850 m, 1 dd. — Stn SM 131, 30°43′ S, 30°42′ E, 780 m, 8 dd. — Stn SM 226, 32°29′ S, 28°59′ E, 710-775 m, 36 dd. — Stn SM 232, 32°15′ S, 29°10′ E, 260-620 m, 1 dd.

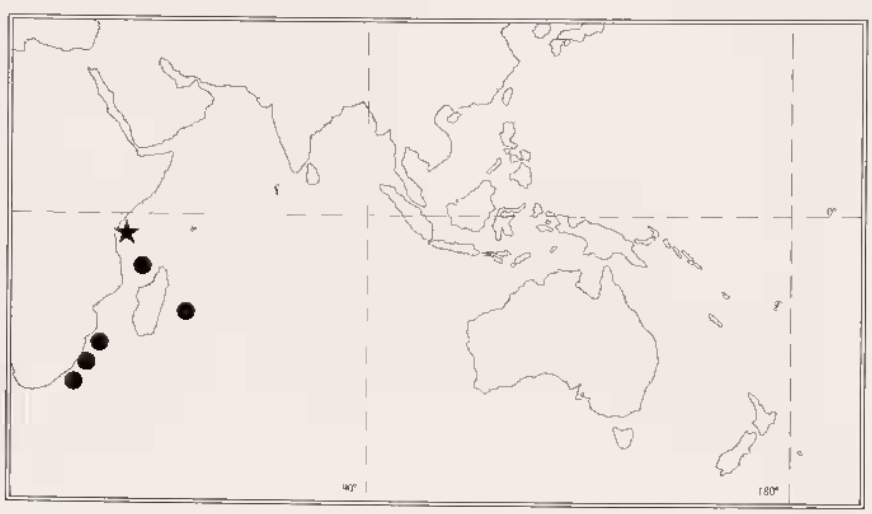


FIG. 68. — Distribution of *Compressidentalium zanzibarense*.

DISTRIBUTION. — Off Zanzibar, now extended to Madagascar, Réunion Island and South Africa, recorded alive from 690 to 1850 m.

Compressidentalium ceciliae sp. nov.

Figs 69, 70 k, 71 i

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 AMS C201725, 1 NMNZ M268958, 1 USNM.

TYPE LOCALITY. — Southern New Caledonia, MUSORSTOM 4, stn DW 220, 22°58′ S, 167°38′ S, 505-550 m.

MATERIAL EXAMINED. — **New Caledonia**. MUSORSTOM 4: stn DW 220, 22°58′ S, 167°38′ S, 505-550 m, 9 lv (holotype and paratypes: 7 MNHN, 1 NMNZ).
BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 4 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 2 lv, 6 dd. — Stn DW 51, 23°05′ S, 167°45′ E, 680-700 m, 13 lv (paratypes: 4 MNHN, 1 AMS), 21 dd (1 paratype USNM).

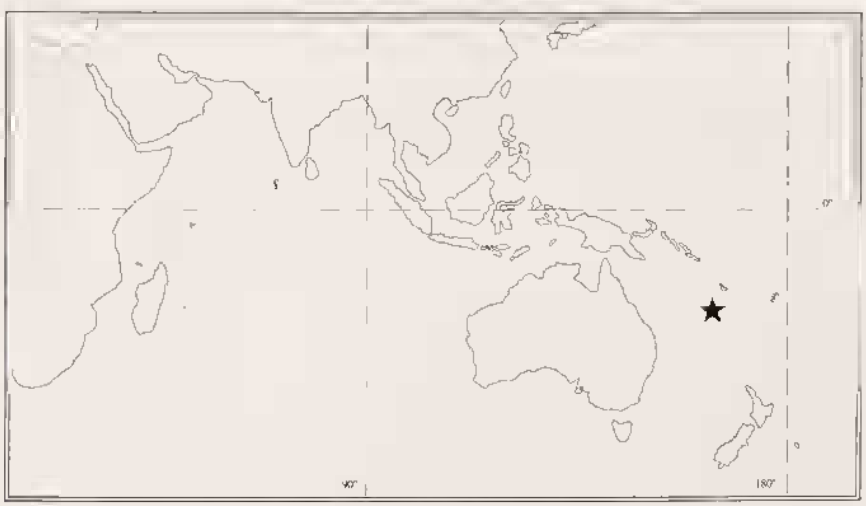


FIG. 69. — Distribution of *Compressidentalium ceciliae*.

DISTRIBUTION. — E and SE New Caledonia, living in 505-700 m.

DESCRIPTION. — *Shell* to 36 mm long, solid, polished, white, straight for the anterior three fourths, then curved at posterior end. Section subcircular at apex, strongly compressed dorsoventrally otherwise. Sculpture consists of 15 smooth prominent, primary ribs, more polished than the interspaces. Two lateral ribs noticeably more prominent are present on some specimens. Secondary ribs originate on the posterior 1/3 of the shell, becoming as prominent as the primary ribs at the anterior end. Mouth oval, more compressed on ventral side. Apex narrow with V-shaped notch on ventral side.

Measurements: holotype L 34.7, W 3.6-3, w 0.5, arc 1 (in the curved part); paratypes L 34, W 3.6-3, w 0.8, arc 0.8; L 31.9, W 3.4-2.9, w 0.7, arc 0.7; L 35.5, W 3.7-3.2, w 0.7, arc 1; L 29, W 3.6-3.1, w 0.9, arc 1.1; L 27.1, W 3.3-3, w 0.7, arc 0.9; L 15.7, W 2.3-2, w 0.7, arc 0.5. W/w ratio 7.2-3.2.

ETYMOLOGY. — Named for the author' s wife, Cecilia VALDÉS.

Other Indo-Pacific species of *Compressidentalium* cited in the literature

Compressidentalium clathratum (Martens, 1881): 66. Off Moreton Bay, NE Australia, *"Gazelle"*, 1005 m. Holotype ZMB 33122 (*fide* KILIAS, 1995).

Compressidentalium lardum (Barnard, 1963a): 445. Off South Africa, 33°26' S, 16°33' E, 2267-2376 m. SAM and paratype BMNH 1964.2.42.
Compressidentalium sibogae (Boissevain, 1906): 39, pl. 4, figs 17-18, textfig. 22. Indonesia, *"Siboga"*, stn 159, 00°59' S, 129°49' E, 411 m. ZMA.
Compressidentalium sumatrense (Jaeckel, 1932): 304, textfig. 3. Indonesia, Sumatra, *"Valdivia"*, stn 191, 00°39' S, 98°52' E, 750 m. Holotype ZMB 61081.

Genus *Coccodentalium* Sacco, 1896

Type species (OD): *Dentalium radula* Schröter, 1784. Miocene, Italy.

DIAGNOSIS. — *Shell* medium in length, nearly straight, solid, polished, white, usually with dark brown markings. Longitudinal sculpture of 6 primary ribs, secondary ribs reaching oral area. Rib section round, irregular due to nodules, cancellate throughout. Intercostal spaces concave, transversally sculptured. Apex with flat V-shaped notch on ventral side, lumen circular. Section polygonal at apex, subpolygonal at aperture.
Radula rachidian with anterior border irregular and granulose; lateral similar to *Dentalium*, smooth; marginal sigmoidal.

DISTRIBUTION. — Eocene-Recent, Pacific and Indian Oceans, shelf to bathyal.

Coccodentalium gemmiparum (Melvill, 1909)

Figs 70 l-m, 72, 73 e-f

Dentalium gemmiparum Melvill, 1909: 120, pl. 5, fig. 10.

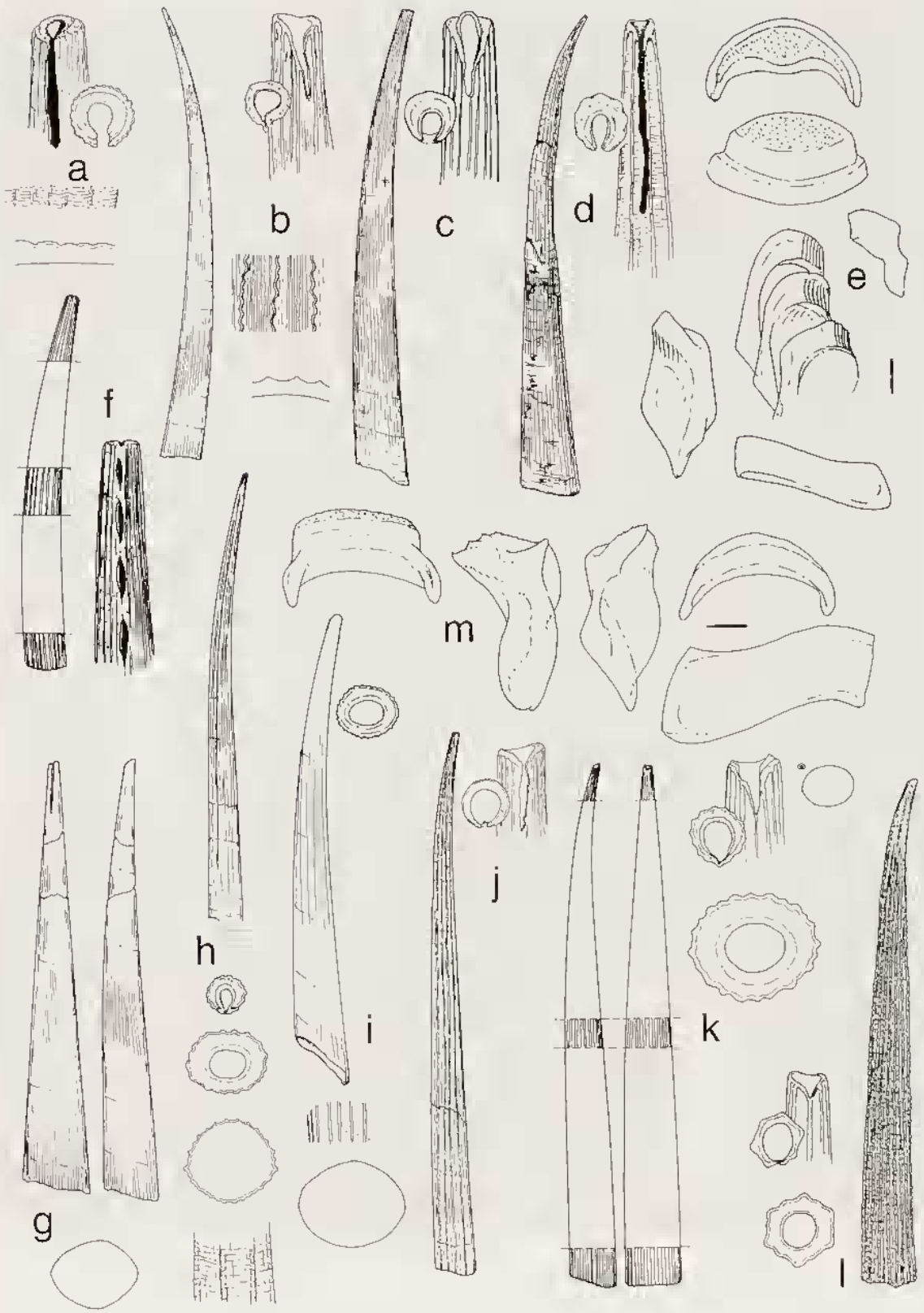
TYPE MATERIAL. — Holotype BMNH 1910.3.17.5.

TYPE LOCALITY. — Indian Ocean, Chagos Archipelago, Diego Garc°a Lagoon.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOGEOCAL: stn CP 278, 22°48' S, 166°20' E, 2250 m, 1 dd.
Philippines. MUSORSTOM 3: stn DR 126, 11°49' N, 121°22' E, 266 m, 2 dd. — Stn CP 139, 11°53' N, 122°14' E, 240-267 m, 153 lv, 96 dd.

DISTRIBUTION. — Chagos Archipelago, now extended to the Philippines and New Caledonia, alive in 240-267 m (present paper), shell (probably washed down) in 2250 m.

FIG. 70. — **a**, *Fissidentalium profundorum*, apex and apical section, detail of sculpture, section of ribs, BIOGEOCAL: stn CP 238. — **b**, *Fissidentalium serrulatum*, shell (65 mm), apex and apical section, detail of sculpture, section of ribs, CORINDON: stn DR 216. — **c**, *Fissidentalium levii* sp. nov., holotype, shell (51.7 mm), apex and apical section. — **d**, *Fissidentalium metivieri* sp. nov. (paratype), shell (154 mm), apex and apical section. — **e**, *Fissidentalium metivieri* sp. nov., radula; rachidian, external and internal face, transversal and sagittal section; laterals, posterior view; marginal contact area with laterals at left. — **f**, *Schizodentalium plurifissuratum*, shell (45 mm), apex. — **g**, *Compressidentalium hungerfordi*, shell (85 mm), ventral and lateral views, oral section, Japan (MNHN). — **h**, *Compressidentalium compressiusculum*, shell (60 mm), apical, posterior 1/4, and anterior1/4 sections (note the two latero-ventral more prominent ribs), detail of the sculpture, ESTASE 2: stn CP 6. — **i**, *Compressidentalium zanzibarense*, shell (32 mm), apical and oral sections, detail of the sculpture, *"Meiring Naudé"*: stn 131 . — **j**, *Compressidentalium sericimcostatum*, shell (52 mm), apex and apical section, *"Vauban"* 1978-79: stn 34. — **k**, *Compressidentalium ceciliae* sp. nov., holotype, shell (34.7 mm), lateral and dorsal views, apex, apical, medial and oral sections. — **l**, *Coccodentalium gemmiparum*, shell (37 mm), apex, apical sections, MUSORSTOM 3: stn CP 139. — **m**, *Coccodentalium* type radula (*C. gemmiparum*). Scale line: 100 µm.



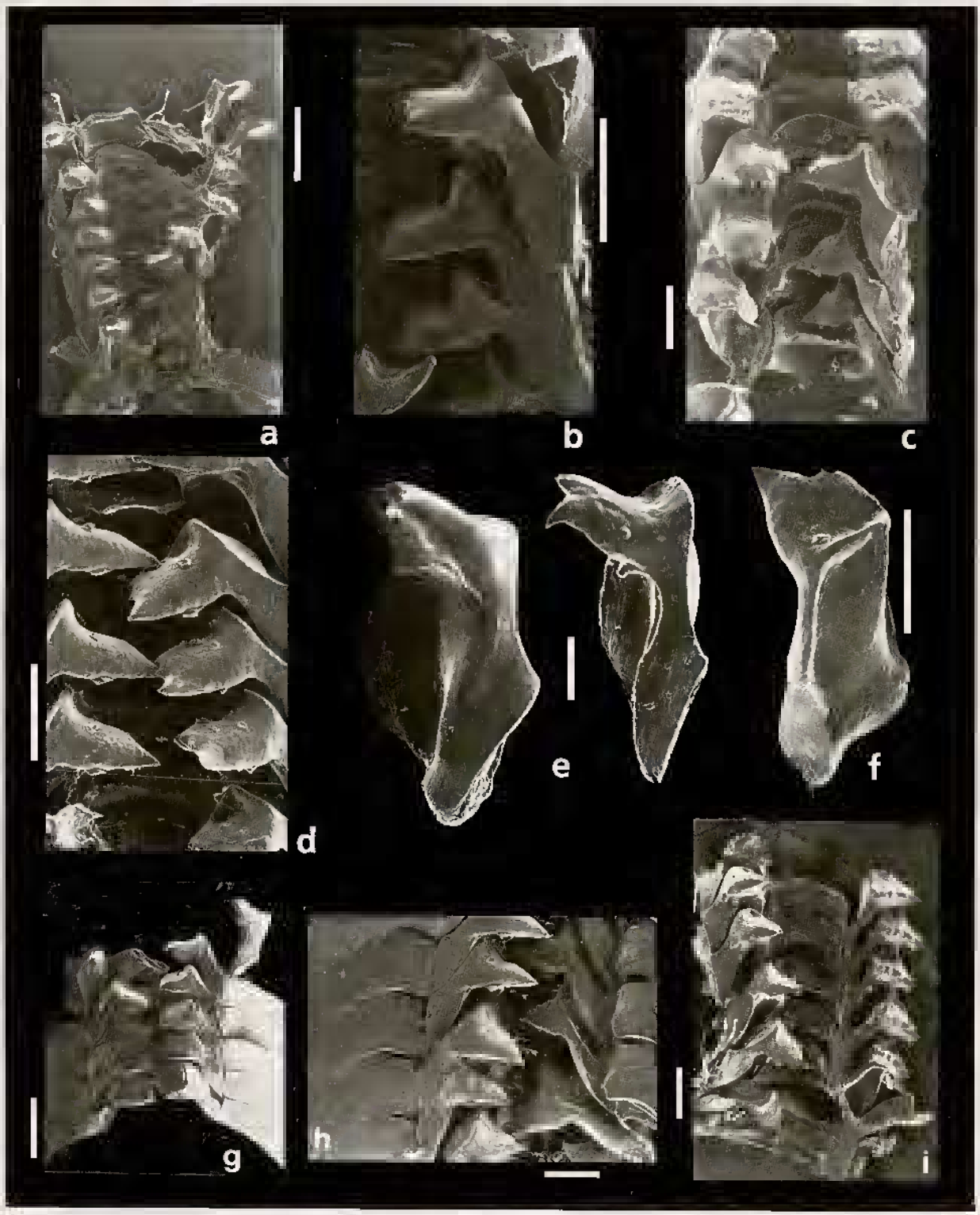


FIG. 71. — Radulae. — **a**, *Deutalium deforgesi*, general view, note the tooth of the right column in different positions. — **b**, same specimen, detail of laterals. — **c**, *Deutalium caledonicum*, general view. — **d**, *Dentalium oryx*, view of the heads of laterals. — **e**, *Fustiaria langfordi*, detail of laterals. — **f**, *Graptacme lactea*, external face of a lateral tooth. — **g**, *Compressidentalium subcurvatum*, general view. — **h**, *Fustiaria vagina*, general view. — **i**, *Compressidentalium ceciliae*, general view. Scale bars: 200 µm (a, c, e), 100 µm (b, d, f, h, i), 500 µm (g).

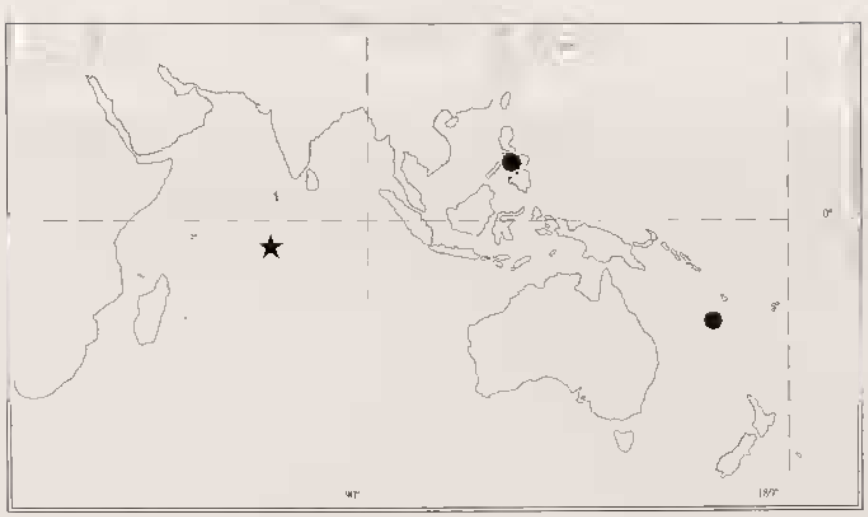


FIG. 72. — Distribution of *Coccodentalium gemmiparum*.

Genus *PICTODENTALIUM* Palmer, 1974

Type species (OD): *Dentalium hirasei* Kira, 1959.

DIAGNOSIS. — *Shell* medium to very large, slightly to well curved, solid, polished, light yellow to brightly coloured with red, violet and green patches. Longitudinal sculpture of wide primary ribs and secondary ribs reaching the oral area. Rib section flat-topped to rounded. Intercostal spaces, straight or concave, smooth or longitudinally sculptured. Apex with terminal callus and flat V-shaped notch on ventral side; fissured terminal pipe. Section circular to slightly compressed dorsoventrally. Oral aperture usually thin and coloured.
Radula rachidian flat, curved, anterior margin very slightly granulose; lateral with prominent primary cusp and sculptured head; marginal slightly curved.

DISTRIBUTION. — Recent, Pacific and Indian Oceans, absent in the Atlantic Ocean, sublittoral to bathyal.

REMARKS. — *Pictodentalium* was invalidly introduced by KIRA (1959), who is generally cited as author of this name. However, I refer to the discussion by BIELER & PETIT (1990), who credit authorship of *Pictodentalium* to PALMER (1974).

Pictodentalium formosum (Adams & Reeve, 1848)

Figs 74, 77 b

Dentalium formosum Adams & Reeve, 1848: 71, pl. 5, figs 1a-b.

Synonyms:

Pictodentalium formosum hirasei Kira, 1959: 117, pl. 41, fig. 11.
Fissidentalium formosum harrisoni Habe, 1970: 95.

Other references:

Dentalium formosum – SOWERBY, 1860: 102, pl. 223 (*Dentalium* 1), fig. 2; 1873: pl. 2, fig. 7. — CLESSIN, 1896: 21, pl. 6, fig. 7. — PILSBRY & SHARP, 1897: 2, pl. 1, figs 9-11. — BOISSEVAIN, 1906: 8, pl. 1, fig. 2. — KIRA, 1955: 80, pl. 40, fig. 11.
Dentalium (Dentalium) formosum – HIRASE, 1931: 135, pl. 3, fig. 3.
Pictodentalium formosum – HABE, 1977: 332.

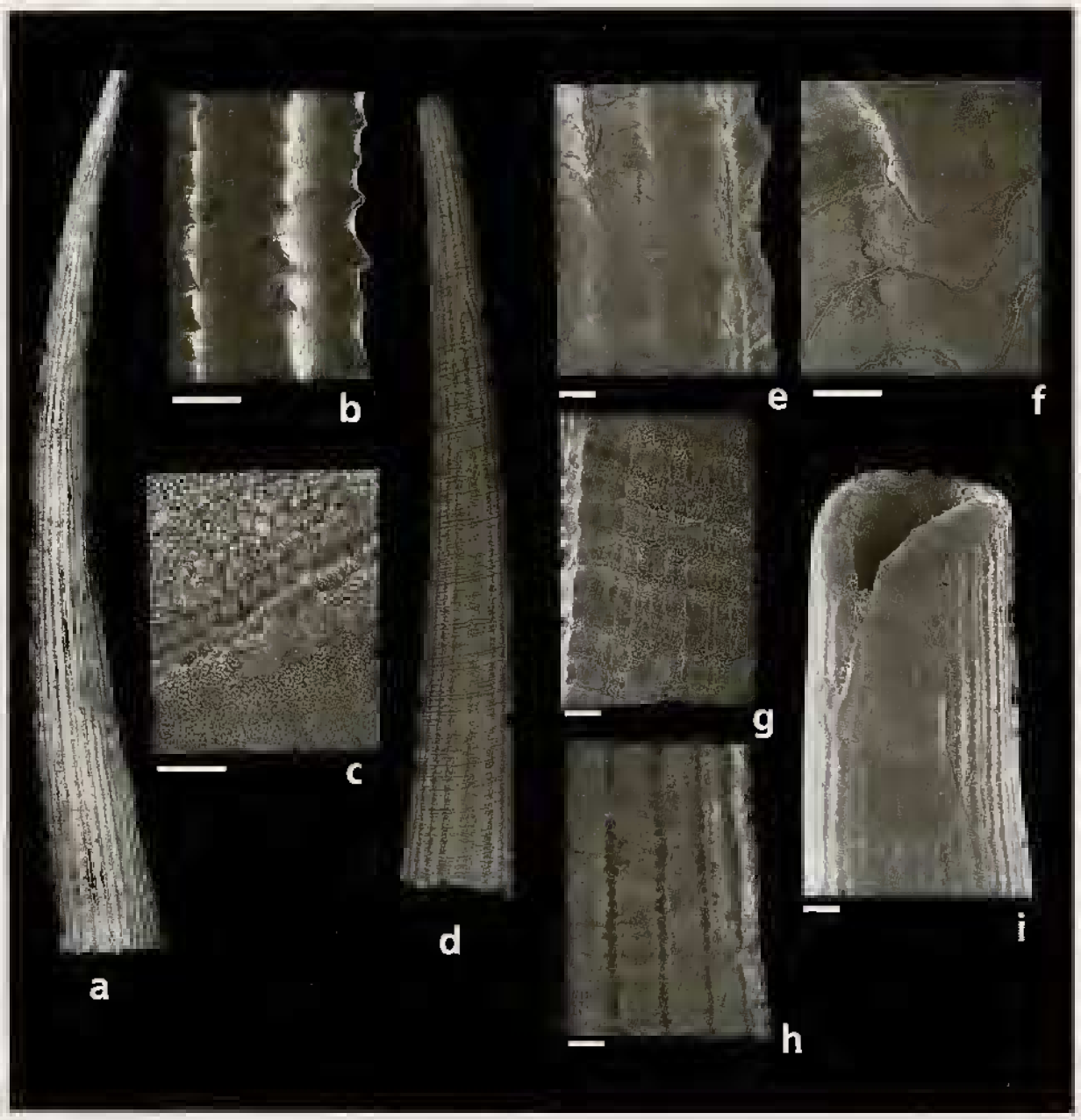


FIG. 73. — **a-d** *Fissidentalium shoplandi* (153 mm), MUSORSTOM 3: stn CP 128. — **b-c**, details of the sculpture. — **d**, *Fissidentalium shoplandi*, holotype (71 mm). — **e-f**, *Coccodentalium gemmiparum*, details of sculpture. — **g**, *Antalis boucheti*, detail of the sculpture. — **h**, *Compressidentalium compressiusculum*, detail of the sculpture. — **i**, *Graptacme lactea*, apex and sculpture. Scale bars: 100 µm (b, e, g, h, i), 10 µm (c, f).

Pictodentalium formosum hirasei – OKUTANI, 1983: 12, pl. 43, fig. 12.
Fissidentalium (Pictodentalium) formosum – HABE, 1963: 255, pl. 37, figs 4, 12, textfig. 22. — HABE & KOSUGE, 1964: 4; 1977: 332. — HABE & KOSUGE, 1966: 117, figs 22-23. — SPRINGSTEEN & LEOBRERA, 1985: 286, pl. 82, fig. 5. — HIGO & GOTO, 1993: 686.
Fissidentalium formosum – QI & MA, 1989: 116, figs 6a-b.
Fissidentalium formosum harrisoni – HIGO & GOTO, 1993: 686.

TYPE MATERIAL. — *D. formosum*: 3 syntypes dd BMNH 1951.2.14.1-3. — *P. f. hirasei*: not checked. — *F. f. harrisoni*: NSMT 37303 (*fide* HABE, 1970) [not seen].

TYPE LOCALITY. — *D. formosum*: Sulu Archipelago, 29-36 m. – *P. f. hirasei*: Southern Japan, 20 fms [37 m]. — *F. f. harrisoni*: South China Sea.

MATERIAL EXAMINED. — The type material of *D. formosum*.
China. South China Sea, Coll. STAADT, 1 dd (MNHN).

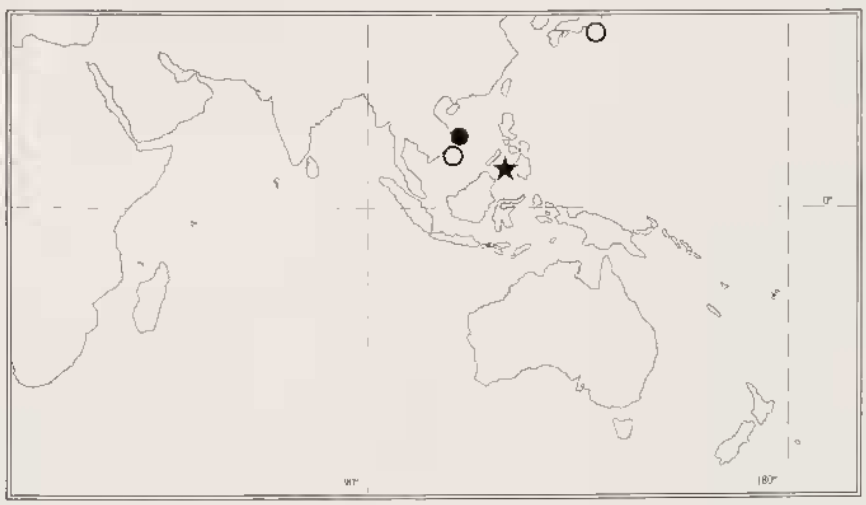


FIG. 74. — Distribution of *Pictodentalium formosum*.

DISTRIBUTION. — Japan, 0-50 m (HABE & KOSUGE, 1964), South China Sea, 77-145 m (QI & MA, 1989), the Philippines (SPRINGSTEEN & LEOBRERA, 1985).

Pictodentalium festivum (Sowerby, 1914)

Figs 62 g, 75, 77 c, 78 b

Dentalium festivum Sowerby, 1914: 8, textfig.

Other reference:
Dentalium festivum – HABE, 1963: 255 (as synonym of *P. formosum*).

TYPE MATERIAL. — Holotype BMNH 1914.4.21.

TYPE LOCALITY. — New Caledonia.

MATERIAL EXAMINED. — The holotype.
Chesterfield Islands. CHALCAL 1: stn DC 6, 20°57′ S, 161°43′ E, 45 m, 1 dd. — Stn DC 26, 19°11′ S, 158°35′ E, 48 m, 2 dd. — Stn DC 37, 19°54′ S, 158°46′ E, 50 m, 2 dd. — Stn DC 45, 20°50′ S,

158°30′ E, 50 m, 1 dd. — Stn DC 50, 21°04′ S, 158°41′ E, 70 m, 1 dd. — Stn DC 56, 21°24′ S, 159°09′ E, 60 m, 1 lv. — Stn DC 59, 21°40′ S, 159°21′ E, 56 m, 1 dd.
MUSORSTOM 5: stn DW 264, 25°20′ S, 159°44′ E, 56 m, 1 lv, 2 dd.
CORAIL 2: stn DW 71, 19°15′ S, 158°24′ E, 55 m, 1 lv. — Stn DW 91, 19°03′ S, 158°55′ E, 43 m, 1 lv. — Stn DW 103, 19°01′ S, 158°32′ E, 58 m, 1 dd. — Stn DW 117, 19°25′ S, 158°32′ E, 52 m, 1 dd. — Stn DW 136, 19°31′ S, 158°16′ E, 37 m, 2 dd.
New Caledonia. LAGON: stn 120, 22°28′ S, 166°44′ E, 46 m, 1 dd. — Stn 129, 22°31′ S, 166°47′ E, 44-46 m, 2 lv, 3 dd. — Stn 151, 22°32′ S, 166°48′ E, 31-33 m, 1 lv. — Stn 229, 22°39′ S, 166°40′ E, 41 m, 1 dd. — Stn 230, 22°38′ S, 166°41′ E, 35 m, 1 lv. — Stn 234bis, 22°32′ S, 166°51′ E, 60 m, 1 dd. — Stn 241, 22°21′ S, 167°00′ E, 35 m, 2 lv. — Stn 313, 22°40′ S, 166°50′ E, 30 m, 1 lv. — Stn 326, 22°26′ S, 167°02′ E, 67 m, 1 dd. — Stn 345, 22°46′ S, 166°50′ E, 39 m, 1 dd. — Stn 358, 22°31′ S, 167°05′ E, 50 m, 1 dd. — Stn 362, 22°38′ S, 167°00′ E, 83 m, 1 dd. — Stn 373, 22°28′ S, 167°11′ E, 52-57 m, 2 dd. — Stn 376, 22°34′ S, 167°06′ E, 75-76 m, 1 dd. — Stn 377, 22°35′ S, 167°08′ E, 56 m, 1 dd. — Stn 382, 22°30′ S, 167°14′ E, 57 m, 1 dd. — Stn 383, 22°32′ S, 167°13′ E, 62 m, 1 lv, 2 dd. — Stn 403, 22°35′ S, 167°18′ E, 45 m, 2 dd. — Stn 414, 22°37′ S, 167°16′ E, 60 m, 1 dd. — Stn 416, 22°38′ S, 167°14′ E, 40-50 m, 1 lv. — Stn 474, 18°02′ S, 163°02′ E, 52 m, 1 lv. — Stn 542, 19°06′ S, 163°10′ E, 50 m, 2 dd. — Stn 603, 22°16′ S, 167°05′ E, 78-80 m, 2 dd. — Stn 607, 22°12′ S, 167°03′ E, 48-54 m, 1 dd. — Stn 619, 22°03′ S, 166°54′ E, 27-42 m, 1 dd. — Stn 729, 21°19′ S, 165°54′ E, 42-45 m, 2 dd. — Stn 858, 20°37′ S, 165°07′ E, 220 m, 2 dd. — Stn 888, 20°22′ S, 164°38′ E, 20 m, 2 lv.
MUSORSTOM 4: stn DW 231, 22°34′ S, 167°10′ E, 75 m, 1 dd.
"Vauban" 1978-79: stn 10, 22°17′ S, 167°05′ E, 80 m, 1 dd.
Ilôt Maître, 20 m, Estival coll. 1980, 2 dd (MNHN).

FIG. 75. — Distribution of *Pictodentalium festivum*.

DISTRIBUTION. — New Caledonia, alive in 20-62 m (present paper).

REMARKS. — HABE (1964) considered *Pictodentalium festivum* a junior synonym of *P. formosum* but examination of the type material and other specimens of both species allows me to reestablish Sowerby's species. *P. festivum* has more ribs (17-19), is angled in section, and the material examined always presented secondary ribs. The ribs of *P. formosum* are wide and round in section, fewer in number (13-17) and have no secondary ribs. Also the color pattern is different, *P. formosum* is basically dark purple with rose and green patches, while *P. festivum* is light purple, rose and cream.

Pictodentalium vernedei (Sowerby, 1860)

Figs 76, 77 a

Dentalium vernedei Sowerby, 1860: 101, pl. 223 (*Dentalium* 1), fig. 3.

Other references:

Dentalium vernedei – Pilsbry & Sharp, 1897: 80, pl. 3, figs 35, 43. — Sowerby, 1873: pl. 1, fig. 3.
Dentalium (*Fissidentalium*) *vernedei* – Hirase, 1931: 137, pl. 3, fig. 8. — Habe, 1953: 293, figs 741-743; 1963: 258, pl. 37, fig. 9, textfigs 30-31.
Fissidentalium vernedei – Kira, 1962: 117, pl. 41, fig. 13.
Fissidentalium (*Pictodentalium*) *vernedei* – Habe, 1964a: 16, pl. 1, fig. 9, pl. 4, figs 30-31. — Habe & Kosuge, 1964: 3. — Habe, 1977: 332. — Ieyama 1993: 246, figs 4-5. — Higo & Goto, 1993: 686.

Type material. — BMNH (not seen).

Type locality. — Japan.

Material examined. — **China**. No further data, Coll. Jousseaume, 1 dd. — Coll. Denis, 3 dd (both MNHN).
Japan. No other data, Coll. Staadt, 3 dd (MNHN).

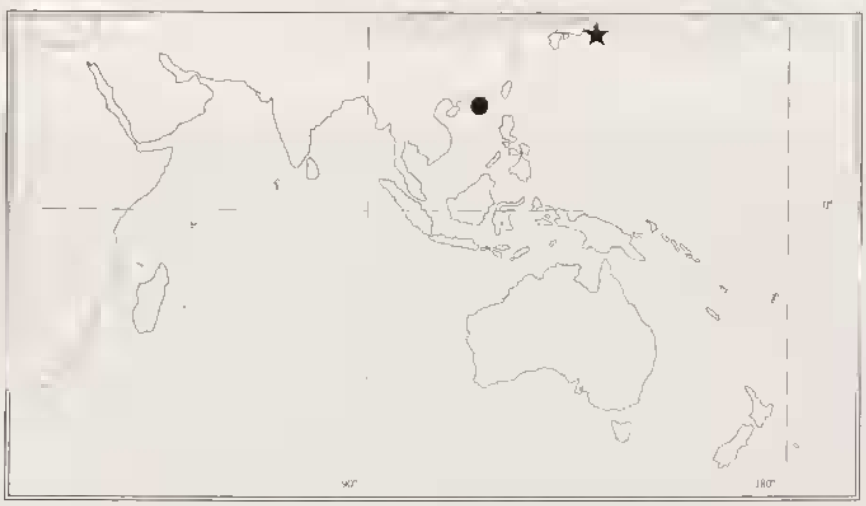


Fig. 76. — Distribution of *Pictodentalium vernedei*.

Distribution. — China and Japan, 20-100 m.

Family Calliodentaliidae Chistikov, 1975

Genus *Calliodentalium* Habe, 1964

Type species (OD): *Dentalium crocinum* Dall, 1907.

Diagnosis. — *Shell* medium to large, well curved, thin but not fragile, polished, shiny, white, yellow or orange. Smooth or sculptured only at apical portion by longitudinal striae or close, fine, encircled wrinkles. Apex simple or with flat V-shaped notch on ventral side. Section subcircular, slightly compressed dorsoventrally, more noticeable on ventral side.

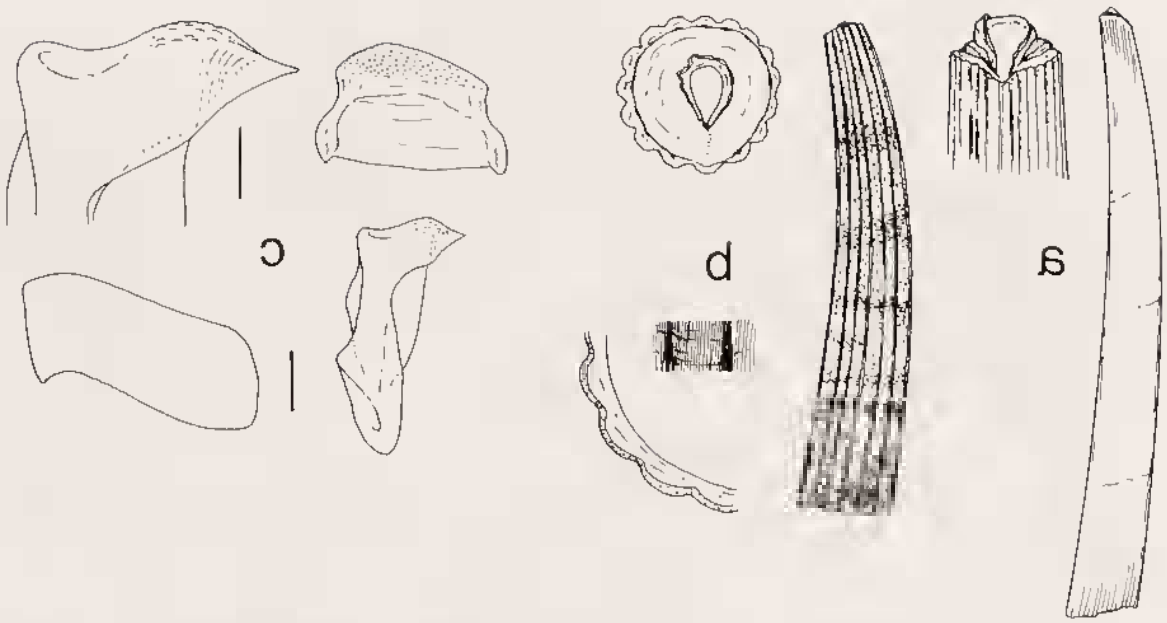


FIG. 77. — a, *Pictodentalium vernedei*, shell (119 mm), apex, Japan (MNHN). — b, *Pictodentalium formosum*, shell (53 mm), apical and oral sections, detail of the sculpture, South China Sea (MNHN). — c, *Pictodentalium* type radula (*P. festivum*); see also Fig. 78 b.

FIG. 78. — Radulae. — **a**, *Fissidentalium magnificum*, rachidian, anterior border. — **b**, *Pictodentalium festivum*, rachidian, detail of the external face. — **c**, *Fissidentalium candidum* (North Atlantic Ocean), rachidian, external face. — **d**, *Fustiaria caesura*, rachidian, anterior border. Scale bars: 100 µm (a), 200 µm (c), 20 µm (b, d).

Radula rachidian slightly curved, anterior margin irregular, smooth; subrachidians (see below) subpyramidal; laterals with the head slightly differenciated from body, one primary cusp almost central and one secondary cusp sharp, another one with low cusp; marginals almost straight.

DISTRIBUTION. — Recent, worldwide, temperate and warm waters, shelf to bathyal.

REMARKS. — This genus presently contains four species: *C. callipeplum* (Dall, 1889) from the Western Atlantic Ocean and Caribbean Sea, *C. crocinum*, *C. semitracheatum*, and *C. balanoides* from the Indo-Pacific. The unique radular formula (1-1-1r-1-1r-1-1) is characteristic, with an accessory structure which I name subrachidian. Though considered by SCARABINO (1981: 30) aberrant in *C. callipeplum* (Dall, 1881) (Fig. 88 d), recent radular study confirmed this formula and tooth morphology for three additional species; I now consider it a generic character. Shells of all four species have similar characteristics, large, with pronounced curvature, rapidly increasing from apex to oral aperture, with high W/w ratio, slight dorsoventral depression, smooth and shiny.
For remarks on the nomenclature of the names *Eboreidens* and Eboreidentidae, see under *Graptacme lactea*.

Calliodentalium semitracheatum (Boissevain, 1906)

Figs 79, 82 a-d, 88 a

Dentalium semitracheatum Boissevain, 1906: 56, pl. 4, figs 20-21.

Synonym:

Dentalium (Plagioglypta) curvotracheatum Plate, 1908a: 358, pl. 30, fig. 47 (**Syn. nov.**).

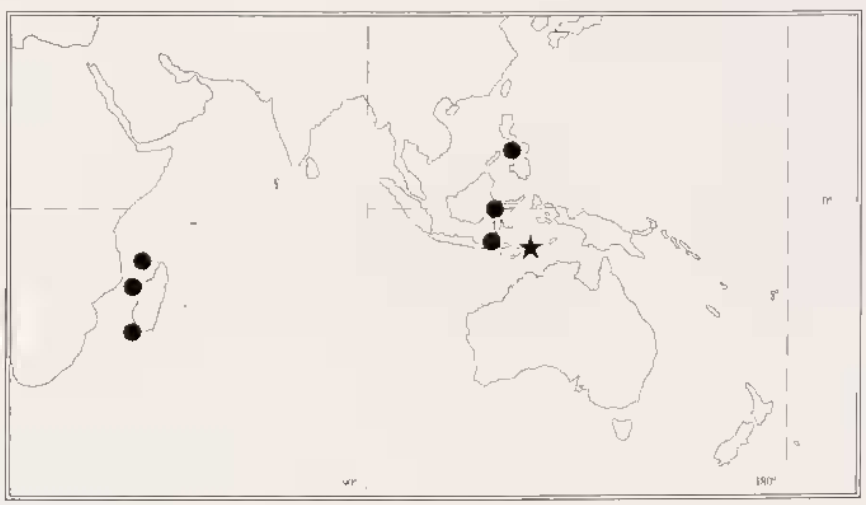


FIG. 79. — Distribution of *Calliodentalium semitracheatum*.

TYPE MATERIAL. — *D. semitracheatum*: lectotype (here designated) ZMA 3.06.072, paralectotypes ZMA 3.06.071. — *D. curvotracheatum*: holotype ZMB 61086 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *D. semitracheatum*: "*Siboga*", stn 284, 08°43′ S, 127°17′ E, 828 m, Timor Sea. — *D. curvotracheatum*: "*Valdivia*", stn 245, 05°28′ S, 39°18′ E, 463 m, Zanzibar Channel.

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 1: stn CP 44, 13°47′ N, 120°30′ E, 592-610 m, 2 dd.
MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 4 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 2 lv, 2 dd. — Stn CP 82, 13°46′ N, 120°28′ E, 550 m, 2 lv.

MUSORSTOM 3: stn DR 93, 13°49' N, 120°02' E, 540 m, 2 lv, 2 dd. — Stn CP 106, 13°47' N, 120°30' E, 640-668 m, 3 dd.
Indonesia. *"Snellius"* II: stn 4.113, 08°19' S, 118°16' E (no depth data), (dd). — Stn 4.131, 08°18' S, 118°18' E, 680-800 m, (dd) (RMNH).
"Galathea": stn 490, 05°25' S, 117°03' E, 585 m, 1 dd (ZMC).
West Indian Ocean. BENTHEDI: stn DR 38, 12°55' S, 45°15' E, 200-500 m, 4 dd. — Stn DS 53, 13°00' S, 44°54' E, 755-770 m, 1 dd.
SW Madagascar. *"Mascareignes III"*, R. von Cosel coll. 1986: stn 69, 22°22' S, 43°05' E, 350-420 m, 1 dd. — Stn 78, 22°21' S, 43°03' E, 530 m, 1 lv. — Stn 81, 22°23' S, 43°03' E, 525 m, 1 dd. — Stn 127, 22°21' S, 43°02' E, 610 m, 1 lv. — Baie de Fanemotra, 450 m, 1 dd.
Madagascar. *"Vauban"*, A. Crosnier coll. 1973: stn 49, 15°18' S, 46°10' E, 500-550 m, 2 dd. — Stn 50, 15°19' S, 46°12' E, 405 m, 3 dd. — Stn 112, 22°18' S, 43°02' E, 640-660 m, 1 lv. — Stn 114, 22°15' S, 43°05' E, 470-475 m, 2 dd.

DISTRIBUTION. — The Philippines and Indonesia, now extended to Madagascar, live records from 450 to 865 m (present paper).

Calliodentalium crocinum (Dall, 1907)

Figs 80, 88 b

Dentalium crocinum Dall, 1907: 169, pl. 27, fig. 6.

Other references:

Dentalium (*Laevidentalium*) *crocinum* – KIRA, 1955: 80, pl. 40, fig. 9. — HABE, 1955: 10.
Laevidentalium crocinum – HABE, 1963: 268, pl. 38, figs 29, 35, textfigs 28-29. — HABE & KOSUGE, 1964: 7.
Calliodentalium crocinum – HABE, 1964a: 31, pl. 2, fig. 35; pl. 4, figs 28-29; 1977: 336, pl. 70, figs 7-8. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 9. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 688.

TYPE MATERIAL. — Holotype USNM 110508.

TYPE LOCALITY. — Japan, Gulf of Tokyo, *"Albatross"*, stn 5094, in 188 fms [161 m].

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 3: stn CP 99, 14°01' N, 120°19' E, 196-204 m, 1 lv. — Stn CP 101, 14°00' N, 120°19' E, 194-196 m, 1 lv. — Stn DR 126, 11°49' N, 121°22' E, 266 m, 1 lv.

FIG. 80. — Distribution of *Calliodentalium crocinum*.

DISTRIBUTION. — Japan Sea (HABE, 1957) to the Philippines (SPRINGSTEEN & LEOBRERA, 1985). Recorded alive from 194 to 266 m (present paper).

Calliodentalium balanoides (Plate, 1908)

Figs 81, 82 e-f, 88 c

Dentalium (Laevidentalium) balanoides Plate, 1908a: 357, pl. 30, figs 42-44.

TYPE MATERIAL. — Holotype ZMB 61109 (*fide* KILIAS, 1995).

TYPE LOCALITY. — *"Valdivia"*, stn 186, 03°22′ S, 101°11′ E, 903 m, West Sumatra.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 dd.
BIOCAL: stn CP 108, 22°03′ S, 167°06′ E, 335 m, 1 dd.
MUSORSTOM 4: stn CC 247, 22°09′ S, 167°13′ E, 435-460 m, 1 lv.
BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 1 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 426, 20°25′ S, 166°23′ E, 610 m, 1 dd.
Philippines. MUSORSTOM 2: stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 3 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865-866 m, 4 dd. — Stn CP 71, 14°00′ N, 120°18′ E, 189-197 m, 1 lv. — Stn CP 75, 13°51′ N, 120°30′ E, 300-330 m, 1 lv.
MUSORSTOM 3: stn DR 95, 13°56′ N, 119°59′ E, 865 m, 1 lv, 1dd. — Stn CP 112, 14°00′ N, 120°18′ E, 187-199 m, 1 lv. — Stn DR 126, 11°49′ N, 121°22′ E, 266 m, 4 dd.

FIG. 81. — Distribution of *Calliodentalium balanoides*.

DISTRIBUTION. — Sumatra, now extended to the Philippines and New Caledonia, living from 187 to 865 m.

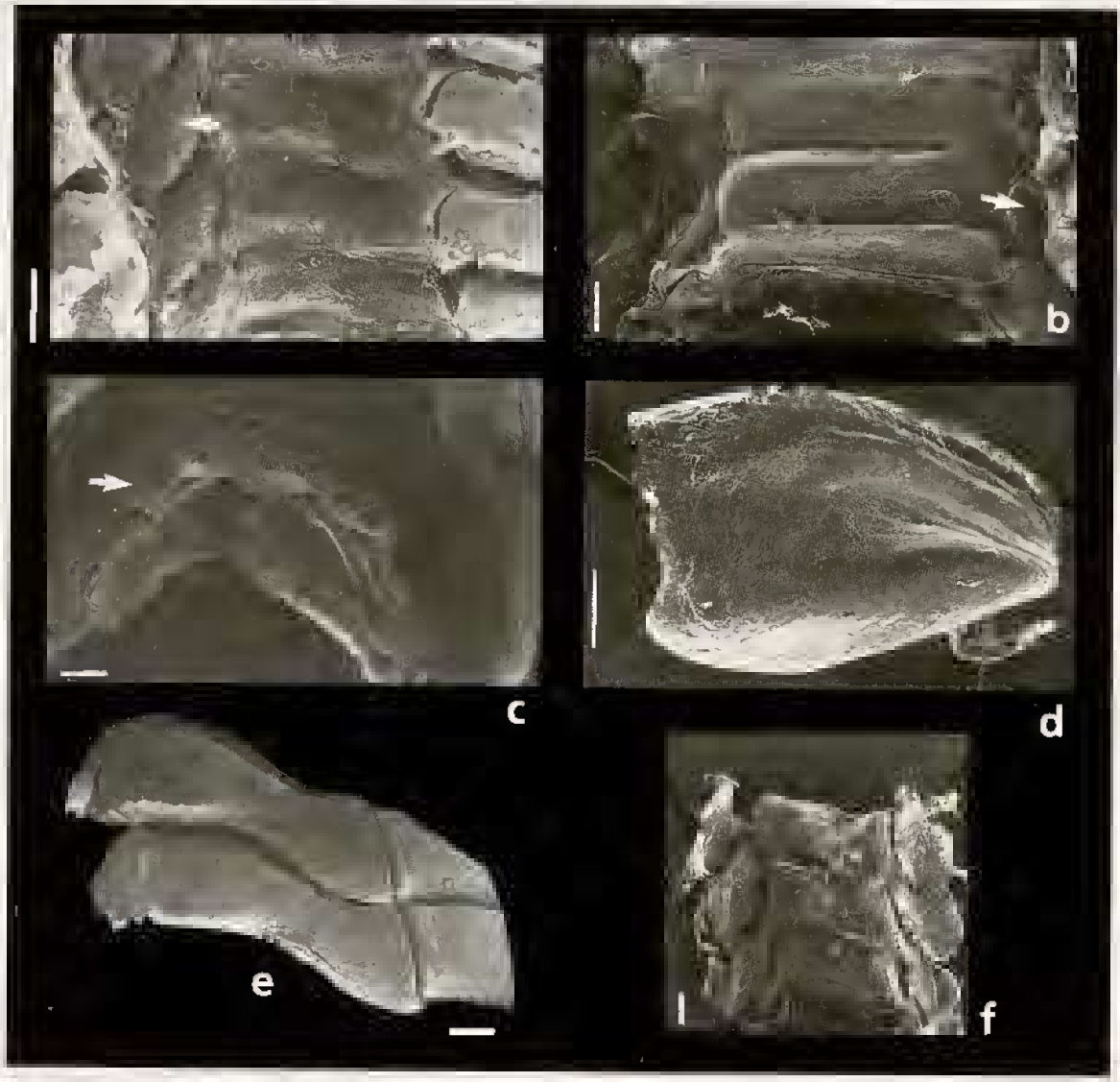


FIG. 82. — **a-d**, *Calliodentalium semitracheatum*, internal view of the radula, note the secondary teeth at left. — **b**, external face of the rachidians and secondary teeth (arrows). — **c**, anterior view of the radula, note the position of the secondary teeth. — **d**, secondary denticle. — **e**, *Calliodentalium balanoides*, lateral teeth. — **f**, internal face of the rachidians and secondary teeth. Scale lines: 100 µm (a-c, e, f), 10 µm (d).

Family FUSTIARIIDAE Steiner, 1991

Genus *FUSTIARIA* Stoliczka, 1868

Type species (SD by PILSBRY & SHARP, 1897): *Dentalium circinatum* Sowerby, 1823. Eocene, Paris Basin, France.

DIAGNOSIS. — *Shell* medium, well curved, fragile but not thin, shiny, translucent white, yellow, orange, red, lacking sculpture. Apex with long, regular slit or short v-shape notch; section circular throughout.

Radula rachidian well curved in section, granulose; lateral with strong, armed granulose head; marginal slightly sinusoidal.

DISTRIBUTION. — Triassic-Recent, worldwide, temperate and tropical waters, sublittoral to shelf and bathyal.

Fustiaria nipponica (Yokoyama, 1922)

Figs 83, 88 e

Dentalium (Fustiaria) nipponicum Yokoyama, 1922: 119, pl. 6, fig. 7.

Synonyms:

Dentalium nagoense Dall, 1927: 1.
Dentalium (Fustiaria) numatai Hirase, 1931: 139, pl. 3, fig. 11.

Other references:

Dentalium (Fustiaria) nipponicum – HIRASE, 1931: 139, pl. 3, fig. 11. — HABE, 1957: 131.
Fustiaria nipponica – HABE, 1964a: 27, pl. 2, figs 6-8; pl. 3, figs 8, 11; pl. 4, figs 1-2; 1971: 490 (Japanese text), 308 (English text), pl. 116, figs 15-16; 1977: 336, pl. 69, figs 1-2. — HABE & KOSUGE, 1964: 6. — SPRINGSTEEN & LEOBRERA, 1985: 287, pl. 82, fig. 8. — HIGO & GOTO, 1993: 687.
Fustiaria (Fustiaria) nipponica – HABE, 1963: 266, pl. 38, figs 6-8, 26, textfigs 1-2.
Dentalium politum – BOISSEVAIN, 1906: 58, pl. 1, fig. 20.
Dentalium stenoschizum – BOISSEVAIN, 1906: 59, pl. 6, figs 16-17.
Dentalium nagoense – HABE, 1964b: 140, pl. 9, figs 1-2.
Dentalium (Fustiaria) numatai – HABE, 1953: 295, figs 755-756.

TYPE MATERIAL. — *D. nipponicum* and *D. numatai*: depository not checked. — *D. nagoense*: holotype USNM 333718.

TYPE LOCALITY. — *D. nipponicum*: Shito, Honshu, Japan (Pleistocene). — *D. nagoense*: Japan, Nago, Okinawa, 15 fms [27 m]. — *D. numatai*: Japan, Osumi and Oshima.

MATERIAL EXAMINED. — The holotype of *D. nagoense*. Material identified as *D. stenoschizum* and *D. politum* by BOISSEVAIN (1906).

Chesterfield Islands. CHALCAL 1: stn DC 17, 19°12′ S, 158°56′ E, 44 m, 2 lv, 1 dd. — Stn D 34, 19°52′ S, 158°20′ E, 33-37 m, 1 dd.

CORAIL 2: stn DW 72, 19°15′ S, 158°21′ E, 32 m, 1 lv. — Stn DW 77, 19°12′ S, 158°36′ E, 60 m, 1 lv. — Stn DW 126, 19°28′ S, 158°27′ E, 46 m, 1 lv, 1 dd. — Stn DW 147, 19°37′ S, 158°14′ E, 25 m, 1 lv.

New Caledonia. LAGON: stn 4, 22°13′ S, 166°21′ E, 9 m, 1 lv, 3 dd. — Stn 8, 22°23′ S, 166°18′ E, 15 m, 2 lv, 4 dd. — Stn 21, 22°23′ S, 166°23′ E, 10 m, 1 dd. — Stn 50, 22°17′ S, 166°12′ E, 12 m, 1 dd. — Stn 51, 22°15′ S, 166°11′ E, 10 m, 1 lv. — Stn 63, 22°26′ S, 166°26′ E, 20 m, 1 lv. — Stn 64, 22°28′ S, 166°25′ E, 15 m, 1 lv. — Stn 65, 22°29′ S, 166°26′ E, 24 m, 2 lv, 2 dd. — Stn 66, 22°28′ S, 166°27′ E, 15 m, 2 lv, 1 dd. — Stn 68, 22°24′ S, 166°30′ E, 22-40 m, 1 lv. — Stn 80, 22°31′ S, 166°28′ E, 33 m, 1 lv. — Stn 83, 22°32′ S, 166°30′ E, 22 m, 1 dd. — Stn 84, 22°30′ S, 166°31′ E, 17 m, 2 lv. — Stn 98, 22°36′ S, 166°32′ E, 15 m, 3 dd. — Stn 161, 22°34′ S, 166°38′ E, 20 m, 1 lv, 1 dd. — Stn 163, 22°12′ S, 166°18′ E, 15 m, 1 lv, 1 dd. — Stn 170, 22°09′ S, 166°07′ E, 22 m, 3 lv. — Stn 185, 22°05′ S, 166°02′ E, 15 m, 1 lv. — Stn 211, 21°55′ S, 165°52′ E, 12 m, 1 lv. — Stn 212, 21°56′ S, 165°53′ E, 10 m, 1 lv. — Stn 214, 21°55′ S, 165°48′ E, 12 m, 1 dd. — Stn 217, 21°53′ S, 165°47′ E, 16 m, 1 dd. — Stn 226, 22°38′ S, 166°39′ E, 28 m, 4 lv, 3 dd. — Stn 233, 22°35′ S, 166°46′ E, 30 m, 1 lv. — Stn 268, 22°20′ S, 166°17′ E, 24 m, 1 lv. — Stn 281, 22°24′ S, 166°24′ E, 10 m, 1 lv. — Stn 284, 22°26′ S, 166°25′ E, 6 m, 3 lv, 1 dd. — Stn 293, 22°42′ S, 166°41′ E, 20 m, 6 lv, 4 dd. — Stn 296, 22°41′ S, 166°44′ E, 26 m, 1 lv. — Stn 304, 22°40′ S, 166°48′ E, 27 m, 1 lv, 1 dd. — Stn 311, 22°44′ S, 166°47′ E, 36 m, 1 lv, 1 dd. — Stn 322, 22°30′ S, 166°58′ E, 71 m, 2 lv. — Stn 340, 22°48′ S, 166°47′ E, 27 m, 1 lv. — Stn 438, 18°10′ S, 162°51′ E, 37 m, 1 lv, 1 dd. — Stn 441, 18°04′ S, 162°56′ E, 37 m, 3 dd. — Stn 442bis, 18°02′ S, 162°56′ E, 39 m, 1 dd. — Stn 446, 18°19′ S, 163°04′ E, 36 m, 7 lv, 3 dd. — Stn 448, 18°22′ S, 163°07′ E, 30 m, 1 lv. — Stn 449, 18°22′ S, 163°09′ E, 21 m, 1 lv. — Stn 450, 18°24′ S, 163°24′ E, 29 m, 1 lv, 1 dd. — Stn 453, 18°29′ S, 163°12′ E,

26 m, 1 lv, 4 dd. — Stn 465, 18°22′ S, 163°05′ E, 45 m, 2 lv, 5 dd. — Stn 466, 18°24′ S, 163°07′ E, 42 m, 5 lv, 2 dd. — Stn 467, 18°25′ S, 163°08′ E, 41 m, 3 lv, 1 dd. — Stn 468, 18°27′ S, 163°10′ E, 40 m, 1 lv. — Stn 469, 18°29′ S, 163°10′ E, 39 m, 1 lv, 1 dd. — Stn 470, 18°28′ S, 163°09′ E, 41 m, 1 dd. — Stn 471, 18°28′ S, 163°07′ E, 42 m, 2 lv, 1 dd. — Stn 473, 18°24′ S, 163°03′ E, 50 m, 1 lv, 3 dd. — Stn 481, 18°57′ S, 163°32′ E, 33 m, 3 lv, 7 dd. — Stn 482, 18°49′ S, 163°31′ E, 33 m, 1 lv, 8 dd. — Stn 512, 19°24′ S, 163°35′ E, 59 m, 1 lv, 3 dd. — Stn 519, 19°02′ S, 163°34′ E, 39 m, 1 lv, 2 dd. — Stn 536, 19°09′ S, 163°23′ E, 61 m, 14 lv. — Stn 554, 22°50′ S, 166°54′ E, 27 m, 1 lv. — Stn 866, 20°38′ S, 165°03′ E, 26 m, 1 lv. — Stn 871, 20°37′ S, 165°00′ E, 27 m, 1 lv. — Stn 916, 20°56′ S, 164°28′ E, 13 m, 2 lv. — Stn 932, 20°46′ S, 164°17′ E, 23 m, 3 dd. — Stn 937, 20°40′ S, 164°15′ E, 50-55 m, 1 lv. — Stn 943, 20°37′ S, 164°11′ E, 15 m, 1 dd. — Stn 984, 20°21′ S, 163°56′ E, 21-23 m, 1 dd. — Stn 1015, 20°10′ S, 163°52′ E, 25 m, 1 dd. — Stn 1025, 20°07′ S, 163°49′ E, 25-28 m, 1 lv. — Stn 1105, 19°40′ S, 163°57′ E, 25 m, 4 dd. — Stn 1118, 19°35′ S, 163°52′ E, 30 m, 2 lv, 2 dd. — Stn 1145, 19°21′ S, 163°45′ E, 38 m, 1 dd. — Stn 1146, 19°08′ S, 163°31′ E, 185 m, 1 dd. — Stn 1154, 19°09′ S, 163°19′ E, 40 m, 1 lv, 1 dd.

Loyalty Islands. MUSORSTOM 6: stn DW 430, 20°21′ S, 166°07′ E, 30 m, 1 lv, 1dd. — Stn DW 431, 20°22′ S, 166°10′ E, 21 m, 1 lv. — Stn DW 435, 20°21′ S, 166°08′ E, 32 m, 2 lv, 1 dd.

Indonesia. *"Snellius"* II: stn 4.020, 05°57′ S, 123°46′ E, 255-275 m, 1 dd. — Stn 4.153, 06°22, S, 120°26′ E, 130-155 m, 1 lv. — Stn 4.155, 06°22′ S, 120°26′ E, 233-274 m, 1 dd (RMNH).

Philippines. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

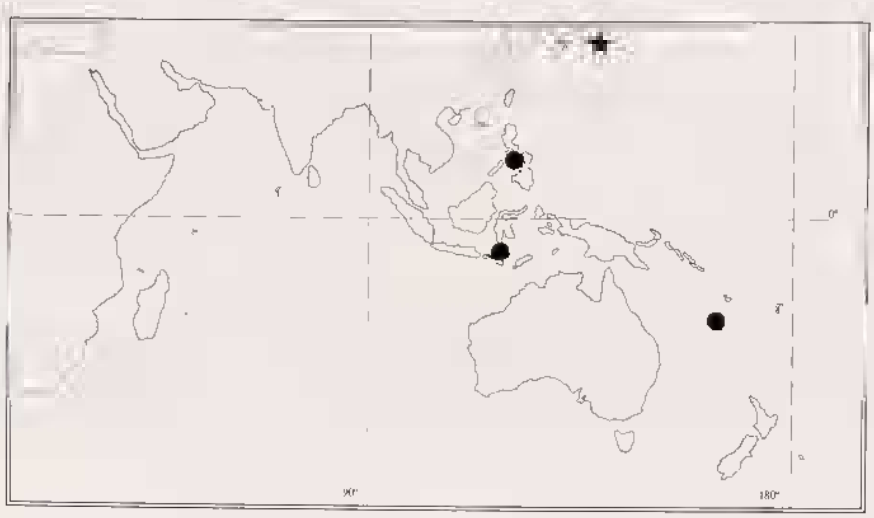


FIG. 83. — Distribution of *Fustiaria nipponica*.

DISTRIBUTION. — Japan, the Philippines, China, 0-200 m (HABE & KOSUGE, 1964), now extended to New Caledonia, living from 6 to 71 m (present paper).

Fustiaria engischista (Barnard, 1963)

Figs 84, 88 f

Dentalium engischistum Barnard, 1963b: 351, fig. 30 f.

TYPE MATERIAL. — Holotype SAM A5463, paratypes BMNH 1964.256.

TYPE LOCALITY. — South Africa, off Cape Natal (Durban), 62 fms [113 m].

MATERIAL EXAMINED. — The type material.
West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 1 dd. — Stn F 77, 12°34′ S, 44°54′ E, 480-530 m, 1 dd. — Stn DR 104, 11°26′ S, 47°22′ E, 330-530 m, 1 dd.
MD32 Réunion: stn DS 178, 21°24′ S, 55°10′ E, 412-460 m, 1 lv.
Nosy Bé Island, NW Madagascar, Plante coll., 6 dd (BMNH).

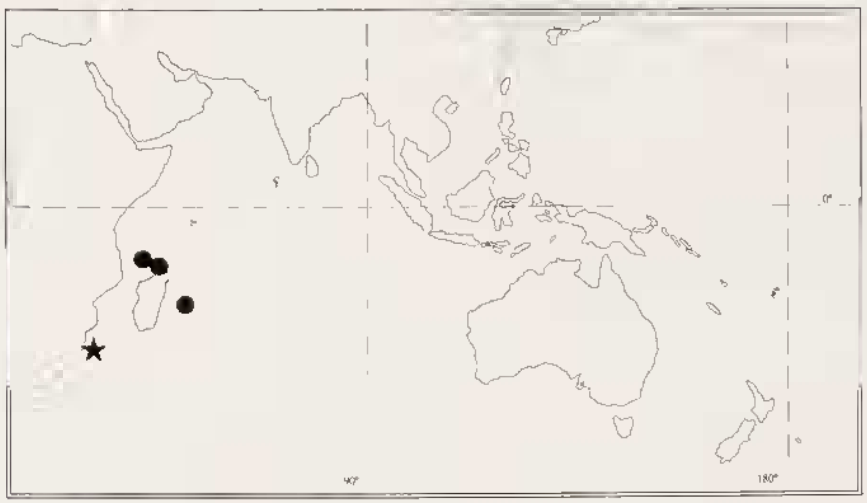


FIG. 84. — Distribution of *Fustiaria engischista*.

DISTRIBUTION. — Southwestern Indian Ocean from Natal to NW Madagascar and Réunion Island, alive in 412-460 m.

Fustiaria caesura (Colman, 1958)

Figs 78 d, 85, 88 g, j

Dentalium (Pseudoantalis) caesura Colman, 1958: 145, fig. 11.

FIG. 85. — Distribution of *Fustiaria caesura*.

TYPE MATERIAL. — Holotype AMS C62230, paratypes C62229.

TYPE LOCALITY. — Australia, off Willongong, New South Wales, 183 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 266, 25°20′ S, 159°46′ E, 240 m, 1 lv. — Stn DC 357, 19°37′ S, 158°46′ E, 630 m, 1 dd. — Stn DC 380, 19°38′ S, 158°44′ E, 555-570 m, 1 dd.
New Caledonia. MUSORSTOM 4: stn DW 159, 18°46′ S, 163°16′ E, 585 m, 3 dd.
Philippines. MUSORSTOM 2: stn DR 34, 13°28′ N, 121°12′ E, 155-167 m, 2 lv.
MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

DISTRIBUTION. — E Australia, now extended to New Caledonia and the Philippines. Live records from 155 to 240 m.

Fustiaria langfordi (Habe, 1963)

Figs 71 e, 86, 88 h

Laevidentalium langfordi Habe, 1963: 268, pl. 38, fig. 22.

Other references:

Laevidentalium langfordi — HABE, 1964a: 35, pl. 2, fig. 22; 1971: 491 (Japanese text), 309 (English text), pl. 65, figs 30-31. — HABE & KOSUGE, 1964: 7. — HABE *et al.*, 1986: 24. — HIGO & GOTO, 1993: 687 (as synonym of *Laevidentalium longitrorsum*).

TYPE MATERIAL. — Holotype NSMT.

TYPE LOCALITY. — Itoman, Okinawa Island, Ryukyu Islands.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 20, 19°12′ S, 158°42′ E, 67 m, 6 dd. — Stn DC 31, 19°33′ S, 158°30′ E, 230 m, 1 dd. — Stn DC 33, 19°45′ S, 158°26′ E, 205 m, 2 lv, 10 dd. — Stn DC 35, 19°45′ S, 158°26′ E, 210 m, 2 dd. — Stn DC 38, 20°00′ S, 158°46′ E, 250 m, 12 dd. — Stn DC 63, 22°11′ S, 159°15′ E, 305 m, 6 dd. — Stn DC 64, 22°12′ S, 159°15′ E, 305 m, 1 lv, 2 dd.
CORAIL 2: stn DW 114, 19°25′ S, 158°38′ E, 217 m, 1 dd. — Stn DW 129, 19°28′ S, 158°34′ E, 215 m, 2 lv, 3 dd. — Stn DW 167, 19°46′ S, 158°29′ E, 270 m, 2 dd.
MUSORSTOM 5: stn DW 263, 25°21′ S, 159°46′ E, 150-225 m, 9 dd. — Stn DW 265, 25°21′ S, 159°45′ E, 190-260 m, 3 lv, 5 dd. — Stn DW 266, 25°20′ S, 159°46′ E, 240 m, 1 lv, 6 dd. — Stn DW 270, 24°49′ S, 159°34′ E, 223 m, 12 lv. — Stn DW 285, 24°09′ S, 159°34′ E, 245-255 m, 2 dd. — Stn CP 289, 24°02′ S, 159°38′ E, 273 m, 1 dd. — Stn DW 298, 22°44′ S, 159°22′ E, 320 m, 1 lv, 3 dd. — Stn DW 299, 22°48′ S, 159°24′ E, 360-390 m, 2 dd. — Stn DW 302, 22°10′ S, 159°23′ E, 345-360 m, 3 dd. — Stn DW 303, 22°12′ S, 159°23′ E, 332 m, 1 lv, 1 dd. — Stn CP 315, 22°25′ S, 159°27′ E, 330-335 m, 1 dd. — Stn DW 328, 20°23′ S, 158°44′ E, 340-355 m, 1 lv, 4 dd. — Stn DW 329, 20°23′ S, 158°47′ E, 320 m, 1 lv, 9 dd. — Stn DW 334, 20°06′ S, 158°48′ E, 315-320 m, 1 lv, 1 dd. — Stn DW 344, 19°39′ S, 158°34′ E, 310 m, 2 dd. — Stn DW 346, 19°40′ S, 158°27′ E, 245-252 m, 6 dd. — Stn DW 349, 19°34′ S, 158°34′ E, 275 m, 1 lv. — Stn DC 376, 19°51′ S, 158°30′ E, 280 m, 6 dd.
Loyalty Islands. MUSORSTOM 6: stn DW 392, 20°47′ S, 167°05′ E, 340 m, 1 dd. — Stn DW 399, 20°42′ S, 167°00′ E, 282 m, 2 dd. — Stn DW 417, 20°42′ S, 167°04′ E, 283 m, 3 dd. — Stn DW 418, 20°42′ S, 167°03′ E, 283 m, 1 lv, 1 dd. — Stn DW 456, 21°01′ S, 167°26′ E, 240 m, 2 dd. — Stn DW 480, 21°08′ S, 167°56′ E, 380 m, 1 lv.
New Hebrides Arc. VOLSMAR: stn DW 17, 22°23′ S, 171°41′ E, 260-300 m, 4 dd.
Indonesia. *"Snellius"* II: stn 4.047, 09°53′ S, 120°43′ E, 100 m, 2 dd (RMNH).

FIG. 86. — Distribution of *Fustiaria langfordi*.

DISTRIBUTION. — Japan, Malaya, 50-200 m (HABE, 1964a), now extended to Indonesia and New Caledonia, live records from 200 to 380 m.

Fustiaria vagina sp. nov.

Figs 71 h, 87, 88 i

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201726, 1 NMNZ M268953, 1 USNM.

TYPE LOCALITY. — New Caledonia, Chesterfield Islands, MUSORSTOM 5, stn DW 340, 19°49′ S, 158°41′ E, 675-680 m.

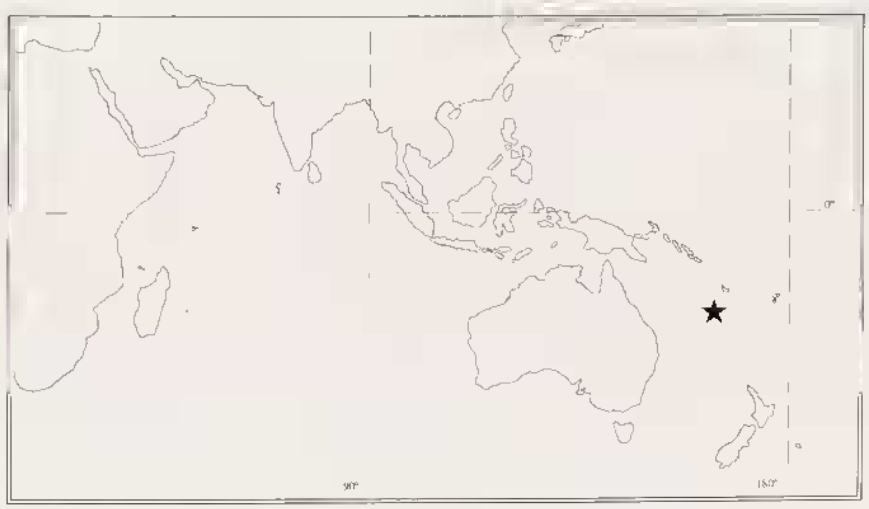


FIG. 87. — Distribution of *Fustiaria vagina*.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 340, 19°49′ S, 158°41′ E, 675-680 m, 3 lv (holotype, 1 paratype AMS). — Stn DW 341, 19°46′ S, 158°43′ E, 630-620 m, 1 lv (paratype). — Stn DW 353, 19°27′ S, 158°40′ E, 290 m, 1 dd (paratype). — Stn DW 357, 19°37′ S, 158°46′ E, 630 m, 1 lv (paratype).
New Caledonia. BIOCAL: stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 2 dd (paratypes). — Stn DW 49, 23°03′ S, 167°32′ E, 825-830 m, 3 dd (paratypes: 2 MNHN, 1 NMNZ).
BIOGEOCAL: stn CP 290, 20°37′ S, 167°03′ E, 760-920 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 468, 21°06′ S, 167°33′ E, 600 m, 1 dd (paratype USNM).

DISTRIBUTION. — New Caledonia, recorded alive in 630-680 m, shells from 290 to 820 m.

DESCRIPTION. — *Shell* to 30 mm, solid, white, glossy, slightly curved, sculptured with growth lines only, conspicuous at posterior end. Apex truncate, oblique on ventral side, with strong callus. Lumen longitudinally elongate, with projecting irregular walls on ventral side. In section, walls are wider on dorsal than on ventral side. Peristome oblique, fragile. Section circular throughout.

Measurements: holotype L 29, W 2.8, w 1, arc 1; paratypes range L 19-29, W 2-3.2, w 0.6-1.5, arc 0.6-1.5. W/w ratio 2.6.

REMARKS. — EMERSON (1962) explicity noted that the genus has varied apical structures. The present species is provisionally placed in *Fustiaria* pending anatomical study.

ETYMOLOGY. — Named for the resemblance of apical structure to the human female vagina.

Other species of *Fustiaria* cited in the literature

Fustiaria rubescens (Deshayes, 1825): 363, pl. 16, figs 23-24. Mediterranean Sea. MNHN. Cited by LUDBROOK (1954) as present off Zanzibar, *"John Murray"*, stn 103, 05°39′ S, 39°11′ E, 101 m. It is doubtful that this Mediterranean species occurs in the Indo-Pacific and LUDBROOK's record should be checked.

Family GADILINIDAE Chistikov, 1975

Subfamily GADILININAE Chistikov, 1975

Genus *GADILINA* Foresti, 1895

Type species (by monotypy): *Dentalium triquetrum* Brocchi, 1814. Miocene, Italy.

DIAGNOSIS. — *Shell* medium to large, well curved, solid, polished, shiny, white. Longitudinally sculptured with two dorso-lateral ribs, more conspicuous at apex, slightly convex dorsally, strongly concave ventrally. Apex truncate, with terminal callus, lumen circular. Section compressed dorsally, circular ventrally.
Radula rachidian slightly curved in section, anterior margin irregular, three wide cusps ventrally; lateral wide, with three primary cusps, the central quite pointed; marginal sinusoidal, with cusp in anterior angle connecting with laterals.

DISTRIBUTION. — Miocene-Recent. Pacific and Indian Oceans, absent in the Atlantic Ocean; temperate-tropical belt, shelf to abyssal.

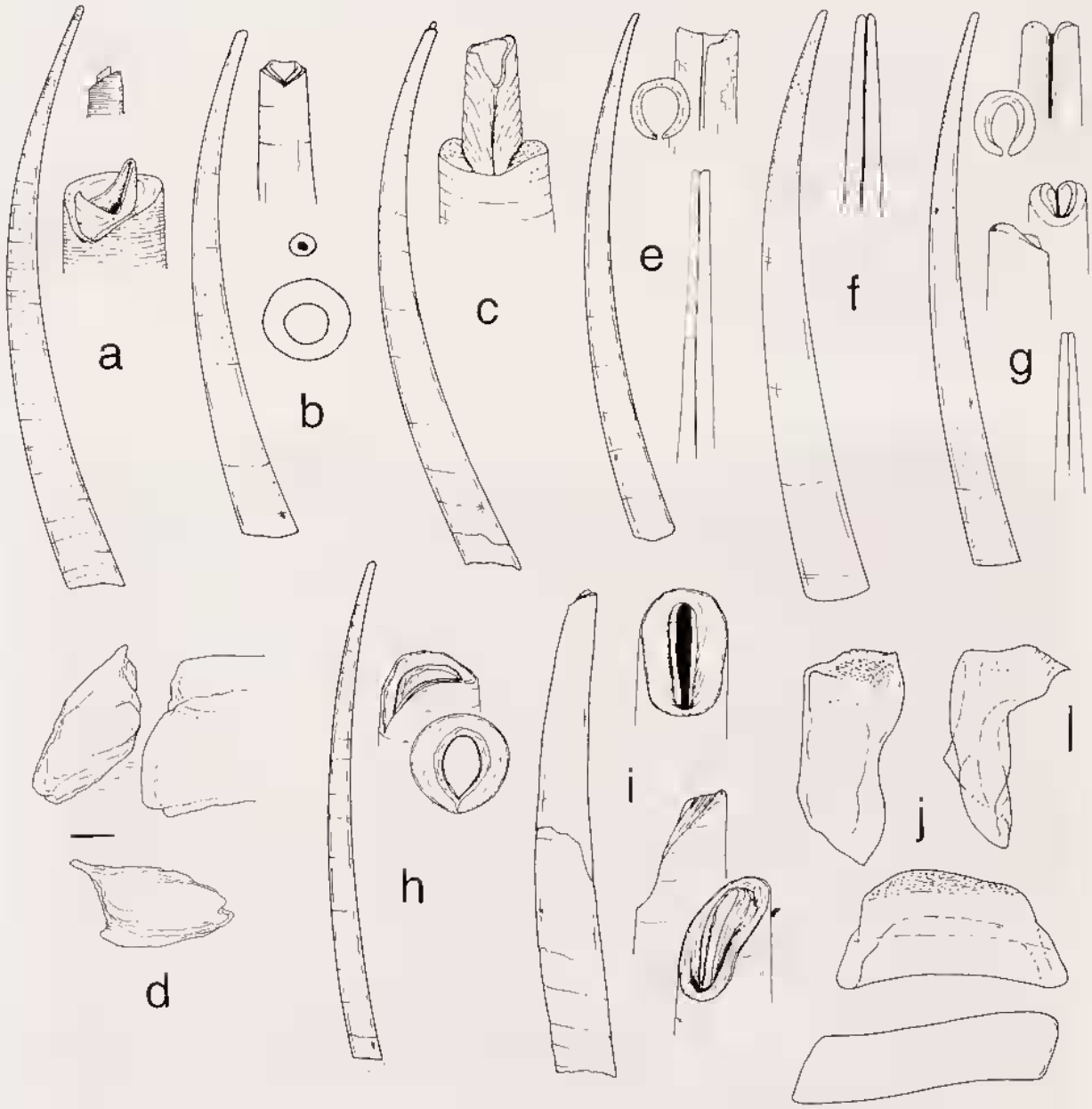


FIG. 88. — **a**, *Calliodentalium semitracheatum*, shell (68 mm) and apex. *"Mascareignes III"*: stn 78. — **b**, *Calliodentalium crocinum*, shell (39 mm), apex, apical and medial sections, MUSORSTOM 3: stn CP 99. — **c**, *Calliodentalium balanoides*, shell (65 mm) and apex, *"Vauban"* 1978-79: stn 40. — **d**, *Calliodentalium* type radula (*Calliodentalium callipeplum*, Caribbean Sea), left accessory denticle, relationship with the rachidian (see also Fig. 82 e). — **e**, *Fustiaria nipponica*, shell (51 mm), apex and apical section, New Caledonia LAGON: stn 214. — **f**, *Fustiaria engischista*, shell (41 mm), and apex, Nosy-Bé (BMNH). — **g**, *Fustiaria caesura*, shell (44 mm), apical views and apical section, MUSORSTOM 2: stn DR 34. — **h**, *Fustiaria langfordi*, shell (49 mm), apex and apical section, MUSORSTOM 6: stn DW 417. — **i**, *Fustiaria vagina* sp. nov., paratype (26.4 mm), views of the apex. — **j**. *Fustiaria* type radula (*F. caesura*); see also Fig. 78 d.

Gadilina insolita (Smith, 1894)

Figs 89, 90 a-f, 95 a-b

Dentalium insolitum Smith, 1894: 168, pl. 4, figs 17-17a.

Synonym:

Dentalium stapes Boissevain, 1906: 50, pl. 5, figs 16-20, pl. 6, figs 79, 81, 83.

Other references:

Dentalium insolitum – Pilsbry & Sharp, 1897: 109, pl. 22, figs 56-57. — Smith, 1906a: 250. — Boissevain, 1906: 49, pl. 5, fig. 15, pl. 6, figs 80-82, 84. — Winckworth, 1940a: 25.
Dentalium (Gadilina) insolitum – Plate, 1908a: 353, pl. 30, figs 50-51. — Jaeckel, 1932: 306. — Ludbrook, 1954: 108.
Gadilina insoluta (*sic*) – Habe, 1964a: 32, pl. 2 fig. 23; pl. 4, figs 13-14. — Habe & Kosuge, 1964: 7. — Higo & Goto, 1993: 688.
Dentalium (Gadilina) stapes – Ludbrook, 1954: 109.
Gadilina stapes – Habe, 1962: 105, pl. 47, fig. 6; 1963: 270, pl. 38, fig. 23, textfigs 13-14; 1964a: 32, pl. 2, fig. 23, pl. 4, figs 13-14. — Okutani, 1964: 76. — Habe & Kosuge, 1964: 7.

Fig. 89. — Distribution of *Gadilina insolita*.

Type material. — *D. insolitum*: 2 syntypes dd BMNH 1952.3.25.83-93. — *D. stapes*: syntypes ZMA 3.06.061, 3.06.062.

Type locality. — *D. insolita*: Bay of Bengal, "*Investigator*", in 597 fms [1091 m]. — *D. stapes*: Indonesia, Banda Sea, "*Siboga*", stn 212, 05°55' S, 120°10' E, 462 m.

Material examined. — The type material.
New Caledonia. BIOCAL: stn DW 56, 23°35' S, 167°12' E, 695-705 m, 1 lv. – Stn DW 106, 21°36' S, 166°29' E, 625-650 m, 2 lv.
BIOGEOCAL: stn CP 232, 21°34' S, 166°27' E, 760-790 m, 2 lv, 1 dd.
LAGON: stn 993, 20°15' S, 163°53' E, 375-400 m, 1 dd.
Indonesia. CORINDON: stn B 210, 00°13' S, 117°53' E, 338 m, 1 dd. — Stn B 213, 00°31' N, 117° 50' E, 488 m, 1 dd.
"*Snellius*" II: stn 4.113, 08°19' S, 118°16' E (no depth data), 1 dd. — Stn 4.127, 08°19' S, 118°18' E, 700-835 m, 2 lv, 1 dd. — Stn 4.128, 08°18' S, 118°16' E, 700-835 m, 2 lv, 1 dd. — Stn 4.130, 08°18' S, 118°18' E, 700-730 m, 2 lv, 1 dd. — Stn 4.267, 08°18' S, 118°21' E, 650 m, 1 lv (RMNH).
Philippines. MUSORSTOM 1: stn CP 49, 13°49' N, 120°00' E, 750-925 m, 1 dd.

MUSORSTOM 2: stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 dd.— Stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 13 dd, 9 lv. — Stn CP 51, 13°59′ N, 120°16′ E, 170-187 m, 1 lv. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 6 lv. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 2 lv, 6 dd. — Stn CP 81, 13°34′ N, 120°31′ E, 856-884 m, 3 lv. — Stn CP 82, 13°46′ N, 120°28′ E, 550 m, 1 lv, 2 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 1 lv, 2 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 3 lv, 6 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 219-220 m, 2 lv, 1 dd. — Stn CP 123, 12°10′ N, 121°45′ E, 700-702 m, 2 dd. — Stn CP 128, 11°50′ N, 121° 42′ E, 815-821 m, 5 dd.

DISTRIBUTION. — Indonesia, Japan, Indian Ocean, now extended to New Caledonia, living from 625 to 950 m (present paper), shells in 200-1134 m (HABE & KOSUGE, 1964).

REMARKS. — I concur with HABE (1964a) in considering this a single highly variable species as examination of a large series shows clear gradation between forms.

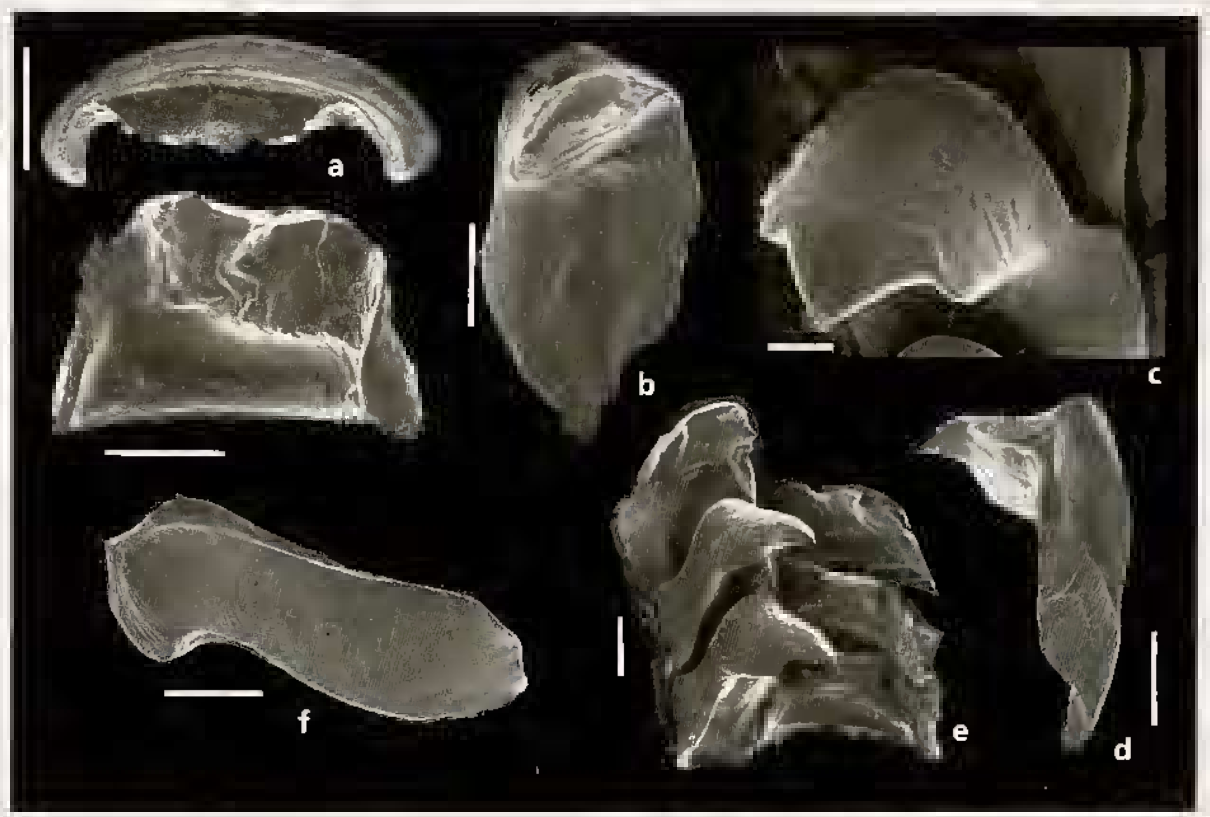


FIG. 90. — Radulae. — **a**, *Gadilina insolita*, rachidian, view from the anterior border and internal face. — **b**, lateral internal face. — **c**, lateral, head. — **d**, lateral, internal face. — **e**, marginal, contact with lateral at left side. — **f**, *Gadilina insolita* form *stapes*, general view. Scale bars: 100 µm (b-f), 10 µm (a).

Other Indo-Pacific species of *Gadilina* cited in the literature

Gadilina pachypleura (Boissevain, 1906): 51, pl. 5, figs 21-22. *"Siboga"*, stn 208, 05°39′ S, 122°12′ E, Banda Sea, 1886 m. ZMA.

Subfamily Episiphoninae Chistikov, 1975

Genus *Episiphon* Pilsbry & Sharp, 1897

Type species (SD by Suter, 1913): *Dentalium sowerbyi* Guilding, 1834. Recent, Caribbean Sea.

Diagnosis. — *Shell* small to medium, slightly curved, fragile but not thin, polished, shiny, white, cream, orange or red. Sculptured apically with close, fine, encircled wrinkles; rarely longitudinal striae near the apex or throughout. Section subcircular or subtriangular, slightly compressed dorsoventrally, more on ventral side. Apex simple or truncate, with terminal callus, lumen circular, small with short pipe.
Radula rachidian slightly curved in section, anterior margin irregular, nearly straight, three cusps on internal face; lateral with few very sharp, pointed cusps; marginal sinusoidal, short.

Distribution. — Worldwide. Temperate-tropical waters, sublittoral-shelf.

Episiphon subtorquatum (Fischer, 1871)

Figs 91, 95 c, f

Dentalium subtorquatum Fischer, 1871: 212, pl. 11, figs 1-1a.

Synonyms:

Dentalium annulosum Brazier, 1877: 58.
Dentalium tornatum Watson, 1879: 518; 1886: 13, pl. 2, fig. 3.
Dentalium (*Episiphon*) *sewelli* Ludbrook, 1954: 107, fig. 10 (**Syn. nov.**).

Other references:

Dentalium subtorquatum – Pilsbry & Sharp, 1897: 101. — Boissevain, 1906: 57, pl. 2, fig. 27, pl. 6, fig. 36. — Moazzo, 1939: 221.
Dentalium (Laevidentalium) subtorquatum – Dell, 1964: 129.
Episiphon subtorquatum – Habe & Kosuge, 1964: 8.
Plagioglypta subtorquatum – Habe & Kosuge, 1964: 8.
Dentalium annulosum – Hedley, 1901: 129, pl. 17, fig. 36.
Episiphon tornatus (*sic*) – Habe & Kosuge, 1964: 6.
Plagioglypta annulosum – Habe & Kosuge, 1964: 8.

Type material. — *D. subtorquatum*: lectotype (here designated: L 11.2, W 1.3, w 0.4) MNHN. — *D. annulosum*: syntype AMS 189. — *D. tornatum*: 5 syntypes dd BMNH 87.2.9.57-60. — *D. sewelli*: holotype BMNH 1952.3.25.125.

Type locality. — *D. subtorquatum*: Suez. — *D. anulosum*: NE Australia, Princess Charlotte Bay. — *D. tornatum*: Levuka, Fiji, 12 fms [22 m]. — *D. sewelli*: Gulf of Oman, *"John Murray"*, stn 75, 25°10′ N, 56°47′ E, 201 m.

Material examined. — The type material and the material examined by Boissevain.
New Caledonia. LAGON: stn 729, 21°19′ S, 165°54′ E, 42-45 m, 2 lv.
West Indian Ocean. BENTHEDI: stn S 18, 12°45′ S, 45°16′ E, 15 m, 4 dd. — Stn S 23, 12°46′ S, 45°16′ E, 6 m, 1 dd. — Stn S 32, 12°45′ S, 47°18′ E, 15-20 m, 1 dd. — Stn S 36, 12°52′ S, 45°16′ E, 30 m, 4 lv. — Stn S 50, 12°55′ S, 44°59′ E, 32 m, 1 lv, 1 dd. — Stn DS 101, 11°26′ S, 47°20′ E, 26 m, 1 dd. Shimoni, Kenya, 1 lv (BMNH). — Kiloa, Zanzibar, 20 m, 1 lv, 2 dd. — Same locality, shore, 13 dd (both MNHN). — Nosy Bé Island, NW Madagascar, Plante coll., 2 lv, 28 dd. — Tuléar, Madagascar, 5 dd (both BMNH).
Red Sea. Suez, 107 dd. — Gulf of Aden, Obock, Republic of Djibouti, 3 dd. — Hodeida, Yemen, 2 dd. — Djibouti, 1 dd. — Aden, 5 dd (all Coll. Jousseaume, MNHN).

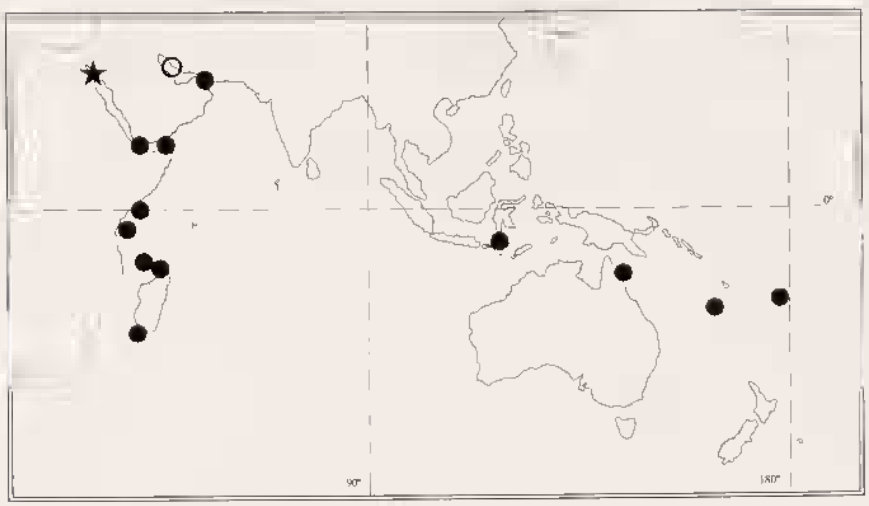


FIG. 91. — Distribution of *Episiphon subtorquatum*.

DISTRIBUTION. — Red Sea, Persian Gulf, and Zanzibar, 21-90 m (LUDBROOK, 1954, as *D. sewelli*), Indonesia (BOISSEVAIN, 1906), North Australia and Fiji, now extended to Madagascar and New Caledonia, alive in 20-45 m, shells down to 201 m.

Episiphon subrectum (Jeffreys, 1883)

Figs 92, 95 d

Dentalium subrectum Jeffreys, 1883: 661.

Synonyms:

Dentalium virgula Hedley, 1903: 328, fig. 62 (**Syn. nov.**).
Dentalium carneum Boissevain, 1906: 48, pl. 6, figs 44-45 (**Syn. nov.**).
Dentalium makiyamai Kuroda & Kikuchi, 1933: 11, pl. 5, fig. 8.

Other references:

Dentalium subrectum — PILSBRY & SHARP, 1897: 120, pl. 8, fig. 5. — BOISSEVAIN, 1906: 47, pl. 6, figs 46-50. — LUDBROOK, 1954: 108. — HABE & KOSUGE, 1964: 6. — HABE, 1964a: 28, pl. 2, fig. 1.
Episiphon carneum — HABE & KOSUGE, 1964: 6.
Episiphon makiyamai — HABE, 1963: 267, pl. 38, fig. 1. — TSUCHIDA *et al.*, 1991: 14, pl. 3, fig. 16.

TYPE MATERIAL. — *D. subrectum*: syntypes USNM (*fide* LUDBROOK, 1954) [not located]. — *D. virgula*: holotype BMNH 1913.4.30.10-14, paratypes AMS C162217. — *D. carneum*: lectotype (here designated) ZMA 3.06.052, paralectotypes ZMA 3.06.053, 073, 055.

TYPE LOCALITY. — *D. subrectum*: Philippines. — *D. virgula*: off Port Kembla, NSW, Australia, 41-50 fms [80-91 m]. — *D. carneum*: Indonesia, Flores Sea, *"Siboga"*, stn 45, 07°24′ S, 118°15′ E, 794 m. — *D. makiyamai*: Toyama Bay, Japan.

MATERIAL EXAMINED. — The type material of *D. virgula* and *D. carneum*. Material identified by BOISSEVAIN, 1906 (ZMA) and by LUDBROOK, 1954 (BMNH 1952.3.25.78-82).
Philippines. MUSORSTOM 2: stn DR 34, 13°28′ N, 121°12′ E, 155-167 m, 14 dd.
MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 3 dd. — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 dd.

FIG. 92. — Distribution of *Episiphon subrectum*.

DISTRIBUTION. — NW Indian Ocean, Indonesia, Philippines, Japan, SE Australia. Shells in 54-900 m.

Episiphon virginieae sp. nov.

Figs 93, 95 e

TYPE MATERIAL. — Holotype lv, MNHN. Paratypes dd: 9 MNHN, 1 AMS C201727, 1 NMNZ M268954.

TYPE LOCALITY. — New Caledonia, Loyalty Islands, MUSORSTOM 6, stn DW 399, 20°42′ S, 167°00′ E, 282 m.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only known from the type locality.

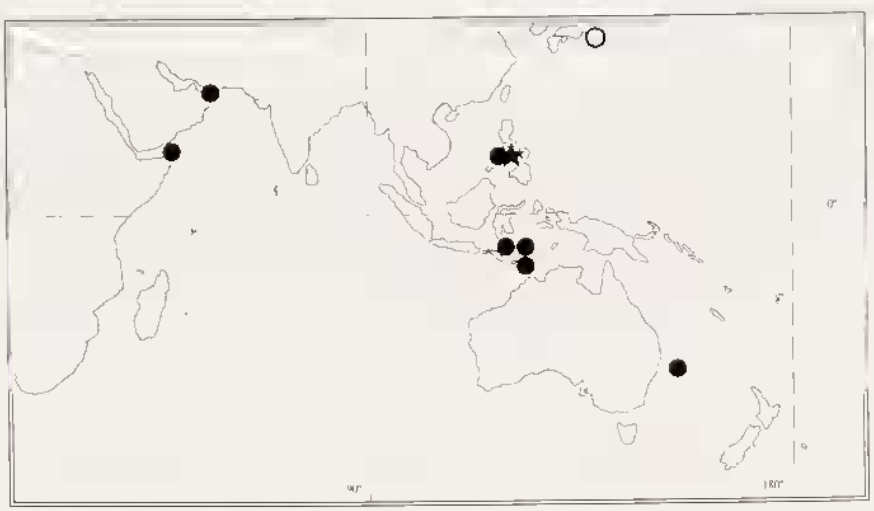


FIG. 93. — Distribution of *Episiphon virginieae*.

DESCRIPTION. — *Shell* to 9 mm long, translucent, fragile, slender, slightly curved. Fine longitudinal sculpture of close, minute lines throughout, noticeable under magnification. Apex truncate, subcircular in section, lumen subcircular with short pipe. Mouth suboval, straight.

Measurements: holotype L 8.6, W 0.9, w 0.7, arc 0.3; paratypes L 8, W 0.8, w 0.4, arc 0.6; L 7.7, W 0.9, w 0.7, arc 0.3; L 8.4, W 0.8, w 0.5, arc 0.5; L 8.3, W 0.8, w 0.4, arc 0.3; L 9.4, W 0.8, w 0.4, arc 0.5; L 7.7, W 0.9, w 0.6, arc 0.3. W/w ratio 1.3-2.

REMARKS. — The longitudinal sculpture throughout the shell is unique in the genus.

ETYMOLOGY. — Named for Virginie HEROS, MNHN, who processed much of the MUSORSTOM material, and who has assisted in many ways with this report.

Other Indo-Pacific species of *Episiphon* cited in the literature

Episiphon candelatum (Kira, 1959): 105, pl. 40, fig. 5. Japan, Tosa Bay, Shikoku, 200 m.

Episiphon gazellae (Plate, 1908): 356, pl. 30, figs 40-41. Northwest Australia, 16 m. Holotype ZMB 33195. Generic allocation uncertain.

Episiphon minutissimum Ludbrook, 1954: 108, fig. 11. Maldive area, *"John Murray"*, stn 147, 04°53′ N, 72°54′ E, 27 m. Holotype and 9 paratypes BMNH 1952. 3.25.113-123. Generic allocation uncertain.

Episiphon truncatum (Boissevain, 1906): 51, pl. 6, fig. 33, textfig. Indonesia, Banda Sea, *"Siboga"*, stn 90, 01°17′ N, 118°53′ E, 281 m. ZMA.

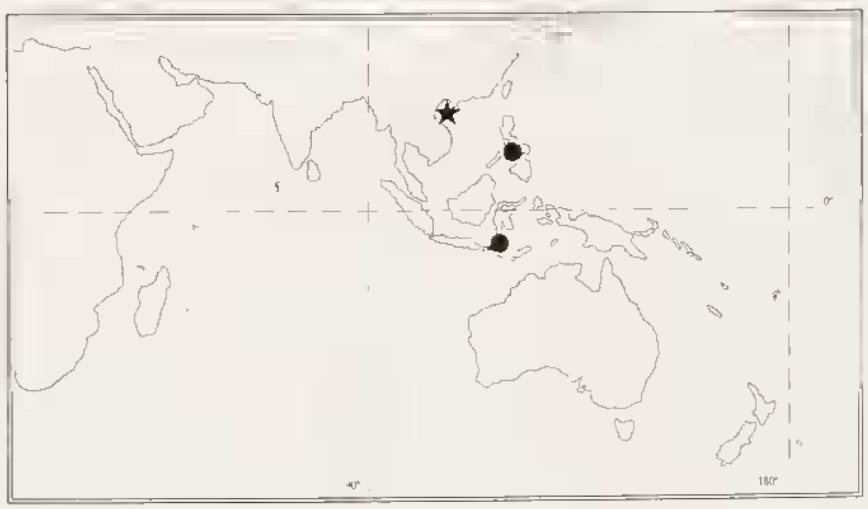


FIG. 94. — Distribution of *Anulidentalium bambusa*.

Subfamily ANULIDENTALIINAE Chistikov, 1975

Genus *ANULIDENTALIUM* Chistikov, 1975

Type species (by monotypy): *A. bambusa* Chistikov, 1975.

DIAGNOSIS. — *Shell* large, slightly curved to almost straight, thin, narrow, fragile, polished, translucent white. Sculpture of encircling swellings at regular intervals. Apex simple. Section subcircular, slightly compressed laterally.

Radula rachidian slighttly curved in section, with three central cusps on inner face; lateral with prominent sharp primary cusp and two secondary cusps placed laterally to each other; marginal short, sinusoidal.

DISTRIBUTION. — Recent, western Pacific Ocean. Shelf-bathyal.

Anulidentalium bambusa Chistikov, 1975

Figs 94, 95 g

Anulidentalium bambusa Chistikov, 1975: 21.

Other reference:
Anulidentalium banibusa — CHISTIKOV, 1979b: 112, fig. 4.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1979) [not seen].

TYPE LOCALITY. — Gulf of Tonking, Viet Nam, 72 m.

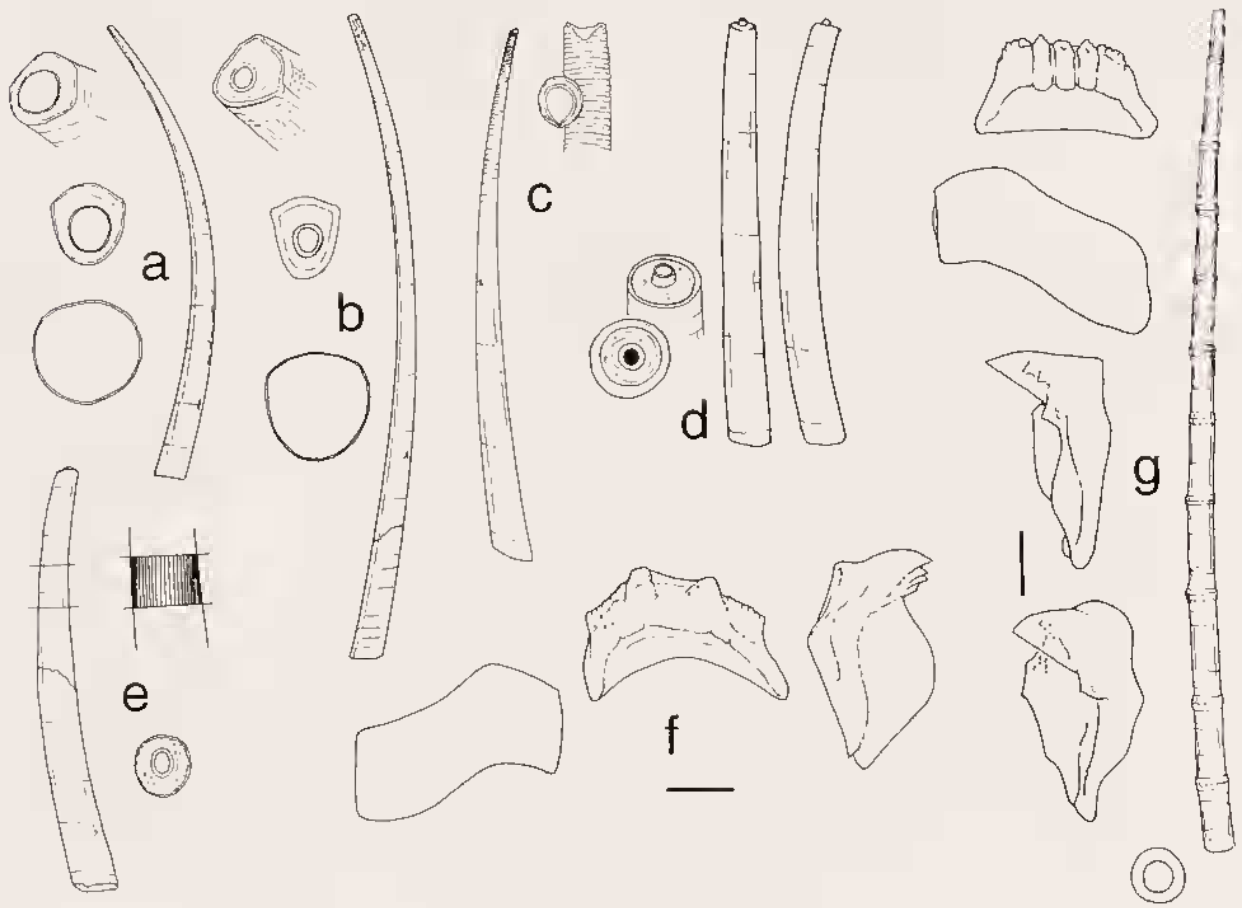


FIG. 95. — **a**, *Gadilina insolita*, shell (49 mm), apex, apical, medial and oral sections, MUSORSTOM 2: stn CP 50. — **b**, *Gadilina insolita* form *stapes*, shell (61 mm) apex, apical and oral sections, MUSORSTOM 2: stn CP 78. — **c**, *Episiphon subtorquatum*, shell (25 mm), apex and apical section, BENTHEDI: stn S 36. — **d**, *Episiphon subrectum*, shell (14 mm), apex and apical section, MUSORSTOM 2: stn DR 34. — **e**, *Episiphon virginieae* sp. nov., holotype, shell (8.6 mm), detail of sculpture and apical section. — **f**, *Episiphon* type radula (*E. subtorquatum*). — **g**, *Anulidentalium bambusa*, shell (52 mm), apical section, MUSORSTOM 3: stn CP 139; *Anulidentalium* type radula (*A. bambusum*) (after CHISTIKOV, 1979b).

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.155, 06°22' S, 120°26' E, 233-274 m, 1 lv.
Philippines. MUSORSTOM 3: stn CP 139, 11°53' N, 122°14' E, 240-267 m, 1 lv, 6 dd.

DISTRIBUTION. — Gulf of Tonking, now extended to the Philippines and Indonesia. Alive from 72 m (CHISTIKOV, 1979b) to ca. 270 m (present paper).

Family LAEVIDENTALIIDAE Palmer, 1974

Genus *LAEVIDENTALIUM* Cossmann, 1888

Type species (OD): *Dentalium incertum* Deshayes, 1825. Eocene, France.

DIAGNOSIS. — *Shell* medium to large, slightly to well curved, thin but not fragile, shiny, translucent white to cream. Sculpture usually fine longitudinal undulations and conspicuous growth lines; in some species, slight swellings at regular intervals. Apex simple or with terminal callus and projectig pipe cylindrical or fissured, lumen distinct. Section circular to subcircular.
Radula rachidian very slightly curved at central portion in transverse section; an irregular zone is present in the center; in frontal view, the anterior margin is irregular with a high central projection. Lateral head not well differentiated, no cusps, anterior margin finely undulated or granulose; marginal long, slightly sinusoidal.

DISTRIBUTION. — Triassic-Recent, worldwide, sublittoral-bathyal.

Laevidentalium eburneum (Linné, 1767)

Figs 96, 102 a

Dentalium eburneum Linné, 1767: 1264.

Synonyms:

Dentalium indicum Chenu, 1843: 1, pl. 3, fig. 11.
Dentalium philippinarum Sowerby, 1860: 98, pl 225 (*Dentalium* 3), fig. 54.

Other references:

Dentalium eburneum – GMELIN, 1791: 3737. — SOWERBY, 1860: 98, pl. 225 (*Dentalium* 3), fig. 53; 1873: pl. 3, fig. 16. — MARTENS, 1887: 200. — PILSBRY & SHARP, 1897: 115, pl. 20, figs 33-34. — SMITH, 1906a: 250. — BOISSEVAIN, 1906: 52, pl. 2, fig. 31, pl. 4, figs 10-11. — HEDLEY, 1916: 223. — WINCKWORTH, 1940a: 25. — DAWIDOFF, 1952: 144. — ROBERTS, SOEMODIHARDJO & KASTORO, 1982: 99.
Calliodentalium eburneum – CHISTIKOV, 1979: 112.
Laevidentalium eburneum – HABE & KOSUGE, 1964: 7.
Dentalium philippinarum – SOWERBY, 1872: pl 3, fig. 18. — PILSBRY & SHARP, 1897: 116, pl. 20, figs 31-32. — BOISSEVAIN, 1906: 53. — HABE, 1963: 269, pl. 38, fig. 33; 1964a: 34, pl. 2, fig. 33.
Laevidentalium philippinarum – HIGO & GOTO, 1993: 687.

TYPE MATERIAL. — *D. eburneum*: depository not located. — *D. indicum*: depository not located. — *D. philippinarum*: depository not located.

TYPE LOCALITY. — *D. eburneum:* India. — *D. indicum:* Indian Ocean. — *D. philippinarum*: Island of Samar, Philippines.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 202, 01°11' S, 117°06' E, 27 m, 7 dd. — Stn CH 205, 01°08' S, 117°19' E, 49 m, 1 dd. — Stn B 207, 00°15' S, 117°52' E, 150 m, 1 lv, 1 dd. — Stn DR 216, 00°04' N, 117°51' E, 96 m, 1 dd. — Stn B 251, 00°54' S, 119°30' E, 65 m, 2 dd. —

Stn B 253, 00°54′ S, 119°30′ E, 17 m, 15 dd. — Stn DG 254, 00°58′ S, 119°29′ E, 53-62 m, 1 lv. — Stn DG 258, 01°57′ S, 119°17′ E, 30 m, 1 dd. — Stn B 268, 01°57′ S, 119°16′ E, 200 m, 1 lv, 1 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°07′ E, 130-137 m, 2 dd.
MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 18 dd. — Stn CP 141, 11°45′ N, 122°44′ E, 44 m, 1 lv.

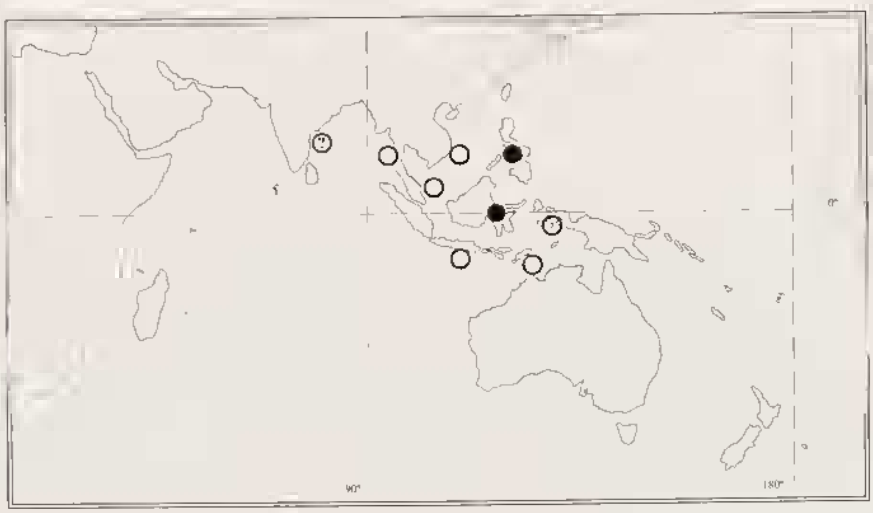


FIG. 96. — Distribution of *Laevidentalium eburneum*.

DISTRIBUTION. — Indian Ocean, China Seas, 75 m (DAWIDOFF, 1952), Malaya, Indonesia, Thailand, Philippines, 10-100 m (HABE & KOSUGE, 1964). Live records from 44 to 200 m (present paper).

Laevidentalium leptosceles (Watson, 1879)

Figs 97, 102 b

Dentalium leptosceles Watson, 1879: 513.

Synonym:
Dentalium banale Boissevain, 1906: 55, pl. 6, fig. 30 (**Syn. nov.**).

Other references:
Dentalium leptosceles — PILSBRY & SHARP, 1897: 110, pl. 3, figs 44-46.
Dentalium leptosceles (?) (sic) — LUDBROOK, 1954: 104, fig. 6.
Dentalium leptoskeles (injustified emendation) — WATSON, 1886: 7, pl. 1, fig. 6.
Laevidentalium banale — HABE & KOSUGE, 1964: 7.

TYPE MATERIAL. — *D. leptosceles*: holotype BMNH 1887.2.9.21. — *D. banale*: holotype ZMA 3.06.068.69.

TYPE LOCALITY. — *D. leptosceles*: S. of Australia, *"Challenger"*, stn 160, 42°42′ S, 134°10′ E, 2600 fms [4758 m]. — *D. banale*: Indonesia, Timor Sea, *"Siboga"*, stn 300, 10°49′ S, 123°23′ E, 918 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn DS 59, 23°56′ S, 166°41′ E, 2650 m, 1 lv.

BIOGEOCAL: stn CP 250, 21°25′ S, 166°26′ E, 2350 m, 1 dd. — Stn KG 276, 21°13′ S, 167°00′ E, 2200 m, 1 lv.
Tasman Sea. *"Galathea"*: stn 574, 39°45′ S, 159°39′ E, 4680-4730 m, 1 dd.
Indian Ocean. SAFARI 1: stn DS 05, 30°37′ S, 48°30′ E, 4500-4612 m, 2 lv. — Stn CP 06, 30°40′ S, 48°14′ E, 4020-4035 m, 1 lv, 1 dd. — Stn CP 09, 30°49′ S, 49°08′ E, 4589-4730 m, 3 lv, 3 dd. — Stn CP 17, 24°26′ S, 58°19′ E, 4987-5025 m, 1 lv. — Stn SIPAN 7909, 30°41′ S, 48°28′ E, 4462 m, 1 dd. SAFARI 2: stn CP 13, 04°30′ S, 86°55′ E, 4950 m, 1 dd. — Stn CP 18, 06°02′ S, 79°32′ E, 5175 m, 1 lv. — Stn CP 29, 12°57′ S, 79°37′ E, 4928-4950 m, 1 dd. — Stn CP 31, 13°45′ S, 76°56′ E, 5300 m, 1 lv, 2 dd.
"Galathea": stn 194, 34°09′ S, 30°45′ E, 4360 m, 1 dd. — Stn 234, 05°25′ S, 47°09′ E, 4830 m, 1 dd.

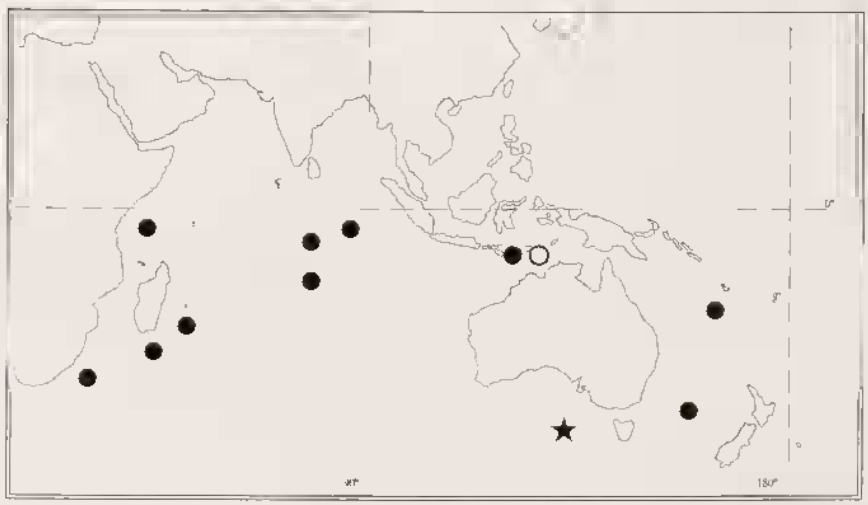


FIG. 97. — Distribution of *Laevidentalium leptosceles*.

DISTRIBUTION. — Widely distributed at bathyal and abyssal depths in the Indian Ocean, Timor Sea, Tasman Sea and New Caledonia. Recorded alive between 2200 and 5300 m (present paper). Shells from 918 m (BOISSEVAIN, 1906, under *D. banale*).

Laevidentalium coruscum (Pilsbry, 1905)

Figs 98, 102 c, f

Dentalium (*Laevidentalium*) *coruscum* Pilsbry, 1905:117, pl. 5, figs 42-43.

Other references:

Dentalium (*Laevidentalium*) *coruscum* – KURODA & KIKUCHI, 1933: 10, pl. 1, fig. 7.
Laevidentalium coruscum – HABE, 1963: 268, pl. 38, figs 15, 29.
Gadilina coruscum – HABE, 1964a: 32, pl. 2, figs 15, 26, 29.

TYPE MATERIAL. — Syntype ANSP.

TYPE LOCALITY. — Heda, Izu, Japan, 306 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 376, 19°51′ S, 158°30′ E, 280 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.127, 08°19′ S, 118°18′ E, 500-550 m, 1 dd. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 2 dd.

Philippines. MUSORSTOM 2: stn CP 66, 14°01′ N, 120°20′ E, 192-209 m, 1 lv, 1 dd. — Stn CP 75, 13°50′ N, 120°30′ E, 300-330 m, 3 lv, 3 dd. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 1 lv, 19 dd.
MUSORSTOM 3: stn CP 99, 14°01′ N, 120°19′ E, 196-204 m, 1 dd. — Stn CP 119, 12°00′ N, 121°13′ E, 320-337 m, 4 dd. — Stn CP 139, 11°53′ N, 122°15′ E, 240-267 m, 5 dd.

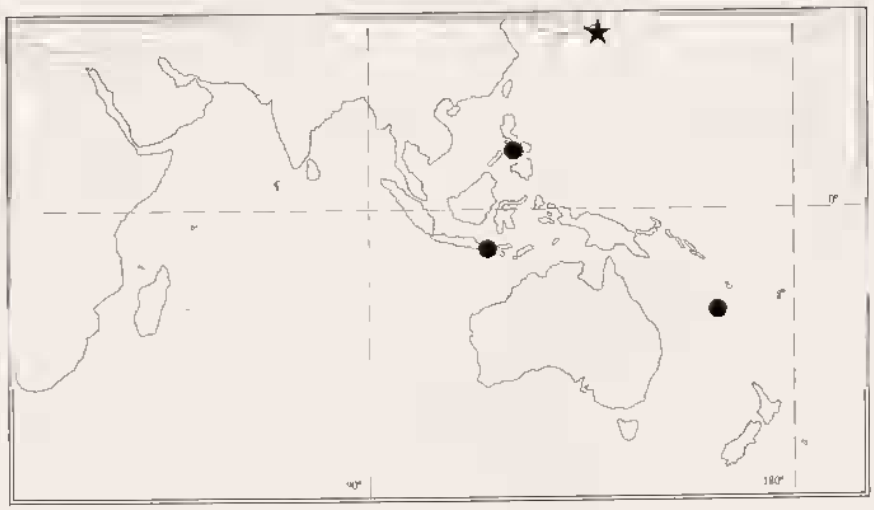


FIG. 98. — Distribution of *Laevidentalium coruscum*.

DISTRIBUTION. — Japan and Indonesia (HABE, 1964) now extended to the Philippines and New Caledonia. Alive in 192-550 m.

REMARKS. — *Laevidentalium coruscum* resembles *L. eburneum*, but it is white, shiny, more slender and possesses apical callus.

Laevidentalium gofasi sp. nov.

Figs 99, 102 e

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201728, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 70, 14°01′ N, 120°17′ E, 191 m.

MATERIAL EXAMINED. — **Loyalty Islands**. MUSORSTOM 6: stn DW 481, 21°22′ S, 167°50′ E, 300 m, 1 lv.
Philippines. MUSORSTOM 2: stn CP 20, 14°00′ N, 120°18′ E, 185-192 m, 1 dd (paratype USNM). — Stn CP 68, 14°01′ N, 120°18′ E, 195-199 m, 2 lv (paratypes). — Stn CP 70, 14°01′ N, 120°17′ E, 191 m, 2 dd (holotype and paratype). — Stn CP 83, 13°55′ N, 120°30′ E, 318-320 m, 1 lv (paratype).
MUSORSTOM 3: stn CP 96, 14°00′ N, 120°18′ E, 190-194 m, 1 dd (paratype AMS). — Stn CP 97, 14°00′ N, 120°18′ E, 189-194 m, 1 dd (paratype). — Stn CP 102, 14°01′ N, 120°18′ E, 192 m, 3 dd (paratypes).

DISTRIBUTION. — The Philippines and New Caledonia, live records from 195 to 320 m.

FIG. 99. — Distribution of *Laevidentalium gofasi*.

DESCRIPTION. — *Shell* to 80 mm long, slender, chalky-white, slightly translucent, polished, moderately to well curved (2 to 6 mm for 27-56 mm length). Surface and sides irregular due to encircling wrinkles of varying size and position, prominent growth lines with associated white bands and longitudinal threads, apparent under magnification, more conspicuous on dorsal side. Section oval, slightly laterally compressed. Apex truncate, simple, strong.

Measurements: holotype L 50, W 1.9-1.7, w 0.53-0.50, arc 6; paratypes L 51.3, W 1.9-1.8, w 0.52-0.50, arc 4.5; L 38.6, W 1.7-1.6, w 0.4-0.3, arc 4; L 56.5, W 1.8-1.7, w 0.6-0.5, arc 6; L 73.5, W 2.7-2.6, w 0.7-0.6, arc 4; L 44, W 1.7-1.6, w 0.6-0.52, arc 2.5. W/w ratio 2.8-4.2.

REMARKS. — Compared with *Laevidentalium houbricki*, *L. gofasi* is stronger, has slightly oval section and longitudinal sculpture.

ETYMOLOGY. — Named for Dr Serge GOFAS, MNHN.

Laevidentalium houbricki sp. nov.

Figs 100, 102 d

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 AMS C201729, 1 NMNZ M268955, 1 USNM.

TYPE LOCALITY. — New Caledonia, Poindimié area, LAGON, stn 835, 20°47′ S, 165°17′ E, 135-150 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 835, 20°47′ S, 165°17′ E, 135-150 m, 1 lv (holotype), 2 dd (paratypes). — Stn 858, 20°37′ S, 165°07′ E, 220 m, 10 lv (8 paratypes: 5 MNHN, 1 AMS, 1 NMNZ, 1 USNM).
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 7 dd.
Indonesia. CORINDON: stn CH 208, 00°15′ S, 117°52′ E, 150 m, 1 dd.

DISTRIBUTION. — Makassar Strait, Indonesia, and New Caledonia, live records in 135-220 m.

DESCRIPTION. — *Shell* to 67 mm, slender, solid, white, polished, very slightly curved. Transversal sculpture consisting of close lines probably corresponding to growth periods. Longitudinal sculpture of undulating threads throughout, observable under magnification. Section slightly compressed laterally. Apex truncate, without notch, strongly walled, lumen circular. Mouth straight.

Measurements: holotype L 60, W 2.3, w 0.8, arc 0.8; paratypes L 66.6, W 2.4, w 0.7, arc 1.2; L 34.6, W 1.8, w 0.6, arc. 1. W/w ratio 2.9-3.4.

FIG. 100. — Distribution of *Laevidentalium houbricki*.

ETYMOLOGY. — Named for the late Dr Richard S. HOUBRICK, USNM, Smithsonian Institution.

Other Indo-Pacific species of *Laevidentalium* cited in the literature

Laevidentalium bisinuatum (André, 1896): 397, pl. 17, fig. 9a-c. Amboyna [= Ambon], Indonesia. Holotype MHNG 1155/40. Generic allocation uncertain.
Laevidentalium pluteum Colman, 1958: 143, fig. 8. Off Willongong, New South Wales, Australia, 183 m. Holotype AMS C18217. Generic allocation uncertain.
Laevidentalium sominium Okutani, 1964: 75, fig. 3. Sagami Bay, Japan, 1320-1400 m.
Laevidentalium toyamense (Kuroda & Kikuchi, 1933): 11, pl. 1, figs 5-6. Toyama Bay, Honshu, Japan, 200 m.

Family OMNIGLYPTIDAE Chistikov, 1975

Genus *OMNIGLYPTA* Kuroda & Habe *in* Habe, 1953

Type species (OD): *Dentalium cerinum* Pilsbry, 1905.

DIAGNOSIS. — *Shell* large, slightly curved, narrow, fragile, translucent, light orange in fresh specimens, cream when eroded. Sculptured with close, fine, regularly spaced encircling wrinkles throughout. Apex simple, section circular.
Radula rachidian slightly curved in section, anterior margin and internal face with irregular projections; lateral irregular, head poorly defined, cusp flat, anterior margin finely undulated; marginal long; nearly straight.

DISTRIBUTION. — Recent, West Pacific and Indian Oceans, absent in the Atlantic Ocean. Shelf-abyssal.

Omniglypta cerina (Pilsbry, 1905)

Figs 101, 102 g-h

Dentalium (Rhabdus) cerinum Pilsbry, 1905: 117, pl. 5, figs 40-41.

Synonym:

Dentalium tracheatum Boissevain, 1906: 56, pl. 4, fig. 22 (**Syn. nov.**).

Other references:

Omniglypta cerina – Habe, 1953: 296, figs 753-754; 1955: 24, figs 1-2; 1962: 106, pl. 47, fig. 13; 1963: 270, textfigs 23-24; 1964a: 37, pl. 4, figs 23-24; 1971: 492 (Japanese text): 310 (English text), pl. 65, figs 24-25; 1977: 337, pl. 70, figs 5-6, pl. 72, fig. 9. — Habe & Kosuge, 1964: 7. — Okutani, 1983: 12, pl. 43, fig. 14. — Habe *et al.*, 1986: 24. — Higo & Goto, 1993: 688.
Dentalium (*Rhabdus*) *cerinum* – Clench & Turner, 1962: 29.
Dentalium (*Plagioglypta*) *tracheatum* – Plate, 1908a: 357.

Type material. — *D. cerinum*: holotype ANSP 88305. — *D. tracheatum*: lectotype (here designated) the specimen illustrated by Boissevain (1906), ZMA 3.06.076, paralectotypes ZMA 3.06.075, 077-080.

Type locality. — *D. cerinum*: Shimizu, Suruga Bay, Japan. — *D. tracheatum*: Indonesia, Banda Sea, "*Siboga*", stn 208, 05°39' S, 122°12' E, 1886 m.

Material examined. — The type material.
Indonesia. "*Snellius*" II: stn 4.130, 08°18' S, 118°18' E, 700-730 m, (dd). — Stn 4.131, 08°18' S, 118°18' E, 680-800 m, 6 dd.
Philippines. ESTASE 2: stn CP 6, 04°38' N, 119°49' E, 2570 m, 2 dd. — Stn DR 5, 04°58' N, 125°19' E, 3925 m, 1 lv.
MUSORSTOM 3: stn DR 115, 12°32' N, 120°44' E, 794 m, 1 lv.

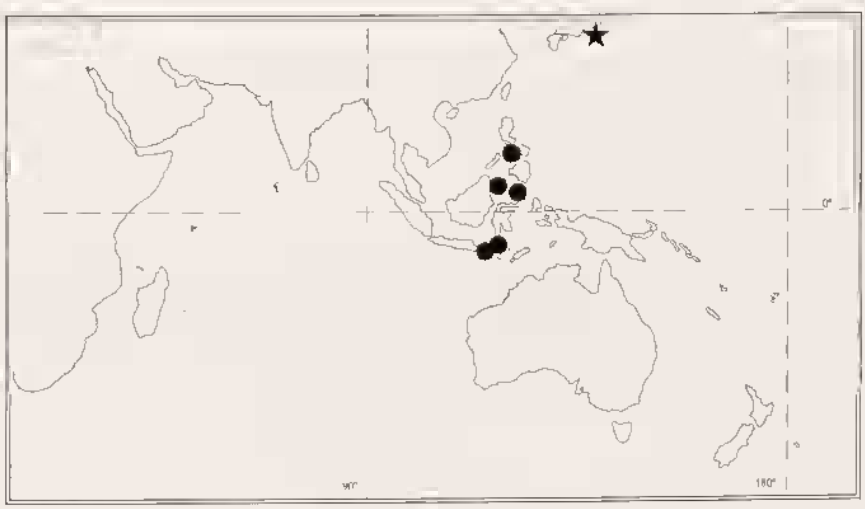


Fig. 101. — Distribution of *Omniglypta cerina*.

Distribution. — Japan and Indonesia, now the Philippines. Habe & Kosuge (1964) give the depth range as 0-1886 m, but this species appears clearly to be a deep-water species, with live records in 800-3925 m (present paper).

Family RHABDIDAE Chistikov, 1975

Genus *RHABDUS* Pilsbry & Sharp, 1897

Figs 102 i-j

Type species (OD): *Dentalium rectius* Carpenter, 1864. Recent, Northeastern Pacific.

DIAGNOSIS. — *Shell* medium to large, almost sraight, fragile, translucent. Sculpture lacking, cross section circular, apex and mouth simple. The pavilion secretes a secondary tube that cannot be distinguished from the primary shell. The annular ciliary organ of the anterior mantle margin is lacking. Instead, a pair of dorsolateral slits with ciliated walls is present. Bundles of longitudinal pedal muscles keep the pedal ganglia in position. The ligament of the buccal septum is missing (STEINER, 1992a).
Radula rachidian slightly curved in section, anterior border irregular, with a prominent central projection and two projections at each side that not reach the border; laterals with wide granulose head, prominent cusp and wrinckles instead of denticles; marginals almost straight.

DISTRIBUTION. — Worldwide, temperate to cold waters, shelf-bathyal.

The genus *Rhabdus* is not represented in the material reported on here.

Order GADILIDA Starobogatov, 1974

Suborder ENTALIMORPHA Steiner, 1992

Family ENTALINIDAE Chistikov, 1979

Subfamily ENTALININAE Chistikov, 1979

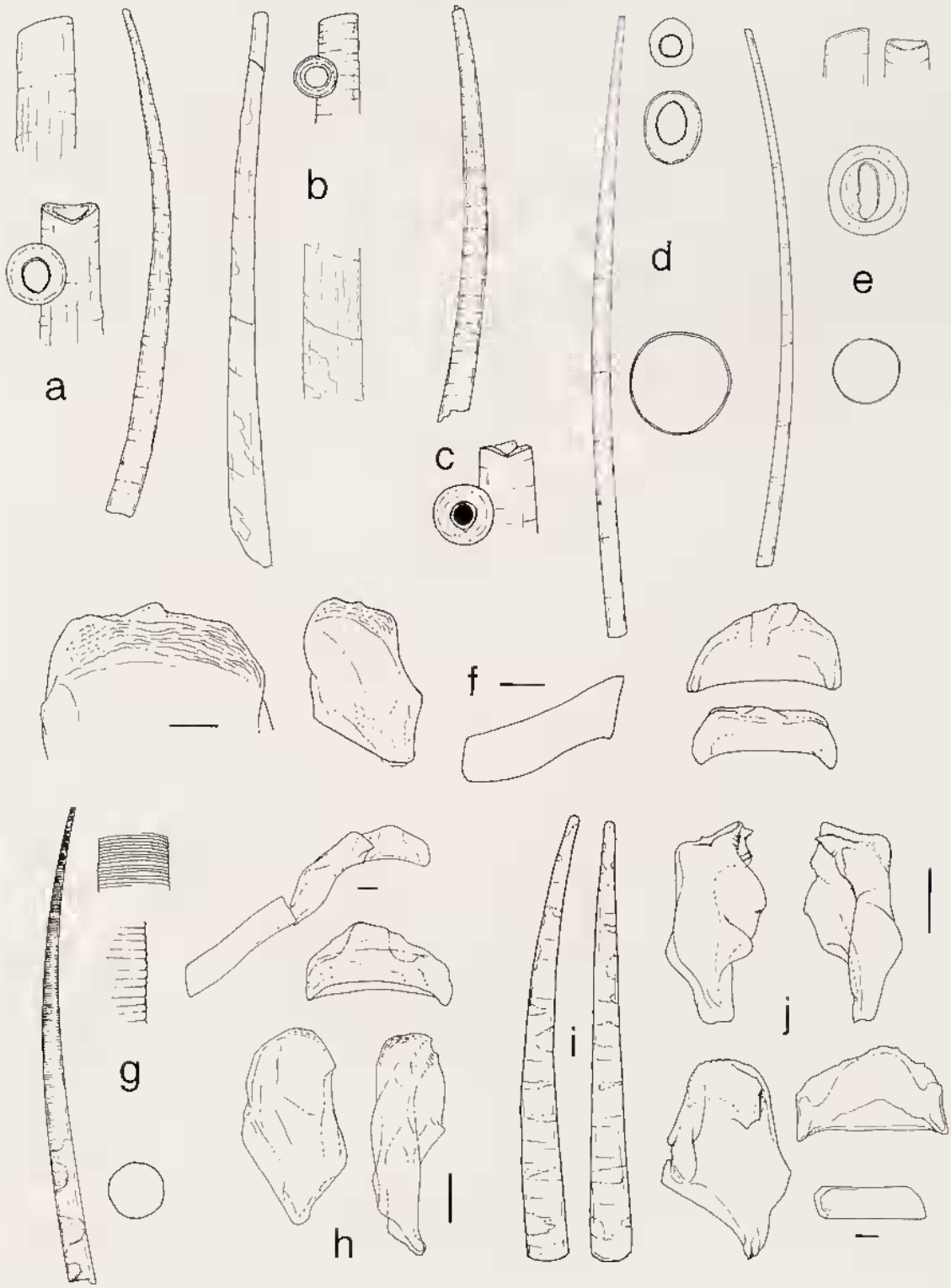
Genus *ENTALINA* Monterosato, 1872

Type species (OD): *Dentalium tetragonum* Brocchi, 1814. Miocene. Italy.

DIAGNOSIS. — *Shell* medium to large, arched, solid, usually polished, translucent white when fresh, chalky when dead. Sculptured by 4-5 primary ribs, secondary riblets present. Rib section flat to rounded, simple or bifurcated. Intercostal spaces straight to convex, smooth or longitudinally sculptured. Apex simple. Section usually pentagonal at the apex; pentagonal or quadrate at mouth. *Radula* rachidian high, narrow, anterior margin usually rounded, but occasionally irregular; lateral high, with two lateral primary cusps, lateral denticles present, including 5-6 subequal secundary denticles; marginal sinusoidal.

DISTRIBUTION. — Miocene-Recent. Worldwide. Sublittoral-bathyal.

FIG. 102. — **a**, *Laevidentalium eburneum*, shell (58 mm), apex and apical section, CORINDON: stn DG 258. — **b**, *Laevidentalium leptosceles*, shell (33 mm), apex and apical section, detail of sculpture, SAFARI: stn CP 09. — **c**, *Laevidentalium eoruseum*, shell (43 mm), apex and apical section, MUSORSTOM 3: stn CP 139 . — **d**, *Laevidentalium houbricki* sp. nov., holotype, shell (60 mm), apical, posterior 1/4 and oral sections. — **e**, *Laevidentalium gofasi* sp. nov., holotype, shell (50 mm), apex, apical and oral sections. — **f**, *Laevidentalium* type radula (*L. eoruseum*). — **g**, *Omniglypta eerina*, shell (62 mm), detail of sculpture and oral section, ESTASE 2: stn CP 6. — **h**, *Omniglypta* type radula (*O. cerina*). — **i**, *Rhabdus perceptum*, (Southern Argentina; Montevideo Museum), shell (60 mm), lateral and dorsal views. — **j**, *Rhabdus* type radula (*R. perceptum*).



Entalina mirifica (Smith, 1895)

Figs 103, 107 a, c

Dentalium mirificum Smith, 1895: 9, pl. 2, fig. 1.

Synonyms:

Entalina quadrangularis Boissevain, 1906: 62, pl. 6, figs 73-75, 85-86 (**Syn. nov.**).
Entalina majestica Kira, 1959: 105, pl. 40, fig. 3.

Other references:

Dentalium mirificum – Winckworth, 1940a: 25.
Entalina mirifica – Pilsbry & Sharp, 1897: 134, pl. 20, fig. 29. — Boissevain, 1906: 62, pl. 2, fig. 37. — Ludbrook, 1954: 111, fig. 15. — Chistikov, 1982c: 1496, pl. 2, figs 2-3.
Entalina (E.) mirifica – Habe & Kosuge, 1964: 8.
Entalina quadrangularis – Plate, 1908a: 358. — Habe, 1964a: 39, pl. 3, fig. 6, pl. 4, figs 20-21. — Okutani, 1966: 13. — Habe, 1977: 339, pl. 71, figs 1-2. — Chistikov, 1982c: 1496. — Habe *et al.*, 1986: 24. — Higo & Goto, 1993: 689.
Entalina (E.) quadrangularis – Habe, 1964b: 8.
Entalina platamodes – Boissevain, 1906: 62, pl. 2, fig. 38, pl. 6, figs 76-78.
Entalina quadriangularis (*sic*) – Habe, 1963: 271, textfigs 20-21. — Okutani, 1964: 78, pl. 6, fig. 5; 1966: 13.

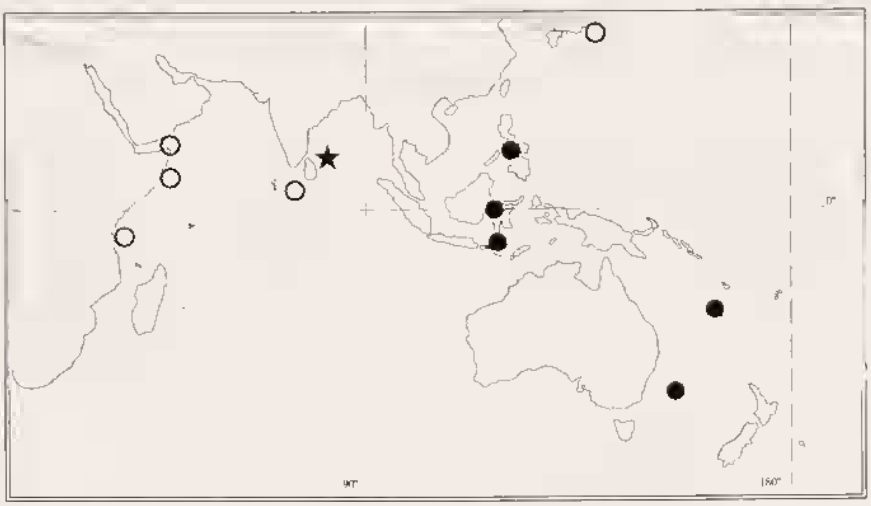


Fig. 103. — Distribution of *Entalina mirifica*.

Type material. — *D. mirificum*: 4 syntypes dd BMNH 1895.7.2.26. — *E. quadrangularis*: lectotype (here designated) ZMA 3.06.081 and paralectotypes ZMA 3.06.082.083.

Type locality. — *D. mirificum:* Indian Ocean, off Trincomalee, *"Investigator"*, stn 172, 200-350 fms [357-640 m]. — *E. quadrangularis*: Indonesia, Celebes Sea, *"Siboga"*, stn 88, 00°35′ N, 119°09′ E, 1301 m. — *E. majestica*: Japan, 30-50 fms [55-91 m].

Material examined. — The type material listed above.
New Caledonia. BIOGEOCAL: stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 1 dd.
"Vauban" 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 7 lv, 10 dd.
Tasman Sea. *"Galathea"*: stn 554, 37°28′ S, 151°51′ E, 1330 m, 5 lv, 4 dd.
Indonesia. CORINDON: stn B 236, 00°07′ N, 119°45′ E, 173 m, 2 dd.
"Snellius" II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 5 dd. — Stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd. — Stn 4.130, 08°18′ S, 118°18′ E, 700-730 m, 1 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 4 dd.

Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 8 lv, 4 dd.
MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 lv, 1 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 1 lv. — Stn CP 50, 13°37′ N, 120°33′ E, 810-820 m, 2 lv, 2 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 2 lv, 5 dd.
MUSORSTOM 3: stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 2 dd. — Stn CP 118, 11°58′ N, 121°06′ E, 448-466 m, 1 dd.

DISTRIBUTION. — Indonesia (BOISSEVAIN, 1906), Northern Indian Ocean, 55-1300 m (HABE & KOSUGE, 1964 as *E. quadrangularis*) as far West as Zanzibar and the Gulf of Aden (LUDBROOK, 1954). Now extended to the Philippines and the South Pacific, live records in 195 — 2050 m.

REMARKS. — The shape of the oral section was the considered the main difference between *Entalina mirifica* and *E. quadrangularis*. When a large series of individuals is examined, the variability of this character indicates the weakness of the former specific distinction. I agree with Japanese authors in considering *E. majestica* also a junior synonym of *E. quadrangularis*.

Entalina subterlineata (Tomlin, 1931)

Figs 104, 107 b

Deutalium subterlineatum Tomlin, 1931: 337.

Other references:

Deutalium subterlineatum — BARNARD, 1963b: 348, fig. 30a.
Entalina subterlineata — CHISTIKOV, 1982c: 1497.

TYPE MATERIAL. — Holotype SAM A6192, paratype NMW (*fide* OLIVER, 1984).

TYPE LOCALITY. — Off South Africa, "Cape Point 17°85′ E, 43 mi, 900 fms" [1645 m].

MATERIAL EXAMINED. — The holotype.
South Africa. *"Meiring Naudé"*: stn SM 94, 28°16′ S, 32°29′ E, 670 m, 2 dd. — Stn SM 123, 30°33′ S, 30°49′ E, 690 m, 2 lv. — Stn SM 129, 30°53′ S, 32°31′ E, 850 m, 16 lv, 20 dd. — Stn SM 131, 30°43′ S, 30°40′ E, 780 m, 1 dd. — Stn SM 184, 33°39′ S, 27°11′ E, 86 m, 6 lv, 10 dd.

FIG. 104. — Distribution of *Entalina subterlineata*.

DISTRIBUTION. — Endemic to South Africa, recorded alive from 690-860 m, shells down 1645 m.

Other Indo-Pacific species of *Entalina* cited in the literature

Entalina adenensis Ludbrook, 1954: 112, fig. 17. Gulf of Aden, *"John Murray"*, stn 185, 13°48′ N, 16°48′ E, 2000 m. Supposedly in BMNH, not located.

Entalina inaequisculpta Ludbrook, 1954: 111, fig. 16. Gulf of Aden, *"John Murray"*, stn 185, 13°48′ N, 16°48′ E, 2000 m. Supposedly in BMNH, not located.

Subfamily HETEROSCHISMOIDINAE Chistikov, 1982

Genus *HETEROSCHISMOIDES* Ludbrook, 1960

Figs 107 d-e

Type species (OD): *Dentalium subterfissum* Jeffreys, 1877. Recent, North Atlantic Ocean.

DIAGNOSIS. — *Shell* medium, slightly curved, regularly tapering, translucent when fresh, milky-white when dead. Longitudinal sculpture of 10-12 primary prominent ribs, intercostal spaces convex. Apex with a deep irregular fissure on dorsal side. Section polygonal, slightly compressed laterally, oral aperture thin.

Radula rachidian with anterior margin rounded and lateral half folded to the ventral side; lateral with sharp pointed primary cusps and 4 important denticles; marginal slightly curved with conspicuous lateral processus.

DISTRIBUTION. — Recent, North Atlantic Ocean, bathyal-abyssal.

REMARKS. — As in *Spadentalina*, the fissure is observed since the embryonic stage of the shell (Fig. 111 g).

The genus *Heteroschismoides* has not been found in the Indo-Pacific region.

Genus *COSTENTALINA* Chistikov, 1982

Type species (OD): *C. elegans* Chistikov, 1982. Recent, Indian Ocean.

DIAGNOSIS. — *Shell* small to medium, slightly to well curved, fragile, translucent white when fresh, opaque to polished when dead. Longitudinal sculpture of 10-12 prominent primary ribs; intercostal spaces convex. Apex simple, truncate, irregular, preapical callus prominent, lumen circular. Section polygonal, oral aperture thin.

Radula rachidian high, polygonal with rounded anterior margin and lateral half folded to ventral side; lateral well armed, with sharp, pointed primary cusps; marginal slightly curved (Fig. 107 h: *C. vemae* Scarabino, 1986).

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Costentalina tuscarorae Chistikov, 1982

Figs 105, 107 f, 111 h, k

Costentalina tuscarorae Chistikov, 1982b: 1316, pl. 1, figs 7-11, pl. 4, figs 1-2.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1982).

TYPE LOCALITY. — NW Pacific, *"Vitiaz"*, stn 3575, 38°02'1 N, 146°33'1 E, 5475 m.

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn CP 2, 14°05' N, 120°02' E, 2050 m, 3 lv, 2 dd. — Stn DW 1, 14°05' N, 120°01' E, 2200 m, 2 lv, 2 dd.

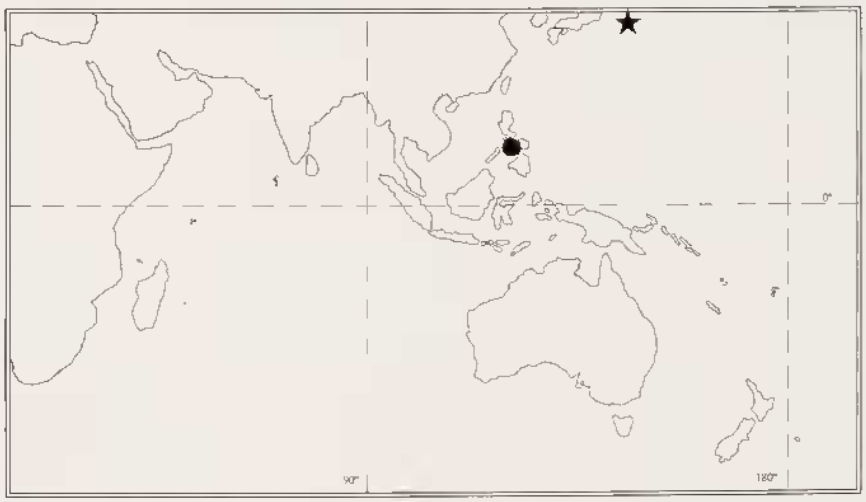


FIG. 105. — Distribution of *Costentalina tuscarorae*.

DISTRIBUTION. — East of Japan and the Philippines. Live records from 2050 m (present paper) to 5475 m (CHISTIKOV, 1982).

Costentalina indica Chistikov, 1982

Figs 106, 107 g

Costentalina indica Chistikov, 1982b: 1318, pl. 1, figs 12-14, pl. 4, figs 4-7.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV, 1982).

TYPE LOCALITY. — Indian Ocean, *"Vitiaz"*, stn 4922, 06°54'2 S, 83°00'7 E, 3980 m.

MATERIAL EXAMINED. — **West Indian Ocean.** BENTHEDI: stn CH 87, 11°44' S, 47°35' E, 3716 m, 8 lv, 5 dd. — Stn CH 90, 11°44' S, 47°30' E, 3700 m, 2 lv.
MD 32 Réunion: stn DS 149, 20°26' S, 55°40' E, 3500-3510 m, 2 lv, 2 dd. — Stn DS 151, 20°51' S, 56°03' E, 3240-3300 m, 4 lv.

SAFARI 1: stn CP 06, 30°40′ S, 48°14′ E, 4020-4035 m, 1 lv. — Stn DS 05, 30°37′ S, 48°30′ E, 4500-4612 m, 2 lv. — Stn DS 08, 24°22′ S, 58°19′ E, 5025-5825 m, 1 lv. — Stn SIPAN 79 09, 30°41′ S, 48°28′ E, 4462 m, 1 lv. — Stn CP 17, 24°26′ S, 58°19′ E, 4987-5025 m, 1 lv.

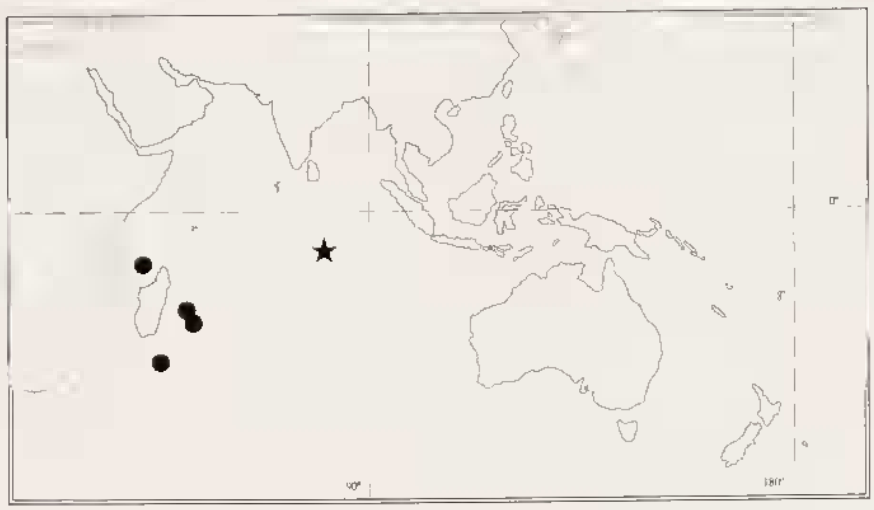


FIG. 106. — Distribution of *Costentalina indica*.

DISTRIBUTION. — Central Indian Ocean, SE of Sri Lanka, Madagascar and Réunion Island. Live records from 3240 to 5285 m (present paper).

Other Indo-Pacific species of *Costentalina* cited in the literature

Costentalina elegans Chistikov, 1982. Indian Ocean, *"Vitiaz"*, stn 6744-5 T, 12°47′ S, 88°54′ E, 5100-5200 m, ZIN.

Genus *ENTALINOPSIS* Habe, 1957

Type species (OD): *Dentalium nivosum* Kuroda & Kikuchi, 1933 [= *Dentalium intercostatum* Boissevain, 1906].

DIAGNOSIS. — *Shell* medium to large, slightly curved, to nearly straight, solid, opaque or polished, chalky white. Longitudinal sculpture of 7 angled primary ribs, one ventral; intercostal spaces convex. Apex simple, with crownlike appearance in fresh specimens due to projection of the primary ribs. Preapical callus prominent, lumen circular. Starlike in section.
Radula rachidian subpyramidal, anterior border rounded, base wide; lateral with one prominent primary cusp and secondary denticles, base wide; marginal long, slightly sigmoidal.

DISTRIBUTION. — Recent, West Pacific and Indian Oceans, absent in the Atlantic. Shelf, bathyal.

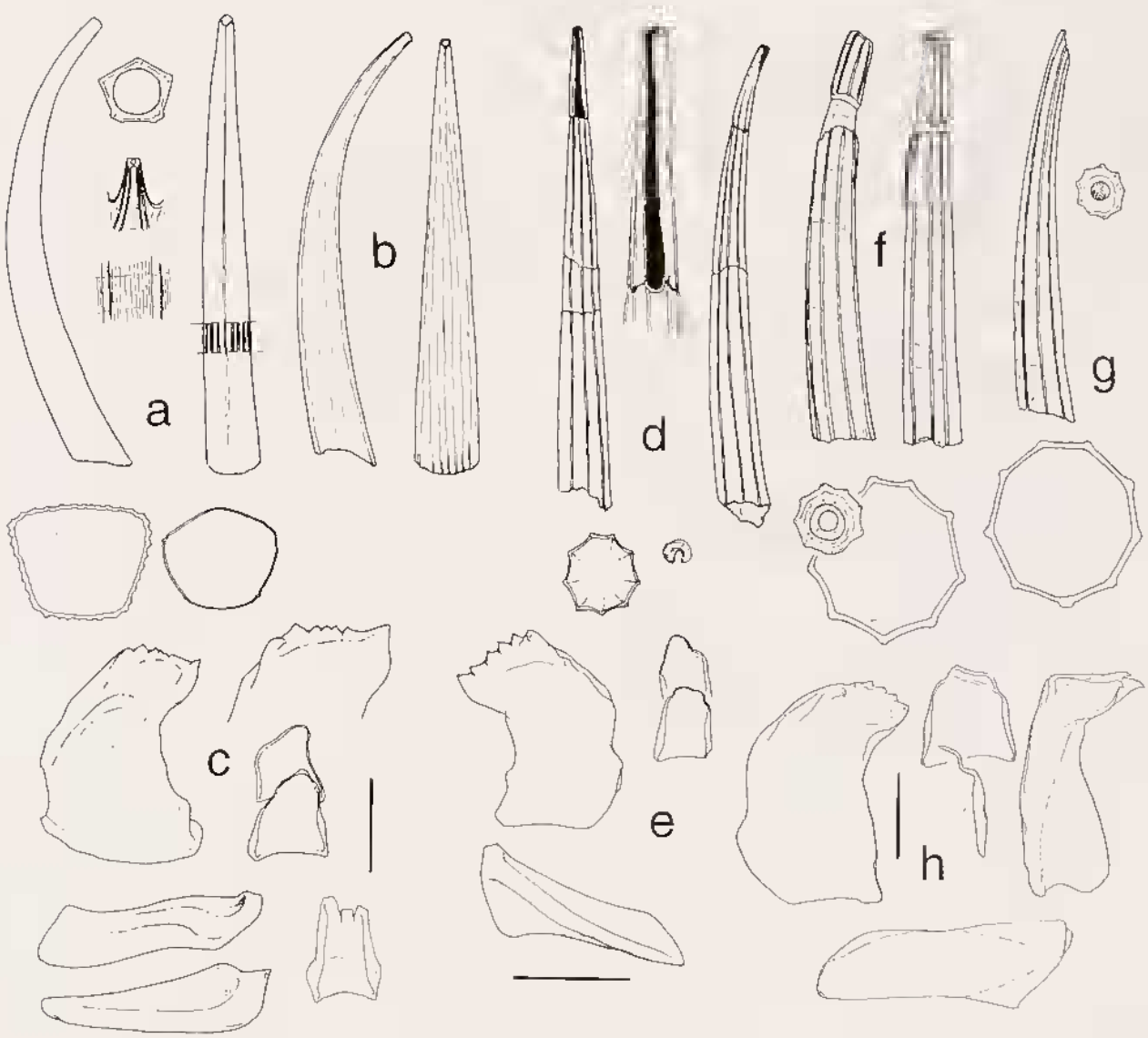


FIG. 107. — **a**, *Entalina tubifera*, shell (21 mm), ventral view of apex (note double ribs), apical section, variation of oral section, detail of sculpture, MUSORSTOM: stn CP 25 and oral section (right fig.), MUSORSTOM 2: stn CP 18 — **b**, *Entalina subterlineata*, shell (17 mm) "*Meiring Naudé*", stn SM 123. — **c**, *Entalina* type radula (*E. tubifera* and an isolated rachidian of *E. quinquangulare* [Northeastern Atlantic Ocean] bottom right). — **d**, *Heteroschismoides subterfissum* (Northeast Atlantic Ocean, Bay of Biscay, MNHN), shell (13 mm), lateral and ventral faces, apex, apical and oral sections. — **e**, *Heteroschismoides* type radula (*H. subterfissum*). — **f**, *Costentalina tuscaroraе*, shell (11 mm), lateral and dorsal faces, apical and oral sections, ESTASE 2: stn CP 2. — **g**, *Costentalina tenuica*, shell (10 mm), apical and oral sections, SAFARI 1: stn DS 5. — **h**, *Costentalina* type radula (*C. venae*, Argentine basin, South Atlantic Ocean). Scale lines: 100 µm.

Entalinopsis intercostata (Boissevain, 1906)

Figs 108, 115 a, d

Dentalium intercostatum Boissevain, 1906: 14, pl. 6, fig. 14, textfig. 11.

Synonyms:

? Dentalium siberutense Plate, 1908a: 348, pl. 30, figs 17-20 (**Syn. nov.**).
Dentalium nitrosum Kuroda & Kikuchi, 1933: 7, pl. 1, figs 9-10, textfigs 1-2.
Dentalium tugaruense Nomura & Hatai, 1940: 73, pl. 3, fig. 4 (*fide* HABE, 1964a).

Other references:

Entalina intercostata – HABE, 1977: 339, pl. 71, figs 3-5.
Entalina (Entalinopsis) intercostata – HABE, 1963: 272, pl. 38, figs 24-25.
Entalina (Entalinopsis) nivosa – HABE, 1957: 135, fig 9.
Entalinopsis intercostatus – HABE, 1964a: 40, pl. 2, figs 24-25, pl. 5, figs 63-65; 1971: 492 (Japanese text), 310 (English text), pl. 65, figs 20-21. — HABE *et al.*, 1986: 24.
Dentalium (Entalina) intercostatum – SHIKAMA, 1964: 35, fig. 1.
Entalinopsis intercostata – HIGO & GOTO, 1993: 689.

TYPE MATERIAL. — *D. intercostatum*: holotype ZMA 3.06.010.

TYPE LOCALITY. — *D. intercostatum*: Indonesia, Ceram Sea, *"Siboga"*, stn 178, 02°40′ S, 128°37′ E, 835 m. — *D. siberutense*: Indonesia, Siberut Island, 00°39′ S, 98°52′ E, 750 m. — *D. nivosum*: Toyama Bay, Japan, 80-150 m. — *D. tugaruense*: Japan.

MATERIAL EXAMINED. — The type material listed.
Indonesia. *"Snellius"* II: stn 4.130, 08°18′ S, 118°18′ E, 700-730 m, 4 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 1 dd. — Stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 lv. — Stn 4.267, 08°18′ S, 118°21′ E, 650 m, 1 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 2 lv, 5 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 82 lv, 282 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 4 dd. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 1 dd.
MUSORSTOM 3: stn DR 93, 13°49′ N, 120°02′ E, 540 m, 1 dd. — Stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 lv, 5 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 30 lv, 43 dd.

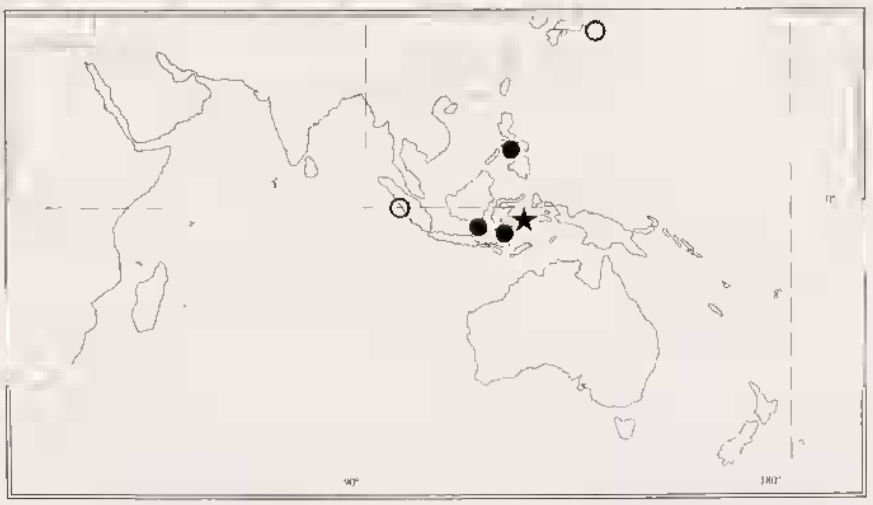


FIG. 108. — Distribution of *Entalinopsis intercostata*.

DISTRIBUTION. — Indonesia, East China Sea, Japan and the Philippines, living from 495 to 842 m (present paper), shells from 50 m (HABE & KOSUGE, 1964).

Entalinopsis micra sp. nov.
Figs 109, 111 c-d, 115 c

TYPE MATERIAL. — Holotype and 6 paratypes dd MNHN.

TYPE LOCALITY. — S New Caledonia, *"Vauban"* 1978-79, stn 40, 22°30′ S, 166°24′ E, 250-350 m.

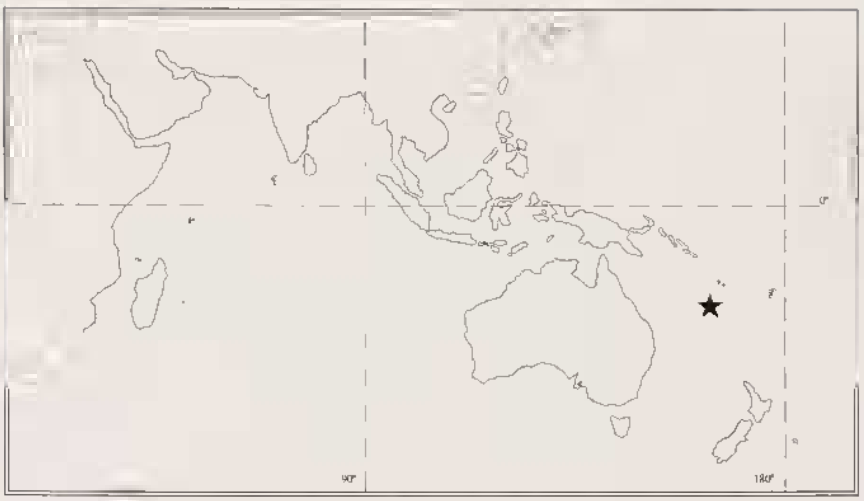


FIG. 109. — Distribution of *Entalinopsis micra*.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — New Caledonia. Shells only in 250-350 m.

DESCRIPTION. — *Shell* to 8 mm long, arched, fragile, translucent, cream in color. Sculpture of seven primary ribs and one to three secondary ribs, originating near the apex, less prominent at the mouth than the primary ribs. Apex fine with protuberant ribs, star-like cross section. Subapical callus fine, lumen circular. Mouth fragile, polygonal in section.

Measurements: holotype L 6.8, W 0.7, w 0.4, arc 0.5; paratypes L 7.4, W 0.6, w 0.4, arc 0.6; L 6.3, W 0.5, w 0.3, arc 0.5; L 6, W 0.5, w 0.3, arc 0.4. W/w ratio 1.8-1.6.

ETYMOLOGY. — From the Latin *micra*, very small.

Entalinopsis stellata sp. nov.

Figs 110, 111 a-b, 115 b

TYPE MATERIAL. — Holotype MNHN. Paratypes: 6 MNHN, 1 AMS C201730, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 18, 14°00′ N, 120°18′ E, 188-195 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 80, 20°32′ S, 166°48′ E, 900-980 m, 1 lv, 1 dd.
Philippines. MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 lv (holotype). — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 4 lv (paratypes: 3 MNHN, 1 AMS), 3 dd (paratypes: 2 MNHN, 1 USNM). MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd (paratype).

DISTRIBUTION. — The Philippines and New Caledonia, living depth range 195-900 m.

DESCRIPTION. — *Shell* to 26.2 mm long, regularly curved, opaque, white. Sculpture of seven prominent, raised ribs, one median on ventral side, two on dorsal one. Intercostal spaces concave with growth lines. Ribs extending over apex, which is star-like in cross section. No secondary ribs. Lumen subcircular, prominent subapical callus. Mouth fragile, polygonal in section, slightly laterally compressed.

Measurements: holotype L 22.7, W 2.3, w 0.85, arc 2; paratypes L 26.2, W 2.9-2.6, w 1.15, arc 2.5; L 20.1, W 2.45, w 1.5, arc 1.5. W/w ratio 1.6-2.7.

FIG. 110. — Distribution of *Entalinopsis stellata*.

REMARKS. — One specimen is sculptured with nine ribs (Fig. 111 a).

ETYMOLOGY. — Named for the star-shaped transverse section.

Other Indo-Pacific species of *Entalinopsis* cited in the literature

Entalinopsis habutae (Kuroda & Kikuchi, 1933): 8, pl. 1, figs 3-4, 12-13. Japan, Toyama Bay, 150-350 m. Geological Institute of Kyoto University, Japan.

Genus *SPADENTALINA* Habe, 1963

Type species (OD): *Dentalium tubiforme* Boissevain, 1906.

DIAGNOSIS. — *Shell* medium to large, slightly to well curved, solid, translucent when fresh, opaque to polished when dead, white to light brown. Longitudinally sculptured by 8 angled or rounded primary ribs, two of which are ventral, two dorsal and two pairs lateral. Secondary ribs present, intercostal spaces convex to straight; the entire surface usually strongly cancellate. Apex with the ventral wall wider and a ventral lobe, often with a regularly spaced series of holes creating the lobe by reabsorption. Preapical callus thin. Section starlike to polygonal, oral aperture thin.
Radula rachidian high, subtriangular, similar to that of *Pertusiconcha*; lateral well armed, with two primary cusps and denticles; marginal slightly curved.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Spadentalina tubiformis (Boissevain, 1906)

Figs 111 i-j, 112, 115 e, 172 a-b

Dentalium tubiforme Boissevain, 1906: 19, pl. 6, fig. 5.

Other references:

Spadentalina tubiformis — HABE, 1964a: 11, pl. 4, figs 9-12; 1977: 333. — HABE & KOSUGE, 1964: 5. — CHISTIKOV, 1982a: 677, pl. 3, figs 8-14, pl. 5, fig. 3. — HIGO & GOTO, 1993: 686.

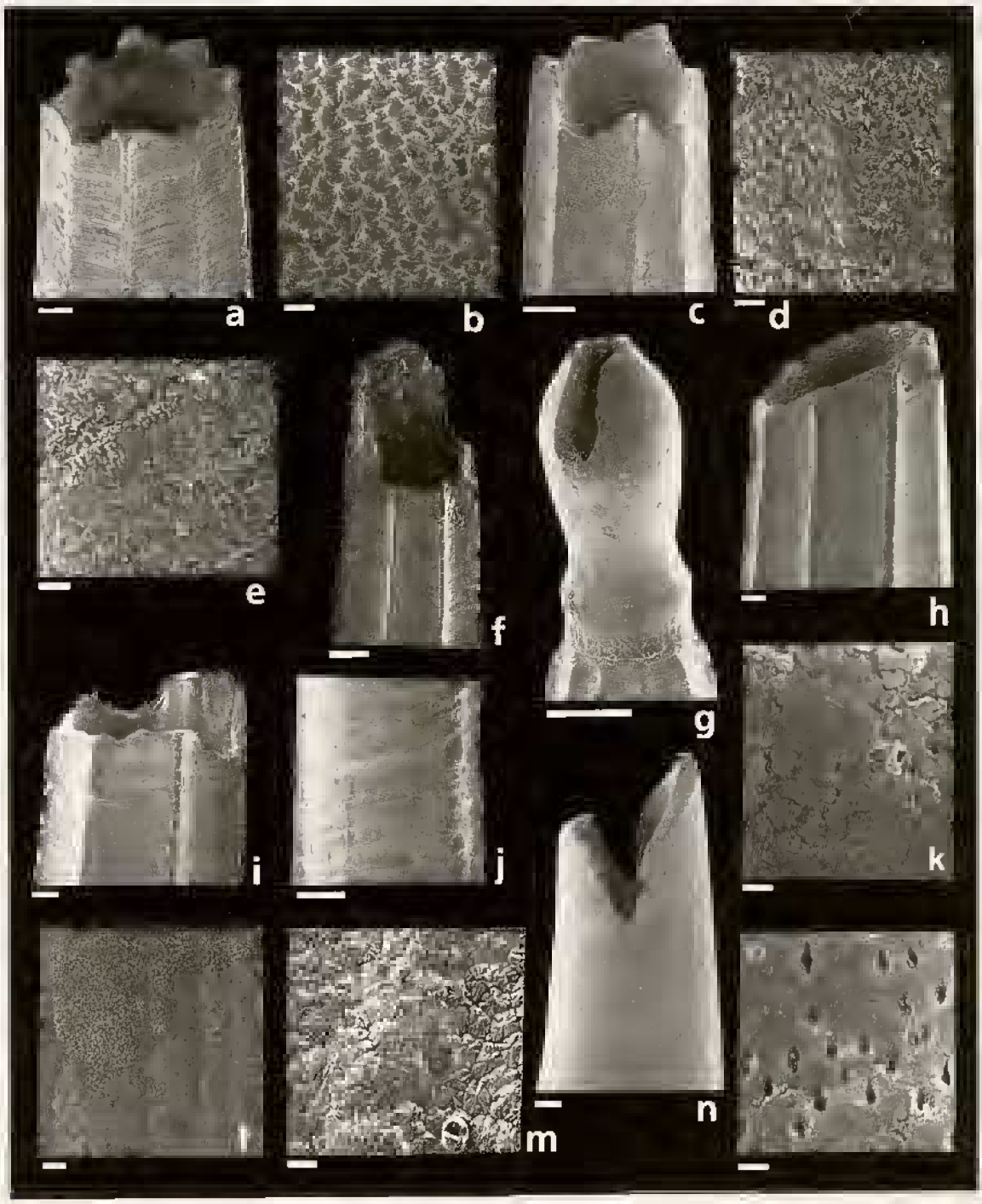


FIG. 111. — **a**, *Entalinopsis stellata*, paratype, apex of a nine-ribbed specimen. — **b**, same specimen, detail of surface in intercostal space. — **c**, *Entalinopsis micra*, paratype, apex. — **d**, same specimen, detail of surface in intercostal space. — **e**, *Spadentalina ingrata*, paratype, detail of surface in intercostal space. — **f**, same specimen, apex. — **g**, *Spadentalina ingrata*, specimen with the embryonic shell. — **h**, *Costentalina tuscarorae*, apex. — **i**, *Spadentalina tubiformis*, apex. — **j**, same specimen, detail of surface. — **k**, *Costentalina tuscarorae*, detail of surface in intercostal space. — **l**, *Striopulsellum minimum*, detail of surface. — **m**, *Solenoxiphus striatulus*, detail of surface of a rib and intercostal spaces. — **n**, *Dischides minutus*, apex. — **o**, same specimen, detail of surface. Scale lines: 100 µm (a, c, f, g, h, i, n), 10 µm (l), 2 µm (b, d, e, j, k, m, o).

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.013, paralectotypes ZMA 3.06.012.

TYPE LOCALITY. — Indonesia, *"Siboga"*, stn 212, 05°56′ S, 120°19′ E, 462 m.

MATERIAL EXAMINED. — The type material.
Indonesia. CORINDON: stn B 210, 00°13′ S, 117°53′ E, 338 m, 2 dd. — Stn B 207, 00°15′ S, 117°52′ E, 150 m, 3 dd. — Stn B 248, 00°54′ S, 119°29′ E, 170 m, 14 dd.
"Snellius" II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 6 dd. — Stn 4.113, 08°18′ S, 118°16′ E (no depth data), 2 dd. — Stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 lv (RMNH).
Philippines. MUSORSTOM 2: stn CP 82, 13°46′ N, 120°28′ E, 550 m, 3 dd. — Stn DR 83, 13°55′ N, 120°30′ E, 318-320 m, 3 lv.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd. — Stn CP 106, 13°47′ N, 120°30′ E, 640-668 m, 3 dd. — Stn CP 122, 12°20′ N, 121°42′ E, 673-675 m, 2 dd. — Stn CP 123, 12°11′ N, 121°45′ E, 700-702 m, 1 dd.

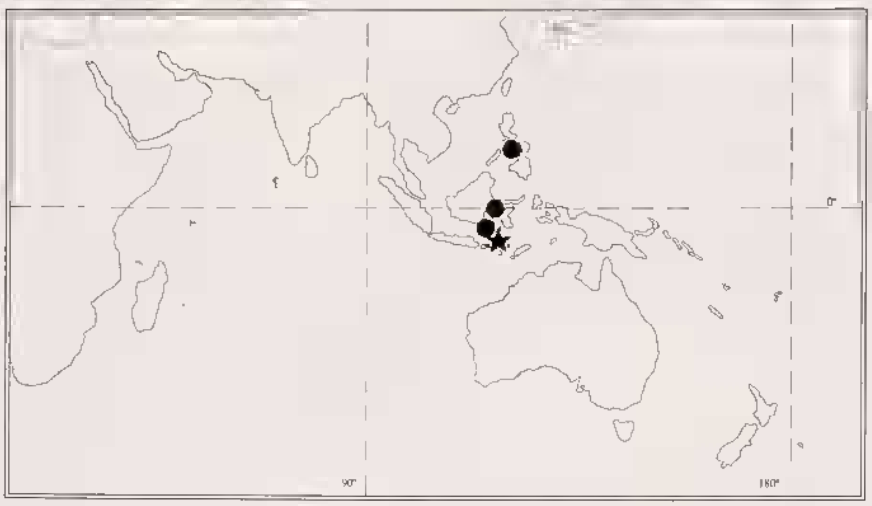


FIG. 112. — Distribution of *Spadentalina tubiformis*.

DISTRIBUTION. — Indonesia and Japan, now recorded from the Philippines, alive in 318-495 m, shells down to 702 m (present paper).

Spadentalina ingrata sp. nov.

Figs 111 e-g, 113, 115 f

TYPE MATERIAL. — Holotype MNHN. Paratypes: 12 MNHN, 1 AMS C201731, 1 NMNZ M268951, 1 USNM.

TYPE LOCALITY. — Loyalty Islands, MUSORSTOM 6, stn DW 444, 20°54′ S, 167°18′ E, 300 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. CHALCAL 1: stn DC 38, 20°00′ S, 158°46′ E, 250 m, 2 dd.
MUSORSTOM 5: stn DW 280, 24°10′ S, 159°36′ E, 270 m, 1 dd (paratype USNM). — Stn DW 282, 24°12′ S, 159°32′ E, 226-230 m, 3 dd (paratypes: 2 MNHN, 1 AMS). — Stn DW 285, 24°09′ S, 159°34′ E,

245-255 m, 3 dd. — Stn DW 334, 20°06′ S, 158°48′ E, 315-320 m, 1 dd (paratype). — Stn DW 335, 20°03′ S, 158°45′ E, 315 m, 1 dd. — Stn DW 344, 19°39′ S, 158°34′ E, 310 m, 1 dd (paratype).
New Caledonia. *"Vauban"* 1978-79: stn 33, 22°33′ S, 166°25′ E, 290-335 m, 3 dd. — Stn 34, 22°32′ S, 166°26′ E, 350-420 m, 1 dd (paratype). — Stn 35, 22°32′ S, 166°26′ E, 250-375 m, 1 dd. — Stn 37, 22°32′ S, 166°26′ E, 175-250 m, 2 dd. — Stn 40, 22°30′ S, 166°24′ E, 250-350 m, 15 lv, 166 dd (paratypes: 3 MNHN, 1 NMNZ).
BIOCAL: stn DW 43, 22°46′ S, 167°15′ E, 400 m, 1 dd. — Stn DW 77, 22°15′ S, 167°15′ E, 440 m, 1 lv. — Stn DW 104, 21°31′ S, 166°21′ E, 375-450 m, 4 dd.
BIOGEOCAL: stn KG 252, 21°31′ S, 166°21′ E, 330 m, 1 dd. — Stn DW 253, 21°32′ S, 166°29′ E, 310-315 m, 17 dd (1 paratype).
Passe de Boulari, B. Richer/ORSTOM coll., 400 m, 5 lv.
Loyalty Islands. MUSORSTOM 6: stn DW 406, 20°41′ S, 167°07′ E, 373 m, 1 dd. — Stn DW 411, 20°40′ S, 167°03′ E, 424 m, 1 lv. — Stn DW 444, 20°54′ S, 167°18′ E, 300 m, 1 lv (holotype). — Stn DW 446, 20°54′ S, 167°19′ E, 360 m, 3 dd (paratypes). — Stn DW 449, 20°54′ S, 167°18′ E, 300 m, 1 dd. — Stn DW 485, 21°23′ S, 167°59′ E, 350 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.031, 05°54′ S, 123°58′ E, 390 m, 1 dd.
Philippines. MUSORSTOM 1: stn CP 62, 14°00′ N, 120°16′ E, 179-194 m, 1 dd.
MUSORSTOM 2: stn CP 20, 14°00′ N, 120°18′ E, 185-192 m, 1 lv, 1 dd. — Stn CP 72, 14°00′ N, 120°18′ E, 182-197 m, 1 lv.
MUSORSTOM 3: stn CP 102, 14°01′ N, 120°18′ E, 192 m, 1 lv, 6 dd. — Stn DR 126, 11°49′ N, 121°22′ E, 266 m, 4 dd.

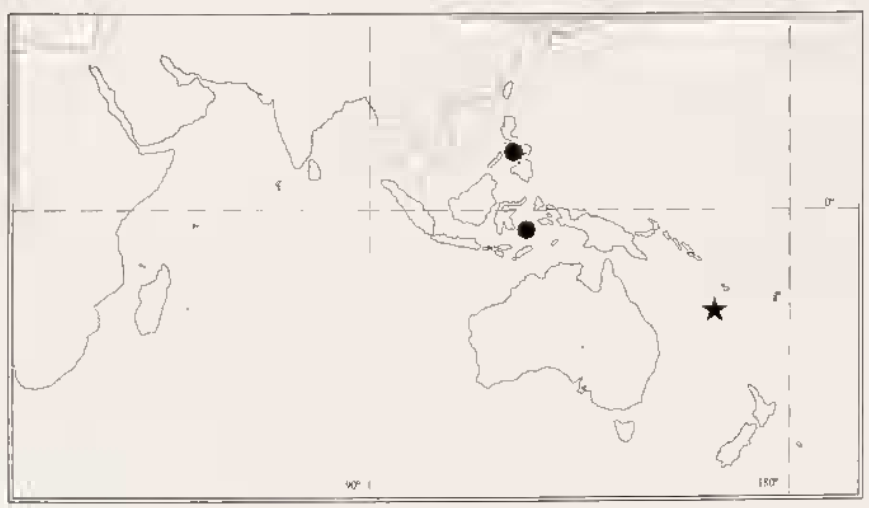


FIG. 113. — Distribution of *Spadentalina ingrata*.

DISTRIBUTION. — The Philippines, Indonesia, New Caledonia, alive from 182 to 440 m.

DESCRIPTION. — *Shell* to 37 mm long, slender, solid. Young specimens regularly curved, adults vary from almost straight to regularly curved or curved only at the posterior end. Sculpture of 8 primary ribs, prominent throughout. Intercostal spaces with 6 to 7 riblets crossed by transversal lines, giving a slightly cancellate appearance. Apex with long lobe-like structure on the ventral side in fresh specimens, showing only the base when broken. Mouth straight, octogonal in section, slightly compressed laterally.

Measurements: holotype L 24.5, W 2.65, w 0.82, arc 2.5; paratypes L 36.4, W 2.2, w 1, arc 0.5; L 26.2, W 1.85, w 0.65, arc 1; L 30.6, W 2, w 1.5, arc 2.5; L 30.5, W 2.2, w 1.2, arc 2; L 25.4; W 2.3, w 0.8, arc 1.5; L 27.6, W 2.5, w 0.85, arc 1.2; L 34.7, W 2.6, w 1.1, arc 1; L 19.2, W 1.2, w 0.4, arc 0.5. W/w ratio 1.3-3.2.

REMARKS. — This species is variable in curvature, but constant in sculpture. It differs from *Spadentalina tubiformis* from which it differs in the less prominent cancellate sculpture. The dorsal lobe is often regularly perforated on both sides (Fig. 115f) in fresh specimens. This character is also noted in *Pertusiconcha* and may be caused by the reabsorption process that forms the apical structure. This species may have been confused with *Entalinopsis habutae* but the later has 6 ribbs and a better defined sculpture.

ETYMOLOGY. — From the Latin *ingrata*, indicating the difficulties noted in defining the species.

Genus *PERTUSICONCHA* Chistikov, 1982

Type species (OD): *Dentalium callithrix* Dall, 1889. Recent, Yucatan strait, 640 fms [1170 m].

DIAGNOSIS. — *Shell* medium to large, slightly curved, solid, opaque or polished, chalky white. Longitudinal sculpture of 8 primary ribs and convex intercostal spaces. Apex truncate, irregular by presence of regularly or irregularly spaced circular holes. Preapical callus prominent, lumen circular. Section oval, laterally compressed.
Radula rachidian high, subtriangular with rounded anterior margin, lateral half folded in, especially at base; lateral head with one sharp pointed primary cusp and several subequal denticles; marginal slightly curved (Fig. 115 g).

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Pertusiconcha tridentata Chistikov, 1982

Figs 114, 115 h

Pertusiconcha tridentata Chistikov, 1982a: 678, pl. 4, figs 2-13.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — *"Dimitri Mendeleyev"*, stn 1244T, Tasman Sea, 31°43′ S, 159°00′ E, 1640 m.

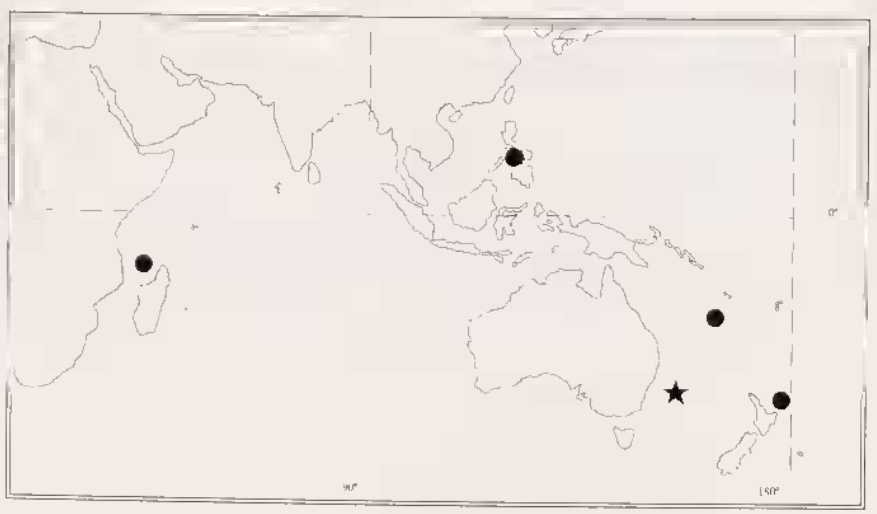


FIG. 114. — Distribution of *Pertusiconcha tridentata*.

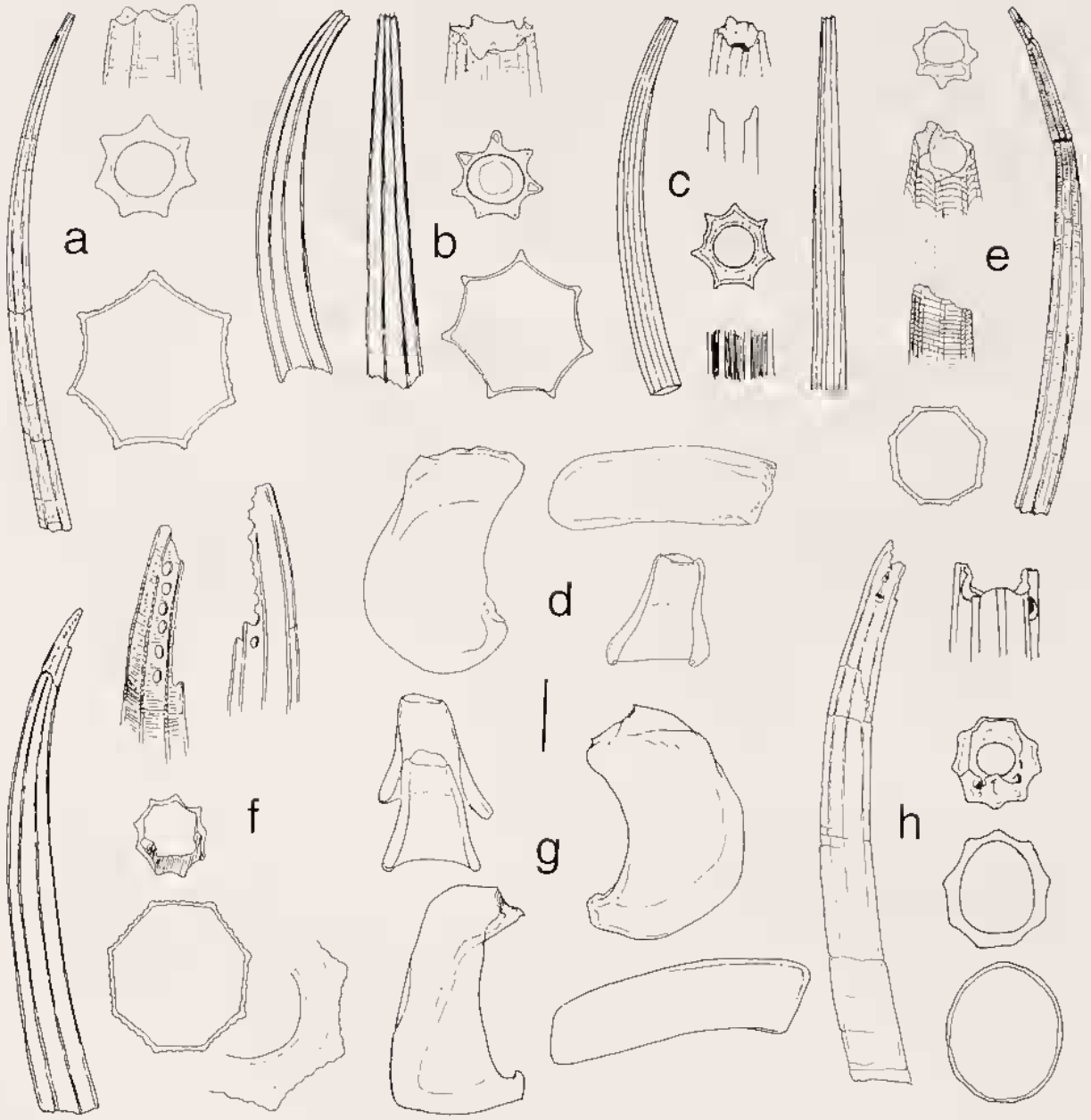


FIG. 115. — **a**, *Entalinopsis intercostata*, shell (55 mm), apex, apical and oral sections, MUSORSTOM 2, stn CP 24. — **b**, *Entalinopsis stellata* sp. nov., holotype, shell (22.7 mm), apex, apical and oral sections. — **c**, *Entalinopsis micra* sp. nov., holotype, shell (6.8 mm), apex and sagital section of apex, apical section, detail of sculpture. — **d**, *Entalinopsis* type radula (*E. intercostata*). — **e**, *Spadentalina tubiformis*, shell (37 mm), apex, apical and oral sections, MUSORSTOM 2; stn CP 82. — **f**, *Spadentalina ingrata* sp. nov., holotype, shell (24.5 mm), apex, apical and oral sections, section near the apex. — **g**, *Pertusiconcha* type radula (*P. callithrix*, Western Atlantic Ocean, Puerto Rico Trench). — **h**, *Pertusiconcha tridentata*, shell (29 mm), apex, apical, medial and oral section. BIOCAL: stn DS 04.

MATERIAL EXAMINED. — **New Zealand**. *"Galathea"*: stn 665, 36°38′ S, 178°21′ E, 2470 m, 1 dd. **New Caledonia**. BIOCAL: stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 1 dd. — Stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 1 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 1 lv, 1 dd. — Stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 1 lv. — Stn DW 79, 20°40′ S, 166°52′ E, 1320-1380 m, 3 dd. — Stn KG 86, 21°01′ S, 166°58′ E, 1860 m,

1 dd. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 1 lv. — Stn DS 98, 21°24′ S, 166°30′ E, 2365-2470 m, 2 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 lv.
BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 dd. — Stn KG 262, 21°02′ S, 167°02′ E, 1380 m, 1 lv. — Stn CP 266, 21°05′ S, 166°57′ E, 1990-2100 m, 2 dd. — Stn CP 273, 21°02′ S, 166°57′ E, 1920-2040 m, 1 dd. — Stn CP 321, 21°12′ S, 167°00′ E, 2190-2205 m, 1 dd.
Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv.

DISTRIBUTION. — Tasman Sea, now extended to New Zealand, New Caledonia, the Philippines and Madagascar. Recorded alive from 825 to 2070 m, shells down to 2470 m.

Subfamily BATHOXIPHINAE Chistikov, 1983

Genus *Bathoxiphus* Pilsbry & Sharp, 1897

Type species (SD by BOISSEVAIN, 1906): *Dentalium ensiculum* Jeffreys, 1877. Recent, North Atlantic Ocean.

DIAGNOSIS. — *Shell* small to medium in size, well arched, solid, polished, white. Almost unsculptured, angled at dorsal and lateral sides. Apex truncate, lumen circular, located submedially due to dorsal wall width in apical area. Section oval, strongly laterally compressed.
Radula rachidian high, anterior margin simple, rounded with latter half folded inward; lateral with two pointed primary cusps and 5 to 6 subequal secondary cusps; marginal slightly curved.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Bathoxiphus soyomaruae Okutani, 1964
Figs 116, 121 a-b

Bathoxiphus soyomaruae Okutani, 1964: 77, fig. 4.

Other references:

Bathoxiphus soyomaruae — HABE, 1964a: 34, pl. 5, figs 61-62; 1977: 337, pl. 70, figs 17-18. — HABE & KOSUGE, 1964: 6. — OKUTANI, 1974: 26, 28, 34; 1975: 77 (as synonym of *Dentalium colmani*). — CHISTIKOV, 1983: 183, pl. 3, figs 6-22, pl. 4, figs 6-9. — HIGO & GOTO, 1993: 688.

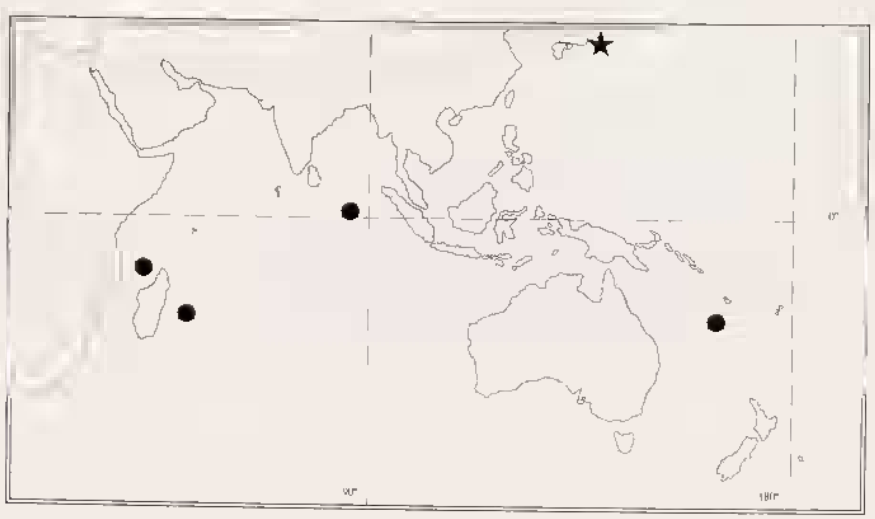


FIG. 116. — Distribution of *Bathoxiphus soyomaruae*.

TYPE MATERIAL. — NSMT, not checked.

TYPE LOCALITY. — Japan, off Aogashima Island, 3150-3350 m.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM 5: stn DW 322, 21°19′ S, 158°00′ E, 975 m, 1 lv, 1 dd.
New Caledonia. BIOGEOCAL: stn KG 233, 21°31′ S, 166°25′ E, 1040 m, 2 lv, 2 dd.
West Indian Ocean. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 1 dd. — Stn CH 90, 11°44′ S, 47°30′ E, 3700 m, 1 lv.
MD 32 Réunion: stn DS 151, 21°51′ S, 56°03′ E, 3240-3300 m, 1 lv. — Stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 dd.
East Indian Ocean. SAFARI 2: stn CP 10, 01°43′ N, 87°08′ E, 4350 m, 1 lv.

DISTRIBUTION. — Japan, now extended to New Caledonia and the Indian Ocean, living from 975 m (present paper) to 5750 m (CHISTIKOV, 1983).

Bathoxiphus inexpectatus sp. nov.

Figs 117, 121 c

TYPE MATERIAL. — Holotype MNHN. Paratypes: 11 MNHN, 1 AMS C201732, 1 NMNZ M268952, 1 USNM.

TYPE LOCALITY. — New Caledonia, N Norfolk Ridge, BIOCAL, stn DW 46, 22°53′ S, 167°17′ E, 570-610 m.

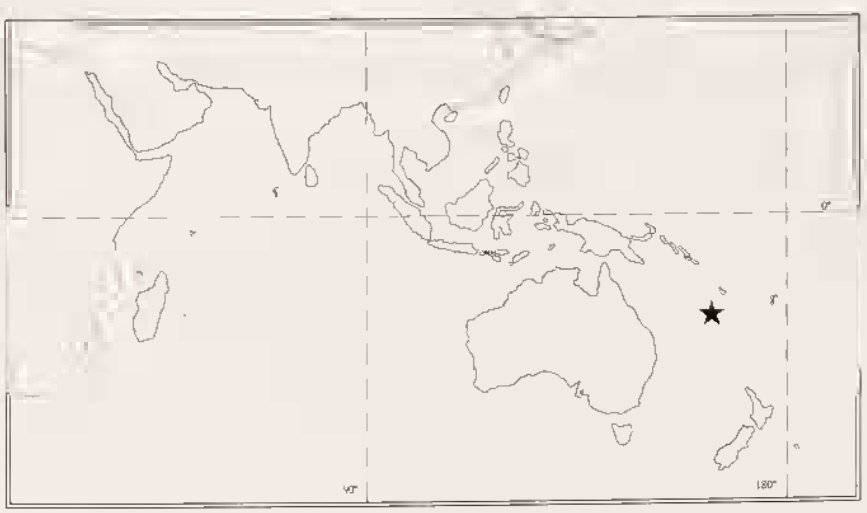


FIG. 117. — Distribution of *Bathoxiphus inexpectatus*.

MATERIAL EXAMINED. — **Chesterfield Islands**. MUSORSTOM: 5 stn DW 362, 19°53′ S, 158°40′ E, 410 m, 1 lv.
New Caledonia. BIOCAL: stn DW 44, 22°47′ S, 167°14′ E, 440-450 m, 6 lv, 4 dd. — Stn DW 46, 22°53′ S, 167°17′ E, 570-610 m, 20 lv (holotype and paratypes: 10 MNHN, 1 AMS, 1 NMNZ, 1 USNM), 17 dd. — Stn DW 66, 24°55′ S, 168°22′ E, 505-515 m, 1 dd.
SMIB 3: stn DW 22, 23°03′ S, 167°19′ E, 503 m, 1 dd.

LAGON: stn 830, 20°49′ S, 165°19′ E, 105-110 m, 1 dd (paratype).
Loyalty Islands. MUSORSTOM 6: stn DW 459, 21°01′ S, 167°31′ E, 425 m, 2 lv, 11 dd.

DISTRIBUTION. — New Caledonia, live records between 410 and 570 m.

DESCRIPTION. — *Shell* to 13 mm long, lacking sculpture, polished, arched, translucent white. Section slightly compressed laterally throughout. Apex strong with two lateral flat V-shaped notches, preapical callus prominent, lumen circular, mouth straight.
Measurements: holotype L 11.9, W 1.2-1.1, w 0.5-0.45, arc 1.6. W/w ratio 2.4.

ETYMOLOGY. — From the Latin, meaning unexpected.

Genus *RHOMBOXIPHUS* Chistikov, 1983

Type species (OD): *Dentalium tricarinatum* Boissevain, 1906.

DIAGNOSIS. — *Shell* small to medium, well arched, solid, polished, white, translucent. Sculpture of 4 flat primary ribs, located ventrally, dorsally and laterally; secondary ribs may be present. Apex truncate, lumen circular located submedially due to the dorsal side width at apical area. Section rhomboidal, strongly laterally compressed.
Radula similar to that of *Bathoxiphus*.

DISTRIBUTION. — Recent, worldwide, bathyal-abyssal.

Rhomboxiphus tricarinatus (Boissevain, 1906)

Figs 118, 121 d, f

Dentalium tricarinatum Boissevain, 1906: 48, pl. 6, figs 40-41.

Synonym:
Dentalium (Compressidens) capense Tomlin, 1931: 340 (**Syn. nov.**).

Other references:
Dentalium (Bathoxiphus) tricarinatus — PLATE, 1908a: 354.
Bathoxiphus tricarinatus — HABE, 1964a: 33, pl. 5, figs 69-70; 1977: 337, pl. 70, figs 15-16. — HABE & KOSUGE, 1964: 6. — HIGO & GOTO, 1993: 688.
Bathoxiphus tricarinatum — OKUTANI, 1964: 76, pl. 6, fig. 10.
Dentalium capense — BARNARD, 1963a: 446; 1963b: 349, fig. 30d; 1974: 742.

TYPE MATERIAL. — *D. tricarinatum*: lectotype (here designated) ZMA 3.06.060, paralectotypes ZMA 3.06.056-059. — *D. capense*: holotype SAM.

TYPE LOCALITY. — *D. tricarinatus*: Indonesia, Ceram Sea, "*Siboga*", stn 178, 02°40′ S, 128°37′ E, 835 m. — *D. capense*: South Africa, "Cape Point, N 86° E, 43 miles, 900 fms" [1645 m].

MATERIAL EXAMINED. — The type material.
Tasman Sea. "*Galathea*": stn 574, 39°45′ S, 159°39′ E, 4680-4730 m, 1 dd.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 9 dd.
BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 1 dd.
Indonesia. CORINDON: stn B 244, 00°56′ N, 119°22′ E, 970 m, 4 dd.
"*Snellius*" II: stn 4.135, 06°29′ S, 121°09′ E, 495 m, 1 dd.

Philippines. ESTASE 2: stn DW 1, 14°05′ N, 120°01′ E, 2200 m, 1 dd. — Stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 13 lv, 10 dd.
MUSORSTOM 2: stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 dd.
MUSORSTOM 3: stn DR 94, 13°47′ N, 120°03′ E, 842 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 02, 12°35′ S, 47°40′ E, 1750 m, 3 lv. — Stn DS 03, 12°36′ S, 47°38′ E, 1100-1150 m, 1 dd. — Stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 dd. — Stn DR 27, 12°38′ S, 47°12′ E, 675 m, 1 dd. — Stn DR 28, 12°42′ S, 45°20′ E, 705 m, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 dd.
MD 32 Réunion: stn DC 64, 21°12′ S, 55°04′ E, 1150-1180 m, 3 dd. — Stn DR 67, 21°13′ S, 55°01′ E, 1390-1425 m, 1 dd. — Stn DS 78, 21°13′ S, 55°04′ E, 1175-1200 m, 2 lv, 2 dd. — Stn DS 100, 21°27′ S, 55°47′ E, 4180-4220 m, 1 lv. — Stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 2 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 dd. — Stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 7 lv, 6 dd.
"Galathea": stn 234, 05°25′ S, 47°09′ E, 4830 m, 1 lv.
South Africa. *"Meiring Naudé"*: stn 94, 28°16′ S, 32°29′ E, 670 m, 1 lv, 1 dd.

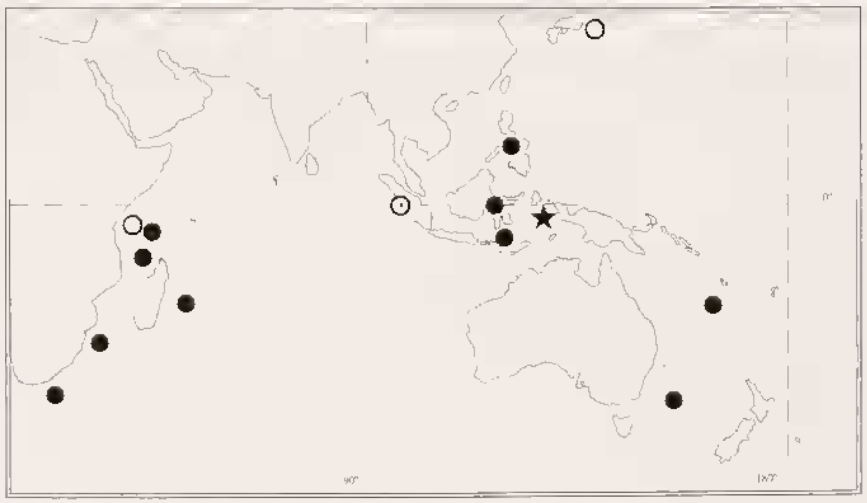


FIG. 118. — Distribution of *Rhomboxiphus tricarinatus*.

DISTRIBUTION. — From Japan to the East coast of Africa, 639-1900 m (HABE & KOSUGE, 1964), now recorded from the Philippines and the SW Pacific. Live records from 495 to 4830 m.

Rhomboxiphus colmani (Palmer, 1974)

Figs 119, 121 e

Dentalium (Bathoxiphus) applanatum Colman, 1958: 145, fig. 12 (*non D. applanatum* Torley, 1908).
Dentalium (Bathoxiphus) colmani Palmer, 1974b: 124, *nom. nov. pro D. applanatum* Colman.

Other references:

Bathoxiphus colanni (*sic*) — OKUTANI, 1975: 77, pl. 3, figs 6-7 (erroneous subsequent spelling).
Rhomboxiphus colmani — CHISTIKOV, 1983: 183.

TYPE MATERIAL. — Holotype and 3 paratypes dd AMS 26652.

TYPE LOCALITY. — Australia, New South Wales, 35 miles E of Sydney, 1463 m.

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 379, 19°53′ S, 158°40′ E, 370-400 m, 1 lv.
New Caledonia. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 2 lv, 4 dd.

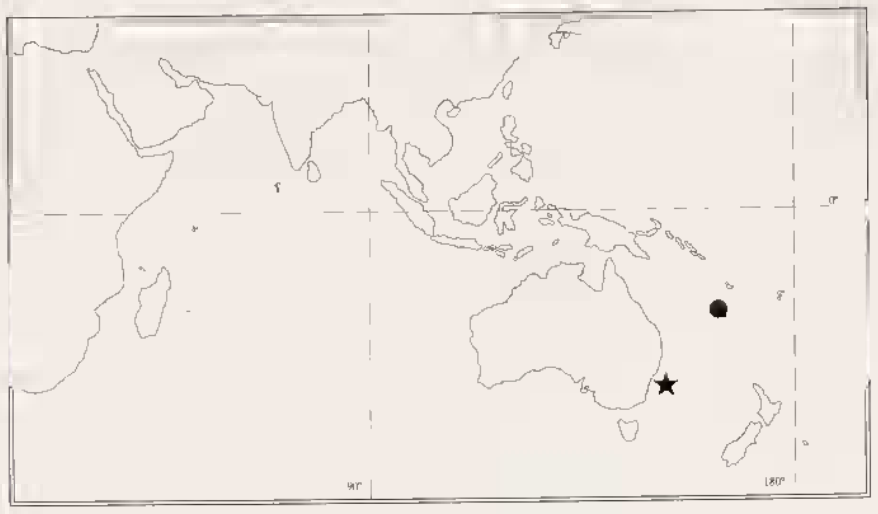


FIG. 119. — Distribution of *Rhomboxiphus colmani*.

DISTRIBUTION. — E Australia now extended to New Caledonia, alive in 370-790 m, shells down to 1463 m.

REMARKS. — CHISTIKOV (1983) synonymized this species with *Bathoxiphus soyomaruae*, but study of type specimens confirms the validity of *Rhomboxiphus colmani*. It is similar to *Rhomboxiphus tricarinatus*, but less sculptured.

Genus *SOLENOXIPHUS* Chistikov, 1983

Type species (by monotypy): *S. striatulus* Chistikov, 1983.

DIAGNOSIS. — *Shell* medium sized, slightly curved, solid, translucent when fresh, white opaque to polished when dead. Longitudinally striated throughout. Apex oblique, the dorsal angle higher than the ventral side, preapical callus wide, lumen circular. Section strongly laterally compressed, dorsal and ventral sides rounded, laterals straight parallel or slightly concave.
Radula rachidian with lateral sides almost parallel, anterior margin with central lobe; laterals with two main cusps and four denticles between, with a third cusp located at the base of the external cusp; marginals slightly sinusoidal.

DISTRIBUTION. — Recent, Pacific Ocean, bathyal-abyssal.

Solenoxiphus striatulus Chistikov, 1983
Figs 111 m, 120, 121 g-h, 172 g

Solenoxiphus striatulus Chistikov, 1983: 187-188, pl. 3, figs 2-13, pl. 5, figs 10-11.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — *"Vitiaz"*, stn 5944-2, North Fiji basin, 14°21′ S, 179°38′ E, 2380 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 1 lv, 1 dd. — Stn DS 04, 21°16′ S, 166°40′ E, 2340 m, 3 lv, 6 dd. — Stn CP 05, 21°16′ S, 166°44′ E, 2340 m, 1 lv, 3 dd. — Stn DS 14, 20°19′ S, 167°18′ E, 3680-3700 m, 2 lv. — Stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 lv, 3 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 2 dd. — Stn CP 72, 22°10′ S, 167°33′ E, 2100-2110 m, 10 lv. — Stn KG 85, 20°59′ S, 167°00′ E, 1639 m, 1 lv. — Stn KG 89, 21°03′ S, 166°56′ E, 2070 m, 2 lv, 7 dd. — Stn KG 90, 21°08′ S, 166°48′ E, 2236 m, 4 dd. — Stn DS 98, 21°24′ S, 166°30′ E, 2365-2470 m, 7 lv, 1 dd. — Stn KG 101, 21°27′ S, 166°24′ E, 1790 m, 1 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 dd.
BIOGEOCAL: stn KG 207, 22°38′ S, 166°29′ E, 1350 m, 1 dd. — Stn KG 240, 21°29′ S, 166°27′ E, 1520 m, 1 lv. — Stn CP 243, 21°27′ S, 166°26′ E, 1820 m, 1 dd. — Stn KG 248, 21°15′ S, 166°29′ E, 2340 m, 1 lv, 2 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 1 lv, 1 dd. — Stn KG 261, 21°02′ S, 167°02′ E, 1508 m, 1 lv, 1 dd. — Stn KG 267, 21°02′ S, 166°59′ E, 1935 m, 2 dd. — Stn KG 268, 21°03′ S, 166°57′ E, 1990 m, 1 dd. — Stn KG 269, 21°02′ S, 166°58′ E, 1810 m, 2 dd. — Stn KG 275, 21°06′ S, 166°53′ E, 1959 m, 2 lv, 1 dd. — Stn KG 277, 21°17′ S, 166°56′ E, 2240 m, 1 lv. — Stn KG 287, 20°43′ S, 166°53′ E, 1560 m, 1 lv. — Stn CP 317, 20°48′ S, 166°53′ E, 1620-1630 m, 1 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 1 lv.

FIG. 120. — Distribution of *Solenoxiphus striatulus*.

DISTRIBUTION. — North Fiji Basin, now extended to New Caledonia, alive in 1500-3700 m.

Suborder GADILIMORPHA Steiner, 1992

Family PULSELLIDAE Scarabino *in* Boss, 1982

Genus *PULSELLUM* Stoliczka, 1868

Type species (SD by COSSMANN, 1888): *Siphonodentalium lofotense* Sars, 1865. Recent, Norwegian Sea, bathyal.

DIAGNOSIS. — *Shell* small, slightly to markedly curved, fragile, translucent to white in dead shells. Sculptured by growth lines, occasionally conspicuous. Apex simple, preapical callus thin, lumen circular. Section circular.

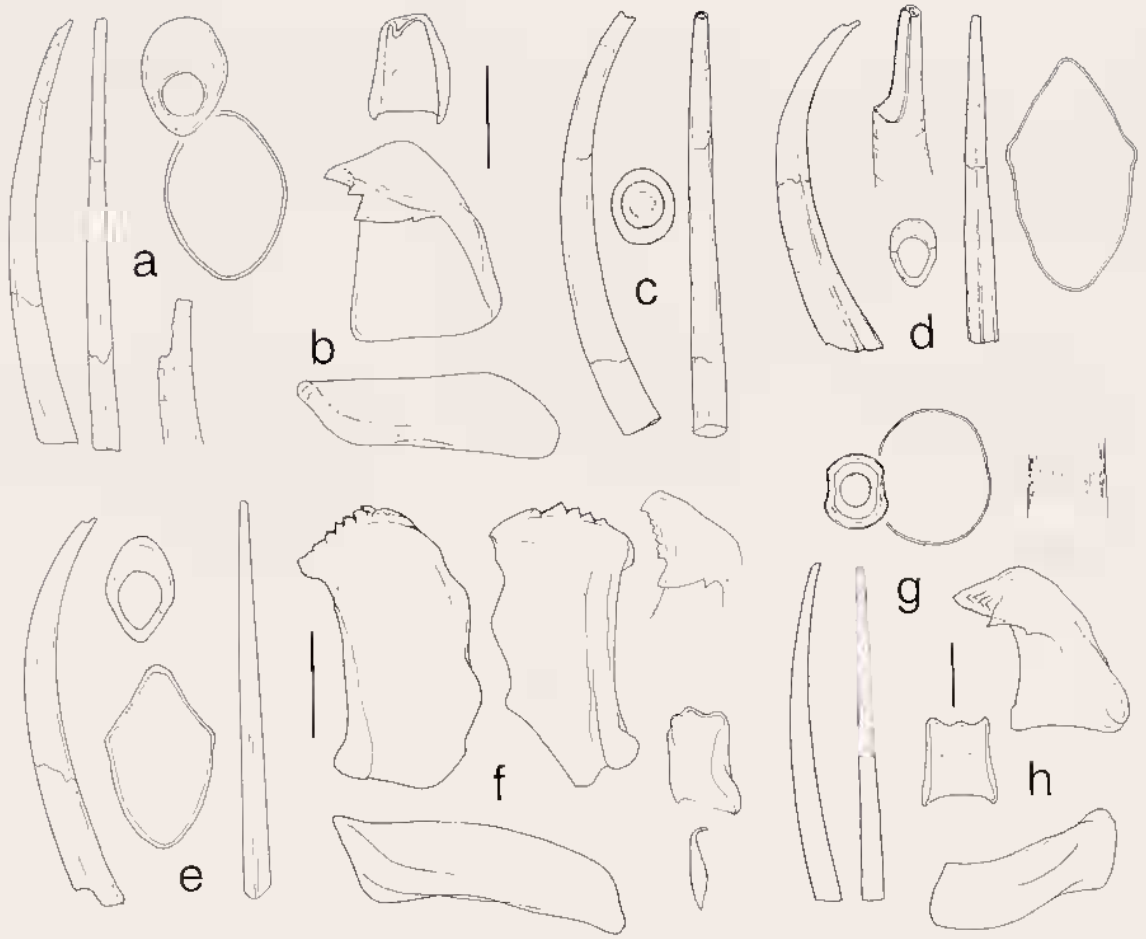


FIG. 121. — **a**, *Bathoxiphus soyomaruae*, shell (22 mm), apex, apical and oral sections, BIOGEOCAL: stn KG 233. — **b**, *Bathoxiphus* type radula (*B. soyomaruae*). — **c**, *Bathoxiphus inexpectatus* sp. nov., holotype, shell (11.9 mm), apical section. — **d**, *Rhomboxiphus tricarinatus*, shell (19 mm), lateral and dorsal views, apex, apical and oral sections, MD 32 Réunion: stn DS 109. — **e**, *Rhomboxiphus colmani*, shell (16 mm), lateral and dorsal views, apical and oral sections, BIOGEOCAL: stn CP 232. — **f**, *Rhomboxiphus* type radula (*R. tricarinatus*). — **g**, *Solenoxiphus striatulus*, shell (16 mm), apical and oral sections, detail of the sculpture, BIOCAL: stn KG 85. — **h**, *Solenoxiphus* type radula (*S. striatulus*).

Radula rachidian polygonal, sides almost parallel, generally with a single cusp on anterior margin; laterals high, with two primary cusps on inner side, one on outer side, 2 to 3 denticles between cusps; marginals slightly sigmoidal.

DISTRIBUTION. — Paleocene-Recent, worldwide, shelf-abyssal.

Pulsellum fragile sp. nov.

Figs 122, 125 a

TYPE MATERIAL. — Holotype lv, MNHN. Paratypes lv: 14 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

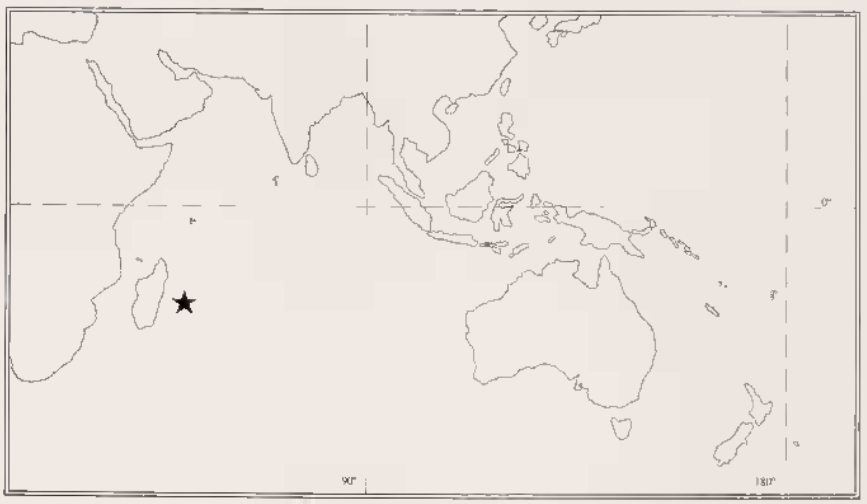


FIG. 122. — Distribution of *Pulsellum fragile*.

MATERIAL EXAMINED. — Only known from the type material.

DISTRIBUTION. — Only know from the type locality.

DESCRIPTION. — *Shell* 1o 3 mm long, fine, delicate, regularly curved, translucent white, opaque. Apical area with fine encircled wrinkles. Section circular, apex simple, mouth simple. Subapical callus weak.

Measurements: holotype L 3, W 0.5, w 0.2, arc 0.3; paratype L 3, W 0.5, w 0.2, arc 0.3; L 3, W 0.5, w 0.2, arc 0.3; L 2.3, W 0.4, w 0.1, arc 0.2; L 2, W 0.4, w 0.1, arc 0.2. W/w ratio 2.5-4.

REMARKS. — *Pulsellum fragile* differs from *P. thomassini* in general shape, by its smaller W/w ratio and better defined transversal sculpture.

ETYMOLOGY. — From the Latin *fragilis*, fragile.

Pulsellum thomassini sp. nov.

Figs 123, 125 b

TYPE MATERIAL. — Holotype and 6 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 86, 21°01′ S, 166°58′ E, 1860 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 lv (holotype). — Stn 88, 11°46′ S, 47°34′ E, 3700 m, 2 lv (paratypes).
MD 32 Réunion: stn DS 106, 20°28′ S, 55°05′ E, 1710-1730 m, 2 lv (paratypes). — Stn DS 151, 20°51′ S, 56°03′ E, 3240-3300, 2 lv (paratypes).

DISTRIBUTION. — SW Indian Ocean and New Caledonia, live records from 1730 to 3716 m.

DESCRIPTION. — *Shell* up 1o 6 mm long, fine, delicate, translucent-white, opaque, regularly curved. Circular in section, apex simple, mouth simple. Subapical callus weak.

Measurements: holotype L 6, W 0.9, w 0.6, arc 0.2; paratypes L 5.6, W 0.8, w 0.5, arc 0.2; L 6, W 0.9, w 0.5, arc 0.2; L 6, W 0.8, w 0.6, arc 0.2. W/w ratio 1.3-1.8.

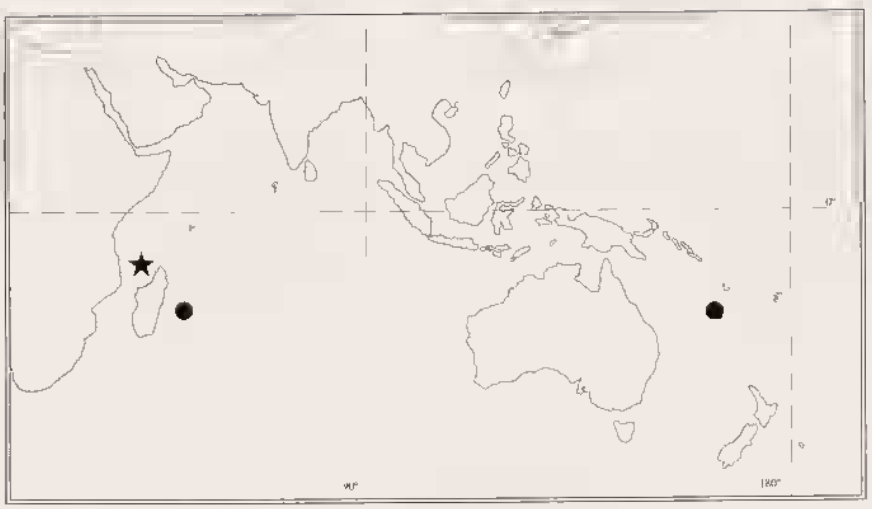


FIG. 123. — Distribution of *Pulsellum thomassini*.

ETYMOLOGY. — Named for Dr Bernard THOMASSIN, Centre Océanologique de Marseille, cruise leader of the BENTHEDI Expedition (1977).

Other Indo-Pacific species of *Pulsellum* cited in the literature

Pulsellum eboracense (Watson, 1879): 523. *"Challenger"*, Torres Strait, Cape York, NE Australia, 9-20 m, 4 syntypes dd BMNH 1887.2.9.69.
Pulsellum hige Habe, 1963: 273, textfigs 47-48. Zushi, Kanagawa, Honshu, Japan, 350 m. NSMT.
Pulsellum kurogenge Habe & Kosuge, 1964: 9. Off Choshi, Chiba Prefecture, Japan, 350 m. NSMT.

Genus *ANNULIPULSELLUM* Scarabino, 1986

Figs 125 d-e

Type species (by monotypy): *Annulipulsellum euzkadii* Scarabino, 1986. Recent, Atlantic Ocean, 12°34' N, 59°09' W, *"Knorr"*, cruise 25, stn 307, 3835-3862 m.

DIAGNOSIS. — *Shell* small to medium sized, fine, regularly curved, translucent white. Sculpture of angulated rings over the entire surface. Apex oblique, preapical callus prominent, cross section circular. Two large central pedal retractor muscles originate directly from dorsoventral muscles and cross the intestinal sinus; pedal base and central portion enter at terminal disk. Center of disk covered by a mucoid epithelium (STEINER 1992b).
Radula rachidian small, high with central denticle at anterior margin; laterals high with two very sharp primary cusps; marginals sinusoidal.

DISTRIBUTION. — Atlantic Ocean, bathyal-abyssal.

The genus *Annulipulsellum* has not been recorded in the Indo-Pacific.

Genus *STRIOPULSELLUM* gen. nov.

Striopulsellum Scarabino, 1979 (published in a thesis, not available).
Striopulsellum Scarabino *in* Boss 1982: 1166 *nom. nud.* (no diagnosis, no species included).
Type species: *Siphonodentalium minimum* Plate, 1908.

DIAGNOSIS. — *Shell* small to medium sized, sculpture of fine, numerous, smooth longitudinal riblets, with secondary riblets near apex; primary riblets throughout. Apex simple, straight or oblique, preapical callus wide.
Radula rachidian polygonal, anterior margin with single cusp; lateral with 1 to 5 denticles between cusps; marginals slightly curved.

DISTRIBUTION. — Pacific and Atlantic Oceans, Southern Ocean, Recent. Bathyal-hadal.

REMARKS. — This genus contains 7 deep-sea species (4 undescribed), mostly known from Atlantic Ocean basins. The named species are *S. striatinum*, *S. minimum* and *S. galatheae*. With a live record from the Sunda Trench in 6900-7000 m, *S. galatheae* is the deepest known scaphopod taken alive.

Striopulsellum minimum (Plate, 1908)

Figs 111 l, 124, 125 f-g

Siphonodentalium minimum Plate, 1908b: 4, fig. 5.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 59728a.

TYPE LOCALITY. — Antarctic, *"Gauss"* Winterstation (approximately 66°02' S, 89°38' W), 3423 m.

FIG. 124. — Distribution of *Striopulsellum minimum*.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 16, 20°34' S, 167°22' E, 3680 m, 1 lv.

DISTRIBUTION. — Circumantarctic, now extended to the New Caledonia basin. Alive from 3423 m (PLATE, 1908b) to 6200 m (SCARABINO, 1979).

Other Indo-Pacific species of *Striopulsellum* cited in the literature

Striopulsellum galatheae (Knudsen, 1964): 125, figs 1-2. Sunda Trench, *"Galathea"*, stn 465, 10°20' S, 109°55' E, 6900-7000 m. ZMC.

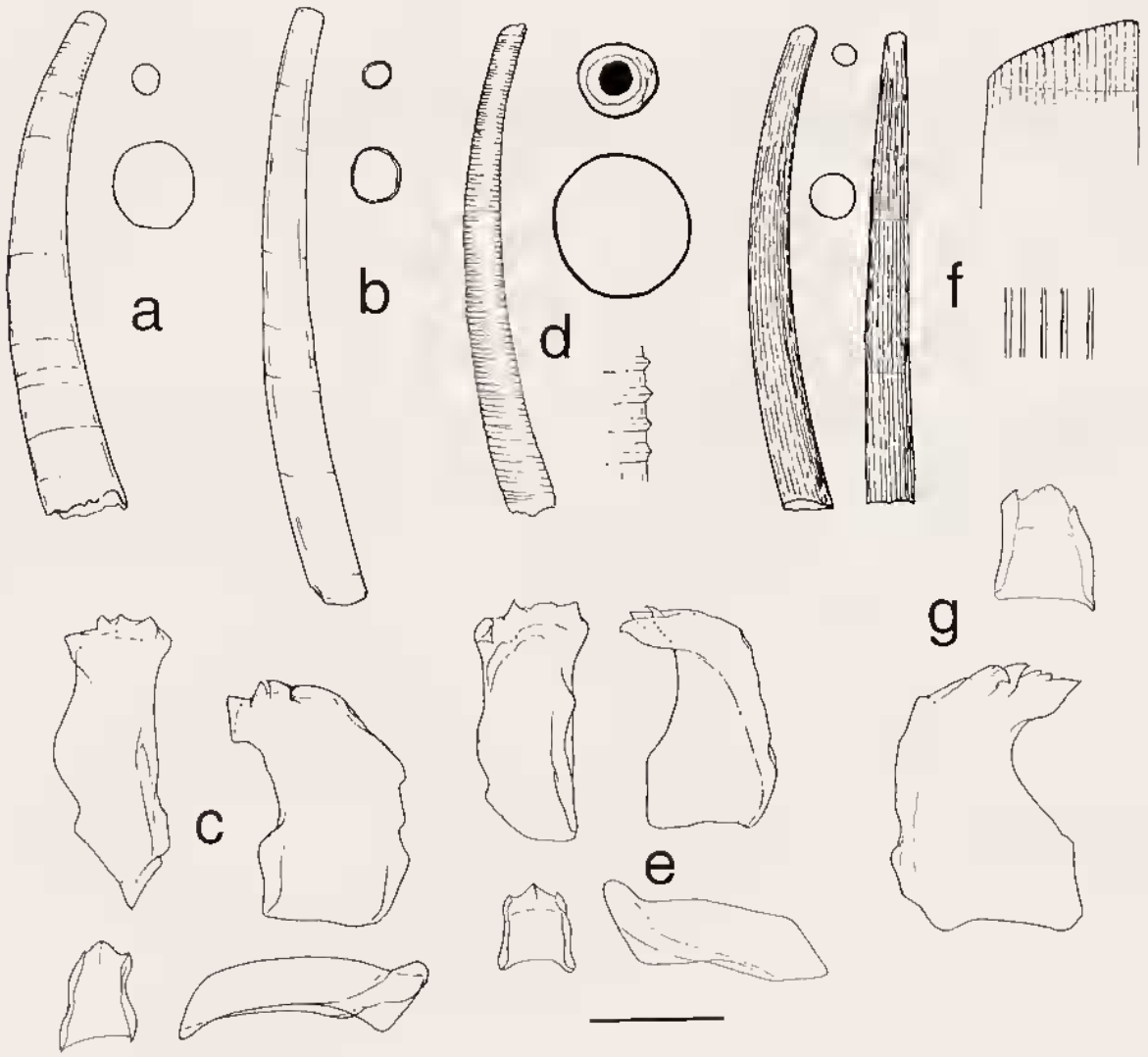


FIG. 125. — **a**, *Pulsellum fragile* sp. nov., holotype, shell (3 mm), apical and oral sections. — **b**, *Pulsellum thomassini* sp. nov., holotype, shell (6 mm), oral and apical sections. — **c**, *Pulsellum* type radula (*P. affine* Sars, 1865, Northeastern Atlantic Ocean). — **d**, *Annulipulsellum euzkadii*, holotype, shell (8.7 mm), apical and oral sections, detail of sculpture. — **e**, *Annulipulsellum* type radula (*A. euzkadii*). — **f**, *Striopulsellum minimum*, shell (5.7 mm), lateral and dorsal views, apical and oral sections, apex and detail of sculpture, BIOCAL: stn KG 16. — **g**, *Striopulsellum* type radula (*S. minimum*).

Family WEMERSONIELLIDAE Scarabino, 1986

Genus *WEMERSONIELLA* Scarabino, 1986

Type species (OD): *W. turnerae* Scarabino, 1986.

DIAGNOSIS. — *Shell* medium to large, straight, white, opaque or polished. Sculpture lacking or with longitudinal undulations on dorsal side. Apex oblique or with two lateral lobes, preapical callus wide, lumen circular. Section slightly ovate to strongly depressed dorsoventrally, oral aperture thin, oblique.
Radula rachidian polygonal with anterior margin simple or with central cusp; laterals strong, with a sharp pointed primary cusp with irregular wrinckle on the outer part of the granulose head; marginals almost straight, pointed at inner margin.

DISTRIBUTION. — Recent, worldwide, abyssal.

REMARKS. — The genus was erected for two abyssal species from the Atlantic Ocean, *W. turnerae* from the North Atlantic in 4125-5150 m, and *W. duartei* Scarabino, 1986a, from the Argentine basin in 5332-5781 m. We add here two new species from the Indo-Pacific. *W. turnerae* is solid while the other three species are fragile.

Wemersoniella indica sp. nov.

Figs 126, 129 a

TYPE MATERIAL. — Holotype MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn CH 87, 11°44′ S, 47°35′ E, 3716 m.

MATERIAL EXAMINED. — **West Indian Ocean**. BENTHEDI: stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 2 dd (holotype and one other shell that has been accidentally broken after it was photographed).

DISTRIBUTION. — Only known from the type locality.

FIG. 126. — Distribution of *Wemersoniella indica*.

DESCRIPTION. — *Shell* up to 11 mm long straight, fragile, dorsoventrally depressed, rapidly increasing in size from apex to oral aperture, opaque white. Apex simple, oblique from ventral to dorsal side, preapical callus prominent, lumen circular. Maximum diameter at oral aperture. Mouth and prominent growth rings oblique.

Measurements: holotype L 10.2, W 2-1.7, w 0.6-0.5, W/w ratio 3.3.

REMARKS. — Apical and radular characteristics are shared with *Wemersoniella turnerae* and with *W. duartei*, but *W. indica* is much more tapering and compressed than *W. duartei* and more fragile than *W. turnerae*.

ETYMOLOGY. — From Indian Ocean, where this species occurs.

Wemersoniella knudseni sp. nov.

Figs 127, 129 b-c

TYPE MATERIAL. — Holotype ZMC. Paratypes: 2 ZMC, 2 NMNZ M268545, 1 MNHN.

TYPE LOCALITY. — *"Galathea"*, stn 664, Kermadec Trench, 36°34′ S, 178°57′ E, 4510-4570 m.

MATERIAL EXAMINED. — **New Zealand**. *"Galathea"*: stn 602, 43°58′ S, 165°24′ E, 4510 m, 1 lv (paratype ZMC). — Stn 662, 36°22′ S, 178°23′ W, 4630 m, 1 lv (paratype ZMC). — Stn 664, 36°34′ S, 178°57′ W, 4150-4570 m, 2 lv (holotype ZMC and paratype MNHN).
"Tangaroa": stn P 934, 41°31′ S, 165°6′ E, 4405-4411 m, 2 lv (paratypes NMNZ).

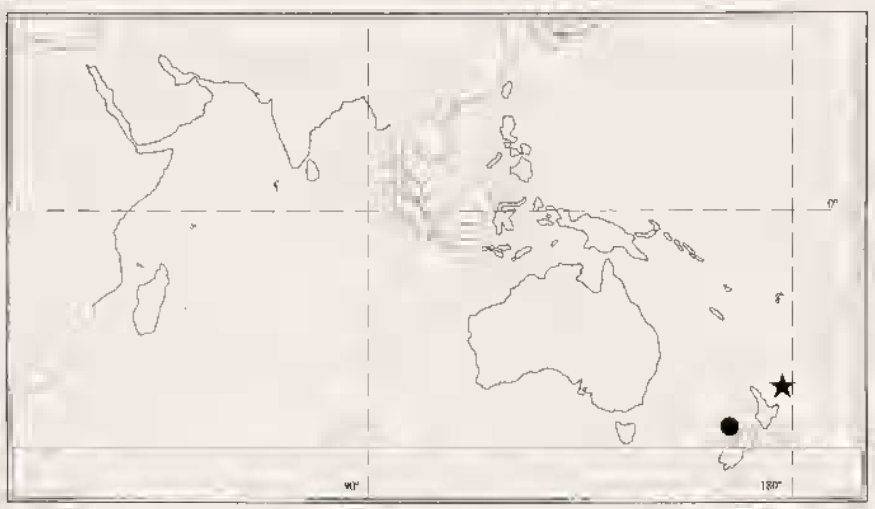


FIG. 127. — Distribution of *Wemersoniella knudseni*.

DISTRIBUTION. — Kermadec Trench and Tasman Sea, alive in 4105-4630 m.

DESCRIPTION. — *Shell* up to 12 mm long, straight, fragile, slightly dorsoventrally depressed, porcellaneous while. Apex with two lateral lobes separated by two wide, rounded basal notches, the dorsal one deeper. Maximum diameter at oral aperture. Mouth oblique; oblique growth rings numerous and pronounced in some specimens.

Radula as for the genus.

Measurements: holotype L 11, W 2.5-2.4, w 1.5-1.4; paratypes L 12, W 2.1-2, w 0.99-0.91; L 6, W 1.4-1.1, w 0.65-0.57; L 11.2, W 2-1.5, w 0.99-0.76. W/w ratio 1.6-2.2.

REMARKS. — This species differs from *Wermersoniella indica* in its apical structure and W/w ratio. *W. indica* is more conical. *W. knudseni* is related to *W. turnerae* in the form of the lobes and to *W. duartei* in its fragility and slight dorsoventral compression.

ETYMOLOGY. — Named for Dr Jorgen Knudsen (ZMC) in recognition for his work on the deep-sea Mollusca.

Chistikovia gen. nov.

Type species: *Chistikovia kermadecae* sp. nov.

DIAGNOSIS. — *Shell* medium, straight, fragile, polished, white. Dorsal side straight, ventral side very slightly curved, more noticeably so on the posterior half; lateral sides similarly curved to the ventral. Maximum diameter at anterior third. Unsculptured except for very oblique, conspicuous and close-set growth lines. Apex wide, with subtriangular lobe, margin thin on dorsal side. Section slightly dorsoventrally depressed. Mouth thin, oblique.
Radula similar to that of *Wemersoniella*.

DISTRIBUTION. — Recent, Pacific and Atlantic Oceans, abyssal.

REMARKS. — In addition to *Chistikovia kermadecae*, an undescribed abyssal species from the North Atlantic Ocean belongs to this genus. The general shape of the shell resembles that of *Wemersoniella*, but the apical structures differ. *Chistikovia* is placed in Wemersoniellidae, but the original diagnosis of the family may require modification to include forms with dorsally lobed apex and maximum diameter not exclusively at oral aperture. The last mentioned character can be observed in gerontic stages of *Wemersoniella*.

ETYMOLOGY. — Named for the late Sergei CHISTIKOV (ZIN) for his contribution to the knowledge of Scaphopoda.

Chistikovia kermadecae sp. nov.

Figs 128, 129 d-e

TYPE MATERIAL. — Holotype ZMC. Paratypes: 4 ZMC, 1 MNHN.

TYPE LOCALITY. — *"Galathea"* stn 664, Kermadec Trench, 36°34' S, 178°57' W, 4150-4570 m.

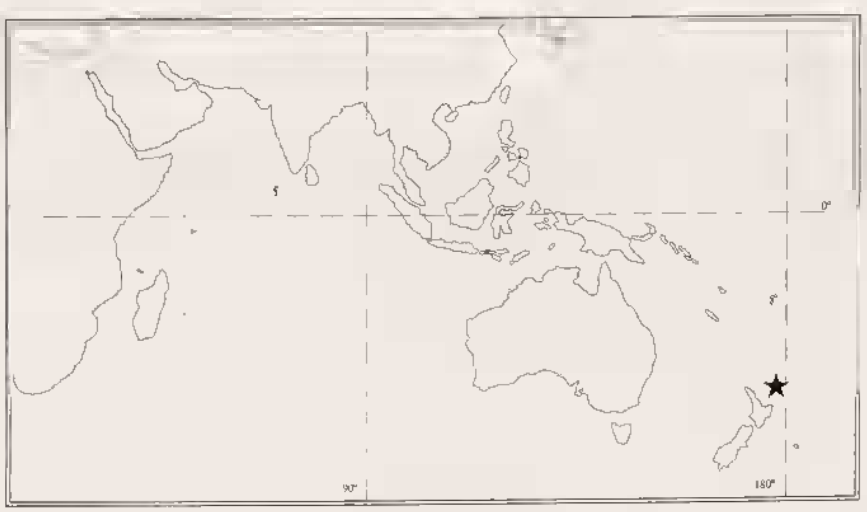


FIG. 128. — Distribution of *Chistikovia kermadecae*.

MATERIAL EXAMINED. — **New Zealand**. "*Galathea*", stn 664, 36°34′ S, 178°57′ W, 4150-4570 m, 3 lv, 2 dd (holotype lv and paratypes ZMC). — Stn 665, 36°38′ S, 178°21′ W, 2470 m, 1 dd (paratype MNHN).

DISTRIBUTION. — Kermadec Trench, alive in 4150-4570 m, shell in 2470 m.

DESCRIPTION. — As for the new genus, dimension up to 11.5 mm.

Measurements: holotype L 11.5, W 2.1, m 1.87, w 1.1-9.3; paratype L 10.2, W 1.9, m 1.7, w 1-0.84.

ETYMOLOGY. — From Kermadec Trench.

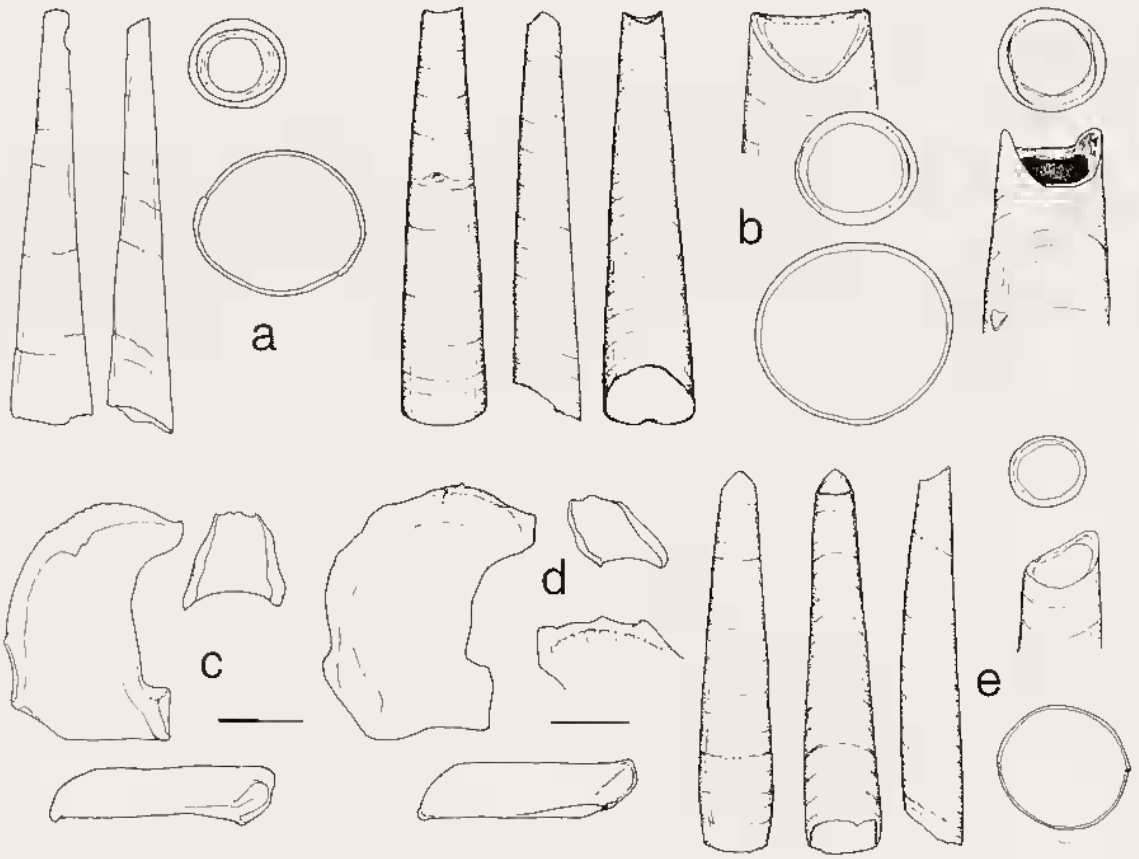


FIG. 129. — **a**, *Wemersoniella indica* sp. nov., holotype, shell (10.2 mm), dorsal and lateral views, apical and oral sections. — **b**, *Wemersoniella knudseni* sp. nov., holotype, shell (11 mm), dorsal, lateral and ventral views, apex, apical and oral sections; at right paratype, apex and apical section. — **c**, *Wemersoniella* type radula (*W. knudseni*). — **d**, *Chistikovia* type radula (*C. kermadecae*). — **e**, *Chistikovia kermadecae* sp. nov., holotype, shell (11.5 mm), dorsal, ventral and lateral views; apex, apical and oral sections.

Family GADILIDAE Stoliczka, 1868

Subfamily SIPHONODENTALIINAE Simroth, 1894

Genus *SIPHONODENTALIUM* M. Sars, 1859

Type species (OD): *Siphonodentalium vitreum* M. Sars, 1859 [= *S. lobatum* Sowerby, 1860]. Recent, Norwegian Sea, Spitzbergen.

DIAGNOSIS. — *Shell* large, strong, polished, white, maximum diameter in anterior 1/3 or near mouth. Sculpture lacking except for longitudinal threads in some species. Circular to subcircular in section. Apex usually strong, with more than four notches and lobes (usually 6). Preapical callus wide, prominent.
Radula rachidian variable in shape, usually with broad base and cusped anterior border; lateral strong with wide head, well armed; marginal usually long [*S. lobatum* Sowerby, 1860, Fig. 135 f; *S. dalli* (Pilsbry & Sharp, 1898), Fig. 135 g].

DISTRIBUTION. — Eocene-Recent, worldwide, shelf-abyssal.

Siphonodentalium colubridens (Watson, 1879)

Figs 130, 135 a

Cadulus colubridens Watson, 1879: 523; 1886: 18, pl. 3, fig. 1.

Other references:

Cadulus colubridens – PILSBRY & SHARP, 1898: 184, pl. 26, fig. 71. — BOISSEVAIN, 1906: 71, pl. 3, fig. 41; pl. 6, fig. 66.
Cadulus (Gadila) colubridens – PLATE, 1908a: 359, pl. 30, fig. 54.
Gadila colubridens – OKUTANI, 1966: 13.

TYPE MATERIAL. — Holotype BMNH 1887.2.9.71.

TYPE LOCALITY. — *"Challenger"*, stn 169, NE Point of New Zealand, 37°34′ S, 179°22′ E, 700 fms [1280 m].

MATERIAL EXAMINED. — The type material.
Chesterfield Islands. MUSORSTOM 5: stn DC 357, 19°37′ S, 158°46′ E, 630 m, 1 dd.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd.
BIOGEOCAL: stn CP 238, 21°28′ S, 166°23′ E, 1260-1300 m, 1 dd. — Stn DW 313, 20°59′ S, 166°59′ E, 1600-1640 m, 1 dd.
Indonesia. CORINDON: stn DR 231, 00°05′ N, 119°48′ E, 980-1080 m, 1 dd.
Philippines. ESTASE 2: stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 2 dd. — Stn DR 4, 06°08′ N, 125°58′ E, 2800 m, 1 dd. — Stn CP 6, 04°38′ N, 119°49′ E, 2570 m, 4 dd.

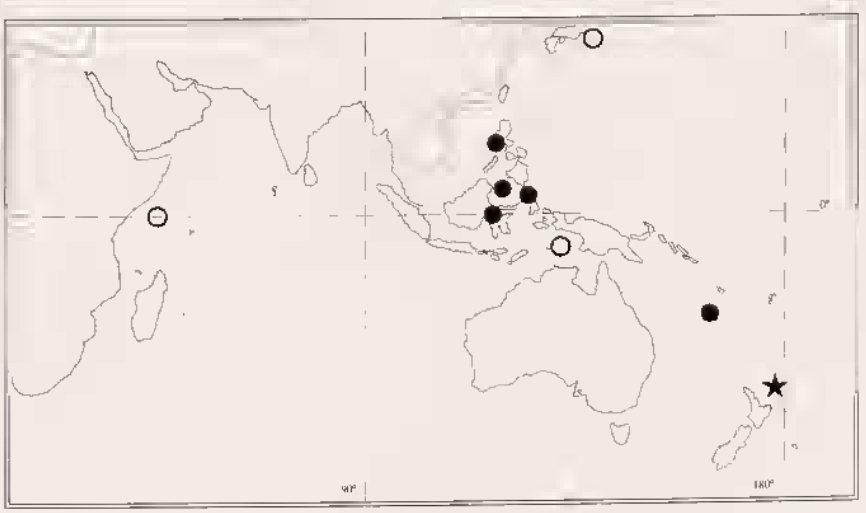


FIG. 130. — Distribution of *Siphonodentalium colubridens*.

DISTRIBUTION. — North New Zealand, New Caledonia, Indonesia, the Philippines, Japan in the Pacific Ocean; East Africa, 1280 m (PLATE, 1908) in the Indian Ocean. Depth range 630 to 2800 m (dead).

Siphonodentalium magnum (Boissevain, 1906)

Figs 131, 135 c

Cadulus magnus Boissevain, 1906: 68, pl. 6, fig. 54, textfig. 33.

Other references:

Cadulus (Polyschides) magus (*sic*) – HABE 1964: 12.
Polyschides magnus – HABE, 1963: 278; 1977: 342; 1971: 496 (Japanese text), 313 (English text), pl. 65, figs 28-29. — OKUTANI, 1966: 14, fig. 7. — HABE, *et al.*, 1986: 24. — HIGO & GOTO, 1993: 690.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.092, paralectotypes ZMA 3.06.091, 3.06.093.

TYPE LOCALITY. — *"Siboga"*, stn 88, Celebes Sea, 00°35′ S, 119°08′ E, 1301 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOGEOCAL: stn CP 250, 21°25′ S, 166°28′ E, 2350 m, 2 dd.

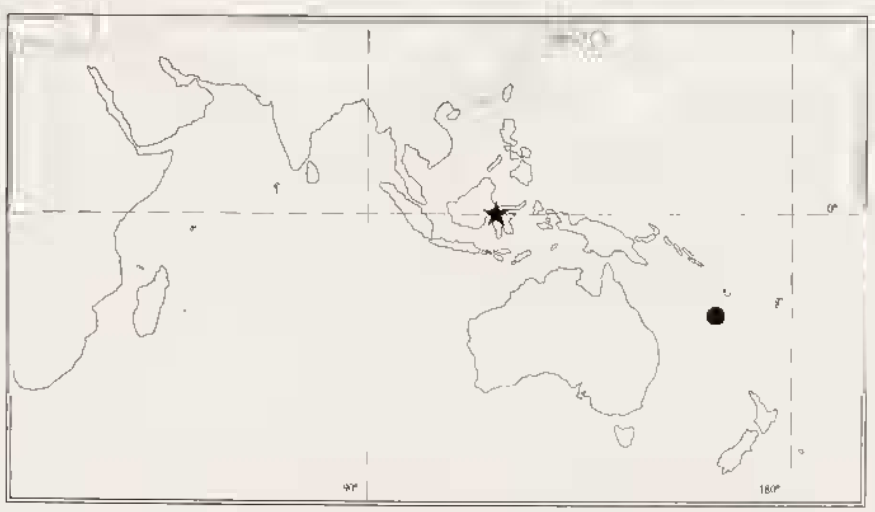


FIG. 131. — Distribution of *Siphonodentalium magnum*.

DISTRIBUTION. — Southern Japan and Indonesia, now extended to New Caledonia. Shells fom 300 m (HABE, 1964a) to 2350 m (present paper).

Siphonodentalium hexaschistum (Boissevain, 1906)

Figs 132, 135 d

Cadulus hexaschistus Boissevain, 1906: 67, pl. 6, fig. 53, textfig. 33.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.178.

TYPE LOCALITY. — *"Siboga"*, stn 178, Ceram Sea, 02°40′ S, 128°37′ E, 835 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. BIOCAL: stn CP 26, 22°40′ S, 166°27′ E, 1618-1740 m, 1 dd.
Indonesia. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd.

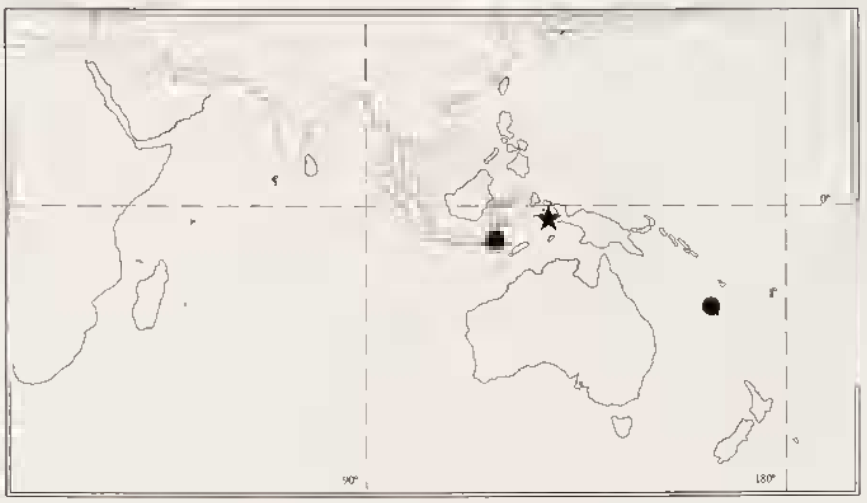


FIG. 132. — Distribution of *Siphonodentalium hexaschistum*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia. Shells in 700 to 1740 m (present paper).

Siphonodentalium promontorii (Barnard, 1963)

Figs 133, 135 b

Cadulus promontorii Barnard, 1963b: 353, figs 30h-l; 1974: 743.

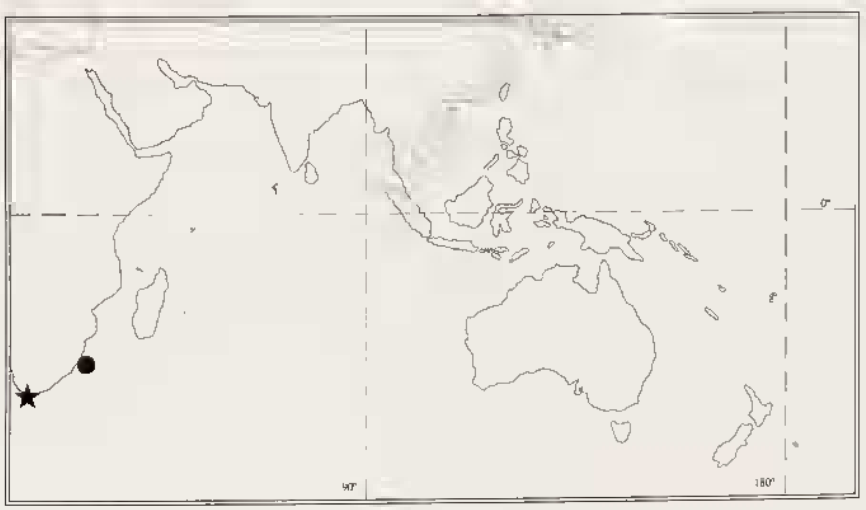


FIG. 133. — Distribution of *Siphonodentalium promontorii*.

TYPE MATERIAL. — Syntypes SAM A7460, and NMW (*fide* OLIVER, 1984).

TYPE LOCALITY. — South Africa, 36 miles of Cape Point, 700 fms [1280 m].

MATERIAL EXAMINED. — The SAM syntypes.
West Indian Ocean. *"Meiring Naudé"*: stn SM 129, 30°53′ S, 30°32′ E, 850 m, 2 dd.

DISTRIBUTION. — Endemic to South Africa, recorded alive in 1100 to 1280 m (BARNARD 1963b), shells from 850 m.

Siphonodentalium jaeckeli sp. nov.

Figs 134, 135 e

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

TYPE LOCALITY. — West Indian Ocean. NW Madagascar, BENTHEDI, stn DS 03, 12°35′ S, 47°38′ E, 1100-1150 m.

MATERIAL EXAMINED. — Only known from the type material.

FIG. 134. — Distribution of *Siphonodentalium jaeckeli*.

DISTRIBUTION. — Only known from the type locality.

DESCRIPTION. — *Shell* to 11 mm long, strong, shiny, white. Equator in anterior third, dorsoventrally compressed in section. Apex subcircular, dorsoventrally compressed, with five lobes, the largest ventral, two laterals and two dorsal. Subapical callus prominent, lumen circular. Mouth simple, subcircular, slightly laterally compressed in section.
Measurements: holotype L 11, W 2.72-2.51, m 1.6-1.5, w 1.2-1.1.

REMARKS. — The apical area, short and wide, almost without neck, is the main distinguishing feature of this species.

ETYMOLOGY. — Named for S. JAECKEL, who studied the scaphopods of the Indian Ocean collected by the German *"Valdivia"* Expedition, 1898-1899.

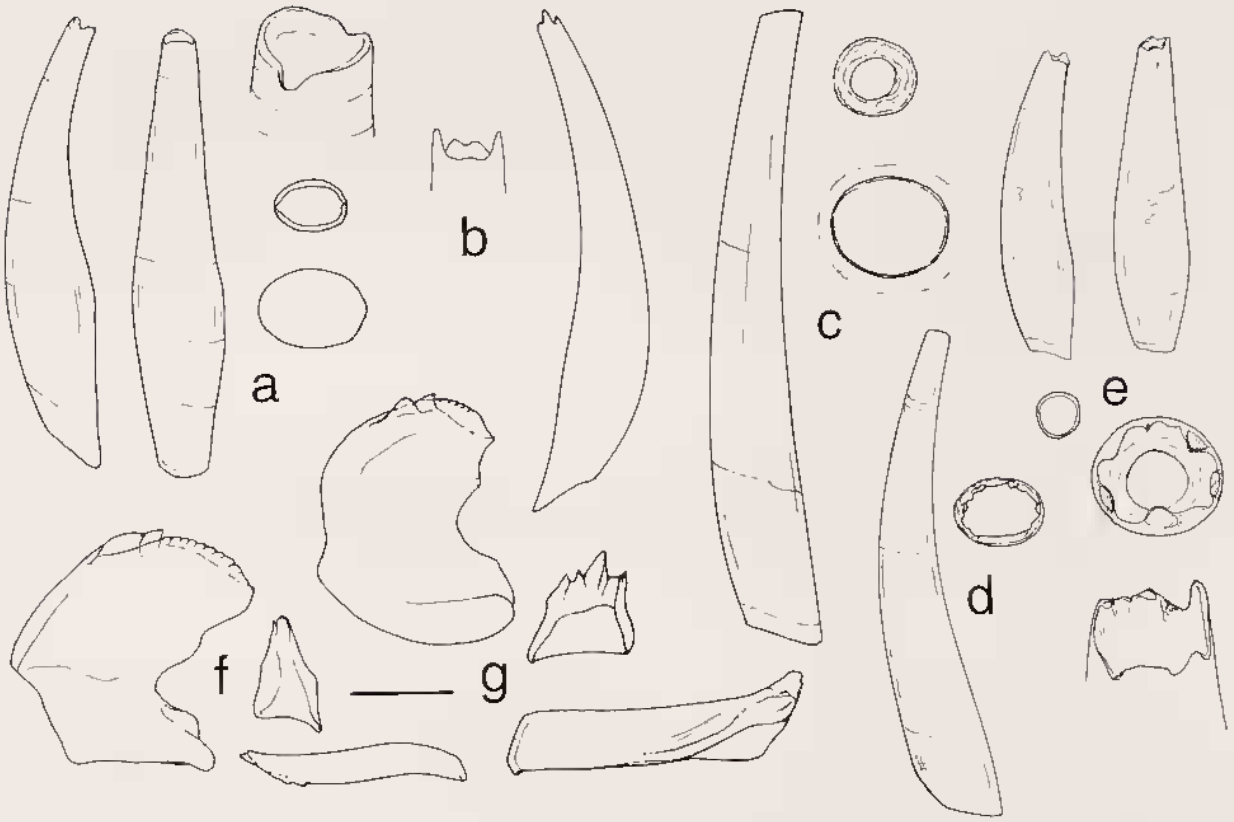


FIG. 135. — **a**, *Siphonodentalium colubridens*, shell (15 mm), lateral and dorsal views, apex, apical and oral sections, MUSORSTOM 5: stn DC 357. — **b**, *Siphonodentalium promontorii* (after BARNARD, 1963, fig. 30). — **c**, *Siphondentalium magnum*, shell (26 mm), apical and oral sections, BIOGEOCAL: stn CP 250. — **d**, *Siphonodentalium hexaschistum*, shell (14 mm) and apical section, *"Snellius"*II, stn 4.128. — **e**, *Siphonodentalium jaeckeli* sp. nov., holotype, shell (11 mm), lateral and dorsal views, apex, apical and oral sections. — **f-g**. *Siphonodentalium* type radula. — **f**, *S. lobatum* (North Atlantic Ocean). — **g**, *S. dalli* (Antarctic).

Other Indo-Pacific species of *Siphonodentalium* cited in the literature

Siphonodentalium australasiae Boissevain, 1906: 64, pl. 6, fig. 68. *"Siboga"*, stn 211, 05°41′ S, 120°46′ E, Banda Sea, 1158 m. Syntype ZMA.

Siphonodentalium booceras (Tomlin, 1926): 298, pl. 15, fig. 11. South Africa, Congella. SAM and NMW (*fide* TREW, 1990).

Siphonodentalium (?) *delicatulum* (Suter, 1913): 823, pl. 32, fig. 7. Southern New Zealand, Milford Sound, 100-120 fms [183-220 m]. New Zealand Geological Survey, Wellington (*fide* DANCE, 1986).

Siphonodentalium isaotakii Habe, 1953: 299. Tokyo Bay, Honshu, Japan. NSMT.

Siphonodentalium japonicum Habe, 1960: 294. Amakusa Island, Kyushu, Japan. NSMT.

Siphonodentalium longilobatum (Boissevain, 1906): 68, pl. 6, figs 55-56. Indonesia, *"Siboga"*, stn 133, off Lirung, Salibabu Island, 36 m. 3 syntypes ZMA.

Siphonodentalium okudai Habe, 1953: 299, figs 759-760. Akkeshi Bay, Hokkaido, Japan. NSMT.

Genus *Sagamicadulus* Sakurai & Shimazu, 1963

Fig. 139 a

Type species (by monotypy): *Striocadulus* (*Sagamicadulus*) *elegantissimus* Sakurai & Shimazu, 1963.

Diagnosis. — *Shell* small to medium, thin, translucent white, glassy. Maximum diameter at the anterior third. Surface smooth at apical portion, striated in median and anterior areas. Apex round in section, with five lobes, two ventral and one flat, dorsal. Mouth ellipsoidal in section, dorsoventrally compressed.
Radula unknown, assumed to be similar to that of *Siphonodentalium*.

Distribution. — Japan, shelf.

The genus *Sagamicadulus* is not represented in the material here reported on.

The type species is the only Indo-Pacific species: *Sagamicadulus elegantissimus* (Sakurai & Shimazu, 1963): 250, textfig. 1. Sagami Bay, Japan, 55-128 m. NSMT.

Genus *Striocadulus* Emerson, 1962

Type species (OD): *Cadulus albicomatus* Dall, 1890. Recent, Ecuador, 401 fms [773 m].

Diagnosis. — *Shell* medium to large, strong, polished, white, maximum diameter in anterior third. Sculptured with numerous close, fine, longitudinal striae throughout. Subcircular in section, dorsoventrally compressed. Apex strong, with two weak, flat lateral lobes, preapical callus prominent. *Radula* similar to that of *Siphonodentalium*.

Distribution. — Recent, Pacific and Indian Ocean, absent in the Atlantic Ocean. Shelf-bathyal.

Striocadulus pulcherrimus (Boissevain, 1906)

Figs 136, 139 b

Cadulus pulcherrimus Boissevain, 1906: 74, pl. 6, figs 58-59.

Other reference:
Cadulus (Gadila) pulcherrimus – Habe & Kosuge, 1964: 11.

Type material. — Lectotype (here designated) ZMA 3.06.104, paralectotypes ZMA 3.06.105.

Type locality. — *"Siboga"*, stn 314, Flores Sea, 07°36' S, 117°31' E, 694 m.

Material examined. — The type material.
Indonesia. CORINDON: stn B 275, 01°54' S, 119°14' E, 530 m, 1 lv, 2 dd.

Distribution. — Indonesia, alive in 530-694 m.

FIG. 136. — Distribution of *Striocadulus pulcherrimus*.

Striocadulus sagei sp. nov.

Figs 137, 139 d-e, 172 c-d

TYPE MATERIAL. — Holotype and 4 paratypes MNHN.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn CP 24, 13°37′ N, 120°42′ E, 640-647 m.

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.128, 08°18′ S, 118°16′ E, 700-835 m, 1 dd. — Stn 4.130, 08°18′ S, 118°19′ E, 700-730 m 3 lv, 9 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m 1 lv, 2 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 5 lv (holotype and paratypes). — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 3 dd.

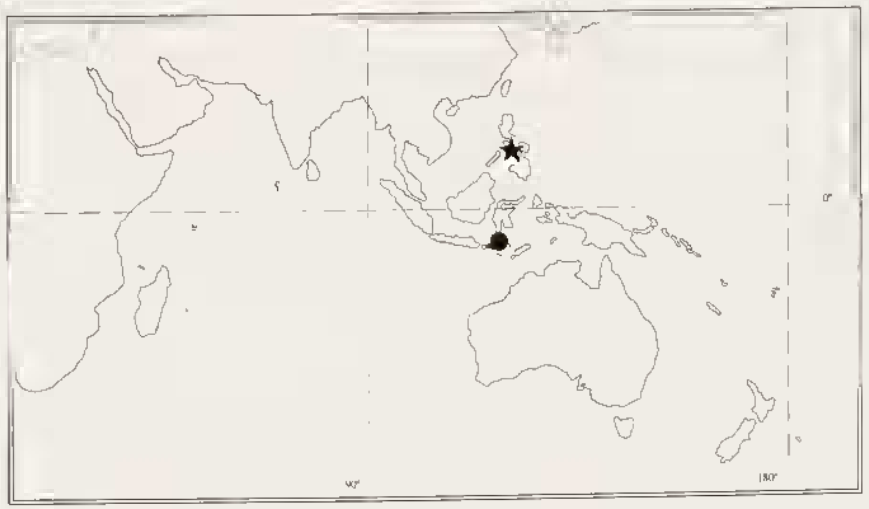


FIG. 137. — Distribution of *Striocadulus sagei*.

DISTRIBUTION. — The Philippines and Indonesia, alive in 640-800 m, shells from 550 m.

DESCRIPTION. — *Shell* to 43 mm long, strong, polished, white, maximum diameter near the oral aperture. Longitudinal sculpture of numerous close, fine, flat round-section riblets, crossed throughout by growth lines. Apex wide, slightly dorsoventrally compressed, with two wide lateral lobes. Oral aperture oblique, dorsoventrally compressed.

Measurements: holotype L 40, W 4.5, m 3.9, w 1.6, arc 3; paratypes L 40, W 4.5, m 4, w 1.9, arc 3; L 43, W 4.6.1, m 4, w 1.8, arc 3; L 39.5, W 4.8, m 4.4, w 1.5, arc 3.5; L 40.2, W 4.6, m 4, w 1.7, arc 4.

REMARKS. — This is the largest species in the order Gadilida. *Siphonodentalium magnum* (Boissevain, 1906) has no sculpture and its apex is circular in section with traces of four flat, irregular lobes. Other species of Gadilidae with longitudinal sculpture are *S. striatulus* (Pilsbry & Sharp, 1898) and *S. albiconnatus* (Dall, 1990) from Western North America, *S. pulcherrimus*, *S. lubrooki* (here described) and *Sagamicadulus elegantissimus* from Japan.

ETYMOLOGY. — Named for Walter SAGE (AMNH), who kindly reviewed linguistically my manuscript.

Striocadulus ludbrooki sp. nov.

Figs 138, 139 c

Cadulus (Polyschides) hexaschistus – LUDBROOK, 1954: 118, fig. 14. [not *C. hexaschistus* Boissevain, 1906]

TYPE MATERIAL. — Holotype and 3 paratypes BMNH 1952.3.25.342-345.

TYPE LOCALITY. — Gulf of Aden, *"John Murray"*, stn 176, 12°05′ N, 50°38′ E, 655-732 m.

MATERIAL EXAMINED. — **Northwestern Indian Ocean**. *"John Murray"*: stn 176, 12°05′ N, 50°38′ E, 655-732 m, 2 dd (holotype and paratype). — Stn 188, 13°46′ N, 47°50′ E, 528 m, 2 dd (paratypes).

FIG. 138. — Distribution of *Striocadulus ludbrooki*.

DISTRIBUTION. — Northern Indian Ocean, shells in 528-732 m.

DESCRIPTION. — *Shell* to 20 mm, translucent, shiny, ventral side regularly curved, dorsal with a swell at first fourth, also observed in frontal view. Apex with two wide, flat lobes, section oval, dorsoventrally compressed. Sculpture by longi-

ludinal striae, more prominent in first 3/4. Mouth oblique, subcircular in section.

Measurements: holotype L 19.5, W 3, m 2, w 1.4; paratype L 20, W 2.8, m 2.3, w 1.2.

REMARKS. — This species is much less tapering than *Striocadulus pulcherrimus* and shorter and less sculptured than *S. sagei*, the other two Indo-Pacific species of the genus.

ETYMOLOGY. — Named after Neils LUDBROOK, who studied the scaphopods taken during the *"John Murray"* expedition (1933-34) in the NW Indian Ocean.

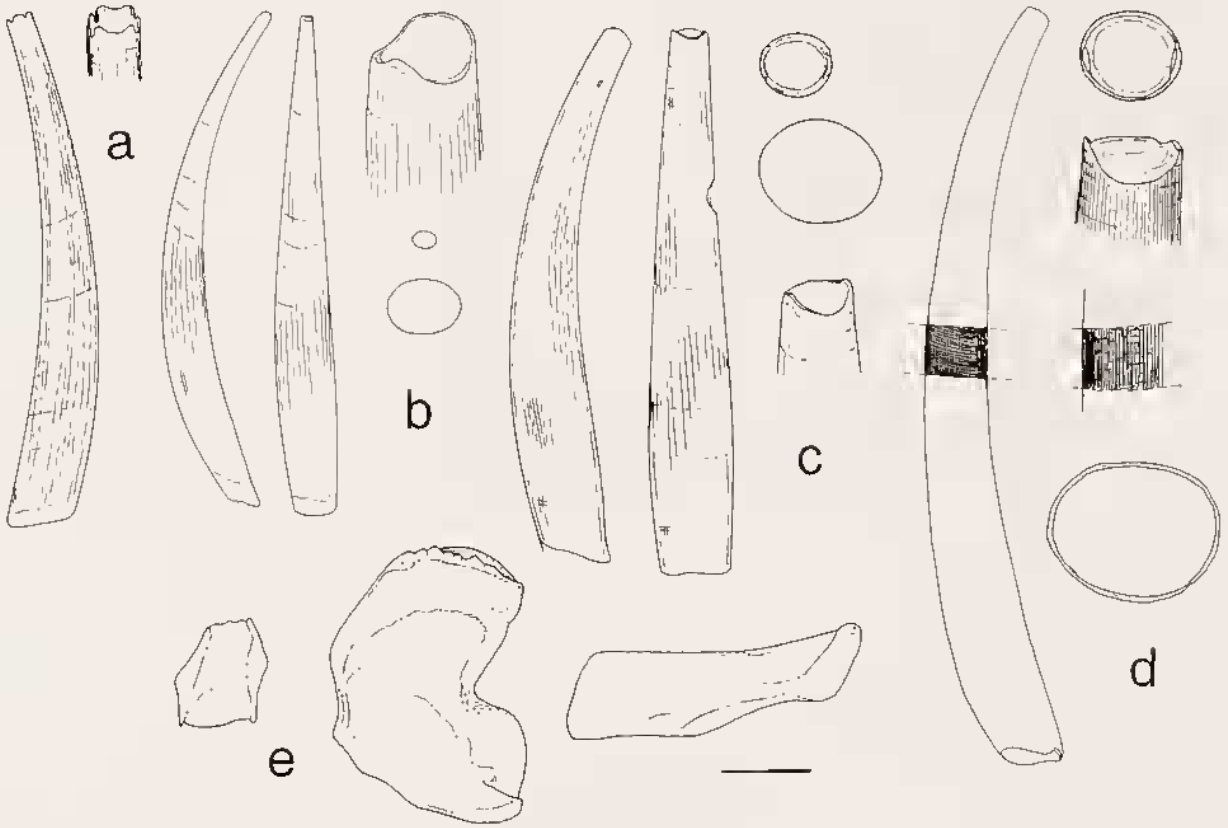


FIG. 139. — **a**, *Sagamicadulus elegantissiums* (after HABE, 1964, pl. 5, figs 45-46), shell and apex. — **b**. *Striocadulus pulcherrimus*, shell (16 mm), lateral and dorsal views, apex, apical and oral sections, CORINDON: stn B 275. — **c**, *Striocadulus ludbrooki*, holotype, shell (19.5 mm), lateral and dorsal views, apical and oral sections, apex. — **d**, *Striocadulus sagei* sp. nov., holotype, shell (40 mm), apical section, apex, detail of sculpture, oral section. — **e**, *Striocadulus* type radula (*S. sagei*).

Genus *POLYSCHIDES* Pilsbry & Sharp, 1898

Type species (OD): *Cadulus tetraschistus* Watson, 1879. Recent, West Atlantic Ocean, *"Challenger"*, off Fernando de Noronha, stn 113a, 03°47' S, 32°24' W, 7-25 fms [13-47 m].

DIAGNOSIS. — *Shell* small to medium, strong, smooth, white, translucent when fresh, polished when dead. Maximum diameter located in anterior third or in the mouth area. Apex wide, with four deep notches and four lobes, two laterals, one dorsal, one ventral. Preapical callus weak.
Radula rachidian subpyramidal with wide base; lateral with two sharp cusps on inner surface, one on outer face; marginal short.

DISTRIBUTION. — Eocene-Recent, worldwide, littoral-bathyal.

Polyschides pelamide Chistikov, 1979

Figs 140, 147 a

Polyschides pelamide Chistikov, 1979b: 143. fig. 7.

TYPE MATERIAL. — ZIN (*fide* CHISTIKOV).

TYPE LOCALITY. — Gulf of Tonking, South China Sea, 56 m.

MATERIAL EXAMINED. — **Indonesia**. CORINDON: stn B 204, 01°09′ S, 117°18′ E, 49 m, 1 lv, 8 dd. — Stn B 207, 00°15′ S, 117°52′ E, 150 m, 4 dd. — Stn B 251, 00°54′ S, 119°30′ E, 65 m, 4 dd. **Philippines**. MUSORSTOM 3: stn DR 140, 11°43′ N, 122°34′ E, 93-99 m, 71 dd.

FIG. 140. — Distribution of *Polyschides pelamide*.

DISTRIBUTION. — Viet-Nam, now extended to the Philippines and Indonesia, alive in 49-56 m, shells down to 150 m (present paper).

Polyschides arnaudi sp. nov.

Figs 141, 147 b, h

TYPE MATERIAL. — Holotype MNHN. Paratypes: 13 MNHN, 1 NMP, 1 USNM.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DC 124, 20°52′ S, 55°37′ E, 40 m.

MATERIAL EXAMINED. — **West Indian Ocean**. MD 32 Réunion: stn DC 10, 21°13′ S, 55°52′ E, 930-980 m, 1 dd. — Stn DR 47, 21°23′ S, 55°37′ E, 205-215 m, 1 dd. — Stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 26 dd. — Stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 7 dd. — Stn DC 86, 20°59′ S, 55°15′ E, 75-90 m, 7 lv, 38 dd. — Stn DR 90, 19°45′ S, 54°09′ E, 65 m, 3 dd. — Stn DC 124, 20°52′ S, 55°37′ E, 40 m, 13 lv, 129 dd (holotype dd, paratypes: 7 lv, 6 dd MNHN, 1 dd NMP, 1 dd USNM). — Stn DC 136, 20°46′ S, 55°36′ E, 915-922 m, 9 dd. — Stn DC 176, 21°02′ S, 55°11′ E, 165-195 m, 1 dd.

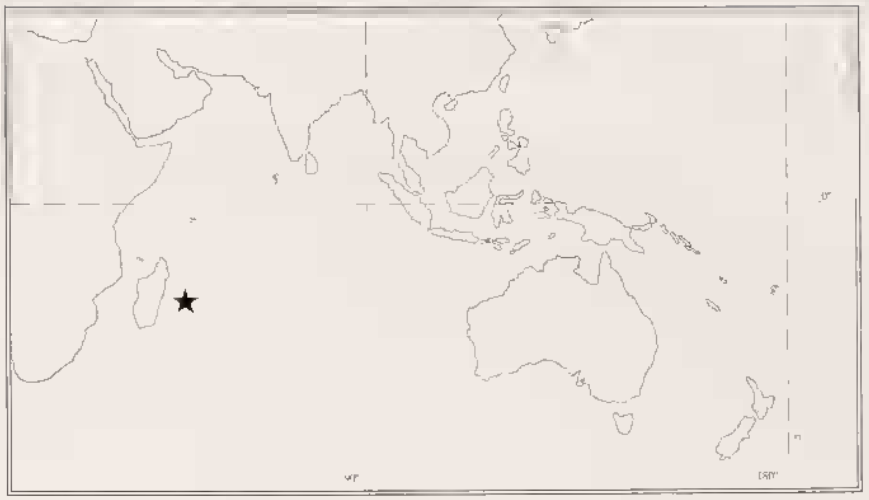


FIG. 141. — Distribution of *Polyschides arnaudi*.

DISTRIBUTION. — Only known from Réunion Island. Alive in 40-90 m, shells (probably washed down) to 980 m.

DESCRIPTION. — *Shell* to 42 mm long, translucent, shiny, smooth. Maximum diameter at anterior 1/8 of shell, swollen at anterior aperture. Apex oval dorsoventrally, wide, with four lobes created by four notches. The latero-dorsal notch is deeper, forming a wide, flat dorsal lobe; two lobes are lateral; the fourth is ventral, higher and posteriorly rounded. Preapical callus prominent, lumen oval. Oral aperture circular, slightly oblique.

Measurements: holotype L 7.5, W 1.2, w 0.9, apex 0.6; paratypes L 6.4, W 1.2, w 0.7, apex 0.5; L 7.9, W 1.3, w 1, apex 0.6; L 7.6, W 1.3, w 0.9, apex 0.5.

REMARKS. — The shell is characterized by alternating white and translucent rings throughout. *Polyschides arnaudi* resembles the Western Atlantic *P. tetrodon* (Henderson, 1920), from which it differs in having a less fusiform shell sape.

ETYMOLOGY. — Named for Dr Patrick M. ARNAUD, Centre Océanologique de Marseille.

Other Indo-Pacific species of *Polyschides* cited in the literature

Polyschides faustus (Kuroda & Habe *in* Habe, 1971): 496 (Japanese text), 313 (English text), pl. 65, figs 18-19. Sagami Bay, Japan.

Polyschides kaiyomaruae Okutani, 1975: pl. 3, fig. 5. N W Pacific, 29°49′ N, 147°09′ E to 28°48′ N, 147°09′ E, 6200 m.

Polyschides sakuraii (Kuroda & Habe *in* Habe, 1962): 105, pl. 47, fig. 3. Off Choshi, Chiba Prefecture, Honshu, Japan, 200 m. NSMT.

Polyschides vietnamicus Chistikov, 1979b: 113, fig. 6. Tonking Bay, Viet Nam, 8 m. ZIN.

Genus *DISCHIDES* Jeffreys, 1867

Type species (by monotypy): *Dentalium bifissum* Wood, 1842. Recent, Mediterranean and East Atlantic; Pliocene of England and Italy.

DIAGNOSIS. — *Shell* small to medium sized, strong, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in anterior half of the shell or near the mouth. Apex wide, with

two deep lateral notches and two lobes, the ventral larger, usually with a central nodule in the inner wall. Preapical callus weak.
Radula similar to that of *Polyschides*.

DISTRIBUTION. — Eocene-Recent, worldwide, well represented in the Indo-Pacific region, littoral-bathyal.

Dischides minutus (H. Adams, 1872)
Figs 111 n-o, 142, 147 c

Cadulus minutus H. Adams, 1872: 10, pl. 3, fig. 9.

Other references:
Dentalium minutus – SOWERBY, 1873: pl. 7, fig. 48. — COOKE, 1885: 273.
Cadulus minutus – PILSBRY & SHARP, 1897: 188, pl. 26, fig. 78. — BOISSEVAIN, 1906: 67, pl. 3, fig. 49.

TYPE MATERIAL. — Presumably in BMNH (not located).

TYPE LOCALITY. — Red Sea.

MATERIAL EXAMINED. — **Red Sea**. Suez, 145 dd. — Gulf of Suez, 15 dd. — Souakin, Sudan, 3 dd. — Djeddah, 1 dd. — Aden, 65 dd (all Coll. JOUSSEAUME, MNHN).

FIG. 142. — Distribution of *Dischides minutus*.

DISTRIBUTION. — Red Sea and Gulf of Aden. Depth distribution unknown, shells probably washed ashore.

Dischides dichelus (Watson, 1879)
Figs 143, 147 e

Siphonodentalium dichelum Watson, 1879: 521; 1886: 15, pl. 2, fig. 7.

Other references:
Cadulus dichelus – PILSBRY & SHARP, 1898: 145, pl. 26, fig. 73. — BOISSEVAIN, 1906: 65, pl. 3, fig. 48, pl. 6, fig. 51.
C. (Dischides) dichelus – HABE & KOSUGE, 1964: 11.

TYPE MATERIAL. — Holotype BMNH 1887.2.9.65.

TYPE LOCALITY. — *"Challenger"*, Levuka, Fiji, 12 fms [22 m].

MATERIAL EXAMINED. — The type material.
West Indian Ocean. MD 32 Réunion: stn DC 56, 21°05′ S, 55°12′ E, 170-225 m, 2 lv, 254 dd. — Stn DC 85, 21°00′ S, 55°15′ E, 58-70 m, 2 dd. — Stn 90, 19°45′ S, 54°09′ E, 65 m, 1 dd. — Stn CP 129, 20°51′ S, 55°36′ E, 290-300 m, 1 dd.
NW Madagascar, Nosy Bé Island, PLANTE coll., 1 lv, 2 dd (BMNH).

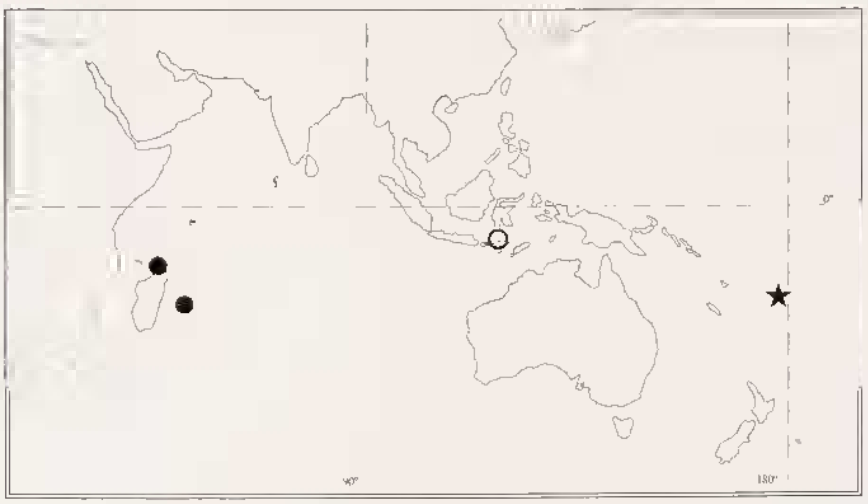


FIG. 143. — Distribution of *Dischides dichelus*.

DISTRIBUTION. — Fiji and Indonesia (BOISSEVAIN, 1906), now extended to Réunion Island and Madagascar; alive in 170-225 m and in indeterminate condition up to 22 m.

Dischides prionotus (Watson, 1879)

Figs 144, 147 d, i

Siphonodentalium prionotum Watson, 1879: 522; 1886: 16, pl. 2, fig. 9.

Other references:
Cadulus prionotus – PILSBRY & SHARP, 1898: 146, pl. 26, fig. 74. — BOISSEVAIN, 1906: 66, pl. 3, fig. 47.

TYPE MATERIAL. — 3 syntypes dd BMNH 1907.10.28.147-149.

TYPE LOCALITY. — *"Challenger"*, stn 185b, 11°38′ S, 143°59′ E, 155 fms [283 m], off Cape York, N Australia.

MATERIAL EXAMINED. — The type material.
New Caledonia. *"Vauban"* 1978-79: stn 33, 22°33′ S, 166°25′ E, 290-350 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DR 08, 11°29′ S, 47°18′ E, 250 m, 5 lv, 4 dd. — Stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 lv, 1 dd. — Stn DS 64, 12°41′ S, 44°57′ E, 770-860 m, 1 lv. — Stn DS 72, 12°31′ S, 45°02′ E, 300-350 m, 1 lv, 2 dd. — Stn DS 94, 11°32′ S, 47°16′ E, 450 m, 1 lv. — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 5 lv, 3 dd.

MD 32 Réunion: stn DC 85, 20°59′ S, 55°15′ E, 58-70 m, 2 dd. — Stn DC 128, 20°51′ S, 55°36′ E, 280-340 m, 1 dd.

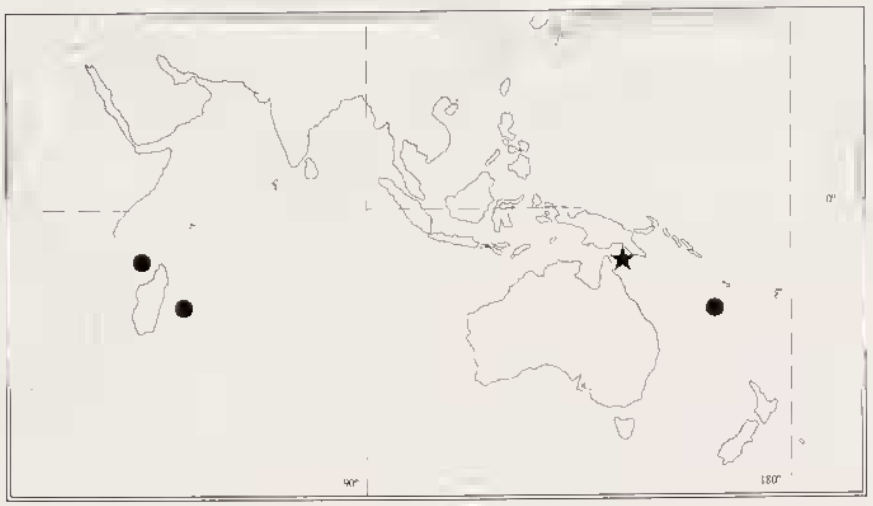


FIG. 144. — Distribution of *Dischides prionotus*.

DISTRIBUTION. — N Australia, now extended to New Caledonia, Réunion Island and NW Madagascar, alive in 250-450 m and shells from 70 m.

Dischides viperidens (Melvill & Standen, 1896)

Figs 145, 147 f

Cadulus viperidens Melvill & Standen, 1896: 314, pl. 11, fig. 79.

TYPE MATERIAL. — Figured syntype Manchester Museum EE 3797; 6 other syntypes NMW (TREW, 1987).

FIG. 145. — Distribution of *Dischides viperidens*.

TYPE LOCALITY. — Lifu and Uvea, Loyalty Islands, New Caledonia.

MATERIAL EXAMINED. — **Loyalty Islands**. Niemak, Ouvéa, beach, 27 July 1978, P. Bouchet coll., 25 dd.

DISTRIBUTION. — Loyalty Islands, shore.

Dischides yateensis sp. nov.

Figs 146, 147 g

TYPE MATERIAL. — Holotype and paratype MNHN.

TYPE LOCALITY. — New Caledonia, LAGON, stn 619, 22°03′ S, 166°54′ E, 27-42 m.

MATERIAL EXAMINED. — **New Caledonia**. LAGON: stn 619, 22°03′ S, 166°54′ E, 27-42 m, 2 dd (holotype and paratype).
Philippines. Coll. JOUSSEAUME, 6 dd, MNHN.

FIG. 146. — Distribution of *Dischides yateensis*.

DISTRIBUTION. — New Caledonia and the Philippines. Shells from the shore to 42 m.

DESCRIPTION. — *Shell* to 13 mm long, strong, shiny, translucent white. Maximum diameter in anterior fifth, where a slight swelling originates near the mouth and rapidly curves towards the peristome; growth lines pronounced. Apex strong, wide, dorsoventrally compressed, with two lateral notches forming two lobes, the dorsal with a rounded edge and the ventral angled with a prominent central denticle. Preapical callus prominent, lumen circular. Mouth straight, oval dorsoventrally.

Measurements: holotype L 12.4, W 2-1.9, m 1.5-1.4, apex 0,9-0.8, arc 0.5; paratype L 12.1, W 2, m 1.8-1.65, apex 0.9-0.8, arc 0.5.

REMARKS. — This species resembles *Dischides prionotus*, which has similar sculpture but different shape, and *D. dichelus*, which is fusiform in outline. The three species share the denticle situated on the ventral lobe of the apex.

ETYMOLOGY. — Named for Yaté, the type locality.

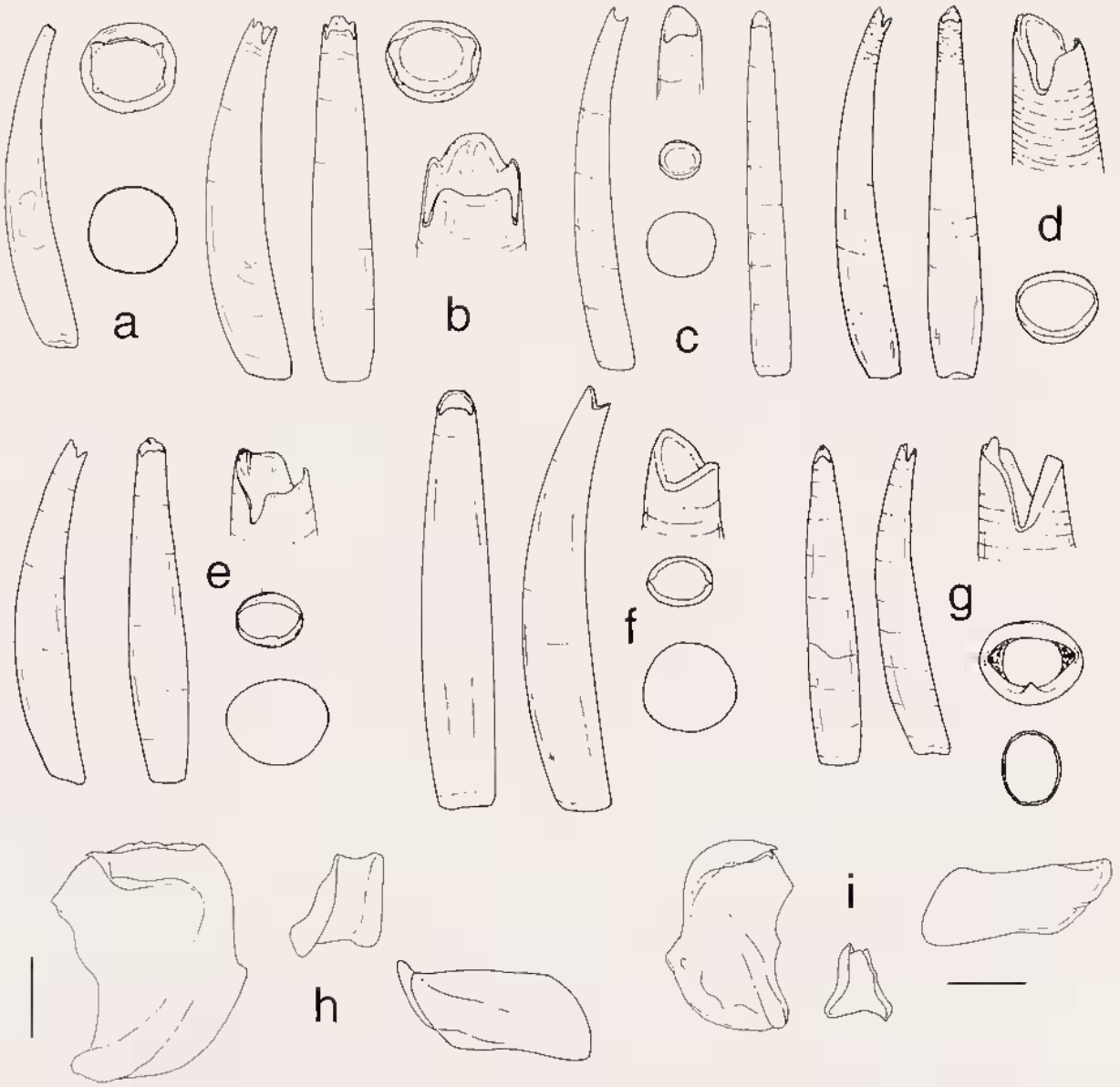


FIG. 147. — **a**, *Polyschides pelaniae*, shell (11.5 mm), apical and oral sections, MUSORSTOM 3: stn DR 140. — **b**, *Polyschides arnaudi* sp. nov., holotype, shell (7.5 mm) lateral and dorsal views, apex and apical section. — **c**, *Dischides minutus*, shell (5 mm), apex, apical and oral sections, Aden (MNHN). — **d**, *Dischides prionotus*, shell (12 mm), lateral and dorsal views, apex and apical sections, BENTHEDI: stn DS 120. — **e**, *Dischides dichelus*, shell (9 mm), lateral and dorsal views, apex, apical and oral sections, MD 32 Réunion: stn DC 56. — **f**, *Dischides viperidens*, shell (6 mm), dorsal and lateral views, apex, apical and oral sections, Loyalty Islands (MNHN). — **g**, *Dischides yateensis* sp. nov., holotype, shell (12.4 mm), dorsal and lateral views, apex, apical and oral sections. — **h**, *Polyschides* type radula (*P. arnaudi*). — **i**, *Dischides* type radula (*D. prionotus*).

Subfamily GADILINAE Stoliczka, 1868

Genus *CADULUS* Philippi, 1844

Type species (by monotypy): *Cadulus ovulum* Philippi, 1844. Recent, Mediterranean Sea.

DIAGNOSIS. — *Shell* small to medium, swollen, solid, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in center of shell. Apex simple or coronate, preapical callus usually prominent, lumen circular. Apical and oral sections variable, usually oval dorsoventrally or laterally compressed.
Radula rachidian variable, polygonal to almost quadrangular, anterior margin generally with cusps; lateral with two to three primary cusps with a series of denticles between cusps; marginal short, slightly curved (Fig. 160 k, *C. tumidosus* Jeffreys, 1877).

DISTRIBUTION. — Cretaceous-Recent, worldwide, shelf-abyssal.

Cadulus simillimus Watson, 1879

Figs 148, 160 a

Cadulus simillimus Watson, 1879: 526; 1886: 20, pl. 3, fig. 6.

Other references:
Cadulus simillimus — BOISSEVAIN, 1906: 69, pl. 3, fig. 46.
Cadulus (Gadila) simillima — HABE & KOSUGE, 1964: 11.

TYPE MATERIAL. — 2 syntypes dd, BMNH 1887.2.9.80-81.

TYPE LOCALITY. — Australia, off Cape York, Queensland, *"Challenger"*, stn 185b, 11°38' S, 143°59' E, 155 fms [283 m].

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 201, 22°40' S, 166°33' E, 595 m, 1 dd. — Stn KG 219, 22°39' S, 166°34' E, 570 m, 2 dd.
North Australia. Port Darwin, Coll. DENIS, 2 dd (MNHN).

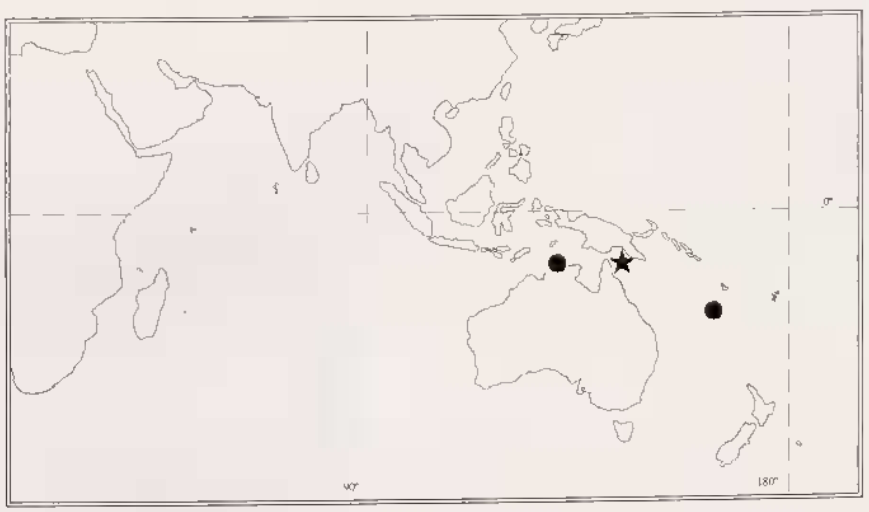


FIG. 148. — Distribution of *Cadulus simillimus*.

DISTRIBUTION. — Northern Australia, now extended to New Caledonia, shells from 6 fms [11 m] (WATSON, 1879) to 595 m (present paper).

Cadulus aratus Hedley, 1899

Figs 149, 160 b

Cadulus aratus Hedley, 1899b: 551, fig. 60.

TYPE MATERIAL. — Syntypes AMS C5635, 36, 38.

TYPE LOCALITY. — Pacific Ocean, Tuvalu, Funafuti Atoll, 66 m.

MATERIAL EXAMINED. — The type material.
New Caledonia. LAGON: stn 729, 21°194 S, 165°54′ E, 42-45 m, 1 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°08′ E, 130-137 m, 3 dd.
West Indian Ocean. BENTHEDI: stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 10 lv. MD 32 Réunion: stn DS 178, 21°04′ S, 55°10′ E, 412-460 m, 2 lv.

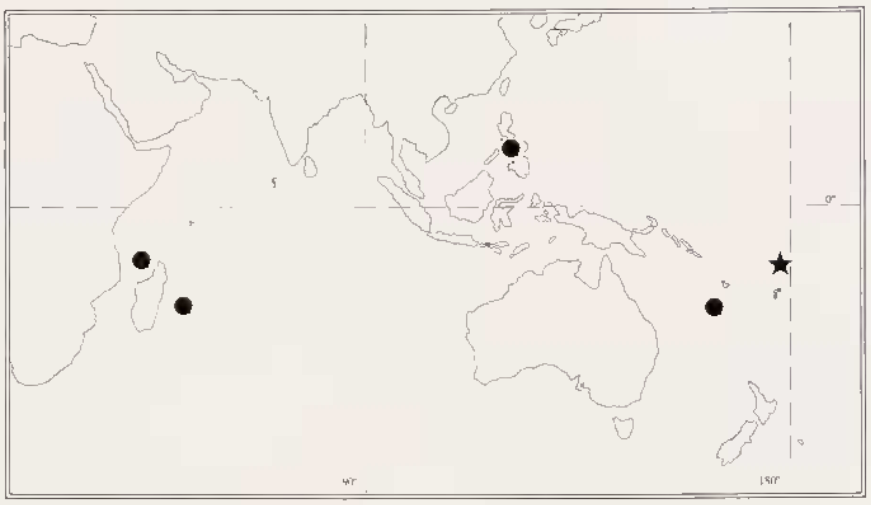


FIG. 149. — Distribution of *Cadulus aratus*.

DISTRIBUTION. — Funafuti Atoll, now extended to New Caledonia, the Philippines, Réunion Island and NW Madagascar, alive in 335-460 m, shells recorded as shallow as 45 m.

Cadulus aequatorialis Jaeckel, 1932

Figs 150, 160 c

Cadulus aequatorialis Jaeckel, 1932: 311, textfig. 10.

Other reference:
Cadulus (C.) aequatorialis – HABE & KOSUGE, 1964: 9.

TYPE MATERIAL. — Lectotype (KILIAS, 1972) ZMB 75372, paratype 75373.

TYPE LOCALITY. — Indonesia, West Sumatra, "*Valdivia*", stn 191, 00°39′ S, 98°52′ E, 750 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 214, 22°43′ S, 166°28′ E, 1590-1665 m, 1 dd. — Stn KG 221, 22°42′ S, 166°24′ E, 1915 m, 1 lv.

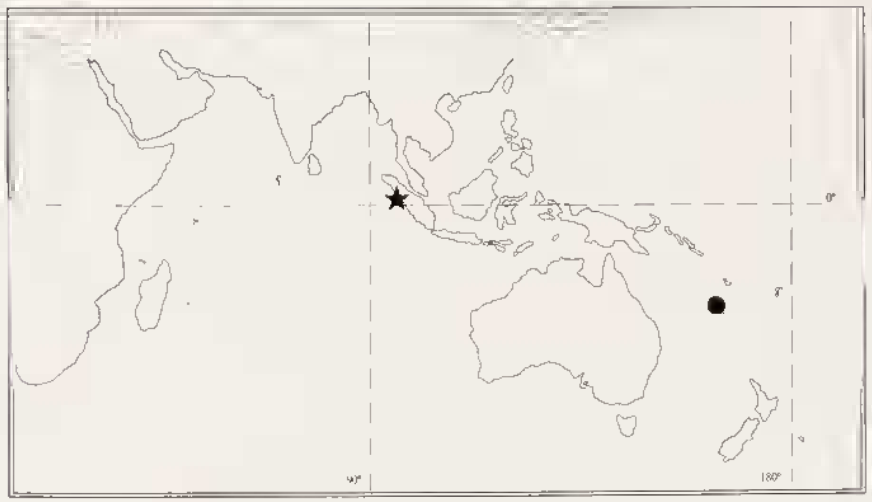


FIG. 150. — Distribution of *Cadulus aequatorialis*.

DISTRIBUTION. — Indonesia, now extended to New Caledonia, alive in 1915 m, shells from 750 m.

Cadulus cyathoides Jaeckel, 1932

Figs 151, 152, 160 d

Cadulus cyathoides Jaeckel, 1932: 308, textfig. 5.

Other reference:
Cadulus (C.) cyathoides — LUDBROOK, 1954: 112, fig. 12.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 75361a.

TYPE LOCALITY. — Indonesia, West Sumatra, *"Valdivia"*, stn 191, 00°39′ S, 98°52′ E, 750 m.

FIG. 151. — *Cadulus cyathoides*, detail of the coronale apex common to all globose *Cadulus*. Scale line: 100 µm.

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn CP 2, 14°05′ N, 120°02′, 2050 m, 2 dd. MUSORSTOM 3: stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 1 lv.
West Indian Ocean. BENTHEDI: stn 42, 13°05′ S, 45°08′ E, 400-520 m, 1 lv.

FIG. 152. — Distribution of *Cadulus cyathoides*.

DISTRIBUTION. — Red Sea, Gulf of Aden (LUDBROOK, 1954) and Indonesia, now extended to the Philippines, alive in 205-520 m and shells down to 2050 m (present paper).

Cadulus chuni Jaeckel, 1932
Figs 153, 160 e

Cadulus chuni Jaeckel, 1932: 309, textfig. 6.
Other reference:
Cadulus (C.) chuni – HABE & KOSUGE, 1964: 10.

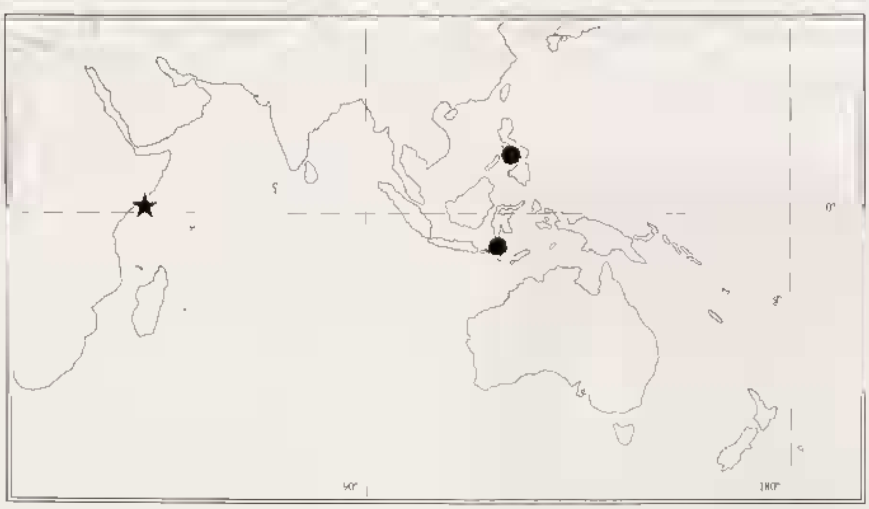


FIG. 153. — Distribution of *Cadulus chuni*.

TYPE MATERIAL. — Lectotype, designated by KILIAS (1995), ZMB 75374a.

TYPE LOCALITY. — East Africa, off Somalia, *"Valdivia"*, stn 256, 01°49′ N, 45°30′ E, 1134 m.

MATERIAL EXAMINED. — **Indonesia**. *"Snellius"* II: stn 4.112, 08°19′ S, 118°16′ E, 365 m, 20 lv, 18 dd.
Philippines. MUSORSTOM 3: stn CP 139, 11°53′ N, 122°14′ E, 240-267 m, 1 lv, 1 dd. — Stn CP 143, 11°29′ N, 124°11′ E, 205-214 m, 3 lv, 15 dd.

DISTRIBUTION. — East Africa, now extended to Indonesia and the Philippines, alive in 205 to 365 m.

Cadulus martini sp. nov.

Figs 154, 160 f

TYPE MATERIAL. — Holotype and 6 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, BIOGEOCAL, stn CP 232, 21°34′ S, 166°27′ E, 760-790 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 232, 21°34′ S, 166°27′ E, 760-790 m, 1 lv (paratype), 3 dd (holotype, 2 paratypes).
BIOCAL: stn CP 75, 22°19′ S, 167°23′ E, 825-860 m, 1 lv (paratype). — Stn DW 106, 21°36′ S, 166°29′ E, 625-650 m, 1 lv, 1 dd (paratypes).
West Indian Ocean. MD 32 Réunion: stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 dd.

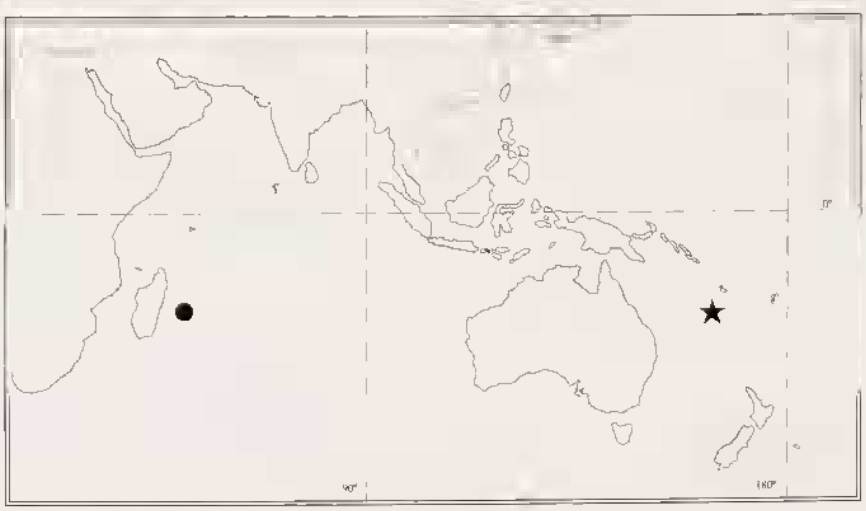


FIG. 154. — Distribution of *Cadulus martini*.

DISTRIBUTION. — New Caledonia and Réunion Island, living in 625-860 m and shells (probably washed down) down to 3500 m.

DESCRIPTION. — *Shell* to 5 mm long, globose, shiny, white. Maximum diameter posterior to center of shell. Apical constriction shorter than oral. In lateral view, the ventral side shows a regular and pronounced curve to the neck. The dorsal side shows alternating concave and convex lines. The oral concave curve reaches maximum depth at 2/5 of the shell; the apical curve at the posterior 1/5. In frontal view, the posterior area from the maximum diameter is shorter and more curved than the anterior area which has straight sides tapering regularly to the mouth. Apex oval dorsoventrally,

with coronate structure. Preapical callus conspicuous, lumen oval dorsoventrally. Mouth laterally compressed, curved on ventral side, oblique.

Measurements: holotype L 5, W 1.9, m 1-0.8, apex 0.7-0.6; paratypes L 5.5, W 2-2, m 1-0.9, apex 0.7-0.6; L 5, W 2-1.9, m 1-0.8, apex 0.7-0.6; L 5.3, W 2-1.9, m 0.9-0.8, apex 0.7-0.6.

REMARKS. — A coronate structure of the apex is common among the globose *Cadulus*, and can be noticed in the apical part of the animal (SCARABINO, 1979).

ETYMOLOGY. — Named for the author's son Martin.

Cadulus glans sp. nov.

Figs 155, 160 g

TYPE MATERIAL. — Holotype and 7 paratypes MNHN.

TYPE LOCALITY. — New Caledonia, Loyalty Basin, BIOGEOCAL, stn KG 227, 21°33′ S, 166°24′ E, 500 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 219, 22°39′ S, 166°34′ E, 570 m, 2 dd (paratypes). — Stn KG 227, 21°33′ S, 166°24′ E, 500 m, 1 dd (holotype). *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 5 dd (paratypes).

FIG. 155. — Distribution of *Cadulus glans*.

DISTRIBUTION. — Only known from New Caledonia, shells from 250-570 m.

DESCRIPTION. — *Shell* to 2 mm long, globose, glossy, translucent white. Equator posterior to the center of the shell. Apical constriction very short, formed by 11-12 lobes. In lateral view, the ventral side is straight to the center of the shell, then curves regularly and strongly to the apex; the dorsal side is sinusoidal, with the concave sector short near the mouth, with a long convex curve that reaches its maximum diameter at the posterior quarter. In frontal view the posterior area from the center is short and more curved than the anterior area, which has straight sides regularly tapering to the mouth. Apex oval laterally, larger than the mouth, with prominent coronate structure. Preapical callus prominent, lumen circular placed ventrally by the callus. Mouth circular, oblique.

Measurements: holotype L 1.7, W 0.89, m 0.44, apex 0.47.

REMARKS. — The coronate structure is formed by 11-12 wide lobes. The most similar species is *Cadulus martini*, from which *C. glans* differs in being the only species with the apex, rather than the lumen, larger than the mouth.

ETYMOLOGY. — From the latin *glans*: acorn-shaped.

Cadulus florenciae sp. nov.

Figs 156, 160 h

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, MD 32 Réunion, stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m.

MATERIAL EXAMINED. — **West Indian Ocean**. MD 32 Réunion: stn DR 104, 20°49′ S, 55°01′ E, 1875-1920 m, 3 dd (paratypes). — Stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m, 1 lv (holotype).

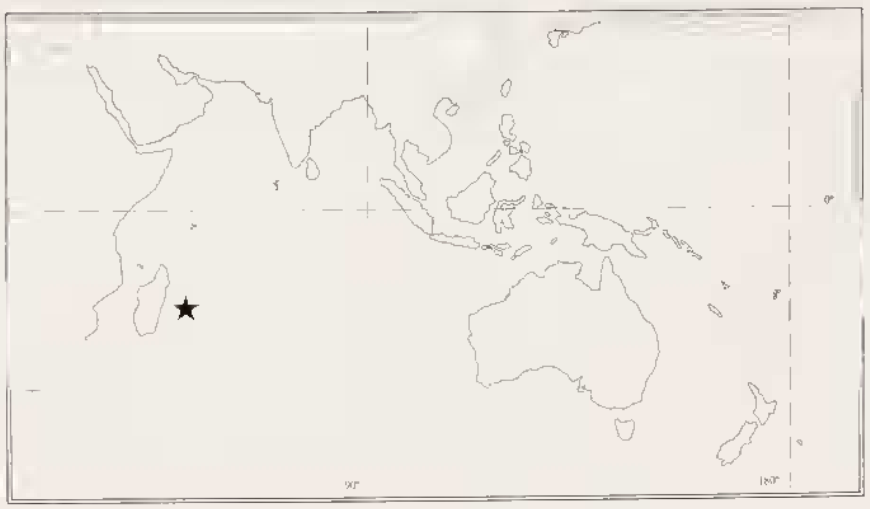


FIG. 156. — Distribution of *Cadulus florenciae*.

DISTRIBUTION. — Only known from off Réunion Island, alive in 1575-1600 m.

DESCRIPTION. *Shell* to 2 mm long, delicate, fusiform, shiny, white, translucent. Maximum diameter at center of shell. The ventral side shows a regular curvature, less prominent in oral area; the dorsal side shows a slight swelling. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen oval. Mouth suboval laterally compressed.

Measurements: holotype L 2, W 0.6, mouth 0.2, apex 0.2

REMARKS. — The most similar species is *Cadulus aequatorialis*, which differs in having a shorter oral area and neck.

ETYMOLOGY. — Named for the author's daughter, Florencia.

Cadulus sofiae sp. nov.

Figs 157, 160 i, l

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 NMP.

TYPE LOCALITY. — West Indian Ocean. MD 32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn KG 03, 21°15′ S, 166°39′ E, 2340 m, 2 dd. — Stn KG 71, 22°10′ S, 167°33′ E, 2099 m, 1 dd. — Stn KG 102, 21°28′ S, 166°26′ E, 1810 m, 1 dd.
BIOGEOCAL: stn CP 243, 21°27′ S, 166°26′ E, 1820 m, 3 dd. — Stn CP 260, 21°00′ S, 166°58′ E, 1820-1980 m, 4 dd. — Stn KG 276, 21°13′ S, 167°00′ E, 2200 m, 1 dd. — Stn CP 317, 20°48′ S, 166°53′ E, 1620-1630 m, 2 dd.
CALSUB: dive 13, 21°26′ S, 166°23′ E, 1600 m, 3 dd.
West Indian Ocean. MD 32 Réunion: stn DS 149, 20°26′ S, 55°40′ E, 3500-3510 m, 1 lv (paratype NMP). — Stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m, 4 lv (holotype and 3 paratypes).
BENTHEDI: stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 dd (paratype). — Stn CH 87, 11°44′ S, 47°35′ E, 3716 m, 6 lv (2 paratypes). — Stn CH 90 11°44′ S, 47°30′ E, 3700 m, 1 dd (paratype).

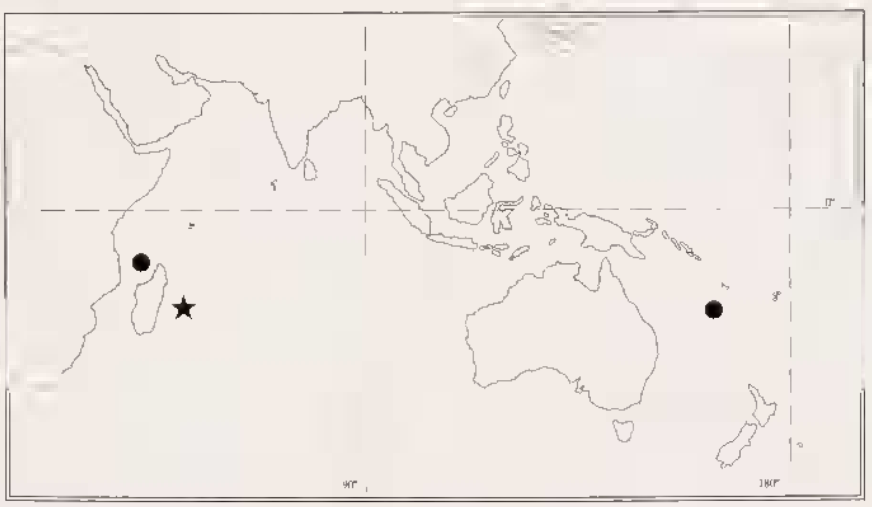


FIG. 157. — Distribution of *Cadulus sofiae*.

DISTRIBUTION. — Réunion Island, NW Madagascar and New Caledonia, alive in 3500 to 3716 m, shells from 1600 m.

DESCRIPTION. — *Shell* to 5 mm, globose, white, shiny, translucent in fresh specimens. Maximum diameter at center of shell. In lateral view the swell is prominent on ventral side; in frontal view, both sides are similar. Rapidly tapering from the maximum diameter to apex and mouth. Circular in section. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen circular. Mouth laterally compressed, oblique.

Mesurements: holotype L 4.5, w 2-2, d 2, m 1.9-1.7, arc 1.

REMARKS. — This species is similar in shape to *Cadulus tumidosus* Jeffreys, 1877, from the Atlantic Ocean, but less globose.

ETYMOLOGY. — Named for the author's daughter Sofia.

Cadulus labeyriei sp. nov.

Figs 158, 160 j

TYPE MATERIAL. — Holotype MNHN. Paratypes: 9 MNHN, 1 USNM.

TYPE LOCALITY. — Philippines, ESTASE 2, stn DW 1, 14°05′ N, 120°01′ E, 2200 m.

MATERIAL EXAMINED. — **Philippines**. ESTASE 2: stn DW 1, 14°05′ N, 120°01′ E, 2200 m, 3 lv (holotype and 2 paratypes). — Stn CP 2, 14°05′ N, 120°02′ E, 2050 m, 8 lv (paratypes: 7 MNHN, 1 USNM).

FIG. 158. — Distribution of *Cadulus labeyriei*.

DISTRIBUTION. — Only known from the Philippines, living from 2050 to 2200 m.

DESCRIPTION. — *Shell* to 3 mm long, delicate, globose, shiny, white, translucent to transparent in fresh specimens. Maximum diameter near center of shell, oval in section, prominent. In lateral view, the ventral side shows regular curvature, while on the dorsal side the swelling is prominent and shows oral and apical constrictions. In front view, the maximum diameter is at the center of the shell, the constriction through mouth and the apex begins straight, near the apex the slight curvature forms a short neck. Apex simple, oval dorsoventrally. Preapical callus conspicuous, lumen circular. Mouth suboval laterally compressed, oblique.

Measurements: holotype L 2.7, W 1.2, m 0.4, apex 0.4; paratype L 3.1, W 1.3, m 0.4, apex 0.2.

REMARKS. — The most similar species is *Cadulus valdiviae*, which differs in its shorter apical and oral constrictions and is more swollen.

ETYMOLOGY. — Named for Dr Laurent LABEYRIE (CNRS, Gif), cruise leader of the ESTASE 2 Expedition aboard R.V. *"Jean-Charcot"*.

Other Indo-Pacific species of *Cadulus* cited in the literature

Cadulus campylus Melvill, 1906: 80, pl. 8, fig. 32. Gulf of Oman, 285 m. Syntype BMNH 1906.10.23.76, and 3 syntypes NMW (*fide* OLIVER, 1984) (not seen).

Cadulus euloides Melvill & Standen, 1901: 459, pl. 24, fig. 24. Gulf of Oman. Syntype BMNH 1901.12.9.12.
Cadulus ovalis Boissevain, 1906: 66, pl. 6, fig. 52. Madura Bay, Indonesia, *"Siboga"*, stn 51, 69-91 m. 2 syntypes dd ZMA.
Cadulus platei Jaeckel, 1932: 311, fig. 9. *"Valdivia"*, stn 109, off South Africa, 35°19′ S, 20°12′ E, 126 m. Holotype ZMB 75376.
Cadulus siberutensis Jaeckel, 1932: 309, fig. 7. Indonesia, Sumatra, *"Valdivia"*, stn 191, 00°39′ S, 98°52′ E, 750 m. Lectotype (KILIAS, 1995) ZMB 75368a.
Cadulus singaporensis Pilsbry & Sharp, 1898: 195, pl. 36, figs 30-32. Singapore. ANSP.
Cadulus valdiviae Jaeckel, 1932: 312, fig. 11. *"Valdivia"*, stn 251, off Somalia, 01°41′ S, 41°47′ E, 693 m. Lectotype (KILIAS, 1995) ZMB 75370a.

Genus *BATHYCADULUS* gen. nov.

Type species: *Bathycadulus fabrizioi* sp. nov.

DIAGNOSIS. — *Shell* medium sized for the family, smooth, shiny. Maximum diameter at the 3/5 median zone, where sides are almost parallel, or in two swellings, one at 2/5 and the other at 4/5 of the total length. Oral and apical constrictions pronounced, with short anterior and posterior areas. Apex simple or with a series of narrow notches forming a coronate edge. Section at apex slightly dorsoventrally compressed with a conspicuous preapical callus. Mouth oblique, laterally compressed. Apical area of animal short with principal muscular ring simple or coronate, neck with conspicuous dermic papillae.
Radula rachidian nearly as high as wide, anterior edge irregular, with a small cusp at the center and two or three denticles at each side. Lateral with well sculptured head, having three major cusps, one located internally, the other two externally, and 4-5 denticles; sculpture of the head of laterals accompanied by a chain of tooth like formations located at the outer side of primary cusps. Marginal slightly sigmoidally depressed, with the union edge to the lateral large and a prominent lateral keel.

REMARKS. — The subfamily Gadilinae includes the genera *Cadulus*, *Gadila* (radula very similar) and *Sulcogadila* Moroni & Ruggieri, 1981 (fossil from the Pleistocene of Sicily). *Cadulus* and *Sulcogadila* have the maximum diameter centrally located in one swelling with concave sides, and *Gadila* has the equator near the oral aperture, and usually concave dorsal and ventral sides. *Bathycadulus* has unique shell characters for the class, with sides almost parallel and even slightly concave at the maximum diameter.

Two additional new species of this genus, from bathyal and abyssal depths of the Atlantic Ocean, will be described elsewhere.

DISTRIBUTION. — Recent, Indian and Atlantic Oceans, abyssal.

Bathycadulus fabrizioi sp. nov.

Figs 159, 160 m-n

TYPE MATERIAL. — Holotype SAM A36258. Paratypes: 1 SAM A36259, 1 USNM, 11 MNHN, 1 NMP, 1 Museo Nacional de Historia Natural, Montevideo, Uruguay 14751.

TYPE LOCALITY. — South Africa, *"Meiring Naudé"*, stn SM 109, 28°41′ S, 32°37′ E, 1300 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn KG 221, 22°42′ S, 166°24′ E, 1915 m, 1 dd. — Stn KG 222, 22°45′ S, 166°25′ E, 1675 m, 1 dd.

West Indian Ocean. MD 32 Réunion: stn DS 78, 21°13′ S, 55°04′ E, 1175-1200 m, 1 lv, 1 dd. — Stn DS 106, 20°48′ S, 55°05′ E, 1710-1730 m, 1 lv. — Stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m, 12 lv (paratypes: 11 MNHN, 1 USNM), 1 dd (paratype NMP). — Stn DS 139, 20°47′ S, 55°38′ E, 1575-1600 m, 8 lv, 2 dd.
"Meiring Naudé": stn SM 109, 28°41′ S, 32°37′ E, 1300 m, 2 lv (holotype and 1 paratype SAM), 1 dd (paratype Montevideo).

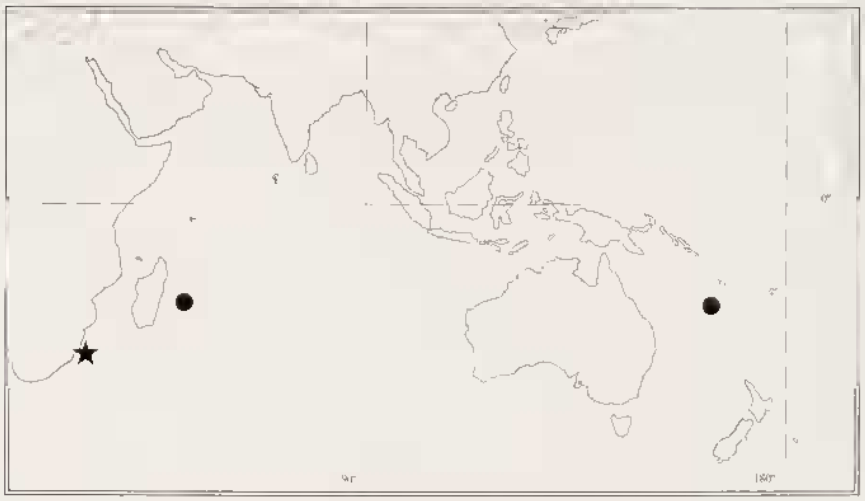


FIG. 159. — Distribution of *Bathycadulus fabrizioi*.

DISTRIBUTION. — Southeast Africa, Réunion Island and New Caledonia, alive in 1200-1600 m, shells down to 1915 m.

DESCRIPTION. — *Shell* to 7 mm long, shiny, translucent to porcellaneous white. Maximum diameter at 3/5 of shell length, sides parallel. Neck and mouth with a short constriction. Apex simple with irregular coronate edge; slightly dorsoventrally compressed in section, with a prominent preapical callus. Oral aperture simple, laterally compressed.
Radula as for the genus.
Measurements: holotype L 5.2, W 1.05, w 0.8, apex 0.8, arc (at the equator) 0.1.

ETYMOLOGY. — Named for the author's son Fabrizio.

Genus *GADILA* Gray, 1847

Type species (OD): *Dentalium gadus* Montagu, 1803. Recent, type locality unknown.

Synonym: *Platyschides* Henderson, 1920. Type species (OD): *Cadulus grandis* Verrill, 1885. Recent, NW Atlantic Ocean, 906 fms [1703 m].

DIAGNOSIS. — *Shell* small to medium, curved, smooth, white, translucent when fresh, shiny when dead. Maximum diameter in anterior third of the shell; ventral side regularly curved, dorsal side sigmoidal in section. Apex simple or with flat lobes, variable in number. Oral and apical section different.
Radula similar to that of *Cadulus* (Fig. 169 h, *Gadila* sp.).

DISTRIBUTION. — Cretaceous-Recent, worldwide, littoral-abyssal.

Gadila virginalis (Boissevain, 1906)

Figs 161, 169 a

Cadulus virginalis Boissevain, 1906: 72, pl. 6, figs 60-64.

Other references:

Cadulus (Platyschides) virginalis – Habe & Kosuge, 1964: 12.
Platyschides virginalis – Habe, 1963: 279, textfigs 40-43; 1964a: 40, pl. 5, figs 40-42.
Polyschides (Platyschides) virginalis – Habe, 1977: 342, pl. 71, figs 22-24. — Higo & Goto, 1993: 690.

Type material. — Lectotype (here designated) ZMA 3.06.096, paralectotypes ZMA 3.06.097-100.

Type locality. — *C. virginalis*: Indonesia, Savu Sea, "*Siboga*", stn 52, 09°03′ S, 119°57′ E, 959 m.

Material examined. — The type material.
New Caledonia. BIOCAL: stn DW 49, 23°03′ S, 167°33′ E, 825-830 m, 1 dd.
Indonesia. CORINDON: stn B 236, 00°07′ S, 119°45′ E, 1730 m, 2 dd.
Philippines. MUSORSTOM 3: stn DR 93, 13°49′ N, 120°02′ E, 540 m, 1 dd.

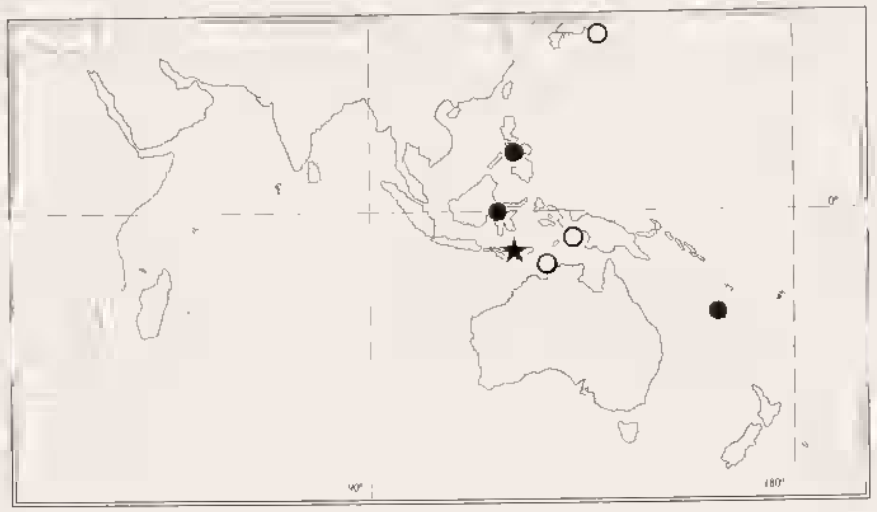
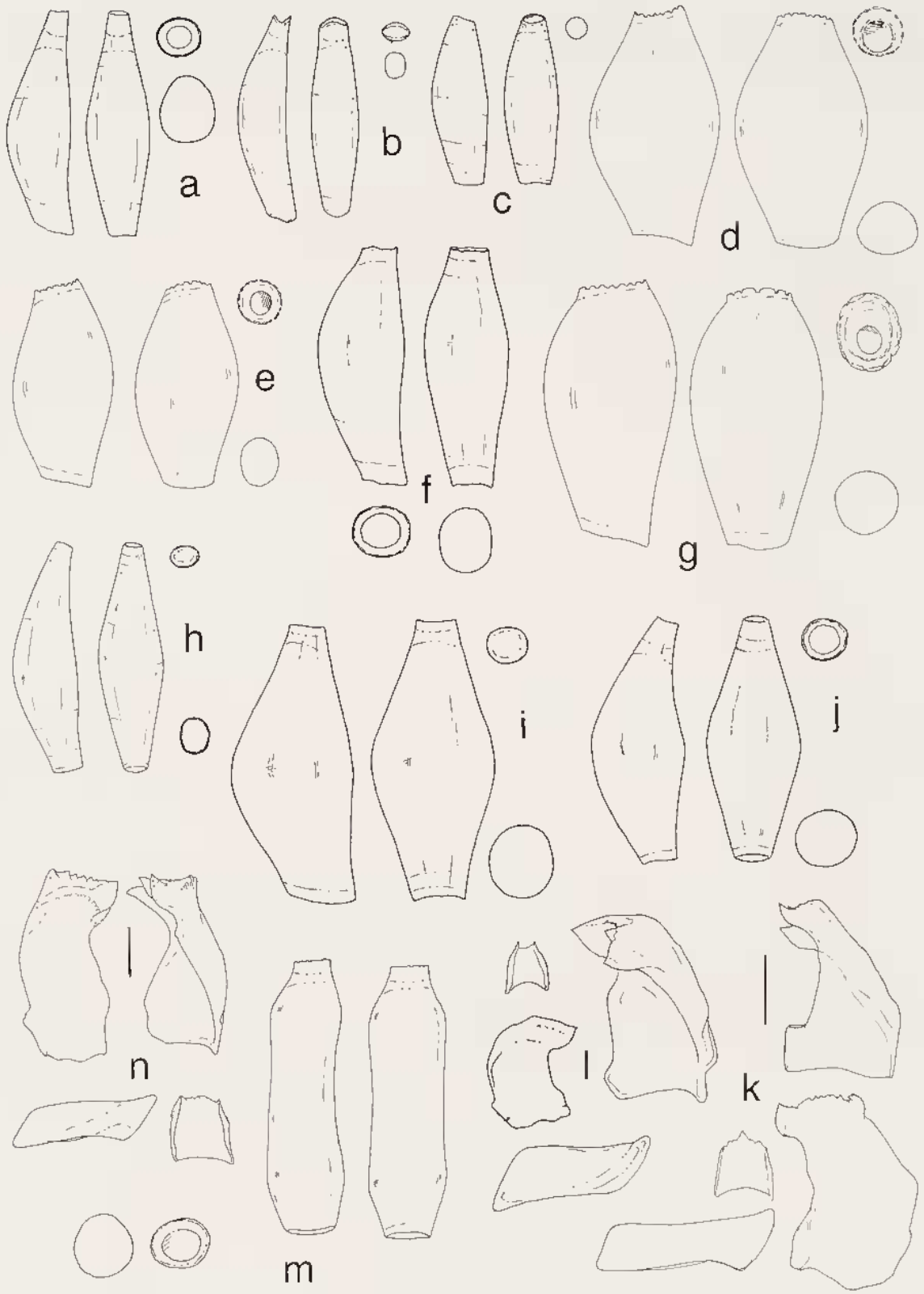


Fig. 161. — Distribution of *Gadila virginalis*.

Distribution. — Southern Japan (?) to Indonesia, now extended to New Caledonia. Shells in 200-3010 m (Habe & Kosuge, 1964).

Fig. 160. — **a**, *Cadulus simillimus*, shell (3 mm), lateral and dorsal views, apical and oral sections, BIOGEOCAL: stn KG 219. — **b**, *Cadulus aratus*, shell (2 mm), apical and oral sections, MUSORSTOM 2: stn DR 33. — **c**, *Cadulus aequatorialis*, shell (4 mm), apical and oral sections, BIOGEOCAL: stn CP 214. — **d**, *Cadulus cyathoides*, shell (2.5 mm), lateral and dorsal views, apical and oral sections, ESTASE 2: stn CP 2. **e**, *Cadulus cluni*, shell (2.5 mm), apical and oral sections, MUSORSTOM 3: stn CP 143. — **f**, *Cadulus martini* sp. nov., holotype, shell (5 mm), apical and oral sections. — **g**, *Cadulus glaus* sp. nov., holotype, shell (1.7 mm), lateral and dorsal views, apical and oral sections. — **h**, *Cadulus florenciae* sp. nov., holotype, shell (2 mm), lateral and dorsal views, apical and oral sections. — **i**, *Cadulus sofiae* sp. nov., holotype, shell (4.5 mm), lateral and dorsal views, apical and oral sections. — **j**, *Cadulus labeyirei* sp. nov., holotype, shell (2.7 mm), lateral and dorsal views, apical and oral sections. — **k-l**, *Cadulus* type radula. — **k**, *C. tumidosus* Jeffreys, 1877 (North Atlantic Ocean). — **l**, *C. sofiae*. — **m**, *Bathycadulus fabrizioi* sp. nov., holotype, shell (5.2 mm), apical and oral sections. — **n**, *Bathycadulus* type radula (*B. fabrizioi*).



REMARKS. — HABE (1963, 1964b, 1977) includes *Gadila novilunata* Kira, 1959 in the synonymy of *virginalis*, but I prefer to keep them separate pending further study. Consequently, it is uncertain whether the records of *Cadulus virginalis* from Japan refer to the present species or to *G. novilunata*.

Gadila zonata (Boissevain, 1906)

Figs 162, 169 b

Cadulus zonatus Boissevain, 1906: 74, pl. 6, fig. 57, textfig. 37.

TYPE MATERIAL. — Lectotype (here designated) ZMA 3.06.102, paralectotypes ZMA 3.06.103.

TYPE LOCALITY. — Indonesia, Banda Sea, *"Siboga"*, stn 214, 06°30′ S, 121°55′ E, 2796 m.

MATERIAL EXAMINED. — The type material.
Philippines. MUSORSTOM 2: stn CP 18, 14°00′ N, 120°18′ E, 188-195 m, 1 dd. — Stn CP 55, 13°54′ N, 119°58′ E, 865 m, 1 dd.

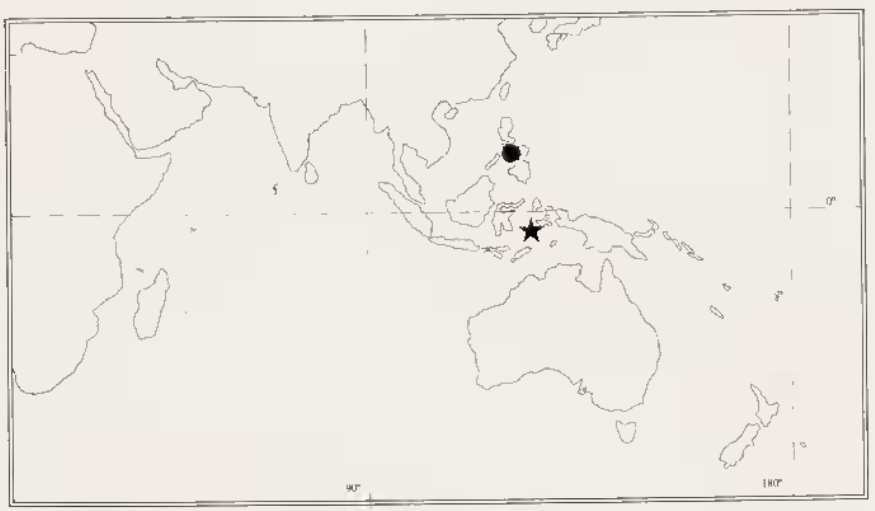


FIG. 162. — Distribution of *Gadila zonata*.

DISTRIBUTION. — Indonesia and the Philippines, shells from 195 to 2796 m, no record of living specimens.

Gadila boissevainae (Jaeckel, 1932)

Figs 163, 169 c

Cadulus boissevaini Jaeckel, 1932: 311, textfig. 8.

Synonym:
Cadulus (Gadila) reesi Ludbrook, 1954: 115, fig. 20 (**Syn. nov.**).

Other reference:
Cadulus (Cadulus) boissevaini – HABE & KOSUGE, 1964: 9.

TYPE MATERIAL. — *C. boissevaini*: lectotype, designated by KILIAS (1995), ZMB 75359a. — *C. reesi*: holotype BMNH 1952.3.25.150.

TYPE LOCALITY. — *C. bossevaini*: East Africa. off Zanzibar, *"Valdivia"*, stn 251, 01°41′ S, 41°47′ E, 693 m. — *C. reesi*: Zanzibar area, *"John Murray"*, stn 105B, 05°34′ S, 39°14′ E, 238-293 m.

MATERIAL EXAMINED. — The type material of *C. reesi*.
Northwest Indian Ocean. Gulf of Aden, *"John Murray"*: stn 176, 12°04′ N, 50°38′ E, 655-732 m, 3 dd. — Stn 179b, 12°02′ N, 50°40′ E, 275 m, 1 dd. — Stn 191, 13°46′ N, 47°49′ E, 274 m, 7 dd (all BMNH)
West Indian Ocean. *"Meiring Naudé"*: stn SM 53, 26°51′ S, 33°13′ E, 720 m, 1 lv, 5 dd. — Stn 59. 27°10′ S, 32°59′ E, 820 m, 8 lv, 35 dd (1 lv, 1 dd MNHN). — Stn SM 69, 27°14′ S, 33°12′ E 680-700 m, 1 lv, 1 dd. — Stn SM 78, 27°32′ S, 32°50′ E, 750 m, 9 lv, 26 dd. — Stn SM 94, 28°50′ S, 32°50′ E, 750 m, 3 dd. — Stn SM 125, 30°32′ S, 30°57′ E, 1280 m, 1 lv, 6 dd. — Stn 162, 32°55′ S, 28°31′ E, 630 m, 1 dd.

FIG. 163. — Distribution of *Cadulus boissevainae*.

DISTRIBUTION. — Western Indian Ocean from the Gulf of Aden to Natal, alive in 680-1280 m, shells up to 274 m.

REMARKS. — Because Maria Boissevain was a woman, the specific name is here emended to *boissevainae* (ICZN, Art. 31(a)(i)). The specimens of *Cadulus reesi* are all fragments, without the neck area. The rest of the shell corresponds to *Gadila boissevainae* and leads me to consider it a junior synonym of Jaeckel's species.

Gadila elenae sp. nov.

Figs 164, 169 d

TYPE MATERIAL. — Holotype MNHN. Paratypes: 7 MNHN, 1 AMS C201733, 1 NMNZ M268956.

TYPE LOCALITY. — New Caledonia, MUSORSTOM 4, stn DW 156, 18°54′ S, 163°19′ E, 525 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOCAL: stn DW 08, 20°34′ S, 166°54′ E, 435 m, 2 dd (paratypes).
MUSORSTOM 4: stn DW 156, 18°54′ S, 163°19′ E, 525 m, 1 lv (holotype), 2 dd (paratypes). — Stn DW 160, 18°42′ S, 163°13′ E, 668 m, 1 lv, 2 dd (paratypes: 1 MNHN, 1 AMS, 1 NMNZ).
Loyalty Islands. MUSORSTOM 6: stn DW 410, 20°38′ S, 167°07′ E, 490 m, 2 dd (paratypes).

FIG. 164. — Distribution of *Gadila elenae*.

DISTRIBUTION. — New Caledonia, living from 525 to 668 m, shells from 435 m.

DESCRIPTION. — *Shell* to 12 mm long, smooth, shiny, translucent white. Ventral side showing a regular curve, dorsal side sinusoidal with convex curve at first quarter and concave curve rising to the apex. Maximum diameter near the anterior quarter of the shell, suboval in section. Apex oval, dorsoventrally depressed with ventral and dorsal lobes, the former larger and with a central denticle-like structure. Preapical callus prominent, lumen circular. Mouth oblique, subcircular in section.

Measurements: holotype L 11.5, W 2.5-2.3, m 1.35-1.20, apex 1-1.8; paratype L 10.1, W 2.3-2.1, m 1.3-1.2, apex 0.9-0.85; L 8.5, W 2.3-2.2, m 1.6-1.4, apex 1.50-1.51.

REMARKS. — The apical structure is similar to that of *Gadila monodonta*, described below, which is larger and fusiform.

ETYMOLOGY. — Named for Elena GOFAS-SALAS (Paris, Malaga).

Gadila doumenci sp. nov.

Figs 165, 169 e

TYPE MATERIAL. — Holotype and 3 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m.

MATERIAL EXAMINED. — **New Caledonia**. BIOGEOCAL: stn CP 260, 21°00′ S, 166°58′ E, 1820-1960 m, 1 dd.
West Indian Ocean. BENTHEDI: stn DS 03, 12°36′ S, 47°38′ E, 1100-1150, 1 lv (paratype). — Stn DS 11, 12°16′ S, 46°42′ E, 2300-2450 m, 1 lv (holotype). — Stn DR 40, 12°56′ S, 45°18′ E, 1300-1480 m, 1 lv, 1 dd (paratypes).

FIG. 165. — Distribution of *Gadila doumenci*.

DISTRIBUTION. — New Caledonia and NW Madagascar, living from 1100 to 2450 m.

DESCRIPTION. — *Shell* to 11 mm long, solid, shiny, moderately curved, white. Maximum diameter at anterior fifth of the shell. Apex almost as wide as mouth, simple. Preapical callus wide, lumen circular. Mouth slightly laterally compressed with the ventral side flattened, straight, simple.

Measurements: holotype L 10.5, W 2.2-2.15, m 1.6-1.5, w 1.1-1.06; paratypes L 9.4, W 2.05, m 1.4, w 1; L 9, W 2, m 1.2, w 0.9.

ETYMOLOGY. — Named for Prof. Dominique DOUMENC, who made possible my work as visiting curator in MNHN.

Gadila desaintlaurentae sp. nov.

Figs 166, 169 f

TYPE MATERIAL. — Holotype MNHN. Paratypes: 8 MNHN, 1 AMS C201734, 1 USNM.

TYPE LOCALITY. — Philippines, MUSORSTOM 2, stn DR 33, 13°32′ N, 121°08′ E, 130-137 m.

MATERIAL EXAMINED. — **New Caledonia**. *"Vauban"* 1978-79: stn 40, 22°30′ S, 166°24′ E, 250-350 m, 1 lv, 12 dd.
Indonesia. CORINDON: stn B 268, 01°57′ S, 119°16′ E, 200 m, 2 dd.
Philippines. MUSORSTOM 2: stn DR 33, 13°32′ N, 121°08′ E, 130-137 m, 3 lv (holotype and paratypes), 15 dd (paratypes: 6 MNHN, 1 AMS, 1 USNM).
MUSORSTOM 3: stn CP 112, 14°00′ N, 120°18′ E, 187-199 m, 1 dd.

DISTRIBUTION. — The Philippines, Indonesia and New Caledonia, living from 137 to 250 m.

DESCRIPTION. — *Shell* to 6 mm long, shiny, white, with maximum diameter at anterior third. Ventral side regularly curved, dorsal side describing a convexity followed by a pronounced concavity that reaches the apex. Apex simple, circular. Preapical callus faint, lumen circular. Mouth simple, oblique, circular.

Measurements: holotype L 6, W 1.1, m 0.7, w 0.4; paratypes L 5.8, W 1.2, m 0.7, w 0.4; L 5.5, W 1.1, m 0.7, w 0.4; L 6.3, W 1.2, m 0.8, w 0.4; L 5.6, W 1, m 0.7, w 0.4.

FIG. 166. — Distribution of *Gadila desaintlaurentae*.

ETYMOLOGY. — Named for Dr Michèle DE SAINT-LAURENT, formerly curator of Crustacea (MNHN), who participated in the first three MUSORSTOM expeditions to the Philippines.

Gadila minutalis sp. nov.

Figs 167, 169 g

TYPE MATERIAL. — Holotype and 8 paratypes lv, MNHN.

TYPE LOCALITY. — West Indian Ocean, MD32 Réunion, stn DS 151, 20°51′ S, 56°03′ E, 3240-3300 m.

MATERIAL EXAMINED. — Only known from the type material.

FIG. 167. — Distribution of *Gadila minutalis*.

DISTRIBUTION. — Only known from Réunion Island, alive in 3240-3300 m.

DESCRIPTION. — *Shell* to 3 mm long, fragile, shiny, white, moderately curved. Maximum diameter at anterior quarter of the shell. Apex simple, circular. Preapical callus thin, lumen circular. Mouth simple, straight, circular.

Measurements: holotype L 2.9, W 0.5, m 0.3, w 0.2.

ETYMOLOGY. — Very small (Latin).

Gadila monodonta sp. nov.

Figs 168, 169 i

TYPE MATERIAL. — Holotype and 2 paratypes MNHN.

TYPE LOCALITY. — West Indian Ocean, BENTHEDI, stn DS 10, 11°29′ S, 47°18′ E, 440 m.

MATERIAL EXAMINED. — **New Caledonia**. CALSUB: dive 20, 22°53′ S, 167°23′ E, 580 m, 1 dd. **West Indian Ocean**. BENTHEDI: stn DS 10, 11°29′ S, 47°18′ E, 440 m, 1 lv (holotype). — Stn DS 120, 11°30′ S, 47°25′ E, 335-390 m, 1 lv (paratype). — Stn DS 122, 11°32′ S, 47°23′ E, 615-625 m, 1 dd (paratype).

FIG. 168. — Distribution of *Gadila monodonta*.

DISTRIBUTION. — NW Madagascar and New Caledonia, alive in 390-440 m, shells down to 625 m.

DESCRIPTION. — *Shell* to 15 mm long, shiny, white, maximum diameter near the center of the shell, giving a generally fusiform shape. Ventral side regularly curved; curve of dorsal side interrupted at the maximum diameter. Apex oval, with ventral lobe showing a central denticle at the edge. Preapical callus thin, lumen suboval. Mouth simple, oblique, slightly dorsoventrally compressed.

Measurements: holotype L 14.2, W 2.6-2.45, m 1.45-1.25, w 0.75-0.7.

REMARKS. — The fusiform shape and distinctive apical feature easily characterize this new species.

ETYMOLOGY. — From the Latin, meaning a single tooth.

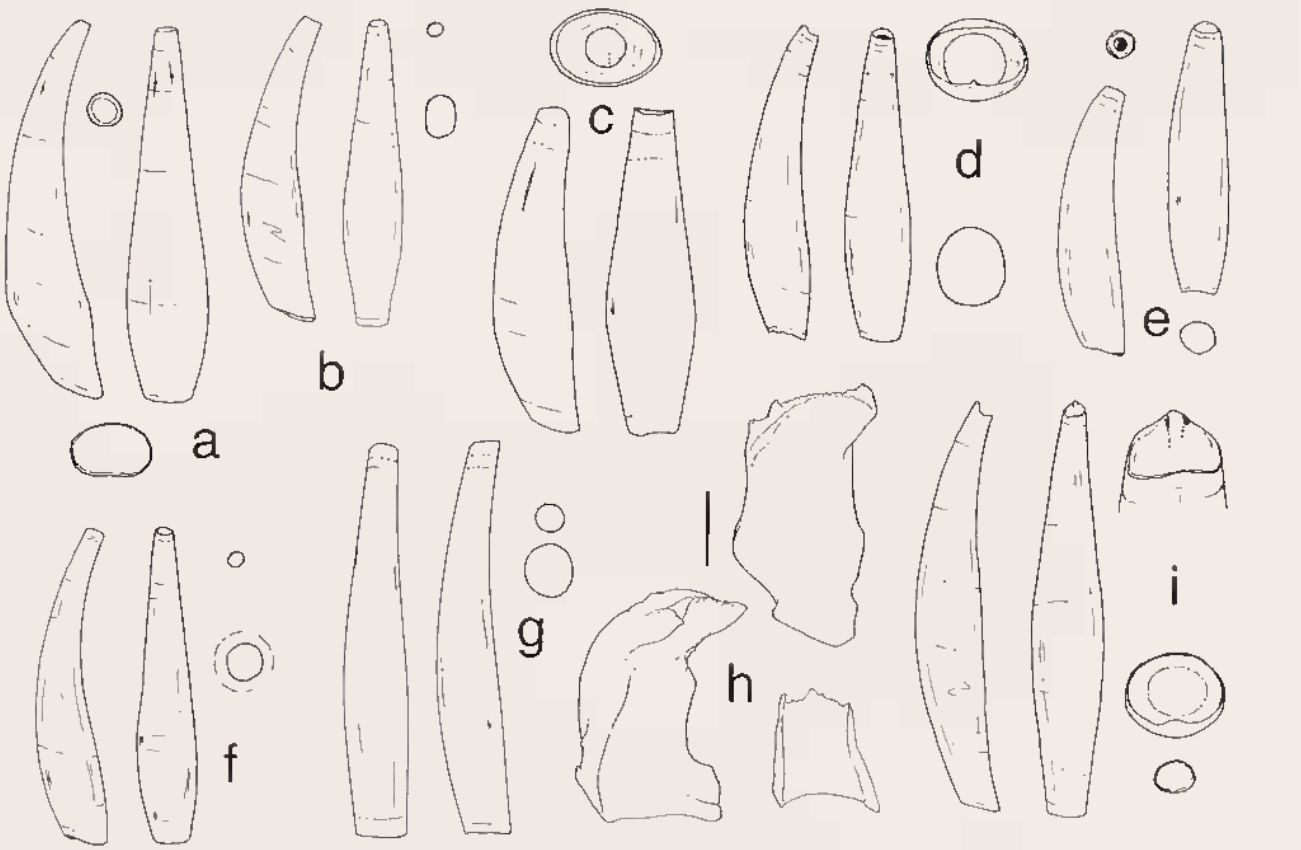


FIG. 169. — **a**, *Gadila virginalis*, shell (16 mm), lateral and dorsal views, apical and oral sections, CORINDON: stn B 236. — **b**, *Gadila zonata*, shell (14 mm), lateral and dorsal views, apical and oral sections, MUSORSTOM 2: stn CP 18. — **c**, *Gadila boissevainae*, shell (7.5 mm), lateral and dorsal views, apical section, *"Meiring Naudé"*, stn SM 59. — **d**, *Gadila elenae* sp. nov., holotype, shell (11.5 mm), lateral and dorsal views, apical and oral sections. — **e**, *Gadila doumenci* sp. nov., holotype, shell (10.5 mm), lateral and dorsal views, apical and oral sections. — **f**, *Gadila desaintlaurentae* sp. nov., holotype, shell (6 mm), lateral and dorsal views, apical and oral sections. — **g**, *Gadila minutalis* sp. nov., holotype, shell (2.9 mm), dorsal and lateral views, apical and oral sections. — **h**, *Gadila* type radula (*Gadila* sp. nov., Caribbean Sea). — **i**, *Gadila monodonta* sp. nov., holotype, shell (14.2 mm), lateral and dorsal views, apex, apical and oral sections.

Other Indo-Pacific species of *Gadila* cited in the literature

Gadila abruptoinflata Boissevain, 1906: 75, pl. 66, fig. 65, textfig. 39. Indonesia, Madura, *"Siboga"*, stn 5, 07°46 'S, 114°31' E, 330 m. Holotype ZMA.

Gadila anguidens (Melvill & Standen, 1898): 32, pl. 1, fig. 6. Off Madras, India. Holotype and paratype, Manchester Museum (*fide* TREW, 1987).

Gadila clavata (Gould, 1859): 166. Hong Kong, China, 11-36 m. Holotype USNM 24245.

Gadila honoluluensis (Watson, 1879): 89. *"Challenger"*, Reefs of Honolulu, Hawaii, 40 fms [73 m]. Holotype BMNH 1887.2.9.70.

Gadila opportuna (Kuroda & Habe, 1961): 105, pl. 47, fig. 2. Sagami Bay, Japan, 200 m. NSMT.

Gadila pseudolivae (Boissevain, 1906): 73, pl. 6, fig. 67, textfig. 36. *"Siboga"*, stn 211, 05°41' S, 120°46' E, Banda Sea, 1158 m. Syntype ZMA.

Gadila subcolubridens Ludbrook, 1954: 115, fig. 21. Gulf of Aden, *"John Murray"*, stn 185, 13°48' N, 49°16' E, 2000 m. Presumably in BMNH (not located).

Gadila subtilis (Plate, 1908a): 360, pl. 30, fig. 48. Off Dar-es-Salaam, Tanzania, *"Valdivia"*, stn 244, 05°56' S, 39°01' E, 50 m. Lectotype (KILIAS, 1995) ZMB 61108a.

Gadila novilunata Kira, 1955: 80, pl. 40, fig. 2. Japan, Shikoku.

Family *incertae sedis*

The following two genera possess confusing characters that do not allow placement in the present classification. *Megaentalina* is the only representative of the Order having a triangular section and a *Siphonodentalium* type radula. *Compressidens* has dorsoventrally compressed and curved shell as a diagnostic character in all species. Pending further data, I have decided to treat both genera separate from the rest.

Genus *Megaentalina* Habe, 1963

Type species (OD): *M. teramachii* Kuroda & Habe *in* Habe, 1963 [= *M. mediocarinata* Boissevain, 1906].

Diagnosis. — *Shell* medium to large, well arched, solid, polished, white to cream. Sculpture of 3 primary ribs, with one angle on dorsal side and a base at the ventral; secondary riblets present; rib section flat-topped to rounded; smooth; intercostal spaces, almost straight. Apex simple or with two flat notches, one dorsal and the other ventral. Section subtriangular at apex, less noticeable at mouth.

Radula rachidian polygonal with wide base, anterior border irregular, with 5-6 prominent nodules in the interior face that overpass the border; laterals similar to *Siphonodentalium*, strong, curved, with short but strong cusps; marginals straight with internal side wider than the external side.

Distribution. — Recent, East Pacific and Indian Oceans, absent in the Atlantic Ocean. Shelf-bathyal.

Remarks. — Steiner (1991) places *Megaentalina* in the Order Dentaliida, on my advice (Scarabino, 1986, pers. com.). This suggestion was incorrect, since it was based on the radula of two animals supposedly conspecific with two shells of *Megaentalina mediocarinata* found in the same vial. Recent study of live animals has corrected this error — the earlier specimens belong to a dentaliid species. My erroneous placement can now be corrected and we await further data for proper classification of this genus.

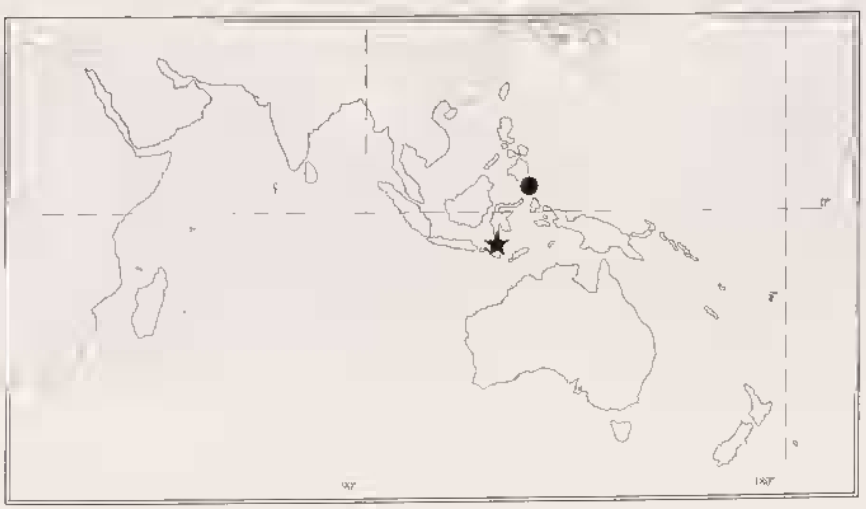


Fig. 170. — Distribution of *Megaentalina cornucopiae*.

Megaentalina cornucopiae (Boissevain, 1906)

Figs 170, 174 b

Entalina cornucopiae Boissevain, 1906: 63, pl. 6, fig. 89.

Other references:

Megaentalina cornucopiae – Habe, 1963: 272, pl. 38, figs 31-32; 1964a: 41, pl. 2, figs 31-32; 1977: 340. — Habe & Kosuge, 1964: 9. — Chistikov, 1982c: 1499, pl. 2, figs 4-6. — Higo & Goto, 1993: 689.

Type material. — Holotype ZMA 3.06.086.

Type locality. — Indonesia, Sumba Sea, "*Siboga*", stn 52, 09°03′ S, 119°57′ E, 959 m.

Material examined. — The type material.
Philippines. ESTASE 2: stn DR 4, 05°02′ N, 125°15′ E, 3250 m, 1 dd.

Distribution. — Japan, the Philippines, Indonesia, shells from 959 to 3250 m.

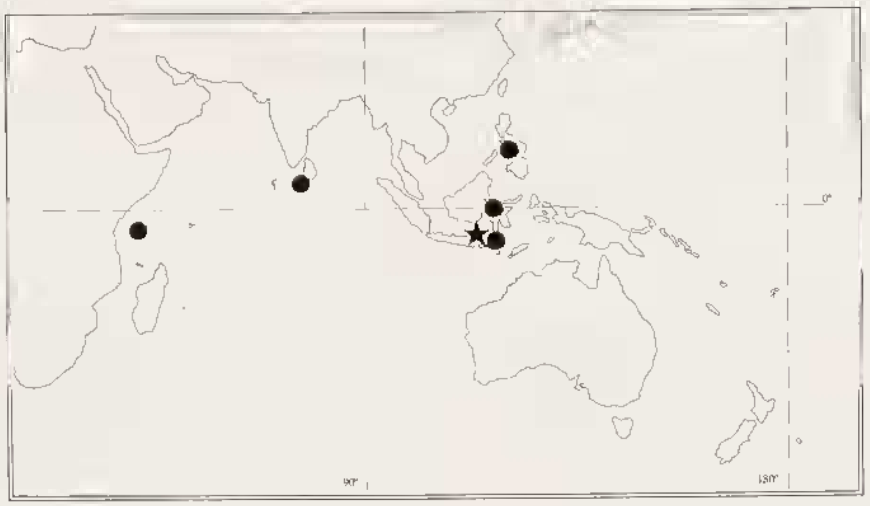


Fig. 171. — Distribution of *Megaentalina mediocarinata*.

Megaentalina mediocarinata (Boissevain, 1906)

Figs 171, 172 e-f, 174 a, c

Entalina mediocarinata Boissevain, 1906: 63, pl. 6, figs 70-72, 87-88.

Synonym:

Megaentalina teramachii Kuroda & Habe *in* Habe, 1963: 273, pl. 38, figs 12-13.

Other references:

Megaentalina mediocarinata – Habe, 1964a: 42, pl. 2, figs 12-13; 1977: 340. — Habe & Kosuge, 1964: 9. — Chistikov, 1982c: 1498. — Higo & Goto, 1993: 689.
Dentalium (*Compressidens*) *comprimatum* – Ludbrook, 1954: 106.

Type material. — *E. mediocarinata*: lectotype (here designated) ZMA 3.06.084, paralectotypes ZMA 3.06.085. — *M. teramachii*: holotype, NSMT.

Type locality. — *E. mediocarinata*: Bali Sea, Indonesia, "*Siboga*", stn 5, 07°46′ S, 114°30′ E, 330 m. — *M. teramachii*: Tosa Bay, Shikoku, Japan, 200 m.

MATERIAL EXAMINED. — The type material of *E. mediocarinata*.
Indonesia. CORINDON: stn B 213, 00°31′ N, 117°50′ E, 488 m, 1 dd.
"Snellius" II: stn 4.130, 08°18′ S, 118°18′ S, 700-730 m, 2 lv, 3 dd. — Stn 4.131, 08°18′ S, 118°18′ E, 680-800 m, 1 dd (RMNH).
Philippines. MUSORSTOM 2: stn CP 24, 13°37′ N, 120°42′ E, 640-647 m, 1 dd. — Stn CP 25, 13°39′ N, 120°43′ E, 520-550 m, 4 lv, 11 dd. — Stn CP 26, 13°49′ N, 120°50′ E, 299-330 m, 3 dd. — Stn CP 40, 13°08′ N, 122°40′E, 280-440 m, 1 dd. — Stn CP 46, 13°26′ N, 122°17′ E, 445-520 m, 1 lv. — Stn CP 78, 13°49′ N, 120°28′ E, 441-550 m, 3 lv, 3 dd.
MUSORSTOM 3: stn CP 123, 12°10′ N, 121°45′ E, 700-702 m, 1 dd. — Stn CP 128, 11°50′ N, 121°42′ E, 815-821 m, 1 dd.
West Indian Ocean. Zanzibar area, *"John Murray"*: st 105B, 05°24′ S, 39°14′ E, 238-293 m, 1 dd [*Dentalium* (*Compressidens*) *comprimatum*] (BMNH).
Northern Indian Ocean. SAFARI 2: stn CP 06, 08°11′ N, 79°03′ E, 1035 m, 1 lv.

DISTRIBUTION. — Japan, the Philippines, now extended to Indonesia and off Sri Lanka and Zanzibar, living depth range 441-1035 m, shells from 300 m.

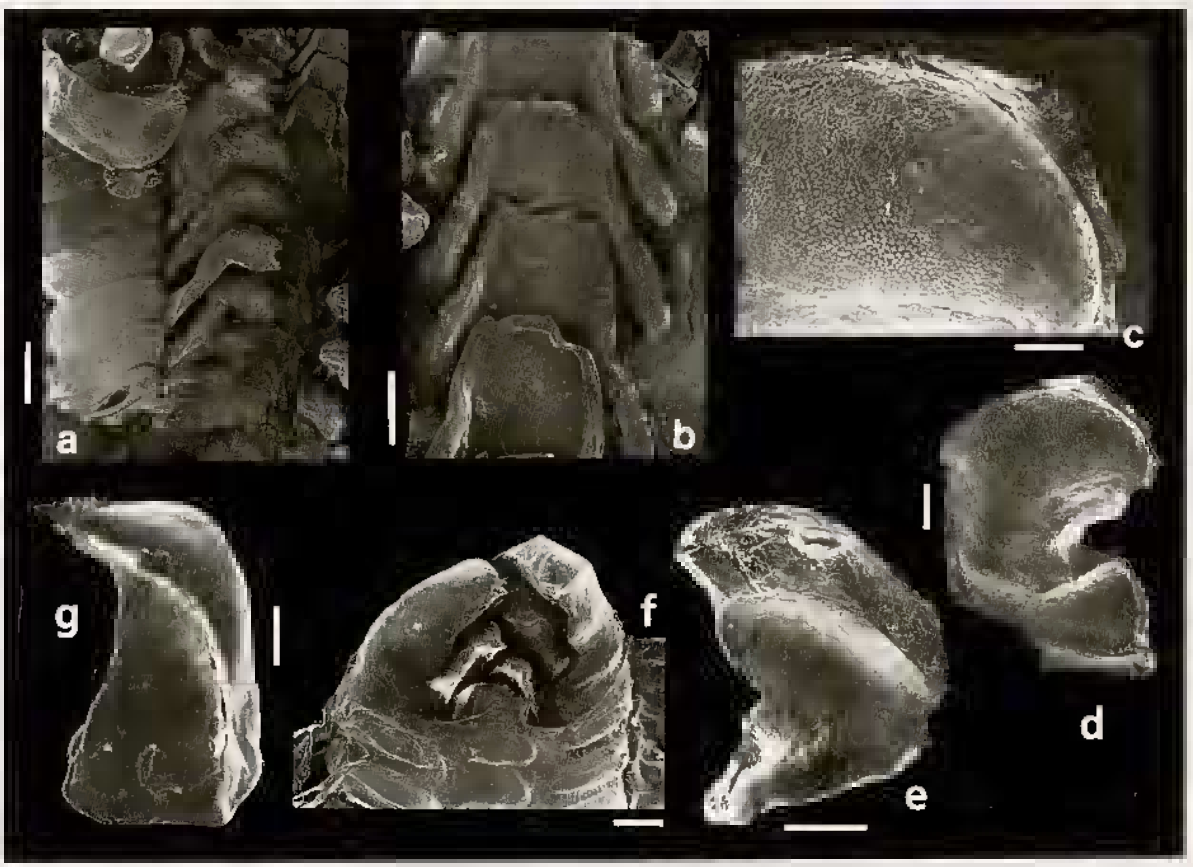


FIG. 172. — Radulae. — **a**, *Spadentalina tubiformis*, general view, note at upper left an internal face view of a lateral teeth, to be compared with *Entalinopsis* and *Pertusiconcha* radulae (Figs 115 d and g respectively). — **b**, same specimen, rachidians. — **c**, *Striocadulus sagei*, margin of the head of a lateral tooth. — **d**, same specimen, general view. — **e**, *Megaentalina mediocarinata*, internal face of lateral tooth. — **f**, *Megaentalina mediocarinata*, external view of lateral and rachidians. — **g**, *Solenoxiphus striatulus*, internal view of lateral tooth. Scale lines: 100 µm (a, d-f), 10 µm (b, c), 20 µm (f).

Genus *Compressidens* Pilsbry & Sharp, 1897

Type species (OD): *Dentalium pressum* Pilsbry & Sharp, 1897. Recent, North of Culebra Island, West Indies, 390 fms [714 m].

Diagnosis. — *Shell* small to medium, well curved, solid, translucent, opaque or polished. Section oval, strongly compressed dorsoventrally. Sculpture variable, with longitudinal riblets, undulations or fine, close encircling wrinkles; growth lines conspicuous. Apex simple or truncate, preapical callus usually wide, lumen circular.
Radula rachidian high, with cusped anterior marging; lateral high, with very sharp-pointed cusps; marginal short, sinusoidal (Fig. 174 e, *C. ophiodon* Dall, 1881).

Distribution. — Miocene-Recent, worldwide, shelf-bathyal.

Compressidens infimus sp. nov.

Figs 173, 174 d

Type material. — Holotype and 8 paratypes lv, MNHN.

Type locality. — West Indian Ocean, MD 32 Réunion, stn DS 109, 20°52′ S, 55°06′ E, 1050-1240 m.

Material examined. — Only known from the type material.

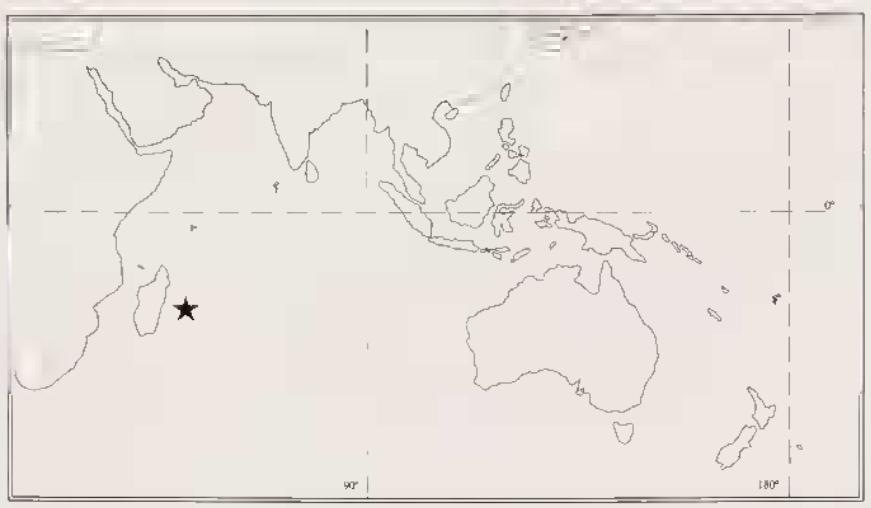


Fig. 173. — Distribution of *Compressidens infimus*.

Distribution. — Réunion Island, alive in 1050-1240 m.

Description. — *Shell* to 5 mm long, fragile, well curved. Sculture of close, fine, encircling wrinkles throughout. Apex subcircular, dorsoventally depressed. Preapical callus thin, lumen circular. Mouth thin, slighily dorsoventrally depressed, especially on ventral side.
Measurements: holotype L 4, W 0.5·0.45, w 0.1, arc 0.22.

REMARKS. — Compared with *Compressidens platyceras*, a shallow water species from Eastern Australia, *C. infimus* is smaller and less compressed. *C. comprimatum* (Plate, 1908a) from Zanzibar Channel, has longitudinal striation.

ETYMOLOGY. — From the Latin meaning very little.

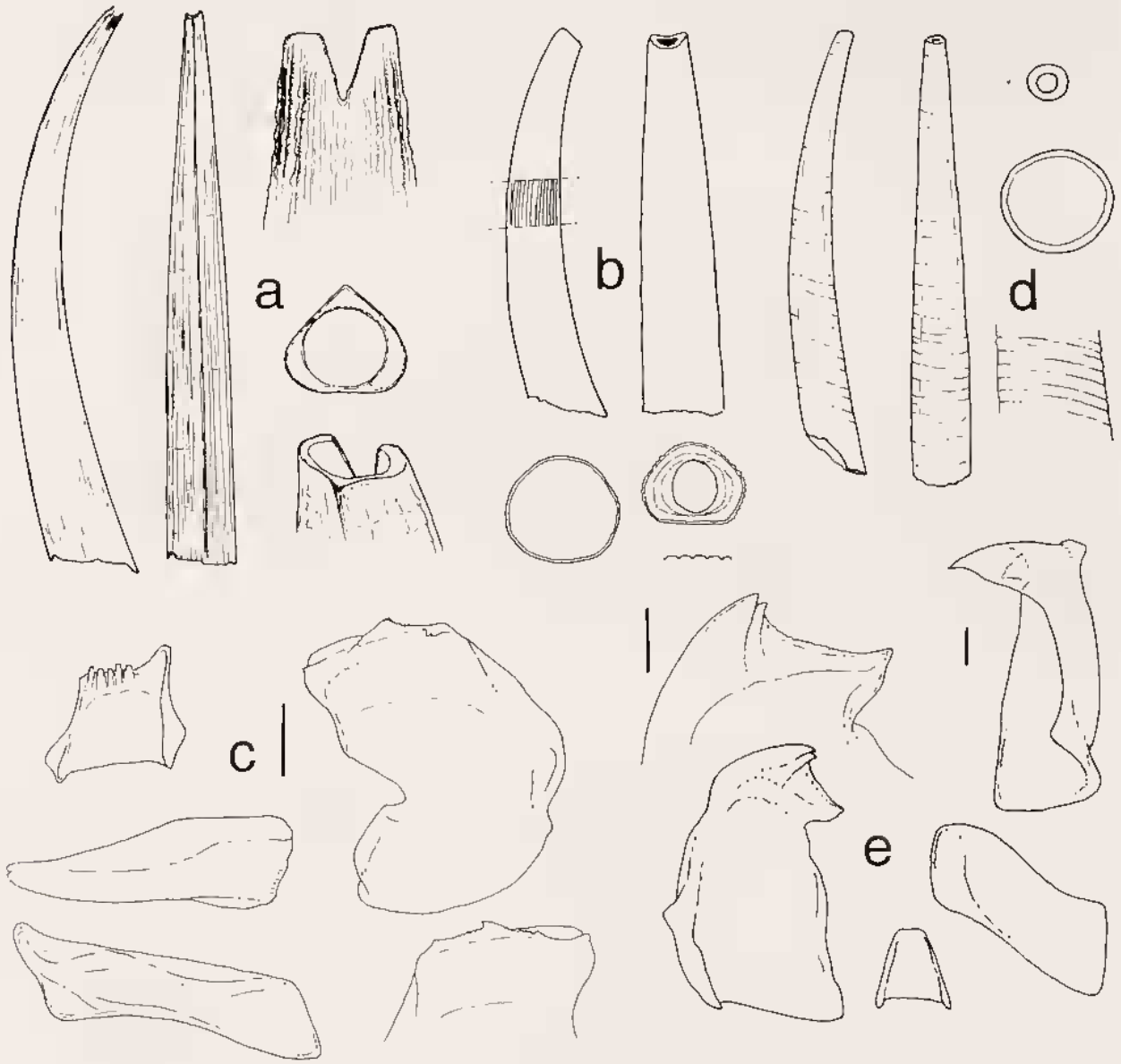


FIG. 174. — **a**, *Megaentalina mediocarinata*, shell (34 mm), lateral and dorsal views, apex and apical sections (USNM). — **b**, *Megaentalina cornucopiae*, shell (22 mm), lateral and dorsal views, apical and oral sections, section of sculpture, ESTASE 2: stn DR 4. — **c**, *Megaentalina* type radula (*M. mediocarinata*); see also Fig. 172 e. — **d**, *Compressidens infimus* sp. nov., holotype, shell (4 mm), lateral and dorsal views, apical and oral sections, detail of sculpture. — **e**, *Compressidens* type radula (*C. ophiodon* Dall, 1881, Northern Brazil).

Other Indo-Pacific species of *Compressidens* cited in the literature

Compressidens comprimatum (Plate, 1908a): 349, pl. 30, figs 26-34. Zanzibar Channel, *"Valdivia"*, stn 245, 05°28′ S, 39°19′ E, 463 m. Lectotype (KILIAS, 1995) ZMB 61101a.

Compressidens kikuchii (Kuroda & Habe, 1952): 9, pl. 1, figs 3-4. Toyama Bay, Honshu, Japan. NSMT.

Compressidens platyceras (Sharp & Pilsbry *in* Pilsbry & Sharp, 1897): 126, pl. 22, figs 58-60. East Australia, Salamander Bay, Port Stephens, New South Wales, 4-8 fms [7-15 m]. Syntypes ANSP 35565 and AMS 55085, 11721.

GENERAL DISCUSSION

The total number of scaphopod species present in discrete geographical subregions of the Indo-Pacific is presented in Table 2. Estimated figures are based on bibliographic sources cited in this paper, as well as actual examination of material. It is likely that data in this Table will become obsolete as new regional revisions, such as the scaphopod part of the ongoing *Fauna of Australia* by HEALY & LAMPRELL, are published. With 73 species currently recorded from there, New Caledonia is now the area with the highest documented scaphopod diversity in the Indo-Pacific. Undoubtedly, differences among different regions reflect intensity in sampling effort, as well as genuine differences in global faunal diversity. Thanks to the series of MUSORSTOM expeditions in the New Caledonia area, the collecting effort in that part of the SW Pacific has been considerably higher than in any other part of the Indo-Pacific of similar size. The total of 73 New Caledonian species represents 53% of the total number of scaphopod species recorded in the present paper, and 31% of the total Indo-West Pacific fauna (237 species). This proportion is particularly remarkable in view of the small size (less than 2 million km^2) of the New Caledonia Exclusive Economic Zone compared to the total extent of the Indo-Pacific region (over 150 million km^2).

TABLE 2. — Estimated number of scaphopod species in selected regions

Region	Total	Dentaliida	Gadilida
Japan	50	30	20
Indonesia	65	41	24
Philippines	50	39	11
Indian Ocean	62	33	29
China Seas	26	22	4
N and E Australia	22	17	5
South Africa	15	10	5
New Zealand	12	5	7
Hawaii	5	3	2
New Caledonia	73	43	30

BATHYMETRIC DISTRIBUTION

Sampling effort in New Caledonia has been rather even between 0 and 2000 m. The fauna deeper than 2000 m is less adequately surveyed, and there are no samples from deeper than 3750 m. Figure 175 illustrates the number of species found at discrete depth intervals in New Caledonia: 0-100, 100-300, 300-500, 500-800, 800-1200, 1200-2000, 2000-3000 and 3000-4000 m. Because a species may have different bathymetric ranges at different latitudes and/or in different hydrological regimes, only depth data for New Caledonia have been considered. Of the 73 species recorded, 48 have been collected alive. For the remaining 25 species, bathymetric ranges are based on empty shells since they apparently depict patterns that are both coherent and consistent with what is known of the depth range of the same species elsewhere in the Indo-Pacific.

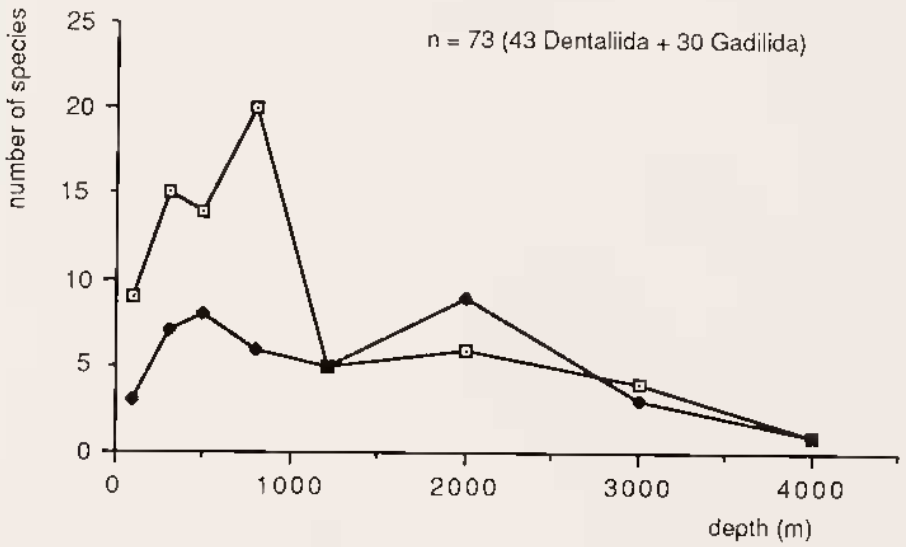


FIG. 175. — Bathymetric distribution of the scaphopod fauna of New Caledonia. Open square: Dentaliida; black square: Gadilida.

The diversity of both Dentaliida and Gadilida increases from 0 to 500 m, is maximal in the 500-800 m depth interval, and decreases abruptly in the 800-1200 m interval. Deeper than 1200 m, the number of Dentaliida continues to decrease, whereas Gadilida show a second, minor peak in 1200-2000 m. In Dentaliida, *Fissidentalium* is most diverse in the deep sea (mostly bathyal and abyssal), other genera being equally represented at all depths. The second peak of the Gadilida is mostly formed by representatives of Entalinomorpha and *Siphonodentalium*. Similar patterns have been noted in the Atlantic Ocean (SCARABINO, 1979, 1986a-b, and unpublished observations) and point to distinct radiation patterns of Dentaliida and Gadilida in the deep-sea.

ACKNOWLEGDEMENTS

This paper has been done in the course of several periods where I was working as visiting curator in the Laboratoire de Biologie des Invertébrés Marins et Malacologie, MNHN, and I am grateful to the director, staff and colleagues for inviting me and entrusting me with this very valuable material: D. Doumenc, B. Métivier, A. Crosnier, S. Gofas, R. von Cosel, V. Héros and J.P. Rocroi.

Scaphopod material was collected during expeditions under the direction of J. Forest (MNHN), C. Levi (MNHN), B. Richer de Forges (ORSTOM, Nouméa), A. Guille (then of MNHN, now at Laboratoire Arago, Banyuls), B. Thomassin (CNRS, Marseille) and L. Labeyrie (CNRS, Gif). CENTOB (IFREMER, Brest) contributed to the sorting of residues. For access to material under their responsability, I thank R. Moolenbeek (ZMA), A. Bogan, R. Robertson, G. Davis (ANSP), the late R. Houbrick (USNM), B. Marshall (NMNZ), K. Way (BMNH), P. Colman (AMS), E. Louw and M. van der Merwe (SAM), J. Knudsen, T. Schiotte (ZMC), E. Gittenberger and J. Goud (RMNH). For technical assistance, I thank D. Guillaumin (Centre Inter-Universitaire de Microscopie Electronique, Université Paris 6) and the staff of MNHN, P. Maestrati and M. Moreau. The manuscript owes especially to P. Bouchet (MNHN) for his criticisms and highly valuable suggestions and to W. K. Emerson and Walter Sage (AMNH) for their suggestions and linguistic assistance.

REFERENCES

ADAMS, A. & REEVE, L., 1848. — Mollusca. *The zoology of the voyage of the H.M.S. Samarang under the command of Capitain Sir Edward Belcher, during the years 1843-1846*. London. 88 pp., 9 pls.

ADAMS, H., 1872. — Further descriptions of new species of shells collected by Robert M'Andrew, Esq., in the Red Sea. *Proceedings of the Zoological Society of London*, (1872): 9-12, pl. 3.

ADAMS, H. & ADAMS, A., 1854. — *The genera of Recent Mollusca; arranged according to their organization*, vol. 1: 11-484. London.

AHMED, M. M., 1975. — *Systematic study on the Mollusca from the Arabian Gulf and Shatt Al-Arab*. Center for Arab Gulf Studies, University of Bashora, Iraq. 78 pp., pls 1-54b, 1 map.

ALCOCK, A. & ANDERSON, A. R. S., 1898. — Illustrations of the zoology of the Royal Indian Marine Surveying Steamer Investigator. Mollusca, 2, pls 7-8. Calcutta.

ANDRÉ, E., 1896. — Mollusques d'Amboine. *Annales du Muséum d'Histoire Naturelle, Genève*, **4** (2): 295-405.

ANGAS, G. F., 1878. — A list of additional species of marine Mollusca to be included in the fauna of the province of South Australia; with notes on their habitats and local distribution. *Proceedings of the Zoological Society of London*, (1878): 864-871.

ANNANDALE, N. Z. & STEWART, F. H., 1909. — Illustrations of the zoology of the Royal Indian Marine Surveying Steamer Investigator. Mollusca, 6, pls 21-23. Calcutta.

ANONYMOUS (Ms). — Indonesian-Dutch Snellius-II Expedition, Coral Reefs. Progress Report, 2, List of Stations, 22 pp. Leiden.

BARNARD, K. H., 1963a. — Deep sea Mollusca from West of Cape Point, South Africa. *Annals of the South African Museum*, **46** (17): 444-452.

BARNARD, K. H., 1963b. — Contributions to the knowledge of South African marine Mollusca, 4. Gastropoda Prosobranchiata; Rhipidoglossa, Docoglosa; Tectibranchiata; Polyplacophora; Solenogastres; Scaphopoda. *Annals of the South African Museum*, **47** (2): 201-360, 30 figs.

BARNARD, K. H., 1974. — Contributions to the knowledge of South African marine Mollusca, 7. Revised faunal list. *Annals of the South African Museum*, **47** (5): 663-781.

BARTSCH, P., 1915. — Report on the Turton collection of South African marine mollusks, with additional notes on other South African shells contained in the USNM. *Bulletin of the United States National Museum*, **91**: 1-305.

BIELER, R. & R. E. PETIT, 1990. — On the various editions of Tetsukai Kira's "Coloured illustrations of the shells of Japan" and "Shells of the Western Pacific in color Vol. 1", with an annotated list of new names introduced. *Malacologia*, **32** (1): 131-145.

BOISSEVAIN, M., 1906. — The Scaphopoda of the Siboga Expedition, treated together with the known Indo-Pacific Scaphopoda. *Siboga Expeditie*, **54** (32): 1-76, 6 pls, 39 textfigs.

BOSCHMA, H., 1936. — *The Snellius-Expedition in the eastern part of the Netherlands East-Indies 1929-1930. 6, Biological data*. Leiden, J. Brill. 29 pp., 11 figs, 1 chart.

BOSS, K. J., 1982. — Mollusca. *In*: PARKER, S. (ed.), *Synopsis and classification of living organisms*, vol. 2: 1093-1166. McGraw-Hill Book Co., New York.

BOSS, K. J., ROSEWATER, J. & RUHOFF, F., 1968. — The zoological taxa of William Healey Dall. *Bulletin of the United States National Museum*, **287**: 1-427.

BRAZIER, J., 1877. — Continuation of the Mollusca collected during the Chevert Expedition. *Proceedings of the Linnean Society of New South Wales*, **2**: 55-60.

BROCCHI, G. B., 1814. — *Conchiologia fossile subappenina con osservazioni geologiche sugli Appennini e sul suolo adiacente*, vol. 2. Milano. 556 pp.

BRONN, H. G., 1862. — *Klassen und Ordnungen der Weichtiere (Malacozoa). Tier-Reichs*. Leipzig & Heidelberg. 1500 pp., 400 pls.

BRUUN, A., 1959. — General introduction to the reports and list of deep-sea stations. *Galathea Reports*, **1**: 1-49.

CARPENTER, P. P., 1864. — Supplementary report on the present state of our knowledge with regard to the Mollusca of the West coast of North America. *British Association for the Advancement of Science*, (1863): 517-686 [August 1864 *fide* PALMER, 1958] [not seen].

CHENU, J-C., 1843. — G. Dentale. *Dentalium* Linné, *In: Illustrations conchyliologiques*, vol. 3. A. Franck, Paris. 4 pp., pls 1-7.

CHERIYAN, P. V., 1968. — A collection of molluscs from the Cochin Harbour area. Marine Biological Association of India, Symposium series. *Proceedings of the Symposium on Molluscs*, **1** (3): 123-135.

CHISTIKOV, S. D., 1975. — [Some problems in the classification of the order Dentaliida (Mollusca Scaphopoda)]. *In*: LIKHAREV, I. M. & STAROBOGATOV, YA. I. (eds.), Molluscs, their systematics, evolution and significance. Abstracts and Comunications of the 5th Meeting on Investigations on Mollusca, Leningrad, 1975: 18-21. Nauka, Moskow. [In Russian. English translations, *Malacological Review*, **11**: 71-73].

CHISTIKOV, S. D., 1979a. — [Phylogenetic relations of the Scaphopoda]. *In*: LIKHAREV, I.M. (ed.), Molluscs, main results of their study. Abstracts and Communications of the Sixth Meeting on the Investigation of Molluscs: 20-22. Zoologicheskogo Instituta, Leningrad. [In Russian].

CHISTIKOV, S. D., 1979b. — [Scaphopoda of Tonking Bay and adjacent parts of the South China Sea]. *Trudy Zoologicheskogo Instituta*, **80**: 108-115 [In Russian].

CHISTIKOV, S. D., 1981. — [Comparative morphology of shells in two species of the genus *Entalina* (Mollusca Scaphopoda)]. *Zoologichesky Zhurnal*, **60** (1): 36-41 [In Russian].

CHISTIKOV, S. D., 1982a. — [Modern molluscs of the family Entalinidae (Scaphopoda Gadilida), 1, subfamily Heteroschismoidinae 1]. *Zoologichesky Zhurnal*, **61** (5): 671-682 [In Russian].

CHISTIKOV, S. D., 1982b. — [Modern molluscs of the family Entalinidae (Scaphopoda Gadilida), 2, subfamily Heteroschismoidinae]. *Zoologichesky Zhurnal*, **61** (9): 1309-1321 [In Russian].

CHISTIKOV, S. D., 1982c. — [Modern molluscs of the family Entalinidae (Scaphopoda Gadilida), 3, subfamily Entalininae]. *Zoologichesky Zhurnal*, **61** (10): 1492-1500 [In Russian].

CHISTIKOV, S. D., 1983. — [Modern molluscs of the family Entalinidae (Scaphopoda Gadilida), 4, subfamily Bathoxiphinae]. *Zoologichesky Zhurnal*, **62** (2): 181-190 [In Russian].

CLENCH, W. J. & TURNER, R. D., 1962. — New names introduced by H.A. Pilsbry in the Mollusca and Crustacea. *Academy of Natural Sciences of Philadelphia, Special* Publication, **4**: 1-218.

CLESSIN, S., 1896. — Dentaliidae. *Systematisches Conchylien Cabinet*, ed. 2, vol. 6 (5): 1-58, 11 pls. Bauer & Raspe, Nurenberg.

COLMAN, P., 1958. — New South Wales Dentaliidae. *Proceedings of the Royal Society of New South Wales*, (1956-57): 140-147.

CONRAD, T. A., 1846. — Descriptions of new species of fossil and recent shells and corals. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **3** (1): 19-27, 1 pl.

COOKE, A. H., 1885. — Report on the testaceous Mollusca obtained during a dredging-excursion in the Gulf of Suez in the months of February and March 1869 by Robert MacAndrew. — Republished, with additions and corrections, III. *Annals & Magazine of Natural History*, ser. 5, **16**: 262-276.

COSSMANN, M., 1888. — Catalogue illustré des coquilles fossiles de l'Eocene des environs de Paris. *Annales de la Societé Royale Malacologique de Belgique*, **23** (3): 1-324, 12 pls.

COTTON, B. C. & GODFREY, F. K., 1933. — South Australian shells, 8, Scaphopoda (including description of new genera and species). *South Australian Naturalist*, **14** (4): 135-150.

DA COSTA, E. M., 1776. — *Elements of conchology*. London. 317 pp.

DALL, W. H., 1890. — Scientific results of explorations by the U.S. Fish Commission Steamer *"Albatross"*. VII. Preliminary report on the collection of Mollusca and Brachiopoda obtained in 1887-1888. *Proceedings of the United States National Museum*, **12**: 219-362, pls 5-14.

DALL, W. H., 1895. — Report on Mollusca and Brachiopoda dredged in deep water, chiefly near the Hawaiian Islands, with illustrations of hitherto unfigured species from North West America. *Proceedings of the United States National Museum*, **17**: 675-733. pls 23-32.

DALL, W. H., 1907. — Descriptions of new species of shells, chiefly Buccinidae from the dredgings of the U.S. *"Albatross"* during 1906, in the Northwestern Pacific, Bering, Okhotsk, and Japanese Seas. *Smithsonian Miscellaneous Collection*, **50**: 139-173.

DALL, W. H., 1926. — New shells from Japan and the Loochoo Islands. *Proceedings of the Biological Society of Washington*, **39**: 63-66.

DALL, W. H., 1927. — Diagnoses of undescribed new species of mollusks in the collection of the USNM. *Proceedings of the United States National Museum*, **70** (19): 1-11.

DANCE, P., 1986. — *A history of shell collecting*. E. J. Brill, Leiden. 265 pp., 32 figs.

DAUTZENBERG, P., 1929. — Mollusques testacés marins de Madagascar. *Faune des Colonies Françaises*, **3**: 321-636, pls 4-6.

DAUTZENBERG, P. & FISCHER, H., 1906. — Contribution à la faune malacologique de l'Indo-Chine. *Journal de Conchyliologie*, **54**: 145-226, pls 5-7.

DAWIDOFF, M. C., 1952. — Contribution à l'étude des invertèbrès de la faune marine benthique de l'Indo-Chine. *Bulletin Biologique de la France et de la Belgique*. Supplement **37**: 1-158.

DELESSERT, B., 1841. — *Recueil de coquilles décrites par Lamarck dans son histoire naturelle des animaux sans vertèbres et non encore figurées*. Masson, Paris. 40 pls.

DELL, R. K., 1953. — A molluscan fauna from the Chatham Rise, New Zealand. *Records of the Dominion Museum*, **2** (1): 37-50.

DELL, R. K., 1964. — Antarctic and subantarctic Mollusca. Amphineura, Scaphopoda and Bivalvia. *Discovery Reports*, **33**: 93-250.

DESHAYES, G-P., 1825. — Anatomie et monographie du genre *Dentale*. *Memoires de la Societé d'Histoire Naturelle de Paris*, **2**: 321-378, pls 1-4.

DHARMA, B., 1992. — *Siput dan kerang Indonesia*, vol. 2 [*Indonesian shells*, vol. 2]. Hemmen, Wiesbaden. 135 pp., 38 pls [In Indonesian].

DINAMANI, P., 1964. — Feeding in *Dentalium conspicuum*. *Proceedings of the Malacological Society of London*, **36** (1): 1-5.

DONOVAN, E., 1802. — *The natural history of British shells*, vol. 5, pls 145-180.

DUNKER, G., 1877. — Mollusca nonnula noya maris japonici. *Malakozoologische Blätter*, **24**: 67-75.

DUNKER, G., 1882. — *Index Molluscorum Maris Japonici*. Fischer, Cassel. 301 pp., 10 pls.

EMERSON, W. K., 1952. — Nomenclatural notes on the scaphopod Mollusca. The type species of *Fusitaria* and *Pseudantalis*. *Proceedings of the Biological Society of Washington*, **65**: 201-206, pl. 10.

EMERSON, W. K., 1954. — Notes on the scaphopod mollusks. Rectifications of nomenclature. *Proceedings of the Biological Society of Washington*. **67**: 183-188.

EMERSON, W. K., 1962. — A classification of the scaphopod mollusks. *Journal of Paleontology*, **36** (3): 461-482, pls 76-80.

EMERSON, W. K., 1978. — Two new Eastern Pacific species of *Cadulus*, with remarks on the classification of the scaphopod mollusks. *The Nautilus*, **92** (3): 117-123.

FISCHER, P., 1871. — Sur la faune conchyliologique marine de la baie de Suez. *Journal de Conchyliologie*, **19**: 209-226.

FISCHER, P., 1882. — Diagnoses d'espèces nouvelles de mollusques recueillis dans le cours des expèditions scientifiques de l'aviso Le Travailleur (1882), pars 2 (1). *Journal de Conchyliologie*, **30**: 273-276.

FISCHER, P., 1885. — *Manuel de Conchyliologie*, part 9: 785-896, figs 637-646. Paris.

FOREST, J., 1981. — Compte rendu et remarques générales. *In*: Résultats des Campagnes Musorstom, vol. 1. *Mémoires ORSTOM*, **91**: 9-50, figs 1-5, 1 table.

FOREST, J., 1986. — La campagne Musorstom II (1980). Compte rendu et liste des stations. *In*: FOREST, J. (ed.), Résultats des campagnes Musorstom, vol. 2. *Mémoires du Muséum National d'Histoire Naturelle*, (A), **133**: 7-30, figs 1-2.

FORESTI, L., 1895. — Enumerazioni dei brachiopodi e dei molluschi plioceni dei dintorni di Bologna. *Bulletino della Societç Malacologica Italiana*, **19**: 240-262.

FRANC, A., 1956. — Mollusques marins. Résultats Scientifiques des Campagnes de la "Calypso". *Annales de l'Institut Océanographique*, **32**: 19-60.

FUKUDA, H., 1992. — A review of the molluscan fauna of Yamaguchi prefecture, Western Japan. Yamaguchi Museum. 99 pp., 50 pls.

GMELIN, J. F., 1791. — *Systema Naturae*, vol. 1 (6): 3021-4120.

GOULD, A. A., 1859. — Descriptions of shells collected in the North Pacific Exploring Expedition. *Proceedings of the Boston Society of Natural History*, **7**: 161-166.

GRAY, J. E., 1847. — A list of the genera of recent Mollusca, their synonyms and types. *Proceedings of the Zoological Society of London*. **15**: 129-219.

GUALTIERI, M., 1757. — *Index testarum conchyliorum*. Florence. i-xx + 110 pls.

GUILDING, L., 1834. — Observations on *Naticina* and *Dentalium*, two genera of molluscous animals. *Transactions of the Linnean Society of London*, **17** (5): 29-35, 1 pl.

GUILLE, A., 1982. — Compte-rendu de la campagne MD32/Réunion effectuée à bord du M.S. *Marion-Dufresne* du 11 août au 10 septembre 1982. Mimeographed Report.

HABE, T., 1953. — *Genera of Japanese shells*. Tokyo. 326 pp., 770 figs.

HABE, T., 1955 *in* KURODA, T. (ed.). — *Illustrated catalogue of Japanese shells*, Series B: 9-11, 23-24. Kyoto.

HABE, T., 1957. — Report on the Mollusca chiefly collected by the S.S. "*Soyo Maru*" of the Imperial Fisheries Experimental Station on the continental shelf bordering Japan during the years 1922-30. 2, Scaphopoda. *Publications of the Seto Marine Biological Laboratory*, **6** (2): 127-136, 1 textfig.

HABE, T., 1960. — New species of molluscs from the Amakusa Marine Biological Laboratory, Reihoku-cho, Amakusa, Kumamoto Pref., Japan. *Publications of the Seto Marine Biological Laboratory*. **8** (2): 289-298.

HABE, T., 1962. — *Coloured illustrations of the shells of Japan*, vol. 2. 183 pp., 66 pls.

HABE, T., 1963. — A classification of the scaphopod molluscs found in Japan and in the adjacent areas. *Bulletin of the National Science Museum*, **6** (3): 252-281, pls 37-38.

HABE, T., 1964a. — *Fauna Japonica, Scaphopoda (Mollusca)*. Biogeographical Society of Japan. 57 pp., 5 pls.

HABE, T., 1964b. — Identification of three asiatic tusk shells. *The Venus*, **23** (3): 140-142, pl. 9.

HABE, T., 1970. — A new subspecies of *Fissidentalium formosum* (Adams & Reeve) from the South China Sea. *Journal of the Malacological Society of Australia*, **2** (1): 95-96, figs 1-2.

HABE, T., 1971. — Class Scaphopoda. *In*: KURODA, T., HABE, T. & OYAMA, K. (eds.), *The sea shells of Sagami Bay*: 485-498 (Japanese text), 305-314 (English text), pls 65, 116. Tokyo.

HABE, T., 1977. — *Systematics of Mollusca in Japan, Bivalvia and Scaphopoda*. Tokyo. 372 pp., 72 pls.

HABE, T. & KOSUGE, S., 1964. — *A list of the Indo-Pacific molluscs, concerning to the Japanese mollusean fauna, 3, Class Scaphopoda*. National Science Museum, Tokyo. 12 pp.

HABE, T. & KOSUGE, S., 1966. — *Shells of the world in colour*, vol. 2, *the tropical Pacific*. Osaka. 191 pp., 68 pls.

HABE, T., KUBOTA, T., KAWAKAMAI, A. & MASUDA, O., 1986. — Check list of shell-bearing Mollusca of Suruga Bay, Japan. *Natural History Museum, Tokai University, Science Report*, **1**: 1-42, 2 pls.

HALL, W. J. & STANDEN, E., 1907. — On the Mollusca of a raised coral reef on the Red Sea coast. *Journal of Conchology*, **12**: 65-68.

HEDLEY, C., 1899a. — The Mollusca of Funafuti, part 1, Gastropoda. *Australian Museum, Sydney, Memoirs*, **3** (7): 395-488.

HEDLEY, C., 1899b. — The Mollusca of Funafuti (Supplement). *Australian Museum, Sydney, Memoirs*, **3** (9): 547-565, figs 59-80.

HEDLEY, C., 1901. — A revision of the types of the marine shells of the Chevert Expedition. *Australian Museum, Sydney, Records*, **4** (3): 121-130, pls 16-17.

HEDLEY, C., 1903. — Scientific results of the trawling expedition of HMCS "*Thetis*" off the coast of New South Wales in February and March, 1898. Mollusca part II. Scaphopoda and Gastropoda. *Australian Museum, Sydney, Memoirs*, **4**: 325-402, pls 36-38.

HEDLEY, C., 1916. — A preliminary index of the Mollusca of Western Australia. *Journal of the Royal Society of Western Australia*, **1**: 152-226.

HEDLEY, C., 1918. — A check list of the marine fauna of New South Wales, part 1, Mollusca. *Journal and Proceedings of the Royal Society of New South Wales*, **51**: 1-120.

HENDERSON, J. B., 1920. — A monograph on the East American scaphopod mollusks. *Bulletin of the United States National Museum*, **111**: 1-151, pls 1-20.

HIGO, S. & GOTO, Y., 1993. — A systematic list of molluscan shells from Japan and adjacent area. 693 pp.

HIRASE, S., 1931. — Scaphopod mollusks found in Japan. *Journal of Conchology*, **19** (5): 132-141, pl. 3, figs 1-12.

IEYAMA, H., 1993. — Karyotypes of two species in the Dentaliidae (Mollusca: Scaphopoda). *The Venus*, **52** (3): 245-248, figs 1-5.

IVANOV, D. L. & CHISTIKOV, S. D., 1990. — [The radula in the mollusean Class Scaphopoda]. *Shornik Trudov Zoologicheskogo Museyn, Moskovskij Gosudarstvennyj Universitet*, **28**: 134-142 [In Russian].

JAECKEL, S. H., 1932. — Nachtrag zu den Scaphopoden der Valdivia-Expedition. *Deutsche Tiefsee-Expedition 1898-1899*, **21** (2): 301-315.

JEFFREYS, J. G., 1867. — Fourth report on dredging among the Shetland isles. *Annals and Magazine of Natural History*, ser. 3, **20**: 247-255.

JEFFREYS, J. G., 1877. — New and peculiar Mollusca of the order Solenoconchia procured in the "*Valorous*" expedition. *Annals & Magazine of Natural History*, ser. 4, **19**: 153-158.

JEFFREYS, J. G., 1883. — On the Mollusca procured during the "*Lightning*" and "*Porcupine*" expeditions, 1868-70, 5. *Proceedings of the Zoological Society of London*, (1882): 656-687, pls 49-50.

JOHNSON, R. I., 1964. — The Recent Mollusca of Augustus Addison Gould. *Bulletin of the United States National Museum*, **239**: 1-182, pls 1-45.

JOUSSEAUME, F., 1894. — Diagnose des coquilles de nouveaux mollusques. *Bulletin de la Société Philomatique de Paris*, ser. 8, **6**: 98-105.

KAY, A. E., 1979. — Hawaiian marine shells. *Bernice P. Bishop Museum Special Publication*, **64** (4): 1-654, figs 1-195.

KILBURN, R. & RIPPEY, E., 1982. — *Sea shells of Southern Africa*. McMillan South Africa Pub. Co., Johannesburg. 250 pp., 42 pls.

KILIAS, R., 1972. — Originalmaterial im Zoologischen Museum Berlin zu den von S. H. F. Jaeckel eingeführten malakologischen taxa. *Mitteilungen aus dem Zoologischen Museum*, **48** (2): 437-448.

KILIAS, R., 1995. — Scaphopoda-Typen und -Typoide (Mollusca) im Zoologischen Museum in Berlin. *Mitteilungen aus dem Zoologischen Museum Berlin*, **71** (1): 171-177.

KIRA, T., 1955. — *Coloured illustrations of the shells of Japan*, ed. 1. 203 pp, 67 pls.

KIRA, T., 1959. — *Coloured illustrations of the shells of Japan*, ed. 2. 239 pp, 72 pls.

KIRA, T., 1962. — *Shells of the Western Pacific in color*. Tokyo. 224 pp., 72 pls.

KNUDSEN, J., 1964. — Scaphopoda and Gastropoda from depth exceeding 6000 meters. *Galathea Reports*, **7**: 125-135, figs 1-2.

KOSUGE, S., 1981. — Studies on the collection of Mr Victor Dan. (4) Descriptions of new species of the genera *Lyria*, *Conus* and *Fissidentalium*. *Bulletin of the Institute of Malacology, Tokyo*, **1** (7): 108-115, 2 pls.

KOSUGE, S., 1985. — Noteworthy Mollusca from North-western Australia. (1) (Preliminary report). *Bulletin of the Institute of Malacology, Tokyo*, **2** (3): 58-59, pls 22-23.

KURODA, T., 1941. — A catalogue of molluscan shells from Taiwan (Formosa) with descriptions of new species. *Memoirs of the Faculty of Science and Agriculture, Taihoku Imperial University*, **22** (4), *Geology*, **17**: 65-216, pls 8-14.

KURODA, T. & HABE, T., 1952. — *Check list and bibliography of the recent marine Mollusca of Japan*. Tokyo. 210 pp.

KURODA, T. & KIKUCHI, K., 1933. — Studies on the molluscan fauna of Toyama Bay, I. *Venus*, **4** (1): 7-14, pl. 1.

LAMARCK, J. B., 1801. — *Système des animaux sans vertèbres*. Paris. 432 pp.

LAMARCK, J. B., 1818. — *Histoire naturelle des animaux sans vertèbres*, vol. 5. Paris. 662 pp.

LAMY, E., 1910. — Coquilles marines recueillies par M. F. Geay à Madagascar (1905). *Mémoires de la Société Zoologique de France*, **22** (3-4): 229-346, pl. 15.

LAMY, E., 1938. — Mission Robert Ph. Dollfus en Egypte, 7, Mollusca Testacea. *Mémoires de l'Institut d'Egypte*, **37**: 1 — 89, 1 pl.

LINNÉ, C., 1758. — *Systema Naturae*, ed. 10. 823 pp.

LINNÉ, C., 1767. — *Systema Naturae*, ed. 12, vol. 1 (2). 1327 pp.

LISCHKE, C. E., 1874. — *Japanische Meeres-Conchylien*, vol. 3. T.Fischer, Cassel. 123 pp., 9 pls.

LISTER, M., 1770. — *Historiae sive synopsis methodicae conchyliorum et tabularum anatomicarum*. Oxonii. 1059 figs.

LOUW, E., 1977. — The South African Museum's Meiring Naudé Cruises, 1. Station data 1975, 1976. *Annals of the South African Museum*, **72** (8): 147-159, 1 fig.

LOUW, E., 1980. — The South African Museum's Meiring Naudé Cruises, 10. Station data 1977, 1978, 1979. *Annals of the South African Museum*, **81** (5): 187-205, 1 fig.

LUDBROOK, N. H., 1954. — Scaphopoda. *The John Murray Expedition, Scientific Reports*, **10** (3): 91-120, 1 pl.

LUDBROOK, N. H., 1960. — Scaphopoda. *In*: MOORE, R.C. (ed.), *Treatise on Invertebrate Paleontology*. 1. Mollusca 1: 137-141.University of Kansas Press.

MAKIYAMA, J. 1931. — Stratigraphy of the Kakegawa Pliocene of Totomi. *Memoirs of the College of Science, Kyoto Imperial University*, (B) **7** (1): 1-55, pls 1-3, 4 textfigs.

MARSHALL, B. A., 1991. — Dates of publication and supraspecific taxa of Bellardi and Sacco's (1873-1904) "I molluschi dei terreni terziarii del Piemonte e della Liguria" and Sacco's (1890) "Catalogo paleontologico del bacino terziario del Piemonte". *The Nautilus*, **105** (3): 104-115.

MARTENS, E. von, 1874. — ber Vorderasiatische Conchylien. Cassel. 127 pp., pls 1-9.

MARTENS, E. von, 1880. — *Beiträge zur Meeresfauna der Insel Mauritius und der Seychellen, Mollusken*. Conchylien: 182-343, pls 19-22.

MARTENS, E. von, 1881. — Mehrere neue arten von conchylien theils aus Central-Asien, theils von den Sammlungen Sr. M. Schiff Gazelle. *Sitzungsbericht den Gesellschaft Naturforschender Freunde*, 4: 63-67.

MARTENS, E. von, 1887. — List of shells of Mergui and its archipelago, collected for the trustees of the Indian Museum, Calcutta, by Dr. John Anderson, FRS, superintendant of the Museum. *Journal of the Linnean Society of London*, **21**: 155-219, pls 14-16.

MARTINI, F. H. W., 1769. — Conchylien Cabinet, vol. 1. 408 pp., pls 1-31.

MASTALLER, M., 1978. — The marine molluscan assemblages of Port Sudan, Red Sea. *Zoologische Mededelingen*, **53** (13): 117-144.

MATSUKUMA, A., OKUTANI, T. & HABE, T., 1991. — *World seashells of rarity and beauty*. Tokyo, National Science Museum. 206 pp., pls 1-96. [in Japanese].

MELVILL, J. C., 1897. — Descriptions of thirty-four species of marine Mollusca from the Arabian Sea, Persian Gulf, and the Gulf of Oman. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, **41** (7): 1-26, pls 6-7.

MELVILL, J. C., 1906. — Descriptions of thirty-one Gastropoda and one scaphopod from the Persian Gulf and Gulf of Oman, dredged by Mr. F. W. Townsend, 1902-1904. *Proceedings of the Malacological Society of London*, **7** (2): 69-80, 2 pls.

MELVILL, J. C., 1909. — Report on the marine Mollusca obtained by Mr. J. Stanley Gardiner, FRS, among the islands of the Indian Ocean in 1905. *Transactions of the Linnean Society of London*, (2) **13**: 65-138, pl. 5.

MELVILL, J. C., 1918. — Descriptions of thirty-four species of marine Mollusca from the Persian Gulf, the Gulf of Oman and Arabian Sea, collected by F. W. Townsend. *Annals and Magazine of Natural History*, ser. 9, **1**: 137-158.

MELVILL, J. C. & ABERCROMBIE, A., 1893. — The marine Mollusca of Bombay. *Memoirs and Proceedings of the Manchester Literary and Philosophical Society*, (4) **7**: 17-51.

MELVILL, J. C. & STANDEN, R., 1896. — Notes on a collection of shells from Lifu and Uvea, Loyalty Islands, formed by the Rev. James and Mrs. Hadfield with list of species. *Journal of Conchology*, **8**: 273-382, pl. 1.

MELVILL, J. C. & STANDEN, R., 1898. — The marine Mollusca of Madras and the immediate neighbourhood. *Journal of Conchology*, **9** (1): 30-48, pl. 1.

MELVILL, J. C. & STANDEN, R., 1899. — Report on the marine Mollusca obtained during the first expedition of Prof. Haddon to the Torres Strait, in 1888-89. *Journal of the Linnean Society of London, Zoology*, **27**: 150-206, pls 10-11.

MELVILL, J. C. & STANDEN, R., 1901. — The Mollusca of the Persian Gulf, Gulf of Oman and Arabian Seas as evidenced mainly through the collections of Mr. F. W. Towsend, 1893-1900, with description of new species, I, Cephalopoda, Gastropoda and Scaphopoda. *Proceedings of the Zoological Society of London*, (1901): 327-460, pls 21-24.

MELVILL, J. C. & STANDEN, R., 1907. — The marine Mollusca of the Scottish National Antarctic Expedition. *Transactions of the Royal Society of Edinburgh*, **46** (1) 5: 119-157, pl. 46.

MOAZZO, P. G., 1939. — Mollusques testacés marins du canal de Suez. *Mémoires de l'Institut d'Egypte*, **38**: 1-285, pls 1-14.

MONTFORT, D. De, 1810. — *Conchyliologie systématique et classification méthodique des coquilles*. Paris. 676 pp.

MONTAGU, G., 1803. — *Testacea Britannica*, vol. 2: 293-600, 14 pls. London.

MONTEROSATO, A. T., 1872. — *Notizie intorno alle conchiglie fossili di Monte Pellegrino e Ficarazzi*. Palermo. 44 pp.

MORONI, M. A. & RUGGIERI, G., 1981. — Cadulus (*Sulcogadila* n. subgen.) *caprotti* n. sp., nuovo scafopoda del Siciliano (Plesistocene inf.) di Palermo. *Bollettino Malacologico*. **17** (1-2): 27-31, 3 figs.

MÜNSTER, G. G., 1844. — *In*: GOLDFUSS, G.A., *Petrefacta Germanicae*, vol. 8 (4): 1-128. pls 119-200.

NOMURA, S., 1938. — Variation of ribs in *Dentalium octangulatum* Donovan. *Venus*, **8** (3-4): 155-158.

NOMURA, S., 1940. — Mollusca dredged by the Husa-Maru from the Pacific coast of Tiba Prefecture. *Records of Oceanographic Works in Japan*, **12**: 81-116.

NOMURA, S. & HATAI, K., 1940. — The marine fauna of Kyuroku-sima and its vicinity, Northeast Honshu, Japan. *Saito Ho-on Kai Museum Research Bulletin*, **19**: 57-115, pls 3-4.

OKUTANI, T., 1964. — Report on the archibenthal and abyssal scaphopod Mollusca mainly collected from Sagami Bay and adjacent waters by the R.V. Soyo-Maru during the years 1955-1963, with supplementary notes for the previous report on Lamellibranchiata. *Venus*, **23** (2): 72-90, 1 pl.

OKUTANI, T., 1966. — Archibenthal and abyssal Mollusca collected by the R.V. Soyo-Maru from Japanese waters during 1964. *Bulletin of the Tokai Regional Fisheries Research Laboratory*. **46**: 1-14, pl. 1.

OKUTANI, T., 1974. — Review and new records of abyssal and hadal molluscan fauna in Japanese and adjacent waters. *Venus*, **33** (1): 23-39, 4 figs.

OKUTANI, T., 1975. — Deep-sea bivalves and scaphopods collected from deeper than 2000 m in the Northwestern Pacific by the R/V *Soyo-Maru* and the R/V *Kaiyo-Maru* during the years 1969-1974. *Bulletin of the Tokai Regional Fisheries Research Laboratory*, **82**: 57-87.

OKUTANI, T., 1982. — A remarkable tusk shell, *Fissidentalium horikoshii* n. sp., trawled from deepsea shelf off Sanriku, Pacific coast of Northeast Honshu, Japan. *Venus*, **41** (1): 1-4, figs 1-5.

OKUTANI, T., 1983. — *World seashells of rarity and beauty*. National Science Museum, Tokyo. 48 pls.

OOSTINGH, C. H., 1925. — Report on a collection of recent shells from Obi and Halmahera (Molucas). *Mededeelingen van de Landbouw-Hoogeschool te Wageningen*, **29** (1): 1-361.

OLIVER, P. G., 1984. — Handlists of the molluscan collection in the Department of Zoology, National Museum of Wales. The Melvill-Tomlin Collection, part 26, Scaphopoda. National Museum of Wales, Cardiff. 10 pp.

OTUKA, Y., 1933. — Description of a new *Dentalium* from Southern Japan. *Venus*, 4 (3): 159-161, figs a-f.

PAETEL, F., 1873. — *Catalog der Conchylien-Sammlung*. Berlin. 172 pp.

PALMER, C. P., 1974a. A supraspecific classification of the scaphopod molluscs. *The Veliger*, **17** (2): 115-123, 4 figs.

PALMER, C. P., 1974b. — Rectification of nomenclature in the molluscan class Scaphopoda. *The Veliger*, **17** (2): 124-127.

PALMER, K.W. 1958. — The type specimens of marine Mollusca described by P. P. Carpenter from the West coast (San Diego to British Columbia). *The Geological Society of America, Memoir*, **76**: 1-376, pls 1-35.

PERRY, G., 1811. — *Conchology, or the natural history of shells containing a new arrangement of the genera and species, illustrated by coloured engravings, executed from the natural specimens and including the latest discoveries*. Miller, London. 4 pp., 61 pls.

PHILIPPI, R. A., 1844. — *Enumeratio Molluscorum Siciliae*, vol. 2. 303 pp., 16 pls.

PILSBRY, H. A., 1895. — *Catalogue of the marine mollusks of Japan*. F. Stearns, Detroit. 195 pp., 11 pls.

PILSBRY, H. A., 1905. — New Japanese marine Mollusca. *Proceedings of the Academy of Natural Sciences of Philadelphia*, **57**: 101-122, pl. 5.

PILSBRY, H. A. & SHARP, B., 1897-1898. — Scaphopoda. *Manual of Conchology*, ser. 1, **17**: i-xxxi + 32-144 (1897); 145-280 (1898), pls 1-39.

PLATE, L. H., 1908a. — Die solenoconchen der Deutschen Tiefsee-Expedition. *Deutsche Tiefsee-Expedition 1898-1899*, **9** (3): 339-361, pl. 30.

PLATE, J. H., 1908b. — Die scaphopoden der Deustche Südpolar-Expedition 1901-1903. *Deustche Südpolar Expedition 1901-1903*, **10** (Zoologie 2): 1-6, figs 1-4.

POWELL, A. W. B., 1979. — *New Zealand Mollusca*. Collins, Auckland. 500 pp., 120 figs, 2 maps.

QI, ZHONG-YAN & MA, XIU-TONG, 1989. — A study of the family Dentaliidae (Mollusca) found in China. *Chinese Journal of Oceanology and Limnology*, **7** (2): 112-122, 14 textfigs.

REEVE, L., 1842a. — Descriptions of new species of shells figured in the Conchologia Systematica. *Proceedings of the Zoological Society of London*, (1842): 197-202.

REEVE, L., 1842b. — *Conchologia Systematica*, vol. 2. London. 336 pp., pls 130-300.

RICHER DE FORGES, B., 1990. — Les campagnes d'exploration de la faune bathyale dans la zone économique de la Nouvelle-Caledonie. *In* : CROSNIER, A. (ed.). Résultats des campagnes Musorstom, vol. 6. *Mémoires du Muséum National d'Histoire Naturelle, Paris*, (A) **145** : 9-54.

RICHER DE FORGES, B., 1991. — Les fonds meubles des lagons de Nouvelle-Calédonie. Généralités et échantillonages par dragages. *In* : RICHER DE FORGES, B. (ed.), *Le benthos des fonds meubles des lagons de Nouvelle-Calédonie*, vol. 1 : 10-148. Etudes & Thèses, ORSTOM, Paris.

ROBERTS, D., SOEMODIHARDJO, S. & KASTORO, W., 1982. — *Shallow water marine molluscs of north-west Java*. Lembaga Oseanologi Nasional. Jakarta. 141 pp., 42 pls.

SACCO, F., 1896. — I molluschi dei terreni terziarii del Piemonte e della Liguria. 22. *Bollettino dei Musei di Zoologia ed Anatomia comparata della Reale Universita di Torino*, **11** (267): 89-98 (*fide* MARSHALL 1991) [not seen].

SAKURAI, K. & SHIMAZU, T., 1963. — A new tusk shell *Striocadulus* (*Sagamicadulus*) *elegantissimus* subgen. et sp. nov. *Bulletin of the National Science Museum, Tokyo*, **6** (3): 250-251, fig. 1.

SARS, M., 1859. — Bidrag til en Skildring af den arctiske Molluskfauna ved Norges nordlige Kyst. *Forhandlinger i Videnskabsselskabet i Kristiania*, (1858): 34-87.

SARS, M., 1865. — *Forhandlinger Videnskabs-Selskabet i Kristiania*, **29**: pl. 6, figs 29-33. [not seen].

SAYTAMURTI, 1956. — Bulletin of the Madras Government Museum (Natural History) 1, 2 (7) (*fide* CHERIYAN, 1968) [not seen].

SCARABINO, V., 1979. — *Les scaphopodes bathyaux et abyssaux de l'Atlantique Sud-occidental (systématique, distribution, adaptations). Nouvelle classification pour l'ensemble de la classe*. Thèse de Doctorat en Océanologie, Université d'Aix-Marseille II. 154 pp.

SCARABINO, V., 1981. — An unusual radular formula in Scaphopoda. *Bulletin of the American Malacogical Union*, (1981): 30.

SCARABINO, V., 1986a. — Nuevos taxa abisales de la clase Scaphopoda (Mollusca). *Comunicaciones Zoologicas del Museo Nacional de Historia Natural, Montevideo*, **11** (155): 1-19.

SCARABINO, V., 1986b. — Systematics of Scaphopoda (Mollusca), 1. Three new bathyal and abyssal taxa of the Order Gadilida from South and North Atlantic ocean. *Comunicaciones Zoologicas del Museo Nacional de Historia Natural, Montevideo*, **11** (161): 1-15, 4 pls.

SCHRÖTER, J., 1874. — Einleigtung in die eonehylien Kenntnis naeh Linné, vol. 2. 726 pp., pls 1-7.

SHIKAMA, T., 1964. — *Selected shells of the world illustrated in colours*, vol. 2, Hokuryu-Kan, Tokyo. 212 pp., 245 figs.

SHIKAMA, T. & HABE, T., 1963. — A strange tusk shell, *Fissidentalium laterisulcatum* sp. nov. *Bulletin of the National Science Museum, Tokyo*, **6** (3): 249, 2 figs.

SHIMEK, R.L., 1989. — Shell morphometries and systematie revision of the slender, shallow-water *Cadulus* of the Northeastern Paeifie. *The Veliger*, **32** (3): 233-246.

SHOPLAND, E. R., 1902. — List of marine shells eolleeted in the neighbourhood of Aden between 1892 and 1901. *Proceedings of the Malacological Society of London*, 5 (2): 171-179.

SIMROTH, H. R., 1894. — Seaphopoda. *In*: Bronn's Klassen und Ordnungen des Thier-Reiehs, vol. 3 (1): 356-467.

SMITH, E. A., 1875. — A list of the Gastropoda eolleeted in Japanese seas by Commander H. C. St. John. *Annals and Magazine of Natural History*, ser. 4, **15-16**: 1-27.

SMITH, E. A., 1884. — Mollusea. *Report on the zoological collections made in the Indo-Paeifie ocean during the voyage of the HMS "Alert" 1881-2*: 34-116, pl. 44. London.

SMITH, E. A., 1894. — Natural history notes from H. M. Indian Marine Survey Steamer *"Investigator"*, Commander C. F. Oldham, R.N. Series 2 (10). Report on Mollusea dredged in the Bay of Bengal and the Arabian Sea. *Annals and Magazine of Natural History*, ser. 6, **14**: 157-174.

SMITH, E. A., 1895. — Natural history notes from H. M. Indian Marine Survey Steamer *"Investigator"*, Commander C. F. Oldham, R.N. Series 2 (19). Report on Mollusca dredged in the Bay of Bengal and the Arabian Sea during 1893-4. *Annals and Magazine of Natural History*, ser. 6, **16**: 1-19, pls 1-2.

SMITH, E. A., 1896. — Natural history notes from H. M. Indian Marine Survey Steamer *"Investigator"*, Commander C. F. Oldham, R.N. Series 2 (22). Deseriptions of new deep-sea Mollusca. *Annals and Magazine of Natural History*, ser. 6, **18**: 369-385.

SMITH, E. A., 1903. — A list of species of Mollusca from South Africa, forming an appendix to G. B. Sowerby's "Marine shells of South Afriea". *Proceedings of the Malacological Society of London*, **5**: 354-402, pl. 15.

SMITH, E. A., 1904. — Natural history notes from H. M. Indian Marine Survey Steamer *"Investigator"*, Commander T. H. Heming, R.N. Series 3 (1). On Mollusca from the Bay of Bengal and the Arabian Sea. *Annals and Magazine of Natural History*, ser. 7, **14**: 1-14.

SMITH, E. A., 1906a. — Natural history notes from R.I.M.S. *"Investigator"*, Series 3 (10). On Mollusea from the Bay of Bengal and the Arabian Sea. *Annals and Magazine of Natural History*, ser. 7, **18**: 245-264.

SMITH, E. A., 1906b. — On South Afriean marine Mollusea, with descriptions of new species. *Annals of the Natal Government Museum*, **1**: 19-71, pls 7-8.

SOWERBY, G. B., 1823. — Genera of reeent shells, *Dentalium*, fig 5. London. (*fide* Emerson, 1952) [not seen]

SOWERBY, G. B., 1860. — Monograph of the genus *Dentalium*. *Thesaurus Conchyliorum or Monographs of Genera of Shells*, vol. 3: 98-104, pls 223-225 (*Dentalium* 1-3). London.

SOWERBY, G. B., 1873. — Monograph of the genus *Dentalium*. *Conchologia Iconica*, 7 pls. L. Reeve & Co. London.

SOWERBY, G. B., 1888. — Description of fourteen new species of shells from China, Japan and the Andaman islands, chiefly collected by Deputy Surgeon-Gen. R. Hungerford. *Proceedings of the Zoological Society of London*, (1888): 565-570, pl. 28.

SOWERBY, G. B., 1892. — *Marine shells of South Africa*. London. 89 pp., 5 pls.

SOWERBY, G. B., 1894. — Description of new species of marine shells from the neighbourhood of Hong Kong. *Proceedings of the Malacological Society of London*, 1: 153-159, pl. 12.

SOWERBY, G. B., 1903. — Mollusca of South Africa. *Marine Investigations in South Africa*, 2: 213-232, 5 pls.

SOWERBY, G. B., 1914. — Descriptions of new species of Mollusca from New Caledonia, Japan, and other localities. *Proceedings of the Malacological Society of London*. **11**: 5-10.

SPRINGSTEEN, F. J. & LEOBRERA, F. M., 1985. — *Shells of the Philippines*. Carfel Seashells Museum, Manila. 377 pp., 100 pls.

STAROBOGATOV, YA. I., 1974. — [Xenoconchias and their bearing on the phylogeny and systematics of some molluscan classes]. *Paleontologicheskij Zhurnal*. (1974): 1-13. [In Russian]

STEARNS, F., 1891. — *A list of Mollusca and other forms of marine life collected in the years 1889-1890 in Japan*. Detroit. i-v + 5-19 pp.

STEINER, G., 1991. — Observations on the anatomy of the scaphopod mantle, and the description of a new family, the Fustiariidae. *American Malacological Bulletin*, 9: 1-20.

STEINER, G., 1992a. — The organization of the pedal musculature and its connection to the dorsoventral musculature in Scaphopoda. *Journal of Molluscan Studies*. **58**: 181-197.

STEINER, G., 1992b. — Phylogeny and classification of Scaphopoda. *Journal of Molluscan Studies*, **58**: 385-400.

STOLICZKA, F., 1868. — The Gastropoda of the Cretaceous rocks of southern India. *Memoirs of the Geological Survey of India. Palaeontologica Indica*, **5** (2). 497 pp., 33 pls.

SUTER, H., 1913. — *Manual of New Zealand Mollusca*. Mackay, Wellington. 1120 pp. Atlas of plates (1915). pls 1-67.

TOKUNAGA, S., 1907. — Fossils from the environs of Tokyo. *Journal of the College of Science, Imperial University of Tokyo*, **21** (2): 1-96.

TOMLIN, J. R. LE B., 1926. — On South African marine Mollusca, with description of new species. *Annals of the Natal Museum*, **5** (3): 283-298.

TOMLIN, J. R. LE B., 1931. — Reports on the marine Mollusca in the collection of the South African Museum. *Annals of the South African Museum*, **29** (2): 337-340.

TREW, A., 1987. — *James Cosmo Melvill's new molluscan names*. National Museum of Wales, Cardiff. 84 pp., 7 figs.

TREW, A, 1990. — *John R. le B. Tomlin's new molluscan names*. National Museum of Wales, Cardiff. 101 pp., 17 figs.

TSUCHIDA, E., HORI, S. & MITOKI, T., 1991. — Study on the Mollusca of Yamaguchi Pref., 4. Some mollusks dredged from Suô-Nada and Iyo-Nada. *Bulletin of the Yamaguti Museum*, **17**: 1-18, 4 pls.

VERRILL, A. E., 1885. — Third catalogue of Mollusca, recently added to the fauna of the New England coast and the adjacent parts of the Atlantic, consisting mostly of deep-sea species, with notes on other previously recorded. *Transactions of the Connecticut Academy of Arts and Sciences*, **6** (2): 395-452. 3 pls.

WALLIN, N., 1992. — *Uppsala University Zoological Museum, Catalogue of type specimens, 4. Linnean specimens*. Uppsala. 233 pp.

WATSON, R. B., 1879. — Mollusca of the *"Challenger"* expedition. II. The Solenoconchia, comprising the genus *Dentalium*, *Siphonodentalium* and *Cadulus*. *Proceedings of the Linnean Society of London*. **14**: 506-529.

WATSON, R. B., 1886. — Report on the Scaphopoda and Gastropoda collected by H.M.S. Challenger during the years 1873-76. *Challenger Reports, Zoology*, **15**: 1-50, pls 1-3.

WHEELER, A., 1993 (MS) . — Zoological collections, List of specimens and indices. Linnean Types in the Linnean Society of London, Mollusca 2-6.

WINCKWORTH, M. A., 1927. — Marine Mollusca from India and Ceylon, 1. *Dentalium*. *Proceedings of the Malacological Society of London*, **17**: 167-169, pl. 14.

WINCKWORTH, M. A., 1940a. — A systematic list of the Investigator Mollusca. *Proceedings of the Malacological Society of London*, **24**: 19-29.

WINCKWORTH, R., 1940b. — New species of shells from Madras. *Proceedings of the Malacological Society of London*. **24** (2): 41-43. 6 figs.

WOOD, S., 1842. — A catalogue of shells of the "Crag". *Annals and Magazine of Natural History*, **9**: 452-455, pl. 15.

WOODRING, W. P., 1925. — Miocene molluscs from Bowden, Jamaica (Pelecypoda & Gastropoda). *Carnegie Institution of Washington, Publication*, 366: 1-222, 28 pls.

YAMAMOTO, G. & HABE, T., 1962. — Fauna of shell-bearing mollusks in Mutsu Bay, Scaphopoda and Gastropoda 1. *Bulletin of the Marine Biological Station of Asamushi, Tôhoku University*, **11** (1): 1-19, pls 1-3.

YOKOYAMA, M., 1922. — Fossils from the Upper Musashino of Kazusa and Shimosa. *Journal of the College of Science, Imperial University of Tokyo*, **44** (1): 1-200, pls 1-17.

ZEIDLER, W. & MACPHAIL, M. K., 1978. — Mollusc type-specimens in the South Australian Museum 1. Cephalopoda and Scaphopoda. *Records of the South Australian Museum*, **17** (26): 381-385.