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The Marine Fauna of New Zealand: Porifera, Demospongiae, Part 4 (Poecilosclerida)

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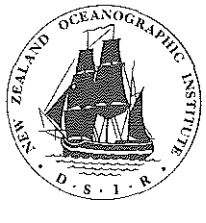
P.R. BERGQUIST and P.J. FROMONT



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The Marine Fauna of New Zealand: Porifera, Demospongiae, Part 4 (Poecilosclerida)

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The Marine Fauna of New Zealand: Porifera, Demospongiae, Part 4 (Poecilosclerida)

by

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ABSTRACT

The classification of the order Poecilosclerida of the class Demospongiae has been reviewed and revised. A twelve family classification is proposed, based on study of representative material from New Zealand and consideration of the literature.

Of the classical characters which have been utilised in sponge systematics, skeletal arrangement has received the most emphasis in this work. The other characters used are external body form, texture, surface detail and spicule complement.

One hundred and eight species are recorded; thirty-eight of these are new species, two are new genera, and one species is given a new name.

Keywords: Porifera, Demospongiae, Poecilosclerida, systematics, new taxa, marine fauna, New Zealand.

INTRODUCTION

Most orders of the Demospongiae have been revised recently and a major contribution has come from Bergquist working primarily on the Demospongiae of New Zealand. Orders of the subclass Tetractinomorpha were revised by Bergquist (1968), the orders Axinellida and Halichondrida by Bergquist (1970), and the orders Haplosclerida and Nepheliospongida by Bergquist and Warne (1980). This leaves only the orders with fibrous skeletons and one spicule containing order, the Poecilosclerida, to be considered. The latter is the largest order of the Demospongiae.

Recent publications specifically devoted to the Poecilosclerida have been those of Lévi (1963) on the South African fauna and van Soest (1984) on the Poecilosclerida of Curacao and other Caribbean Islands. Three authors have published taxonomic studies which include Poecilosclerida from New Zealand: Brøndsted (1923, 1924), Dendy (1924) and Bergquist (1961a, 1961b). These works were limited in scope by the amount of material available, and in total described fifty-one species of Poecilosclerida. Now, with extensive collections having been made of the

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intertidal, shallow subtidal and deep water sponge faunas, a more complete account of the Poecilosclerida is possible.

The primary aim of this study was to record the Poecilosclerida of New Zealand and to undertake a systematic revision of this fauna. At the same time consideration was given to providing a guide to identification for workers in general marine biology, ecology and biochemical fields by incorporating macroscopic detail and ecological notes where possible. A major objective of the taxonomic treatment was to integrate morphological characters with histological, reproductive and biochemical studies already documented by previous workers. The number of species to be described has proved to be far greater than anticipated with the result that this wealth of material has necessitated a taxonomic treatment predominantly utilising classical techniques. Fortunately, in skeletal characteristics the Poecilosclerida present greater diversity than any other order of Demospongiae, and more parameters are available for classical taxonomic treatment than is the case in most other orders.

What is presented below is a series of concise redescriptions of existing species with full descriptions of the new species. A diagnosis of each genus and family represented in New Zealand is given as an aid to identification by other sponge workers. The latter practice, while desirable, has not been widely used in previous taxonomic works. Discussion of the generic placements, and the affinities and relationships of each family, are summarised after the species descriptions. Finally, an appraisal and revision of the present systematic relationships within the order Poecilosclerida is given, based on the features clarified by study of the New Zealand fauna.

The following criteria are used throughout the species descriptions.

(1) Description: Details of the external appearance are recorded when the sponge is alive, since contraction of the tissues often results in the loss of some features after preservation. The taxonomist must be aware of the variability of the species being dealt with. Unique habitats often result in unusual external appearances in the sponges living there. For instance, *Plocamia novizelanicum* is usually a thick encrusting sponge, but in a situation of low wave exposure the species may become ramose. The shape of a sponge can usually be described only in general terms such as encrusting, massive or ramose.

(2) Dimensions: The dimensions of the sponge are recorded as a supplement to the description. Size of the sponge can be dictated by skeletal content and arrangement and therefore can assist in diagnosis. For instance, the plumose non-anastomosing skeleton found in species of *Hymedesmia* limits the development of the sponge to a thick encrustation.

(3) Colour: The aspect of the individual in relation to light has a great effect on the pigmentation of many sponges. However, noting a range of colour and any colour difference after preservation enables the use of pigmentation as an additional systematic character. The necrotic behaviour of some sponges reflects a chemical transformation of pigments and is characteristic of the species. For instance, *Stylopus australis* is bright orange in life, rapidly becomes deep blue after exposure to air, and is purple in the alcohol preserved state. Other sponges vary little in colour from the living to the preserved state. *Tedania battershilli* is varying shades of orange in life and tends to fade only slightly when preserved. Colour notations always refer to the Munsell "Book of Colour" (Munsell 1942).

(4) Texture: The consistency of the sponge is recorded in the descriptions as this feature can convey information regarding the type of skeletal elements present. Sponges with a high spicule:spongin ratio are likely to be firm and crisp, e.g., *Chondrocladia*, those with a high spongin:spicule ratio will be compressible, e.g., *Clathria*, and those incorporating sand will be brittle and incompressible, e.g., *Chondropsis*. Certain species are characterised by mucous production, e.g., many *Mycale* and *Tedania* species.

(5) Surface: In many genera and species, special surface structures are developed in relation to inhalent and exhalent apertures. All genera in the families Hymedesmiidae and Phorbasidae have characteristic areolate pore-fields. Species of the families Coelosphaeridae and Cornulidae have fistulose surface structures. The thick surface skin found in *Rhaphidophlus* is characteristic of the genus.

(6) Skeleton: In this study great importance is placed upon skeletal architecture. The Poecilosclerida have a wide range of skeletal types, which when discussed in conjunction with the spicule complement, characterise the families, genera and species of the order. A diagrammatic presentation of the skeletal nomenclature used throughout the study is given in Fig. 1. The term "choanosomal skeleton" refers to the internal skeleton of the sponge, the "ectosomal skeleton" refers to the immediate sub-surface skeleton, while the term "dermal skeleton" refers to the outermost surface skeleton.

(7) Spicules: All poecilosclerid sponges contain spicules. According to their morphology and disposition these are termed megascleres or microscleres; there is no actual size difference that defines the two categories. Megascleres are found in the principal skeleton, where, along with spongin fibre, they maintain the gross form of the sponge and the regional internal substructure. Microscleres generally act as packing between megasclere tracts or are scattered in surface or internal membranes. Names for the two categories of megascleres used in this study are formed by adding a numerical prefix to the root "actine" when the number of rays is referred to. A spicule pointed at both ends is diactinal; if pointed at one end and

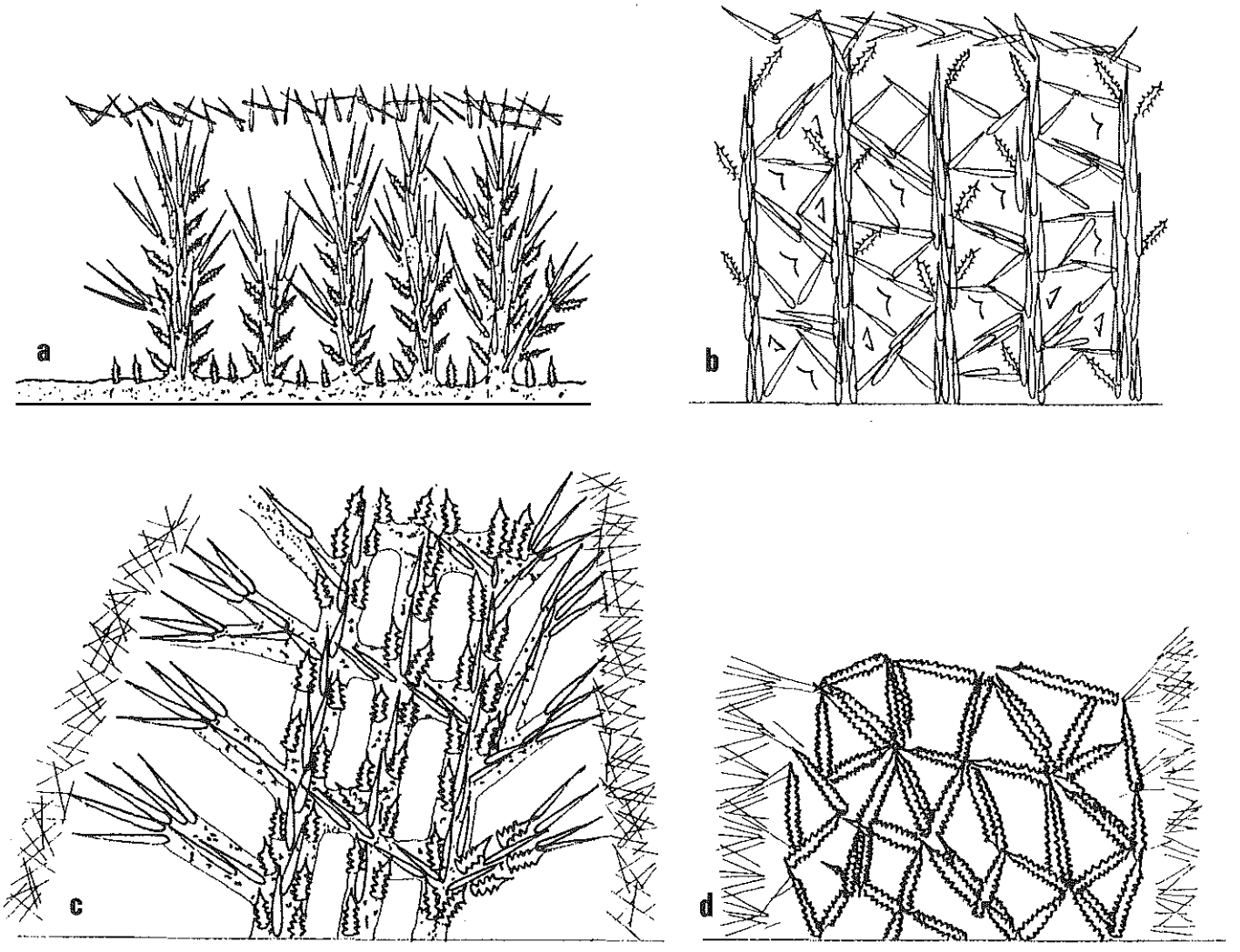


FIG. 1. Diagrammatic representation of the major types of skeletal architecture found within the order Poecilosclerida. a, plumose skeleton; b, plumo-reticulate skeleton; c, reticulate skeleton; d, isodictyal skeleton.

rounded at the other, it is monactinal. The major spicule types found in the Poecilosclerida and discussed in this study are shown in Figs 2 and 3. Some terms relating to spicule position in the skeleton are defined as follows:

(a) Echinating – a megasclere with its head implanted in a fibre or spicule tract and which diverges at an angle to the principal skeleton.

(b) Principal – spicule composing the primary internal skeleton.

(c) Accessory – spicules additional to the primary skeleton, including the echinating spicules.

(d) Auxiliary – also referred to as ectosomal spicules and found in the peripheral skeleton.

Spicule size ranges are relatively consistent within a species, and in conjunction with the spicule complement and morphology, are major determinants in species identification. Spicule dimensions have been given as a mean of ten measurements, along with the range of the ten measurements, for each spicule type in every sponge examined.

The familial classification of the Poecilosclerida that is adopted follows Lévi (1973) and Bergquist (1978) with the following modifications:

(1) The Agelasidae, placed in the Poecilosclerida by Lévi (1973), are not included as they have been shown clearly to have axinellid affinities (Bergquist 1978).

(2) The Biemnidae, often associated with the Axinellida (Bergquist 1970, Hooper 1984) are, following Lévi (1973) and Bergquist (1978), included in the Poecilosclerida.

Acknowledgments

We wish to acknowledge support from the New Zealand Oceanographic Institue for field time on the

r.v. *Tangaroa*, and the University of Auckland Research Grants Committee and the University Research Grants Committee for their continued financial support for this project. Assistance of colleagues from museums throughout the world is also acknowledged.

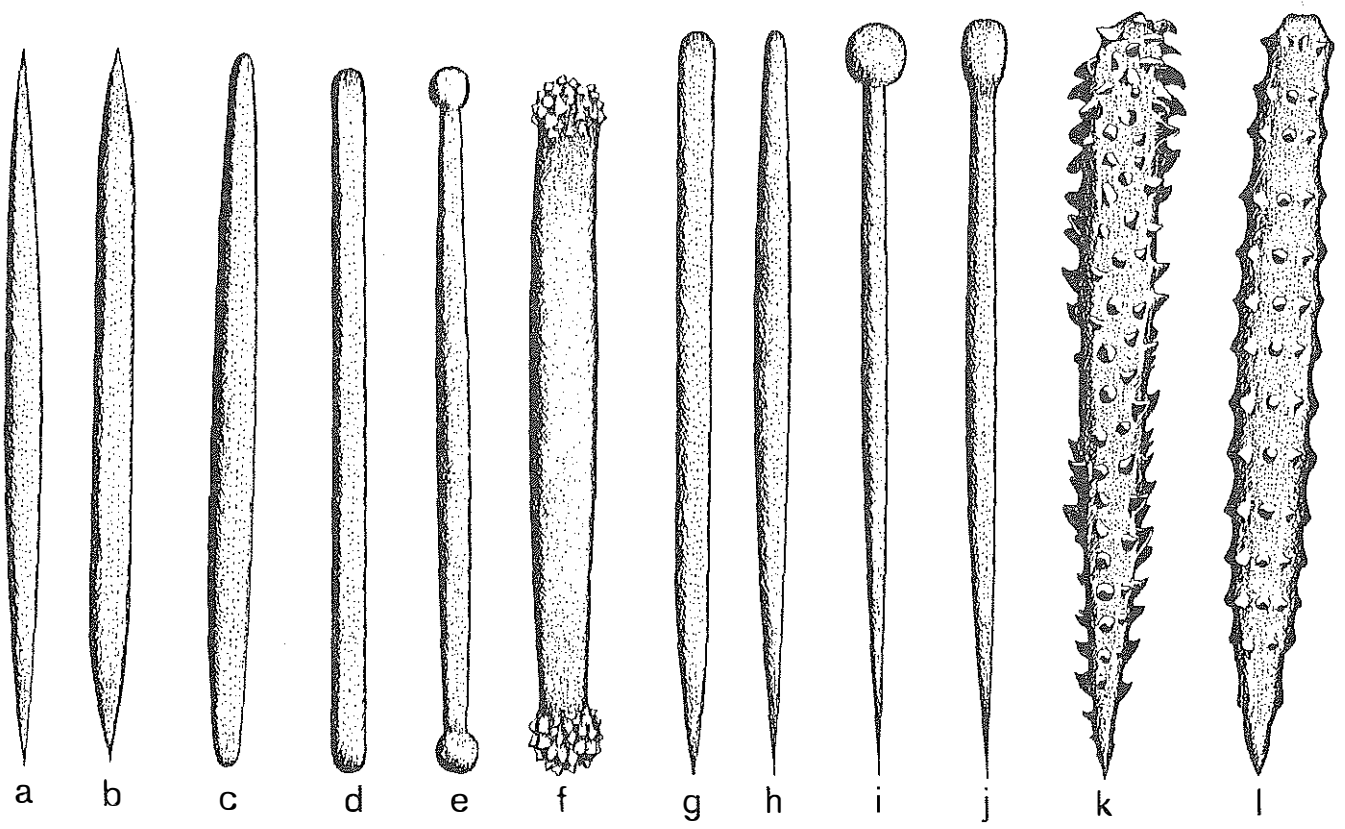
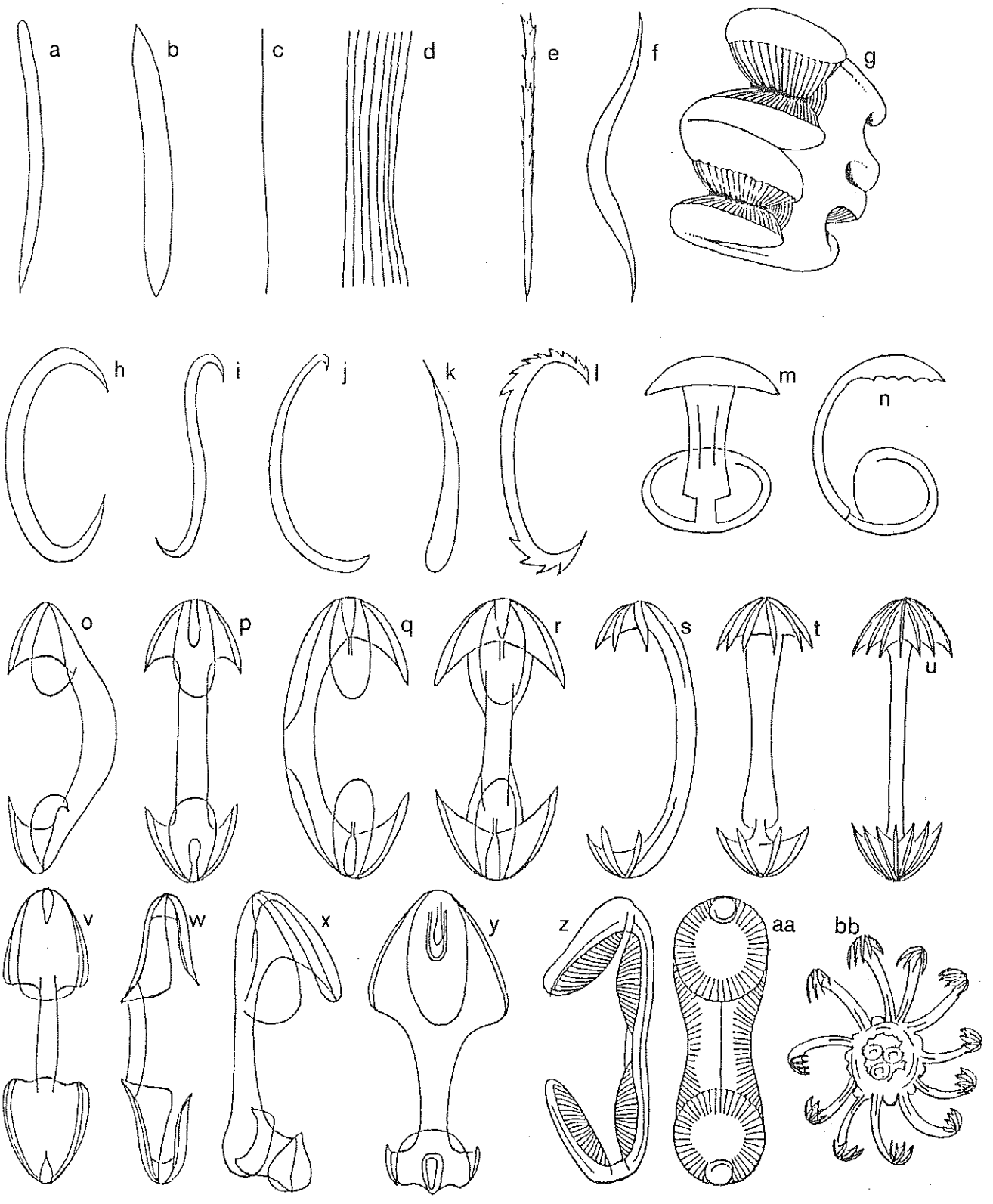


FIG. 2. Diagrammatic representation of megasclere types found within the order Poecilosclerida. a–f, diactinal spicules: a, oxea; b, hastate oxea; c, strongyloxea; d, strongyle; e, tylote; f, tylote with spined heads. g–l, monactinal spicules: g, style; h, anisostrongyloxea; i, tylostyle; j, subtylostyle; k, acanthostyle; l, acanthostyle with verticillate spining.

FIG. 3 (*opposite*). Diagrammatic representation of microsclere types found within the order Poecilosclerida. a, microstyle; b, microxea; c, rhaphide; d, trichodragmata; e, onychaete; f, toxa; g, tetrapocilli; h, sigma, C-shape; i, sigma, S-shape; j, sigma, hook-shape; k, comma; l, sigma with spines; m, inequiended bipocilli, front view; n, inequiended bipocilli, side view; o, arcuate isochelae, side view; p, arcuate isochelae, front view; q, anchorate isochelae, side view; r, anchorate isochelae, front view; s, unguiferate isochelae, side view; t, unguiferate isochelae, front view; u, birotulate chelae; v, palmate isochelae, front view; w, palmate isochelae, side view; x, palmate anisochelae, side view; y, palmate anisochelae, front view; z, placochelae, side view; aa, placochelae, front view; bb, rosette of isochelae.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COLLECTIONS EXAMINED

Personal collections, supplemented by material from fellow sponge workers, were made intertidally throughout New Zealand, and shallow sub-tidal collections were undertaken using SCUBA at selected locations. These were added to existing collections which included deep-water dredgings and trawl collections (Figs 4 and 5).

New Zealand Oceanographic Institute (NZOI)

N.Z. Oceanographic Institute data are given below in abbreviated form from field notes logged in the Station Register. Records of individual occurrences of animals noted in the field but not relevant to this report have been omitted. The following abbreviations for equipment are used: BT - Beam trawl; DCMB - cone dredge with cylindrical steel wire mesh bag with canvas as inner lining; DL - large dredge (900 × 300 mm); DR - rock dredge, modified to include a flexible chain-linked mid-section, with steel wire mesh bag.

Sta. 59 (11 February 1954) 43°38'S, 177°19'E. Chatham Rise. BT, DL. Depth 531 m.

B93 (22 September 1958) 34°00.0'S, 172°30.0'E. North-east of Three Kings Islands. BT, DC. Depth 55–91 m.

E268 (7 April 1965) 34°30.0'S, 172°35.0'E. Near Cape Maria van Diemen. DCMB. Depth 44 m.

E269 (7 April 1965) 34°30.0'S, 172°35.5'E. Near Cape Maria van Diemen. DCMB. Depth 59 m.

E271 (7 April 1965) 34°30.0'S, 172°20.0'E. West of Cape Maria van Diemen. DCMB. Depth 134 m.

E367 (14 April 1965) 34°25.0'S, 173°05.0'E. Near North Cape. DCMB. Depth 29 m.

J953 (18 June 1981) 34°39.6'S, 172°13.1'E. Western continental slope, Northland. DR. Depth 260–270 m.

J954 (18 June 1981) 34°38.0'S, 172°13.5'E. Western continental slope, Northland. DR. Depth 192–204 m.

J955 (18 June 1981) 34°25.9'S, 172°34.6'E. Near Cape Reinga. DR. Depth 50 m.

J957 (19 June 1981) 34°09.5'S, 172°08.7'E. Great Island, Three Kings Islands. SCUBA. Depth 10–33 m.

J969 (21 June 1981) 35°08.8'S, 174°21.1'E. Off Cape Brett. DR. Depth 70–106 m.

J970 (21 June 1981) 35°08.6'S, 174°21.1'E. Off Cape Brett. DR. Depth 86–91 m.

J974 (22 June 1981) 35°42.6'S, 175°19.2'E. North of Great Barrier Island. DR. Depth 152 m.

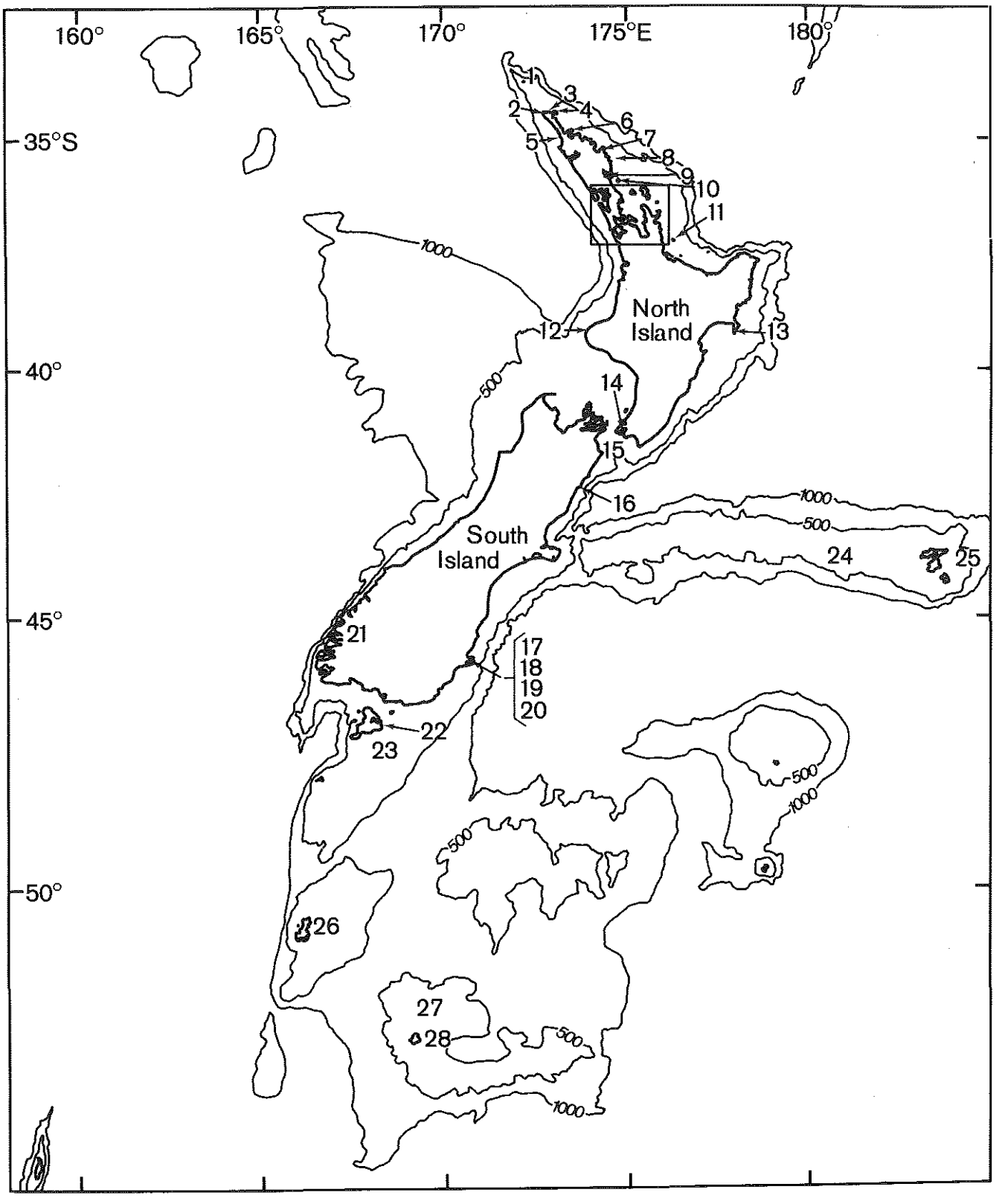
J975 (22 June 1981) 35°40.5'S, 175°23.6'E. North of Great Barrier Island. DR. Depth 205 m.

Q739 (12 July 1982) 44°36.13'S, 167°49.4'E. Dale Point, Milford Sound. SCUBA. Depth 35 m.

Q743 (14 July 1982) 44°57.6'S, 167°27.0'E. South-west Arm, George Sound. SCUBA. Depth 37 m.

Material was also examined from the following museum collections: Copenhagen Museum – Th. Mortensen Expedition (Brøndsted); British Museum – British Antarctic "Terra Nova" Expedition (Dendy), Discovery Expedition (Burton), and Sealark Expedition (Dendy); Canterbury Museum – Chatham Islands Expedition.

FIG. 4 (*opposite*). Map of New Zealand region showing sites from which material considered in this monograph was collected. 1, Three Kings Islands; 2, Cape Maria van Diemen; 3, Spirits Bay; 4, North Cape; 5, Ninety Mile Beach; 6, Cape Karikari; 7, Cape Brett; 8, Poor Knights Islands; 9, Whangarei; 10, Hen and Chickens Islands; 11, Mayor Island; 12, New Plymouth; 13, Mahia Peninsula; 14, Wellington; 15, Cook Strait; 16, Kaikoura; 17, Port Chalmers; 18, Portobello; 19, Dunedin; 20, Papanui Beach; 21, Fiordland; 22, Fantail Bay; 23, Stewart Island; 24, Chatham Rise; 25, Chatham Islands; 26, Auckland Islands; 27, Campbell Plateau; 28, Campbell Island. For localities in the area enclosed by the box, refer to Fig. 5.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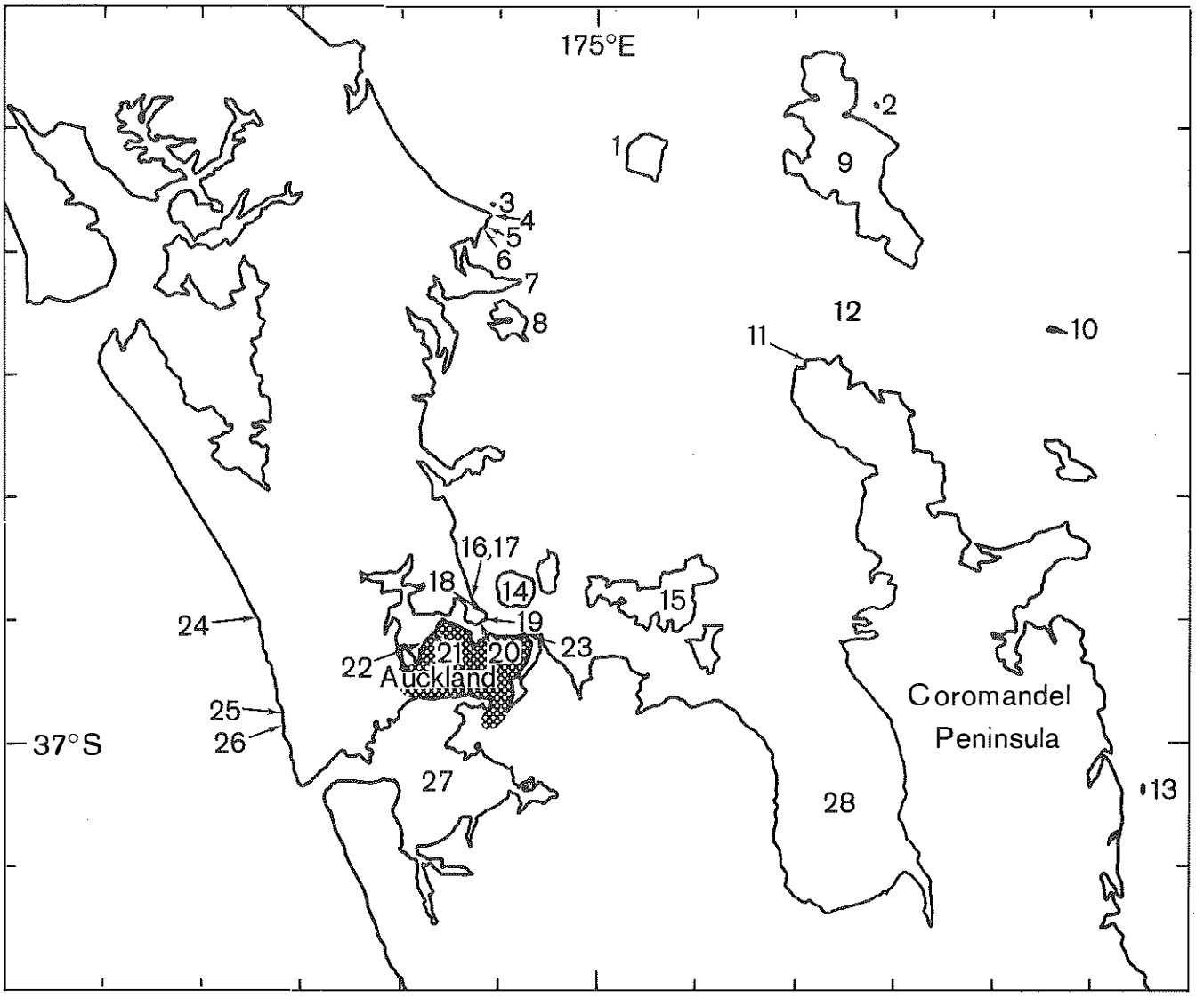

FIG. 5. Map of Hauraki Gulf and Auckland showing sites from which material considered in this monograph was collected. 1, Little Barrier Island; 2, Rakitu Island; 3, Goat Island; 4, Leigh; 5, Maori Island; 6, Ti Point; 7, Tokatu Point; 8, Kawau Island; 9, Great Barrier Island; 10, Cuvier Island; 11, Cape Colville; 12, Colville Channel; 13, Slipper Island; 14, Rangitoto Island; 15, Waiheke Island; 16, Takapuna Reef; 17, Clifton Beach; 18, Narrow Neck; 19, Cheltenham Beach; 20, Devonport Wharf; 21, Westmere Reef; 22, Point Chevalier Reef; 23, Ladies Bay Reef; 24, Muriwai Beach; 25, Piha Beach; 26, Maori Bay; 27, Manukau Harbour; 28, Firth of Thames.

LIST OF SPECIES DESCRIBED

***Denotes species not recollected during this investigation.**

Class DEMOSPONGIAE Sollas

Order POECILOSCLERIDA Topsent

Family MYCALIDAE Lundbeck

Genus **Mycale** Gray
M. novaezealandiae Dendy
M. murrayi (Ridley and Dendy)
**M. rara* (Dendy)

Genus **Aegogropila** Gray
A. flagelliformis n.sp.

Genus **Carmia** Gray
C. macilenta (Bowerbank)
C. tasmani n.sp.
C. hentscheli n.sp.

Genus **Paresperella** Dendy
P. microsigma n.sp.

Genus **Esperiopsis** Carter
**E. glaber* Brøndsted
**E. crassofibrosa* Brøndsted
**E. normani* (Bowerbank)
**E. edwardii* (Bowerbank)
**E. macrosigma* var. *novaezealandiae* Dendy
**E. megachela* Dendy

Family CLADORHIZIDAE de Laubenfels

Genus **Chondrocladia** Wyville Thomson
**C. clavata* Ridley and Dendy

Family BIEMNIDAE Hentschel

Genus **Biemna** Gray
B. rhabderemioides Bergquist
B. flabellata Bergquist
B. rufescens n.sp.
**B. novaezealandiae* Dendy

Genus **Microtylostylifer** Dendy
M. anomalus Dendy

Genus **Desmacella** Schmidt
D. dendyi de Laubenfels
D. ambigua n.sp.

Family DESMACIDONIDAE Gray

Genus **Desmacidon** Bowerbank
D. mamillatum n.sp.

Genus **Strongylacidon** Lendenfeld
S. conulosa n.sp.
**S. inaequalis* (Hentschel)

Genus **Isodictya** Bowerbank
**I. cavicornuta* Dendy

Genus **Plumocolumella** Burton
P. novaezealandiae (Brøndsted)

Genus **Guitarra** Carter
G. fimbriata Carter
**G. antarctica* var. *novaezealandiae* Dendy

Genus **Chondropsis** Carter
C. kirkii Carter
C. topsentii Dendy
C. sp.

Genus **Psammopemma** Marshall
**P.* sp.a. Brøndsted
**P.* sp.b. Brøndsted
**P. crassum* (Carter)

Genus **Echinostylinos** Topsent
E. reticulatus Topsent

Genus **Tetrapocillon** Brøndsted
T. novaezealandiae Brøndsted

Family COELOSPHAERIDAE Hentschel

Genus **Coelosphaera** Wyville Thomson
C. globosa Bergquist
C. calcifera (Burton)
C. transiens n.sp.

Genus **Histodermella** Lundbeck
H. australis Dendy

Genus **Amphiastrella** Dendy
A. kirkpatricki Dendy

Genus **Inflatella** Schmidt
I. spherica Dendy

Genus **Manawa** n.g.
**Manawa demonstrans* (Dendy)

Family CORNULIDAE Lévi and Lévi

Genus **Cornulum** Carter
C. strepsichela Dendy

Genus **Paracornulum** Hallmann
P. sinclairi n.sp.

Genus **Coelocarteria** Burton
C. spatulosa n.sp.

Genus **Zyzza** de Laubenfels
Z. massalis (Dendy)

Family TEDANIIDAE Hentschel

Genus **Tedania** Gray
T. connectens (Brøndsted)
T. diversirhaphidiophora Brøndsted
T. spinostylota n.sp.
T. battershilli n.sp.
T. purpurescens n.sp.

Genus **Tedaniopsis** Dendy
T. turbinata Dendy

Family HYMEDESMIIDAE Topsent

Genus **Hymedesmia** Bowerbank
H. lundbecki Dendy
H. anisostrongyloxea n.sp.
H. microstrongyla n.sp.

Genus **Stylopus** Fristedt
S. lissostyla n.sp.
S. australis n.sp.

Family PHORBASIDAE de Laubenfels

Genus **Phorbas** Duchassaing and Michelotti
P. intermedia Bergquist
P. areolata n.sp.

Genus **Pronax** Gray
P. anchorata n.sp.
P. fulva n.sp.

Genus **Hamigera** Gray
H. macrostongyla n.sp.
H. tarangaensis n.sp.

Family CRELLIDAE Hentschel

Genus **Crella** Gray
C. incrustans (Carter)
C. fristedi (Dendy)
C. affinis (Brøndsted)

Genus **Naniupi** de Laubenfels
N. novaezealandiae n.sp.

Family MYXILLIDAE Topsent

Genus **Myxilla** Schmidt
**M. novaezealandiae* Dendy
M. columna n.sp.

Genus **Lissodendoryx** Topsent
L. isodictyalis (Carter)

Genus **Ectyomyxilla** Lundbeck
E. kerguelensis Hentschel
E. ramosa n.sp.

Genus **Ectyodoryx** Lundbeck
**E. crelloides* (Brøndsted)

Genus **Iophon** Gray
I. proximum Ridley
I. laevistylus Dendy
I. minor (Brøndsted)

Genus **Sigmarotula** n.g.
S. lamellata n.sp.

Genus **Allocia** Hallmann
A. chelifera (Hentschel)

Genus **Antho** Gray
A. brondstedi n.sp.

Family CLATHRIIDAE Hentschel

Genus **Microciona** Bowerbank
M. dendyi n.sp.
M. coccinea Bergquist
M. rubens Bergquist
**M. novaezealandiae* Brøndsted
**M. pyramidalis* Brøndsted

Genus **Dictyociona** Topsent
D. contorta n.sp.
D. atoxa n.sp.

Genus **Clathria** Schmidt
C. lissosclera n.sp.
C. mortensenii Brøndsted
C. terraenovae Dendy
**C. intermedia* Kirk
**C. macropora* Lendenfeld

Genus **Pseudanchinoe** Burton
P. scotti (Dendy)

Genus **Rhaphidophlus** Ehlers
R. coriocrassus n.sp.
**R. anchoratum* (Carter)

Genus **Ophlitaspongia** Bowerbank
O. oxeata n.sp.
O. reticulata n.sp.
O. sp.

Genus **Isociella** Hallmann
I. incrustans Bergquist

Genus **Axociella** Hallmann
A. macrotoxa n.sp.
A. toxitenuis n.sp.
A. multitoxaformis n.sp.

Genus **Artemisina** Vosmaer
A. jovis Dendy
**A. elegantula* Dendy

Genus **Plocamia** Schmidt
P. novizelanicum (Ridley)
**P. prima* (Brøndsted)

Genus **Axoplocamia** Burton
**A. ornata* (Dendy)

SYSTEMATICS

Order POECILOSCLERIDA Topsent

Demospongiae with a main skeleton composed of megascleres which may be monactinal, diactinal, or both, and including spongin in amounts varying from an interspicular cement to distinct fibres. Both fibre and mineral skeletons always show regional differentiation, which most frequently extends to development of distinct categories of ectosomal and choanosomal megascleres defined in terms of disposition and/or structure. Acanthostyles may be present. Microsclere types are diverse, frequently chelate, sigmoid, toxiform, or rhaphoid with many structural variants. Larvae are incubated parenchymellae, incompletely ciliated with the posterior pole bare; the anterior and posterior poles may show differential pigmentation.

Family MYCALIDAE Lundbeck, 1905

DIAGNOSIS: Poecilosclerida with a plumose or plumo-reticulate choanosomal skeleton. The megascleres are monactinal, usually styles or subtylostyles. The ectosomal skeleton, if present, consists of the same spicules that constitute the choanosomal skeleton. The microscleres always include anisochelae or isochelae, to which may be added toxas, sigmas, and rhaphides of many types.

REMARKS: This diagnosis has been expanded to include the genus *Esperiopsis* which some authors had previously placed in the Desmacidonidae (Esperiopsidae *sensu* Lévi 1973, van Soest 1984). Justification for including *Esperiopsis* in the Mycalidae rests upon the presence in *Esperiopsis* of monactinal megascleres of one type only, a plumose or plumo-reticulate choanosomal skeleton, and diverse microscleres which always include palmate isochelae.

The type of *Esperiopsis, E. villosa*, is very similar in morphology to species described as *Mycale* subgenus *Mycale* by van Soest (1984), but *E. villosa* does not have the anisochelae characteristic of *Mycale*. *Esperiopsis* at present includes many species, not all of which conform to the original generic description. A revision of *Esperiopsis* and the incorrectly associated genus *Amphilectus* is obviously necessary, but cannot be undertaken on the basis of the species represented within New Zealand. The indications from study of the New Zealand representatives are that they fall into three genera and two families. Some species may ultimately be placed in the Clathriidae where they most closely resemble *Isociella*. Other species conform to the diagnosis of *Esperiopsis* as defined by Carter (1882) and would remain in that genus. The remainder are effectively of the "reduced *Esperiopsis*" type. A full discussion of this problem is included after the diagnosis of *Esperiopsis*.

Mycale Gray, 1867

Esperella Vosmaer, 1885

DIAGNOSIS: Mycalidae in which the choanosomal skeleton consists of plumose or plumo-reticulate tracts of styles or subtylostyles. The ectosomal skeleton consists of spicules identical to those making up the choanosomal skeleton, but arranged as a multi-layered tangential skeleton supported by erect spicule brushes (Fig. 6a). Microscleres are anisochelae, which may be accompanied by sigmas and rhaphides. The sponge surface is marked by pore grooves and plates.

TYPE SPECIES: *Hymeniacidon lingua* Bowerbank, 1866

REMARKS: This diagnosis is adapted from the description by van Soest (1984) of the sub-genus *Mycale*. The species of Mycalidae described from New Zealand fall into the sub-generic categories outlined by van Soest. He recognised four sub-generic groups within *Mycale* on the basis of habit, ectosomal skeleton, choanosomal skeleton, microsclere types present, number of size categories of microsclere present, and size of megascleres. These are the same characters used as generic discriminators in other poecilosclerid families; thus, to maintain uniformity within the order, van Soest's sub-genera are given generic status in this study.

There have been three attempts to date to subdivide the large genus *Mycale*. Topsent (1924), working with European species, distinguished four sub-genera.

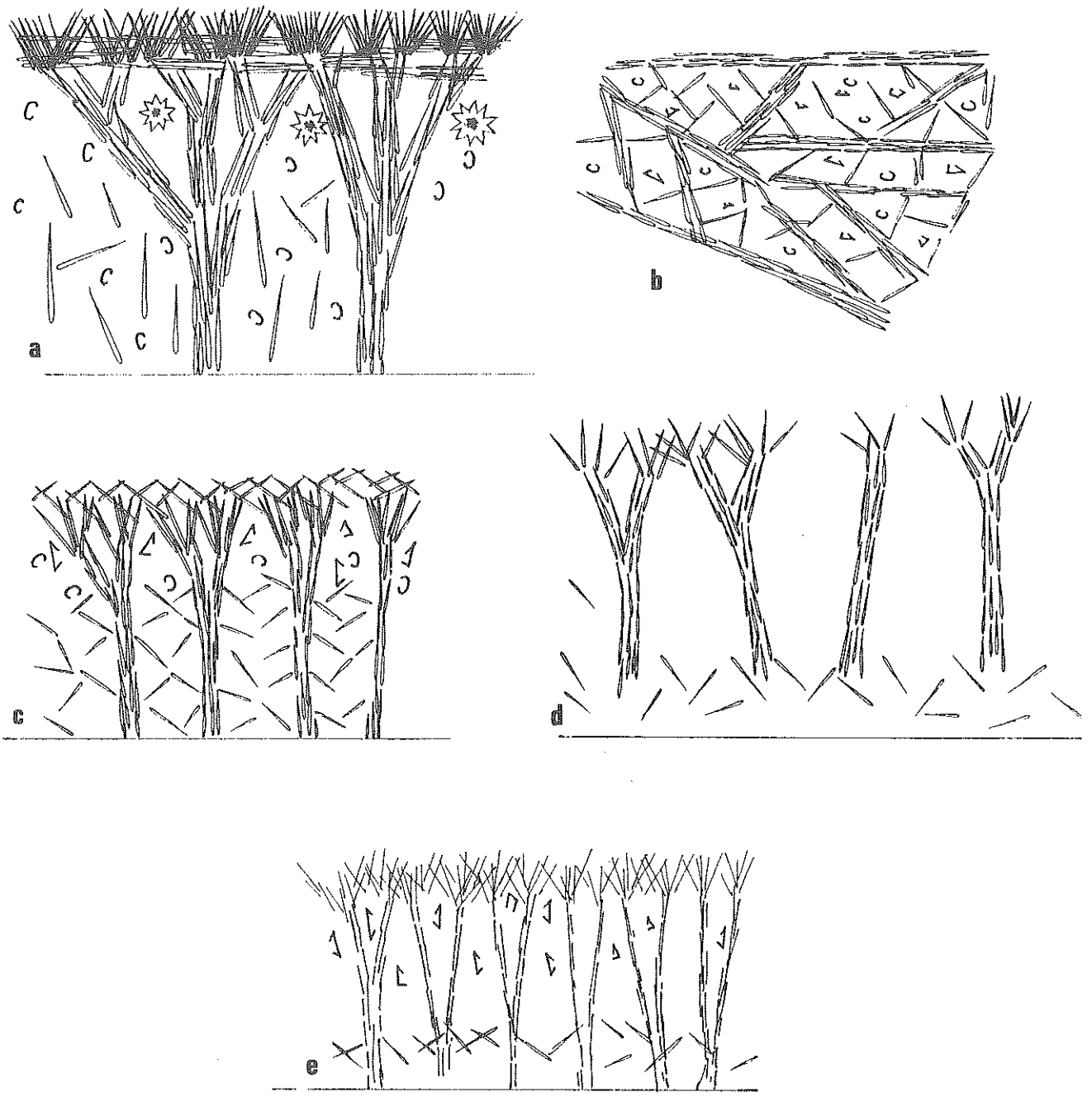

FIG. 6. Skeletal organisation in some genera of the family Mycalidae. a, *Mycale novaezealandiae* Dendy and *M. murrayi* (Ridley & Dendy). b, c, *Aegogropila flagelliformis* n.sp: b, surface detail; c, choanosomal skeleton. d, *Carmia macilenta* (Bowerbank). e, *Carmia tasmani* n.sp.

These were *Mycale* Gray, 1867, *Aegogropila* Gray, 1867 and *Carmia* Gray, 1867, which were differentiated on the basis of skeletal structure, and *Anomomycale* Topsent, 1924, which was distinguished by having peculiar anisochelae.

De Laubenfels (1936) divided *Mycale* on the basis of microsclere content and placed toxa-containing species in the genus *Carmia*. *Mycale* was reserved for species with palmate anisochelae and sigmas, and *Mycalecarmia* was proposed for species with anisochelae and rhaphides. Both Topsent (1924) and van Soest (1984) considered division on the basis of microsclere content only to be unsound.

Van Soest (1984) re-evaluated Topsent's subdivision and considered twenty-seven species. He recognised four groups of *Mycale*, three of which occur in

New Zealand and are given generic status: *Mycale, Aegogropila* and *Carmia*. The fourth group, *Acamasina*, includes species that exude large amounts of mucous. Preserving the skeleton of these sponges for microscopic examination requires fixing the sponges underwater. These species are known from West Australia and Jamaica but have not been found in New Zealand. In some mycalid sponges the canal to tissue ratio is very high and this morphology, in conjunction with histological characters, could provide additional factors to assist in diagnosing further genera within the Mycalidae.

Mycale novaezealandiae Dendy (Plate 1, A–C)

Mycale novae zealandiae Dendy, 1924: 339, pl. v fig. 3, pl. xiii figs 6–13.

MATERIAL EXAMINED: BM(NH) 23.10.1.102, Three Kings Islands, 183 m (holotype). NZOI Stns B93, Three Kings Islands, 55–110 m; J957, Three Kings Islands, 10–33 m.

DESCRIPTION: The preserved material is not intact, so therefore it is difficult to add to the type description. Dendy's specimen was pear-shaped and attached by the narrow end. Strongly developed spicule tracts are visible macroscopically in the collapsed choanosome of the sponge.

DIMENSIONS: Height 84 mm; maximum width 44 mm.

COLOUR: In life, yellow brown (5.0Y 7/8); in spirit, light brown (2.5Y 6/4), spicule tracts greyish-white.

TEXTURE: The sponge is soft and compressible.

SURFACE: The surface is irregular and microscopically hispid. Pores 0.5 mm wide are found at the apices of small turrets 2.0 mm high.

SKELETON: The choanosomal skeleton consists of plumose tracts of styles up to 230 μm wide. The tracts may branch but there is no irregular reticulation as described by Dendy. At the surface, the tracts divide into well-developed dermal brushes which project through the dermal membrane. This membrane supports tangential styles. The large anisochelae, arrayed in rosettes, are abundant throughout the ectosome and are also found in the choanosome (Plate 1, A).

SPICULES (Plate 1, B, C):
Megascleres: Long straight styles that can look almost oxeote. They have narrow heads, wide shafts, and are sharply pointed at the apex. There are two size classes; large styles, which are found in the spicule tracts, and small styles, which are found in the ectosomal skeleton.
Microscleres: Large anisochelae (Plate 1, C), medium and small anisochelae, and palmate chelae of normal form. Sigmas, in two size ranges. Rhaphides, which are very fine and are found in trichodragmata or in large balls.
For spicule dimensions *see* Table 1.

REMARKS: The large styles measured in the holotype were broken in the spicule mounts of the two Three Kings Islands specimens. Dendy (1924) commented that *Mycale novaezealandiae* was related to the North Atlantic species *M. placoides* and *M. lingua*, and the Australian species *M. murrayi*. A characteristic feature of all these species is the presence of surface pore grooves and this character has been incorporated into the generic diagnosis.

TABLE 1. Spicule dimensions of *Mycale novaezealandiae*.

Locality		Large styles (μm)	Small styles (μm)	Large anisochelae (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Large sigmas (μm)	Small sigmas (μm)	Rhaphides (μm)
HOLOTYPE Three Kings Is Dendy (1924)		up to 1120 × 24	approx. 500 × 16	88	36	24	80	16	80 × 1.6
HOLOTYPE remeasured	x̄	1119 × 22	618 × 19	86	32	25	62	25	81
	Range	925–1300 × 15–25	500–825 × 14–26	75–92	28–35	21–28	55–70	18–38	75–90
NZOI Stn J957, Three Kings Is, 10–33 m	x̄	not present in spicule mount	447 × 11	81	31	21	47	14	84
	Range		300–610 × 8–14	70–88	28–34	18–23	40–60	11–16	75–93
NZOI Stn B93, Three Kings Is, 55–110 m	x̄	not present in spicule mount	566 × 12	88	27	22	73	24	90
	Range		475–675 × 10–15	75–95	26–30	18–23	50–115	15–28	75–103

Mycale murrayi (Ridley & Dendy)
(Plates 1, D–F; 2, A–C)

Esperella murrayi Ridley & Dendy, 1886: 338; 1887: 67, pl. xiii figs 11, 13, 14, 16, 17, 18, pl. xiv figs 1, 1a; Whitelegge 1906: 469.

MATERIAL EXAMINED: BM(NH), Port Jackson, Australia, 55–64 m (holotype, skeletal slide). NZOI Stns E271, west of Cape Maria van Diemen, 134 m; J953, western continental slope, Northland, 260–270 m; J970, off Cape Brett, 86–91 m. Cuvier Island, 77 m.

DESCRIPTION: The sponges are massive or globular, tapering to a constricted basal stem.

DIMENSIONS: Piece of holotype: height 80 mm; width 70 mm; thickness 45 mm. Sponge from NZOI Stn J953: overall height 50 mm, height of stem 15 mm, width × thickness of stem 15 × 15 mm, width × thickness of sponge body 27 × 20 mm.

COLOUR: In life, pale yellow; in spirit, fawn (2.5Y 7/5).

TEXTURE: Soft and compressible.

SURFACE: The surface is corrugated with grooves in which pores up to 5.0 mm wide are located (Plate 1, D). The surface is microscopically hispid and coarse to the touch.

SKELETON: The choanosomal skeleton consists of plumose tracts up to 300 μm wide, made up of styles (Plate 1, E). The tracts branch but do not form a reticulation. Styles are strewn interstitially as well. Near the surface the tracts divide into well-developed dermal brushes that extend beyond the dermal membrane. Tangential styles are present in the dermal membrane (Plate 1, F). Rosettes of large anisochelae are present in the ectosome and choanosome (Plate 2, A). All other microscleres are abundant throughout the sponge.

SPICULES (Plate 2, B,C):
Megascleres: Long straight styles that tend towards anisostrongyloxeas in shape. They taper towards a narrow head, have a wide shaft and a short, sharp point.
Microscleres: Palmate anisochelae of normal form which are found in three size classes. Sigmas of normal form and in two size classes. Rhaphides occurring in trichodragmata.
For spicule dimensions *see* Table 2.

REMARKS: Ridley and Dendy (1887) described *Mycale murrayi* from Port Jackson, Australia. The shape and size of the styles, large anisochelae, large sigmas and rhaphides are identical in the Australian and New Zealand specimens (Table 2). Ridley and Dendy did not give the size of the small anisochelae although these were mentioned in the description. There was no mention of a small size category of sigmas, but these may have been overlooked. Ridley and Dendy stated that the choanosomal skeleton was reticulate; neither the slide of the type specimen nor the New Zealand specimens show any reticulation. No spicules of the type specimen of *M. murrayi* have been examined but the description is in close agreement with the New Zealand specimens and the skeletons are identical.

M. murrayi is similar to *M. novaezealandiae*. The

TABLE 2. Spicule dimensions of *Mycale murrayi*.

Locality		Styles (μm)	Large anisochelae (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Large sigmas (μm)	Small sigmas (μm)	Rhaphides (μm)
TYPE Port Jackson, 55–64 m Ridley & Dendy (1887)		700 × 19	72	size not given	size not given	53	not mentioned in description	76
NZOI Stn J970, off Cape Brett, 86–91 m	x̄	674 × 19	91	41	23	47	31	72
	Range	610–725 × 19–20	70–105	33–52	20–30	42–55	28–35	60–80
NZOI Stn E271, 134 m	x̄	577 × 16	84	31	22	52	19	63
	Range	490–660 × 12.5–19	78–92	30–33	18–30	42–60	15–22	55–70
NZOI Stn J953, 260–270 m	x̄	614 × 18	100	41	21	53	25	74
	Range	550–730 × 15–22	92–110	36–55	20–22	36–61	18–31	63–88
Cuvier Island, 77 m	x̄	536 × 18	99	41	31	51	21	77
	Range	245–665 × 14–22	88–110	36–50	26–33	40–56	18–28	63–85

overall shape of the sponges, surface characteristics, skeletal structure and spicule complement, are very close. The two species can be distinguished easily by the shape of the large anisochelae (cf. Plates 1, C and 2, C).

OTHER RECORDS: Botany Bay, 37–71 m.

***Mycale rara** Dendy, 1895

Esperella rara Dendy, 1895: 18.
Mycale rara. Bergquist 1961a: 39.

REMARKS: Only a few fragments remain of the one specimen of this species which was identified by Burton. These fragments do not agree at all closely with Dendy's description; not only are trichodragmata absent but the spicule complement includes subtylostyles, styles, toxas, and isochelae. The specimen appears to be an *Axociella.* Until more material becomes available no further comment can be made, except that the record of *M. rara* from New Zealand must be regarded as doubtful.

OTHER RECORDS: Australia.

Aegogropila Gray, 1867

DIAGNOSIS: Mycalidae with a choanosomal skeleton of plumose tracts of styles or subtylostyles. Between the tracts is a loose reticulation of single spicules. The ectosomal skeleton consists of a neat tangential reticulation of spicules of the same type as found in the choanosome and supported by dermal brushes (Fig. 6b, c). Microscleres are anisochelae, which may be accompanied by sigmas and rhaphides.

TYPE SPECIES: *Halichondria aegogropila* Johnston, 1842

REMARKS: Van Soest (1984) defined this sub-group on the presence of the ectosomal reticulation, the choanosomal skeleton of primary tracts with a reticulation between them, and intermediate sized megascleres. The megascleres of *Aegogropila flagelliformis* are smaller than those found in *Mycale novaezealandiae* and *M. murrayi*, and larger than those in the species of *Carmia* found in New Zealand. Megasclere size is not included in the generic diagnosis as it is not considered to be a reliable generic character.

Aegogropila flagelliformis n.sp.
(Plates 2, D–F; 3, A, B)

MATERIAL EXAMINED: Barren Arch, Poor Knights Islands, 18 m; North Channel, Kawau Island, 18 m; North Channel, Kawau Island, 16 m; Fantail Bay, 33 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 88.

TYPE LOCALITY: North Channel, Kawau Island, 18 m.

DESCRIPTION: A soft amorphous sponge which varies in form according to substrate. It is usually found growing over bivalve shells, where it has an inflated appearance resembling a coelosphaerid without fistules. Where the sponge binds several shells together it becomes more compact, and the dermal membrane adheres closely to the choanosomal spicule tracts.

DIMENSIONS: Height 7–40 mm, length 40–80 mm, width 31–64 mm, thickness of dermal membrane 0.3 mm.

COLOUR: In life, white or grey-white to pale orange (10.0YR 8/8–7.5YR 7/10); in spirit, grey-white to pale brown (5.0Y 8/2–5.0Y 6/4).

TEXTURE: The sponge is papery externally, soft and pulpy internally.

SURFACE: The surface is smooth superficially, but is lightly folded and microscopically hispid (Plate 2, D).

SKELETON: The choanosomal skeleton consists of plumose tracts of subtylostyles which form simple columns with minimal branching (Plate 2, E). Between the tracts there is a disorganised reticulation of single subtylostyles. Beneath the surface of the sponge (1.5 mm) the choanosomal tracts branch and expand to form dermal brushes. The ectosomal skeleton consists of a neat tangential reticulation of subtylostyles (Plate 2, F).

SPICULES (Plate 3, A, B):
Megascleres: Smooth, slender subtylostyles with a faintly expanded head and short sharp point.
Microscleres: Palmate anisochelae of normal form in three size classes. Large C-shaped sigmas in two size classes; the larger are flagelliform, the smaller may be flagelliform or of normal form.
For spicule dimensions *see* Table 3.

REMARKS: This species is characterised by the papery exterior, the neat ectosomal skeleton and the large flagelliform sigmas. In external appearance it is similar to *Mycale fistulata* Hentschel, 1911, but differs considerably from this species in spicule complement.

Carmia Gray, 1867

DIAGNOSIS: Mycalidae with a choanosomal skeleton of dendritic-plumose tracts of styles or subtylostyles. There is no definite ectosomal skeleton, rather, the plumose tracts extend to the surface of the sponge where occasionally they expand slightly into brushes (Fig. 6d, e). Microscleres are anisochelae, which may be accompanied by sigmas and toxas.

TYPE SPECIES: *Hymeniacidon macilenta* Bowerbank, 1866

REMARKS: Van Soest (1984) recognised the sub-genus *Carmia* on the basis of the lack of a definite ectosomal skeleton, a plumose choanosomal skeleton, and generally a low density of intermediate to "feeble-sized"

TABLE 3. Spicule dimensions of *Aegogropila flagelliformis*.

Locality		Subtylostyles (μm)	Large anisochelae (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Large sigmas (μm)	Small sigmas (μm)
North Channel, Kawau Island, 18 m	x̄	473 × 8	76	31	24	44	26
	Range	430–500 × 6–9	72–80	30–32	20–28	30–52	18–30
North Channel, Kawau Island, 16 m	x̄	465 × 9	74	30	20	48	36
	Range	440–490 × 6.5–11.5	68–80	28–31	18–22	40–65	32–45
Fantail Bay, 33 m	x̄	470 × 12	81	30	21	50	28
	Range	390–540 × 9.5–14	75–90	25–35	18–24	40–60	20–35
Barren Arch, Poor Knights Is, 18 m	x̄	479 × 8	69	29	23	48	34
	Range	442–500 × 6–10.5	60–75	26–32	20–25	40–55	23–42

spicules. The megascleres of the New Zealand species of *Carmia* are of intermediate to small size, and in some specimens are not abundant.

Carmia macilenta (Bowerbank) (Plate 3, C–F)

RESTRICTED SYNONYMY:
Hymeniacidon macilenta Bowerbank, 1866: 176.
Mycale macilenta. Topsent 1924: 105, figs 11, 12.
Carmia macilenta. de Laubenfels 1936: 116; Lévi 1963: fig. 6.

MATERIAL EXAMINED: BM(NH) 36.1.2.1; Muriwai Beach, intertidal; Ladies Bay Reef, intertidal.

DESCRIPTION: The sponge is a thin encrustation, growing on the under surfaces of rocks about the mid-tidal region.

DIMENSIONS: Thickness 1.0–1.5 mm; extent of spread approx. 15 × 30 mm.

COLOUR: In life, dull orange (2.5YR 5/8); in spirit, cream to grey.

TEXTURE: The living sponge is elastic but upon preservation becomes soft and spongy.

SURFACE: The surface is smooth but irregular. Pores are not visible in the preserved material.

SKELETON: The choanosomal skeleton consists of plumose branching tracts of subtylostyles up to 120 μm wide (Plate 3, C). There is no fibre development or reticulation formed and single subtylostyles lie at various angles between the tracts. The ectosomal skeleton is not well-developed and consists of the choanosomal tracts expanding to form irregularly spaced dermal brushes (Plate 3, D).

SPICULES (Plate 3, E, F):
Megascleres: Short, slender subtylostyles with slightly expanded heads and elongate tapered points.
Microscleres: Palmate anisochelae that occur in three size classes, but are always identical in form. Sigmas, in two size ranges. Rare toxas with a slight central flexure and considerable range in size.
For spicule dimensions *see* Table 4.

REMARKS: This description is in close agreement with published descriptions of the species.

OTHER RECORDS: Atlantic coasts of Europe; Mediterranean Sea; South Africa.

Carmia tasmani n.sp. (Plate 4, A–F)

MATERIAL EXAMINED: Maui A Platform, near New Plymouth, 33–37 m (3 specimens).

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 85.

TYPE LOCALITY: Maui A Platform, near New Plymouth, 37 m.

DESCRIPTION: Two of the specimens are soft and amorphous because of preservation in formalin; the third specimen has remained compact and is a thin encrusting sponge.

DIMENSIONS: Thin encrusting specimen (Plate 4, A): height 4 mm; length 85 mm; width 70 mm. Poorly preserved specimens (Plate 4, B): height 7–30 mm; length 70–120 mm; width 50–90 mm.

COLOUR: In life, purple exterior, yellow interior; in spirit, pink (10.0R 6/6) to fawn (10.0YR 8/4).

TEXTURE: Soft, compressible; the sponge pulls apart easily.

SURFACE: All specimens have smooth but uneven surfaces with oscules 2.5 mm wide.

TABLE 4. Spicule dimensions of *Carmia macilenta*.

Locality		Subtylostyles (μm)	Large anisochelae (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Large sigmas (μm)	Small sigmas (μm)	Toxas (μm)
TYPE BM(NH)36.1.2.1 remeasured	x̄	252 × 6	38	21	13	only broken sigmas in slide	21	not present in spicule mount
	Range	240–265 × 4–7.5	35–40	18–25	11.5–15		11–28	
Muriwai Beach, intertidal	x̄	221 × 5	42	25	13	92	36	95
	Range	198–230 × 3.5–6	40–48	23–27	11–16	85–98	28–43	48–150
Ladies Bay Reef, intertidal	x̄	220 × 6	45	24	13	96	21	90
	Range	203–232 × 6	42–47	23–29	11–15	87–102	17–24	70–110

SKELETON: The thicker sponges have plumose branching tracts of subtylostyles in the choanosome, and in basal regions these tracts are poorly developed and spicule density generally low. Near the surface the tracts are more clearly defined and form sparse dermal brushes. Some subtylostyles, sigmas, and anisochelae are dispersed in the choanosome. Both specimens are invested with filamentous algae.

In the thin encrusting sponge the choanosomal tracts are plumose, well-defined and abundant (Plate 4, C). There is no definite ectosomal skeleton and well-defined choanosomal tracts extend to the surface of the sponge (Plate 4, D).

SPICULES (Plate 4, E, F):
Megascleres: Slender subtylostyles with rounded subtylote heads, and with a constriction beneath the head. They taper to long points.

Microscleres: Palmate anisochelae of three sizes and normal form. Large sigmas, up to 6 μm thick; C-, S-, or hook-shaped. Fine toxas with a wide central flexure and slightly recurved ends.
For spicule dimensions *see* Table 5.

REMARKS: This species is characterised by large thick sigmas, and well-defined plumose skeletal tracts with no separate ectosomal skeleton.

Carmia tasmani is closely related to *Mycale arenicola* Ridley and Dendy, 1887 from Bass Strait. *Mycale arenicola* has a loosely structured choanosomal skeleton and no dermal reticulation. The skeleton of *M. arenicola* incorporates some foreign material, which was also seen in *Carmia tasmani*. The spicule complements differ however; there are rhaphides in the Australian species, and the subtylostyles are larger than those of the New Zealand species.

TABLE 5. Spicule dimensions of *Carmia tasmani*.

Locality		Subtylostyles (μm)	Large anisochelae (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Sigmas (μm)	Toxas (μm)
Maui A platform, 37 m	x̄	195 × 3	39	23	13	79	92
	Range	175–210 × 3–4.5	32–44	20–29	11.5–14	65–90	70–110
Maui A platform, 37 m (thin encruster)	x̄	226 × 4	41	25	14	88	99
	Range	208–242 × 3.5–4	40–42	23–26	13–15	82–92	75–130
Maui A platform, 33 m	x̄	230 × 5	41	25	15	99	130
	Range	220–240 × 4.5–5	38–45	21–30	12.5–15	90–104	90–203

Carmia hentscheli n.sp. (Plate 5, A–D)

MATERIAL EXAMINED: Anchor Bay, Tokatu, 4.5 m; Maori Bay, intertidal; Harrington Point, Dunedin, 12 m; Portobello, 6 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 86.

TYPE LOCALITY: Anchor Bay, 4.5 m.

ETYMOLOGY: This species is named after the German sponge authority, Dr E. Hentschel.

DESCRIPTION: A thick encrusting amorphous sponge. Some mucous is discharged when the sponge is collected (Plate 5, A).

DIMENSIONS: Thickness up to 20 mm; exent of growth 80 × 90 mm.

COLOUR: In life, black-red to dark purple exterior (7.5R 2/2–7.5RP 3/2), yellow or orange interior (10.0YR 6/10–7.5YR 6/8); in spirit, fawn (10.0YR 6/4).

TEXTURE: Soft and compressible; the sponge pulls apart easily.

SURFACE: The sponge is impregnated with filamentous algae which force the dermal membrane into irregular conules. Otherwise the surface is smooth, and occasional oscules (3.0 mm wide) flush with the surface are present.

SKELETON: The choanosomal skeleton consists of irregular dendritic or plumose tracts of subtylostyles, occasionally branching and anastomosing. Sand grains and other foreign material have been incorporated into the spicule tracts, which may form a reticulation (Plate 5, B). Subtylostyles are also found loose interstitially. The ectosomal skeleton consists of sparse dermal brushes of subtylostyles (Plate 5, C).

SPICULES (Plate 5, D):
Megascleres: Smooth subtylostyles with a swollen subtylote head and a constriction beneath the head. The shaft is thick, and the point short and sharp.
Microscleres: Palmate anisochelae of two sizes; the larger size has a bent shaft. Very fine sigmas that are not abundant.
For spicule dimensions *see* Table 6.

TABLE 6. Spicule dimensions of *Carmia hentscheli*.

Locality		Subtylostyles (μm)	Medium anisochelae (μm)	Small anisochelae (μm)	Sigmas (μm)
Anchor Bay, Tokatu, 4.5 m	x̄	229 × 6	24	18	21
	Range	222–232 × 5.5–7.5	21–26	17–20	20–23
Harrington Pt, Dunedin, 12 m	x̄	227 × 5	22	15	24
	Range	198–240 × 3.5–6	20–25	13–17	20–30
Maori Bay, intertidal	x̄	249 × 6	21	17	23
	Range	230–260 × 5–6.5	18–23	15–18	21–25
Portobello, Dunedin, 6 m	x̄	254 × 6	24	19	24
	Range	210–270 × 4.5–7.5	22–26	16–21	20–28
Harrington Pt, Dunedin, 12 m	x̄	222 × 4	22	15	24
	Range	205–235 × 3–5	20–26	13–20	20–28

REMARKS: *Carmia hentscheli* is similar in gross morphology and colour to *C. tasmani*. *Carmia hentscheli* is characterised by having a reduced spicule density, a weakly developed choanosomal skeleton which may form a loose reticulation, and no ectosomal skeleton. This species differs from *Carmia tasmani* in its reduced spicule complement, and in the tendency for the skeleton to become reticulate. *Carmia hentscheli* has two sizes of anisochelae, which are both small and difficult to distinguish from each other, and small thin sigmas quite different from the large sigmas found in *C. tasmani*.

This species is closely related to *Mycale phyllophila* Hentschel, 1911, from West Australia, and recorded by Lévi (1963) from South Africa. The external appearance, habitat, skeletal characters including the incorporation of foreign material, and reduced spicule complement, are in agreement. *Carmia hentscheli* has larger palmate anisochelae and smaller sigmas than found in *M. phyllophila* and these differences justify separation of the species until material of *M. phyllophila* can be examined.

Paresperella Dendy, 1905

DIAGNOSIS: Mycalidae in which the choanosomal skeleton consists of plumose or plumo-reticulate tracts of styles or subtylostyles. The ectosomal skeleton, if present, consists of the same spicules that constitute the choanosomal skeleton. Microscleres are anisochelae and serrated sigmas, to which may be added toxas and other microsclere forms.

TYPE SPECIES: *Esperia serratohamata* Carter, 1880

REMARKS: Dendy (1905) established this genus for species of Mycalidae with serrated sigmas. The genus is recognised by Bergquist (1978), Lévi (1963, 1973) and van Soest (1984). Van Soest discussed the possession of serrated sigmas, and concluded that this was a sufficiently distinct character to assume that the species possessing them are a monophyletic group. Nonetheless, it should be pointed out that this is a genus characterised solely by microsclere complement.

Paresperella microsigma n.sp.

(Plates 5, E, F; 6, A)

MATERIAL EXAMINED: Kawau Channel; Dunedin, 73–110 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 89.

TYPE LOCALITY: Dunedin, 73–110 m.

DESCRIPTION: Both sponges are incomplete. They are encrusting specimens overgrowing barnacles and worm tubes.

DIMENSIONS: Thickness 7 mm; extent of piece of sponge 27 × 25 mm.

COLOUR: In life, pale orange; in spirit, cream.

TEXTURE: The sponge is soft and compressible.

SURFACE: The surface is smooth, but with little of the surface intact further description is not possible.

SKELETON: The choanosomal skeleton consists of branching plumose tracts of subtylostyles which occasionally anastomose (Plate 5, E). Some fibre development surrounds the tracts. Many subtylostyles lie at various angles throughout the choanosome. The ectosomal skeleton consists of a reticulation of tangential subtylostyles (Plate 5, F) supported by spicule brushes that extend from the tracts in the choanosome. Rosettes of anisochelae and sigmas are present in the dermal skeleton and in the choanosome.

SPICULES (Plate 6, A):
Megascleres: Slender wavy subtylostyles with slightly expanded heads and elongate points.
Microscleres: Palmate anisochelae of normal form, in two size classes. Sigmas with serrated heads (Plate 6, A).
For spicule dimensions *see* Table 7.

REMARKS: This species is characterised by the possession of small serrated sigmas in conjunction with a typical mycalid skeleton.

Few species of *Paresperella* have been described. Dendy (1905) recorded two species from Ceylon, *P. serratohamata* Carter, which has toxas, and *P. bidentata* Dendy, which has large serrated sigmas. Lévi (1963) described two new species from South Africa, both with considerably larger sigmas than are found in *Paresperella microsigma.*

TABLE 7. Spicule dimensions of *Paresperella microsigma.*

Locality		Subtylostyles (μm)	Large anisochelae (μm)	Small anisochelae (μm)	Sigmas (μm)
Kawau Channel	x̄	299 × 6	74	31	12
	Range	272–330 × 5–7	70–80	26–33	11–13
Dunedin, 73–110 m	x̄	333 × 7	71	36	14.5
	Range	285–360 × 5–8	66–76	32–40	13–15

Esperiopsis Carter, 1882

Mycalopsis Topsent, 1927
Brondstedia Burton, 1929

DIAGNOSIS: Mycalidae in which the choanosomal skeleton consists of plumose or plumo-reticulate tracts of styles, or subtylostyles. Styles may be scattered interstitially, and spongin fibre development may occur in some species. The ectosomal skeleton, if present, consists of the same spicules that constitute the choanosomal skeleton. Microscleres are palmate isochelae, which may be accompanied by sigmas, toxas, and rhaphides.

TYPE SPECIES: *Esperia villosa* Carter, 1874.

REMARKS: The genus *Esperiopsis* presently includes a large number of species with varying growth forms, skeletal structures, and spicule complements. For the purposes of this discussion the genus is treated as falling into two subgroups.

Sub-group one: Carter (1882) established *Esperiopsis* for species similar to those of *Mycale*, except in having palmate isochelae rather than anisochelae. Carter described the species of *Esperiopsis* as having mycalid structure in the fibre skeleton, mycalid skeletal spicules, large microscleres, massive and encrusting growth forms, and isochelae. The type species, *E. villosa*, has large monactinal spicules, sigmas, and three sizes of isochelae. The skeletal structure is similar to species placed in *Mycale* subgenus *Mycale* by van Soest (1984). The large isochelae occur in rosettes and a tangential ectosomal skeleton is present. *Esperiopsis macrosigma* var. *novaezealandiae* and *E. megachela* from New Zealand conform to this diagnosis of *Esperiopsis.*

Sub-group two: Species have been included in the genus *Esperiopsis* that have small monactinal spicules, no sigmas, and a single small category of palmate isochelae. These species usually have a disorganised reticulate skeleton formed by primary tracts of styles, and linked by tracts of one to three styles. There is no ectosomal skeleton. Occasionally species have been described that have two sizes of monactinal spicules, e.g., *E. normani* Lundbeck, 1905, and *E. cylindrica* Ridley and Dendy, 1887. The thinner styles have usually been described as developmental forms; Ridley and Dendy, however, described them as occurring in surface tufts in *E. cylindrica.*

This sub-group of *Esperiopsis* is characterised by having a reticulate skeleton that is frequently irregular, small monactinal spicules of one or two categories, and one category of small palmate isochelae. The species in this sub-group could be described as "reduced *Esperiopsis*", corresponding to the "reduced

Mycale's", subgenus *Carmia* (van Soest 1984). All species which have been assigned to *Esperiopsis* need to be studied to ascertain whether this sub-group distinction is consistent before it is formalised as a generic distinction.

There has also been confusion with various interpretations of the diagnosis of *Amphilectus* Vosmaer, 1880, to which Burton (1932) referred a number of species of *Esperiopsis*. Vosmaer established *Amphilectus* with the following diagnosis: "Rods smooth or spined. Anchors bi- or tri-dentate, or palmato-dentate, equi- or inequiended. Neither true 'keratode-fibre', as in *Desmacidon*, nor total absence of it as in the slimy *Myxilla*". He named the type species as *Isodictya gracilis* Bowerbank, 1866, which has arcuate isochelae. Vosmaer placed forty-one other species in this genus, which he considered to be the "living stock" of genera such as *Esperia, Desmacidon*, and *Myxilla*. He included in *Amphilectus* species whose affinities were difficult to identify, or which did not show the distinct characters of the above genera, and also, provisionally, species he considered to be imperfectly described. Dendy (1921) concluded that the genus as originally proposed "was a sort of zoological waste-paper basket", and he redefined *Amphilectus* as follows: "Megascleres smooth styles or tylostyles. Microscleres isochelae with three or more teeth at each end. External form without definite symmetry." Dendy thus restricted the genus to species with styles and arcuate isochelae, which adheres to the original description of the type species by Bowerbank (1866). Burton (1929) incorrectly restricted the diagnosis of the genus further: "Mycaleae with a reticulate skeleton of short styles, microscleres small palmate isochelae. No special dermal skeleton." Burton did this on the basis that the type species, *A. gracilis*, was a synonym of *A fucorum*. *Amphilectus fucorum* has palmate isochelae, but as mentioned above, *A. gracilis* has arcuate isochelae, and the two species are not synonymous. Hence Burton's use of *Amphilectus* for species with palmate isochelae is totally incorrect.

Amphilectus may yet need to be declared unrecognisable on the basis of the imperfectly known type species, and the numerous generic types subsequently allocated to it. Species such as *A. gracilis* may have desmacidonid affinities, some like *A. fucorum* may be "reduced *Esperiopsis*", while others may have clathriid affinities, e.g., *Amphilectus apollinis* Ridley and Dendy, 1887, with spined toxas, may belong in *Artemisina*. Lack of specimens precludes a full discussion of these ideas, but a review of the species in *Amphilectus* is required if the genus *Esperiopsis* is to become well-defined. Burton (1932) referred more than twenty species of *Esperiopsis* and *Amphilectus* in synonymy with *Amphilectus fucorum*, and these species would all need to be examined to establish their correct generic placement.

The genus *Mycalopsis* Topsent, 1927, has been synonymised with *Esperiopsis*. *Mycalopsis* was established for Mycalinae with palmate isochelae of several size groups and monactinal megascleres, and differs from *Esperiopsis* only in lacking sigmas. The two genera are similar in other characters and the absence of a microsclere category is not alone considered sufficient reason to retain the two genera.

***Esperiopsis glaber** Brøndsted (Plate 6, B, C)

Esperiopsis glaber Brøndsted, 1923: 141, fig. 20a–c.
Brondstedia glaber. Burton 1929: 428.

MATERIAL EXAMINED: Campbell Island, intertidal (type, Copenhagen Museum).

DESCRIPTION: The sponge is poorly preserved but was a thick encrustation.

DIMENSIONS: Length 25 mm; width 20 mm; thickness 15 mm.

COLOUR: The colour in life was not recorded by Brøndsted; in spirit, pinkish-brown (5.0YR 5/4).

TEXTURE: Soft; the sponge falls apart when touched.

SURFACE: The surface lacks any form of dermal membrane, and is porous and uneven. Large oscules are visible in clusters of two or three, and each oscule is approximately 1.0–2.0 mm wide.

SKELETON: The choanosomal skeleton is a disorganised reticulation with some fibre development. The reticulation consists of plumose tracts 800 μm wide extending for short distances and cored by styles, which are also scattered interstitially. No microscleres are visible (Plate 6, B).

SPICULES (Plate 6, C):
Megascleres: Slightly curved, smooth styles, 250–325 × 6.5–9.5 μm ($\bar{x}$ = 287 × 8 μm).
Microscleres: None?

REMARKS: Brøndsted (1923) stated that the skeleton of *Esperiopsis glaber* "... consists of fairly well-developed main fibres ... a tolerably regular network of rectangular meshes ... a special dermal skeleton ... parallel with and just beneath the surface." Fibre development was not common in the type material examined while the collapsed condition of the preserved specimen may be responsible for the absence of an organised reticulation in the choanosomal skeleton. No ectosomal tangential spicules were found in the sponge. Brøndsted described the sponge as having palmate isochelae and sigmas; neither were present in the type specimen.

Burton (1929) established a genus *Brondstedia* for "Mycaleae with a reticulate skeleton of short styli and with a special dermal layer of tangentially arranged styli differing in no respect from the styli of the main skeleton; microscleres, small palmate isochelae to which sigmata may be added." He named *Esperiopsis glaber* Brøndsted as the type species. Since the microscleres and dermal layer of styles are lacking in

the type species the genus *Brondstedia* has not been retained.

This species has not been recollected, so further comment on the correct systematic position of this sponge is not possible.

***Esperiopsis crassofibrosa** Brøndsted

Esperiopsis crassofibrosa Brøndsted, 1923: 139, fig. 19a–c.

REMARKS: The specimen labelled TYPE from the Copenhagen Museum was examined and found to have oxeas and sigmas. It is clearly not the type of *E. crassofibrosa*, which Brøndsted described as having styles and isochelae. It appears that the type specimen is lost, and since there have been no further collections of the species, no comment can be made.

DISTRIBUTION: Port Ross, 18 m.

***Esperiopsis normani** (Bowerbank)

RESTRICTED SYNONYMY:
Isodictya normani Bowerbank, 1866: 320; 1874: 141, pl. lvi figs 1–5.
Esperiopsis normani. Lundbeck 1905: 13, pl. viii fig. 2a–d; Brøndsted 1923: 138.

REMARKS: Brøndsted (1923) recorded this species from New Zealand, but to date it has not been recollected. Brøndsted's material could not be located at the Copenhagen Museum and thus the record cannot be verified.

DISTRIBUTION: Carnley Harbour, 64 m.

***Esperiopsis edwardii** (Bowerbank) (Plate 6, D)

RESTRICTED SYNONYMY:
Isodictya edwardii Bowerbank, 1866: 325.
Esperiopsis edwardii. Dendy 1924: 340.
Amphilectus fucorum Burton, 1932: 289.

MATERIAL EXAMINED: BM(NH) 23.10.1.103, Plymouth (spicule slide only).

SPICULES (Plate 6, D):
Megascleres: Smooth curved styles with long tapered points.
Microscleres: Palmate anisochelae of normal form.
For spicule dimensions *see* Table 8.

TABLE 8. Spicule dimensions of *Esperiopsis edwardii*.

Locality		Styles (μm)	Isochelae (μm)
Three Kings Is, 182 m (Dendy 1924)		300 × 12	28
BM(NH)23.10.1.103	$\bar{x}$	332 × 11	28
	Range	315–350 × 9.5–12.5	26–30

REMARKS: The spicule measurements of the specimen from the British Museum are in accord with Dendy's description of the specimen from northern New Zealand.

Burton (1932) included *E. crassofibrosa, E. normani*, and *E. edwardii* in his massive relegation of species to *Amphilectus fucorum*, along with at least fifteen other species. He noted differences between these species in external morphology, and consequently expanded the diagnosis of *A. fucorum* to accommodate sponges of encrusting, massive, or branching form. In the absence of type or new material it is not possible to comment on the validity of Burton's action relating to the synonymy of *E. crassofibrosa* and *E. normani*, and consequently Brøndsted's names have been retained.

A specimen of *Amphilectus fucorum* from Plymouth was available for examination from the British Museum (BM(NH) 31.6.20.91). The skeleton of this sponge is an irregular square-meshed reticulation. The spicule dimensions are 183–225 × 8–10 μm ($\bar{x}$ = 203 × 9 μm) (Plate 6, E), palmate isochelae 20–23 μm ($\bar{x}$ = 22 μm).

Burton (1932) stated that Southern Hemisphere sponges which he referred to *Amphilectus fucorum* invariably had larger styles and chelae than did the Northern Hemisphere specimens. Comparison of the spicule measurements of *A. fucorum* (Plymouth) with Dendy's description of *E. edwardii* from northern New Zealand show this to be correct. In view of the fact that *E. edwardii* from Plymouth also has much larger spicules than *A. fucorum* from the same location, little can be said in support of lumping these species together (cf. Plate 6, D and E).

Burton's synonymy is clearly invalid, and has served only to confuse the concept of the genus *Amphilectus* and the relationships between species referred to that genus and to *Esperiopsis*.

***Esperiopsis macrosigma** var. **novaezealandiae** Dendy (Plate 6, F)

Esperiopsis macrosigma Stephens, 1916: 235; 1921: 19, pl. ii fig. 4.
Esperiopsis macrosigma var. *novae zealandiae* Dendy, 1924: 341, pl. xiii figs 14–20; Lévi & Lévi 1983: 959, fig. 21.

MATERIAL EXAMINED: BM(NH) 23.10.1.110, Three Kings Islands, 183 m (type; skeletal slide only).

REMARKS: The type specimen of *E. macrosigma* var. *novaezealandiae* was a small encrusting sponge, preserved dry; now it has almost vanished from the rock on which it was marked by Dendy. The spicules are generally in agreement with Dendy's (1924) description (*see* Table 9). However, the small isochelae (16 μm) are not apparent, the subtylostyles are broken and cannot be measured (but are long slender spicules), and an intermediate size category of sigmas (130 μm) is abundant. Dendy mentioned the presence of intermediate sizes of isochelae and sigmas, but did

TABLE 9. Spicule dimensions of *Esperiopsis macrosigma* var. *novaezealandiae*.

Locality	Subtylostyles (μm)	Large isochelae (μm)	Medium isochelae (μm)	Small isochelae (μm)	Large sigmas (μm)	Medium sigmas (μm)	Small sigmas (μm)
Three Kings Is, 183 m (Dendy 1924)	425 × 6.5	⩽80	44	16	340		48
TYPE Three Kings Is remeasured	not measured	76	40	not measured	330	130	40
New Caledonia, 250–375 m Lévi & Lévi (1983)	370–490 × 7–8	60–80 × 15–20		15	350–400 × 250–300 × 15	130–140 × 2–5	50–60

not include a measurement for the sigmas. The skeleton has tracts of spicules but no fibre development. Subtylostyles also lie singly or in groups of two or three, scattered through the choanosome (Plate 6, F).

A specimen of *Esperiopsis* has been collected from a block of basalt dredged in Whangaroa Harbour, Northland (13 m). Only a spicule slide remains of this material. From the spiculation, the sponge is similar to *E. macrosigma* except for the absence of the large category of sigmas (Plate 7, A). No other specimens of *Esperiopsis* have been collected from the New Zealand mainland.

OTHER RECORDS: New Caledonia, 250–375 m.

***Esperiopsis megachela** Dendy (Plate 7, B)

Esperiopsis megachela Dendy, 1924: 341, pl. xiii figs 21–25.

MATERIAL EXAMINED: BM(NH) 23.10.1.111, Three Kings Islands, 183 m (type; skeletal slide only).

REMARKS: The type of *E. megachela* was a thick encrustation over a rock; it was preserved dry and is now almost gone. The skeleton and spiculation of the type specimen are in agreement with Dendy's description (Plate 7, B). The small category of palmate isochelae, and the two categories of sigmas, were not apparent in the skeletal slide.

Burton (1929) synonymised *E. macrosigma* var. *novaezealandiae* and *E. megachela* with *E. villosa*. He divided into three categories the species he placed in synonymy with *E. villosa*, and *E. macrosigma* var. *novaezealandiae* and *E. megachela* were allocated to group b – sponges with three categories of isochelae, in which the larger size differed slightly in form from those usually found in *E. villosa*. Burton failed to notice other important differences between these three species: the subtylostyles of *E. villosa* are similar in size to those of *E. megachela*, but much larger than those found in *E. macrosigma*; large sigmas are absent in *E. megachela*, and the large sigmas of *E. macrosigma* are of a distinctive shape, quite different from those of *E. villosa*. The large isochelae of *E. villosa* are long slender microscleres and no comparable spicules are present in the New Zealand species.

Family CLADORHIZIDAE de Laubenfels, 1936

DIAGNOSIS: Deep-water Poecilosclerida with a heavily siliceous skeleton which has some axial organisation from which radial tracts diverge. The sponges are small with symmetrical bodies, and are frequently stalked. The megascleres are monactinal, the microscleres are chelae and sigmas.

REMARKS: This diagnosis is adapted from Lévi (1973) and Bergquist (1978). There is insufficient generic representation of this family in New Zealand waters to warrant any systematic discussion.

Chondrocladia Wyville Thomson, 1873

DIAGNOSIS: Small, symmetrical sponges with a basal stem and apical projections arising from a rounded head. The skeleton consists of a spicule axis which branches into plumose tracts in the head of the sponge. Megascleres are styles. Microscleres are unguiferate isochelae and sigmas.

TYPE SPECIES: *Chondrocladia virgata* Wyville Thomson, 1873

REMARKS: One species has been recorded from New Zealand by Bergquist (1972). This material was reexamined as no new material has been collected to date.

***Chondrocladia clavata** Ridley & Dendy (Plate 7, C–F)

Chondrocladia clavata Ridley & Dendy, 1886: 345; 1887: 100, pl. xx figs 1, 1a, pl. xxi fig. 11; Burton 1929: 431; Lévi 1964: 76, fig. 26, pl. ivd; Bergquist 1972: 125; Boury-Esnault and van Beveren 1982: 57.

MATERIAL EXAMINED: Cook Strait, 990 m.

DESCRIPTION: A single damaged specimen previously collected by Bergquist has been examined. The sponge is stalked with a round head from which protrude at least six erect branches. Three branches have rounded terminal expansions (Plate 7, C).

DIMENSIONS: Diameter of head 10 mm; length of branches 3–10 mm; diameter of branches 1 mm.

COLOUR: In life, pale grey (7.5Y 7/2); in spirit, pale grey (7.5Y 7/2).

TEXTURE: Hard and brittle.

SURFACE: The surface is granular and corrugated by tangential spicules. No pores or oscules are visible.

SKELETON: The skeleton in the stalk consists of an axially condensed tract of styles (Plate 7, D). At the head of the sponge the tract branches and forms irregular plumose tracts of spicules. The ectosomal skeleton consists of a tangential layer of styles.

SPICULES (Plate 7, E, F):
Megascleres: Smooth, thick, slightly curved styles with narrowed heads, in two sizes.
Microscleres: Unguiferate isochelae with short alae, of large size range (Plate 7, F). Sigmas, usually C-shaped. For spicule dimensions *see* Table 10.
OTHER RECORDS: Fiji, 252 m; McMurdo Sound, 342–434 m; Victoria Land, 252–434 m; Madagascar, 4820 m; Kerguelen, 3025 m.

TABLE 10. Spicule dimensions of *Chondrocladia clavata*.

Locality		Large styles (μm)	Small styles (μm)	Isochelae (μm)	Sigmas (μm)
Fiji Islands Ridley & Dendy (1887)		1000 × 22		57	44
Cook Strait, 990 m	$\bar{x}$	1170 × 23	327	69	78
Bergquist (1972)	Range	508–1560 × 17–28	300–340 × 4.5	39–80	60–89

Family BIEMNIDAE Hentschel, 1923

Desmacellinae Ridley & Dendy, 1887

DIAGNOSIS: Poecilosclerida with a skeleton organised irregularly or in plumose or plumo-reticulate fashion. The megascleres are monactinal, typically of one type only. Microscleres are abundant and include sigmas, microxeas, toxas, commas, and microstyles.

REMARKS: Confusion as to both the ordinal placement of species here assigned to this family and the correct family name to apply has occurred frequently throughout the sponge literature. Lévi (1973), Bergquist (1978) and van Soest (1984) recognised the family Biemnidae as designated by Hentschel and located it within the Poecilosclerida. These authors are followed here.

The type genus of the family, *Biemna* Gray, 1867, antedates the genus *Desmacella* Schmidt, 1870, type genus of the family Desmacellidae, which is the alternative name most frequently used. The Biemnidae was the first of these groups to be accorded family status, and from its inception was a well-characterised family. Ridley and Dendy (1886) recognised a group, the Desmacellina, which in 1887 they raised to subfamily status as the Desmacellinae. This subfamily was placed in the family Heterorrhaphidae to receive sponges with monactinal megascleres that were styles or tylostyles, and microscleres that were sigmas, toxas, or both. This subfamily contained only the genus *Desmacella*. Hentschel (1923) established the family Biemnidae for sponges with monactinal megascleres and without chelae in their microsclere complement, and included *Desmacella* in this family. It is logical, following this definition, to conclude that the Biemnidae as construed by Hentschel incorporates Ridley and Dendy's subfamily Desmacellinae. The name Biemnidae is preferred also because the real affinities and characteristics of *Desmacella*, beyond spicular characters, are not clear from present literature.

Further confusion over family names followed Lévi's (1955) publication dealing with the Clavaxinellida. In this work he established a family Sigmaxinellidae for sponges with an axial skeleton, monactinal megascleres, and sigmas for microscleres, perhaps accompanied by toxas and trichodragmata. He also discussed Ridley and Dendy's subfamily, referring to it as the Desmacellidae, but at no stage did he formally diagnose it or state that it should receive familial status. It appears that Lévi simply used the familial ending as a casual reference. This reasoning is consistent with Lévi's later work (1973) where the family Sigmaxinellidae is maintained within the Axinellida, and following Hentschel, the family Biemnidae is used for poecilosclerid genera with monactinal megascleres that lack chelae in their microsclere complement.

Wiedenmayer (1977) and Hooper (1984) recognised an entity Sigmaxinellidae within the Axinellida, but considered that the family name Desmacellidae had priority over this. For Hooper (1984), this included the Biemnidae as well; it is not clear what genera Wiedenmayer would include. Their view is not upheld both for the reasons stated above, and because it fails to recognise the very basic differences in skeletal organisation between the two groups, one poecilosclerid (the Biemnidae), and the other axinellid (the Sigmaxinellidae).

Biemna Gray, 1867

DIAGNOSIS: Biemnidae with a plumose or plumo-reticulate skeleton of monactinal spicules, typically styles

of one size only. Spongin fibre development may occur in the central region of the sponge or at the nodes of the reticulation, but no axial disposition of skeletal elements occurs. The ectosomal skeleton is made up of monactinal spicules which usually form a palisade, but which occasionally are disposed tangentially. Microscleres always include sigmas and microxeas, the latter frequently in trichodragmata, and small commas and spheres may be added.

TYPE SPECIES: *Desmacidon peachii* Bowerbank, 1866

REMARKS: A major taxonomic problem centres around the diagnosis of the genera *Biemna* and *Sigmaxinella*, which are identical in spicule complement. The primary basis for separation of these genera is their skeletal organisation. *Biemna* has a plumose or plumoreticulate skeleton lacking an axially orientated skeletal component while *Sigmaxinella* has a pronounced axial skeleton. Not only does this difference in spicule orientation discriminate between the genera but it argues for ordinal distinction. *Biemna* is placed in the family Biemnidae, order Poecilosclerida and *Sigmaxinella* is placed in the family Sigmaxinellidae, order Axinellida. This is the position previously adopted by Lévi (1973), Bergquist (1978) and van Soest (1984).

In other works, Hallmann (1916), Bergquist (1970) and Hooper (1984), *Biemna* has been placed in the Axinellida. Bergquist (1970), in placing *Biemna* in the Sigmaxinellidae, noted the traces of axial condensation in several New Zealand species but failed to distinguish between a condensed reticulum and a skeleton with genuine axial disposition. The species concerned are now known to be more correctly located in *Sigmaxinella*, leaving in *Biemna* only plumo-reticulate sponges. Hooper (1984) argued that at the generic level *Sigmaxinella* and *Biemna* were separated by their habit and by the degree of axial condensation of the skeleton, and that both genera were Axinellida, belonging to the family Desmacellidae.

Species of both genera have been examined and compared in this study to assist in definition, and to arrive at the correct generic allocation of individual species. As a consequence, *Biemna stylotata* (Brøndsted) is returned to the genus in which it was originally described, i.e., *Sigmaxinella.* Bergquist (1970) referred *Sigmaxinella stylotata* to *Biemna* on the basis that it did not have a ramose habit or axinellid construction. This sponge is a thick encrustation with erect papillae and in this respect it is similar to species of *Biemna.* However, the skeleton has a condensed axial component from which plumose extra-axial tracts diverge; this arrangement is typical of an axinellid species (Plate 8, A). The diagnosis of *Sigmaxinella* should be expanded to include sponges whose habit is thickly encrusting or massive. Other genera of the Axinellida exhibit such massive construction, e.g., *Pseudaxinella* Schmidt.

A specimen of *Sigmaxinella* has been collected from Three Kings Islands (NZOI Stn E269). The skeleton of this sponge and the skeleton of *Sigmaxinella arborea* Kirkpatrick, 1903 from Natal were examined and compared with *S. stylotata.* All three species have a skeletal arrangement which is typically axinellid (Plate 8, B, C).

Biemna flabellata Bergquist, 1970 is a stalked lamellate sponge with a reticulate skeleton which is condensed in the stem. However, the construction of this region remains reticulate and is distinct from the vertically disposed axial spicule component seen in *Sigmaxinella* (Plate 8, D).

Brøndsted (1923) established a new species of *Biemna, B. rhaphidiophora,* for a sponge found in Carnley Harbour. The type specimen has been re-examined and shows this sponge to have two sizes of tylostyles, no microscleres, and the skeletal arrangement of a *Suberites.* A few rhaphides and sigmas are found at the surface of the sponge but these are contaminants. Bergquist (1970) stated that *B. rhaphidiophora* is a synonym of *Suberites affinis* Brøndsted, 1923 and this view is supported. Burton (1930) established a new genus, *Carnleia,* for this sponge, because it had two categories of tylostyles, while de Laubenfels (1936) described it as a species of *Desmacella* on the basis of having rhaphides in addition to sigmas and tylostyles.

Other views have been expressed on the placement of the genus *Biemna.* Dendy (1921) retained *Biemna* in the Poecilosclerida and considered it to be a lipochelous genus derived from *Mycale.* Hallmann (1916) saw a relationship between *Biemna* and *Allantophora,* a genus with a centrally reticulate skeleton, on the basis of the similarity in spicule types, and he synonymised the two genera and placed them in the family Axinellidae. Burton (1930) stated that any resemblance between *Allantophora* and *Biemna* was superficial only and due entirely to convergence, and agreed with Dendy on placement of *Biemna* in the order Poecilosclerida. It is most probable that *Allantophora* is a synonym of *Biemna* but this must await confirmation from examination of type material.

Hartman (1967) noted a close relationship between *Biemna* and *Neofibularia,* a genus with a well-developed spongin fibre reticulation, and he suggested that both genera showed affinity with *Mycale*; both genera were thus considered to belong in the Poecilosclerida. Van Soest (1984) mentioned that the Biemnidae showed axinellid affinities but in architecture and microsclere spiculation they seemed to be close to the Mycalidae. Neither Hartman nor van Soest elaborated upon the observed relationship with mycalid sponges. There is some similarity between *Biemna* and *Mycale* in that both generally have a single megasclere category and plumose skeletal architecture, which in *Biemna* is augmented by reticulation. Plumose skeletal organisation is common in the Poecilosclerida, for example, in the Clathriidae, Hymedesmiidae, Cladorhizidae and Coelosphaeridae, and does not on its own provide an adequate reason to

relate the genera closely. The possession of abundant microscleres of a range of types and of trichodragmata are features in common between *Biemna* and *Mycale*.

Knowledge of reproductive characters in species of *Biemna* would contribute to confirming ordinal placement, as indeed would investigation of sterol chemistry. Fatty acid analysis of *Biemna rufescens* n.sp. from New Zealand shows this sponge to conform more closely to other poecilosclerid species than to any axinellid genera analysed (Bergquist *et al.* 1984).

A major problem remains the inadequacy of many early descriptions of *Biemna* and *Desmacella* species where information on skeletal arrangement is lacking. Careful re-examination of this character as new material becomes available should enable a definitive generic location of the species.

Biemna rhabderemioides Bergquist (Plate 8, E)

Biemna rhabderemioides Bergquist, 1961a: 40, fig. 10a–b; 1970: 25, pl. 16c.

MATERIAL EXAMINED: NMNZ Por. 11, Rangitoto Island, mid tidal (type).

DESCRIPTION: An encrusting to massive cushion-like sponge found on the undersides of intertidal boulders and in shallow water on shell-covered sea floors.

DIMENSIONS: Length 20–40 mm; width 15–30 mm; thickness 10–20 mm.

COLOUR: In life, yellow (2.5Y 8/6); in spirit, pale yellow-brown (2.5Y 6/4).

TEXTURE: Firm and compressible.

SURFACE: The surface is minutely reticulate, conulose and hispid. Oscules are level with the surface and are fed by prominent sub-dermal channels.

SKELETON: The choanosomal skeleton is plumo-reticulate with thick tracts of styles ± 110 µm wide running to the surface. The styles form an irregular reticulation between the primary columns (Plate 8, E), and microxeas and sigmas are abundant in a thin dermal region and throughout the choanosome. Microxeas occur most frequently in trichodragmata.

SPICULES:

Megascleres: Long, smooth styles curved along their length.

Microscleres: Very abundant microxeas which are strait, narrow, fusiform, and of two sizes; the large size finer than the smaller size. Thick C-shaped sigmas that are abundant and occur in two size ranges. Bean-shaped to spherical lumps of silica; constantly present but varying greatly in abundance.

For spicule dimensions *see* Table 11.

REMARKS: This species is characterised by having two sizes of sigmas and two sizes of microxeas. It is similar to *Biemna megalosigma* Hentschel, 1912, differing mainly in having two smaller size categories of sigmas.

OTHER RECORDS: MacGregors Bay, low tide; North Channel, 8 m.

Biemna flabellata Bergquist (Plates 8, D, F; 9, A–C)

Biemna flabellata Bergquist, 1970: 23, pls 5c, 17a.

MATERIAL EXAMINED: NMNZ Por. 28, 256 m (holotype). NZOI Stn B93, Three Kings Islands, 55–110 m (2 specimens).

DESCRIPTION: An erect, stalked, lamellate sponge (Plate 8, F).

DIMENSIONS: Height 50–190 mm; width of stalk 5–28 mm, width of lamella 30–80 mm; thickness of lamella 2–8 mm; oscules 0.8–1.2 mm diameter; pores 0.1–0.3 mm diameter.

COLOUR: In life, dull yellow (2.5Y 7/8); in spirit, straw coloured (5.0Y 7/4) or white.

TEXTURE: Firm and solid in the centre of the sponge, but crumbly near the edges.

TABLE 11. Spicule dimensions of *Biemna rhabderemioides*.

Locality		Subtylostyles (µm)	Styles (µm)	Small microxeas (µm)	Large microxeas (µm)	Small sigmas (µm)	Large sigmas (µm)	Spheres (µm)
Rangitoto Id, mid tide Bergquist (1961a)		420–480 × 10–16	420–470 × 10–16	50 × 3	90	12–14	42–45	
Rangitoto Id Bergquist (1970)			300–560 × 10–16	53 × 1.6	98 × 1	14.6	46	4
				40–58 × 1.6	80–120 × 1	12–16	42–50	
TYPE remeasured	$\bar{x}$		474 × 14	49	86	15	42	5
	Range		410–520 × 11–17.5	38–55	78–90	14–19	39–46	3.5–6

SURFACE: The surface is microscopically hispid. One surface has numerous oscules flush with the surface and spaced regularly apart; the opposing surface is covered in small pores.

SKELETON: The choanosomal skeleton is reticulate with some spongin fibre development at the nodes of the reticulation (Plate 9, A). Fibres are more prominent in the central axis of the sponge, where the ascending tracts thicken and the reticulation is less prominent (Plate 8, D). There is no differentiation of dermal spicules, rather, the styles form an ectosomal palisade and some may lie tangentially. Microxeas usually occur in trichodragmata and microxeas and sigmas are abundant interstitially.

SPICULES (Plate 9, B, C):
Megascleres: Smooth stout styles, broadly rounded beneath the head and slightly curved.
Microscleres: Fusiform microxeas in two sizes; the larger ones may be rhaphide-like. Thin, usually comma-shaped, sigmas, in two size ranges.
For spicule dimensions *see* Table 12.

REMARKS: The spheres described in the holotype by Bergquist (1970) were not seen in the specimens examined. Bergquist noted their rarity and it is suggested that their occurrence is not a reliable discriminatory character.

Biemna rufescens n.sp. (Plates 9, D–F; 10, A)

MATERIAL EXAMINED: Middle Arch, Poor Knights Islands, 15 m. Waterfall Reef, Leigh, 12 m. Sponge Garden, Leigh, 16 m and 18 m. Maori Island, 18 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 87.

TYPE LOCALITY: Middle Arch, Poor Knights Islands, 15 m.

DESCRIPTION: The sponge is encrusting to massive with prominent oscular fistules (Plate 9, D).

DIMENSIONS: The majority of the specimens form thick mats; length $\leqslant$ 200 mm; width $\leqslant$ 200 mm; thickness 10–18 mm; height of turrets 4–10 mm; width of oscules 2–5 mm.

COLOUR: In life, external upper surfaces purple (10.0P 3/2), interior and basal areas yellow (10.0YR 6/8); in spirit, fawn to brown (2.5Y 7/4–6/4).

TEXTURE: Soft and compressible and easily pulled apart.

SURFACE: The surface varies from an uneven, quite smooth and finely hispid surface with low oscular fistules, to an uneven, reticulate and coarsely hispid surface with high oscular fistules.

SKELETON: In the choanosome plumose columns of styles 50 μm wide run perpendicular to the surface of the sponge (Plate 9, E). There is a weak skeletal reticulation in deeper regions of the sponge, but generally styles are found loose in the choanosome, often at right angles to the primary columns. These columns fan into brushes at the surface, supporting a dermal membrane which incorporates foreign material (Plate 9, F). Between the brushes are sub-dermal spaces surrounded by abundant sigmas. Rhaphides are abundant in trichodragmata and may form short columns in the choanosome.

SPICULES (Plate 10, A):
Megascleres: Long, slender styles, usually bent or wavy; oxeote modifications occur.
Microscleres: Fusiform microxeas in two sizes; the

TABLE 12. Spicule dimensions of *Biemna flabellata*.

Locality		Styles (μm)	Small microxeas (μm)	Large microxeas (μm)	Small sigmas (μm)	Large sigmas (μm)	Spheres (μm)
HOLOTYPE Three Kings Is, 256 m		380 × 21	32 × 1.2	115 × 2.2	11.8	34	
		280–496 × 10–30	26–45 × 1.2	96–140 × 2–2.5	9.6–15	28–40	⩽ 8
HOLOTYPE remeasured	$\bar{x}$	402 × 25	41	133	14	25	
	Range	335–470 × 20–29	35–48	118–143	11–19	23–28	
NZOI Stn B93, Three Kings Is, 55–110 m specimen 1	$\bar{x}$	323 × 20	40	127	12	28	
	Range	260–370 × 18–24	33–50	120–133	11–15	25–33	
NZOI Stn B93, Three Kings Is, 55–110 m specimen 2	$\bar{x}$	303 × 19	39	112	13	43	
	Range	250–350 × 15–25	32–58	105–118	12.5–17.5	23–59	

larger size finer than the smaller size. Sigmas of variable form, usually C-shapes or hooks, and in three sizes of which the largest is thicker than both smaller types. Spherical lumps of silica, variable in size and shape, but not present in all specimens.
For spicule dimensions *see* Table 13.

REMARKS: The New Zealand species of *Biemna* can be distinguished by their habit. *Biemna rhabderemioides* is encrusting or cushion-like, *B. flabellata* is erect and lamellate, and *B. rufescens* is massive with characteristic oscular fistules. *Biemna rufescens* has three sizes of sigmas, a feature which distinguishes it from other New Zealand species, but which recalls species of *Biemna* recorded from South Africa by Lévi (1963) – *B. anisotoxa, B. megalosigma* subspecies *sigmodragma, B. pedonculata* and *B. polyphylla. Biemna rufescens* differs from *B. pedonculata* and *B. polyphylla* in the width of the styles and size ranges of the sigmas, from *B. anisotoxa* in the absence of microstyles, and from *B. megalosigma* subspecies *sigmodragma* in most spicule measurements. *Biemna rufescens* is closely related to *B. fistulosa* (Topsent), differing only in its larger styles and in having three size categories of sigmas.

***Biemna novaezealandiae** Dendy

Biemna novae zealandiae Dendy, 1924: 346, pl. xiv figs 1–4; Bergquist 1970: 23.

REMARKS: No new material has been collected to date. *Biemna novaezealandiae* is a well characterised species with very long styles (up to 1070 μm), an encrusting form, and three sizes of microxeas. Dendy (1924) mentioned another species of *Biemna* but did not describe it as only small fragments of the sponge were available.

DISTRIBUTION: Three Kings Islands, New Zealand.

Microtylostylifer Dendy, 1924

DIAGNOSIS: Biemnidae with monactinal megascleres and microscleres that are microstyles. The skeleton is an irregular reticulation; occasionally short tracts are present subdermally. Microstyles form a tangential dermal layer and are abundant interstitially.

TYPE SPECIES: *Microtylostylifer anomalus* Dendy, 1924

REMARKS: Dendy (1924) decided there was no alternative but to establish a new genus for this sponge and he placed the genus tentatively in the subfamily Suberitinae. He suggested that the spiculation most closely approached that of *Polymastia*, if the microstyles of *Microtylostylifer* could be equated with the small tylostyles of *Polymastia.* However, Dendy also noted that the external form, skeletal arrangement and absence of a cortex in *Microtylostylifer* is quite uncharacteristic of hadromerid sponges. De Laubenfels (1936) placed *Microtylostylifer* in the Ophlitaspongiidae but expressed little confidence in the allocation.

It is clear that this sponge is not hadromerid as it lacks any trace of radial skeletal construction or cor-

TABLE 13. Spicule dimensions of *Biemna rufescens.*

Locality		Styles (μm)	Small microxeas (μm)	Large microxeas (μm)	Small sigmas (μm)	Medium sigmas (μm)	Large sigmas (μm)
Middle Arch, Poor Knights Is, 15 m	$\bar{x}$	430 × 6	53	111	16	23	37
	Range	390–470 × 5–8	50–58	103–115	13–17	21–25	30–45
Waterfall Reef, Leigh, 12 m	$\bar{x}$	421 × 6	54	117	16	26	42
	Range	360–465 × 5.5–7	48–60	100–125	14–20	23–31	33–48
Sponge Garden, Leigh, 16 m	$\bar{x}$	465 × 9	60	119	15	25	43
	Range	410–480 × 7.5–11.5	55–73	103–130	14–19	21–30	33–50
Sponge Garden, Leigh, 18 m	$\bar{x}$	403 × 8	65	103	15	24	44
	Range	370–440 × 6–9	45–63	90–113	14–17	20–30	38–50
Maori Island, Leigh, 18 m	$\bar{x}$	412 × 8	54	106	15	25	42
	Range	350–440 × 6–9	48–59	95–118	13–16	22–32	37–46

tical development, *Microtylostylifer anomalus* is certainly poecilosclerid and with monactinal megascleres, a reticulate skeletal arrangement and abundant microscleres, is easily accommodated within the Biemnidae. It differs from other genera only in having microstyles as microscleres. A more detailed examination of the skeletal arrangement and habit of the sponge must await collection of further material.

Dickinson (1945) described a second species of *Microtylostylifer, M. partida*, from Mexico. This species has a distinct cortical layer, a coarse hispid surface, cork-like texture and radial skeletal construction. The microscleres of this species were not figured and it is suggested that *M. partida* is a hadromerid sponge. The type material will need re-examination in order to complete a generic assignment.

Microtylostylifer anomalus Dendy (Plate 10, B–E)

Microtylostylifer anomalus Dendy, 1924: 382, pl. xv figs 46–49.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m.

DESCRIPTION: Only a fragment of this sponge was collected; it was a basal portion of a flabellate or club-shaped sponge.

DIMENSIONS: Height 7 mm; width basally 5 mm; width apically 7 mm.

COLOUR: In life, dull red (7.5R 5/6); in spirit, brown (7.5R 5/4).

TEXTURE: Firm and compressible.

SURFACE: The surface is smooth, covered by a thin dermal membrane.

SKELETON: Numerous small tangential styles lie in the plane of the dermal membrane, which is easily separable from the underlying choanosomal reticulation. The reticulation is irregular and composed of two sizes of styles, with faintly spined microstyles parallel to the styles (Plate 10, B). The larger spicules do not have any regular disposition, but are more frequent and occasionally are concentrated as short tracts in the subdermal region. Microstyles are abundant interstitially (Plate 10, C).

TABLE 14. Spicule dimensions of *Microtylostylifer anomalus*.

Locality		Large styles (μm)	Small styles (μm)	Microstyles (μm)
TYPE Three Kings Is, 183 m (Dendy)	x̄	760 × 27		64 × 1.6
Three Kings Is, 55–110 m	x̄	632 × 18	283 × 7	58 × 1
	Range	620–650 × 13–24	258–299 × 7–9	48–68 × 1–2

SPICULES (Plate 10, D, E):
Megascleres: Smooth styles with constricted bases and short, sharp points; in two size ranges.
Microscleres: Slender microstyles, usually curved, that are faintly spined along their length (Plate 10, E).
For spicule dimensions *see* Table 14.

REMARKS: Dendy (1924) described the microscleres as microtylostyles, but the heads of these spicules are only occasionally faintly swollen and they are more accurately described as microstyles. He noted the presence of a few sigmas and suggested they were foreign; this is confirmed by their absence in the specimen examined.

Desmacella Schmidt, 1870

Tylodesma Thiele, 1903a

DIAGNOSIS: Biemnidae with an irregular plumose or disordered choanosomal skeleton of monactinal spicules which are typically tylostyles of uniform size. The ectosomal skeleton consists of regular, erect, monactinal spicule brushes. Microscleres are sigmas and rhaphides.

TYPE SPECIES: *Desmacella pumilio* Schmidt, 1870

REMARKS: The validity of the generic name *Desmacella* as opposed to *Tylodesma* has been much debated by Thiele (1903a) and Dendy (1921), but it is generally accepted that *Desmacella* has priority. In the present work, the generic diagnosis is expanded to include species possessing rhaphides.

When Schmidt (1870) established *Desmacella*, he included in the genus *Halichondria johnsoni* Bowerbank, a sponge with diancistras as microscleres. Gray (1867) had already proposed the genus *Hamacantha* for sponges with diancistras, and *H. johnsoni* was established as the type species of this genus by Gray in 1867. Vosmaer (1887), Thiele (1903a) and Burton (1930) all accepted that *Desmacella* was a synonym of *Hamacantha*. However, the type species of *Desmacella, D. pumilio*, does not contain diancistras, and consequently Dendy (1921) and all recent authors consider that the earlier interpretation is incorrect.

Desmacella has also been confused with *Biemna*. According to Dendy (1921), Topsent (1892a) when redescribing the genera *Biemna* and *Desmacella*, misread and exactly reversed their diagnoses. Thiele (1903a) established *Tylodesma* for species of *Biemna sensu* Topsent. These were characterised by an irregular skeletal structure and spiculation of tylostyles and sigmas, and were in reality *Desmacella* species. *Tylodesma* thus becomes a synonym of *Desmacella*. Dendy's interpretation is logical and accepted as correct by all recent authors. Lévi (1973) synonymised *Desmacella* with *Biemna*, an action which overlooked the differences in skeletal organisation and megasclere morphology between these genera.

Van Soest (1984) included styles or tylostyles and toxiform rhaphides in his diagnosis of *Desmacella*, thus distinguishing it from *Biemna* because it had a more irregular choanosomal skeleton and an ectosome of "halichondroid-confused tufts" of tangential megascleres. He suggested that trends in skeletal arrangement cut through the traditional distinction of the two genera based on megasclere and microsclere complement. Van Soest has further confused the genera by distinguishing them only on skeletal arrangement. This feature is poorly documented in many descriptions and not clearly expounded in van Soest's own work. *Biemna* is at present a well-characterised genus, many species of which have been well described. The real affinities of *Desmacella* are, however, not completely clear.

In this work *Desmacella* is placed in the family Biemnidae rather by default than conviction; type material will need to be restudied in order to define this genus as many descriptions lack full information on the skeleton.

Desmacella dendyi de Laubenfels
(Plates 10, F, 11, A, B)

Desmacella vestibularis. Dendy 1924: 345.
Desmacella dendyi de Laubenfels, 1936: 114; Hooper 1984: 17, 49.

MATERIAL EXAMINED: NZOI Stn J953, western continental slope, Northland, 260–270 m; Barren Arch, Poor Knights Islands, 15 m; Poor Knights Islands, 20 m; Leigh Reef, 27 m; Tokatu Point, 11 m.

DESCRIPTION: This species is found commensal upon various species of Choristida. It is a thin encrusting sponge that may completely invest the host.

DIMENSIONS: Thickness 1–3 mm.

COLOUR: In life, pale yellow (2.5Y 8/6) to orange (10.0R 4/10); in spirit, straw coloured (2.5Y 7/4) to brown (2.5YR 4/4).

TEXTURE: Firm and incompressible.

SURFACE: The surface is even and microscopically hispid, with scattered oscules 0.5 mm wide.

SKELETON: The ectosomal skeleton consists of erect fans of tylostyles (Plate 10, F). Further into the choanosome there is little skeletal organisation and the tylostyles are scattered without orientation. Sigmas are abundant in the choanosome. The skeleton of *Desmacella* intergrades with that of the host sponge (Plate 11, A).

SPICULES (Plate 11, B):
Megascleres: Smooth, straight or slightly curved tylostyles, with well-developed tylostylote heads and tapering sharp points. There is a large size range in these spicules.
Microscleres: Fine sigmas, C-shaped or hooks, with a large size range.
For spicule dimensions *see* Table 15.

TABLE 15. Spicule dimensions of *Desmacella dendyi*.

Locality		Tylostyles (μm)	Sigmas (μm)
Three Kings Is, 20–37, 128 m Dendy (1924)		140–630 × 6–12	10–44
NZOI Stn J953, 260–270 m	$\bar{x}$	334 × 11	23
	Range	170–530 × 8–14	14–29
Barren Arch, Poor Knights Is, 15 m	$\bar{x}$	215 × 6	18
	Range	145–302 × 4.5–8	11–28
Poor Knights Is, 20 m	$\bar{x}$	211 × 5	28
	Range	140–300 × 4–5	23–30
Leigh Reef, 27 m	$\bar{x}$	269 × 6	18
	Range	190–370 × 5–9	13–25
Tokatu Point, 11 m	$\bar{x}$	288 × 7	24
	Range	120–405 × 5–8	16–28

REMARKS: De Laubenfels (1936) established *Desmacella dendyi* for the New Zealand specimen recorded by Dendy (1924) as *D. vestibularis*. He quoted the smaller megascleres and very large sigmas found in the New Zealand sponge as being distinctive characteristics. In fact, de Laubenfels misquoted the size of the sigmas as 44–100 μm; Dendy's description stated their size to be 10–44 μm. Further, de Laubenfels did not include the complete range of tylostyle dimensions given by Dendy, which was 140–630 × 6–12 μm. These measurements are indeed very close to those given by Wilson (1904) for *D. vestibularis*. However, the two species are retained on differences in skeletal arrangement and because of their disjunct distribution. *Desmacella vestibularis* was described by Wilson as having a skeleton composed of "radial or obliquely radial tracts which extend toward the surface, there ending in projecting brushes composed of diverging short tracts." *Desmacella dendyi* has a marked ectosomal skeleton, but because of the epizooic habit no underlaying choanosomal tracts can be discerned. Examination of the type specimen of *D. vestibularis* would be necessary to ascertain whether these species are synonymous. *Desmacella vestibularis* has been recorded from the Galapagos Islands, Antarctica and the Philippines, and if all of these records represent correct identifications, it appears to have a very wide distribution.

OTHER RECORDS: Three Kings Islands, New Zealand, 20–37 m and 128 m.

Desmacella ambigua n.sp. (Plate 11, C–F)

MATERIAL EXAMINED: Clifton Beach, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 92.

TYPE LOCALITY: Clifton Beach, intertidal.

DESCRIPTION: A thin encrusting sponge growing over a rock and invested with algae.

DIMENSIONS: Length 50 mm; width 30 mm; thickness 0.5–1 mm.

COLOUR: In life, orange (5.0YR 6/10); in spirit, creamy-white.

TEXTURE: Firm and difficult to tear.

SURFACE: The surface is microscopically hispid, macroscopically smooth and even.

SKELETON: The choanosomal skeleton consists of vague, plumose tracts of tylostyles extending to the surface of the sponge (Plate 11, C), but the majority of the tylostyles lie without orientation. Fine rhaphides form columns in the choanosome, lie singly, or occur in trichodragmata (Plate 11, D). At the surface of the sponge erect and tangential rhaphides are found in a thin layer (Plate 11, E); tylostyles, generally erect, lie beneath the rhaphides. The three sizes of tylostyles are not found localised in particular regions of the sponge.

SPICULES (Plate 11, F):
Megascleres: Smooth, slender tylostyles with pronounced rounded heads and long tapered points; in three sizes that intergrade.
Microscleres: Long fine rhaphides, straight, or slightly wavy.
For spicule dimensions *see* Table 16.

REMARKS: This species is characterised by having only rhaphides, which can occur in trichodragmata, as microscleres, by a poorly organised surface skeleton, and in having a thin encrusting habit. The sponge is typical of the Biemnidae in its skeletal arrangement, having irregular plumose spicule tracts.

No species of *Desmacella* have been described that lack sigmas, although Burton (1928) described *Biemna liposigma* from the Andaman Islands at 495 m which had only rhaphides as microscleres. However, *B. liposigma* has styles, rhaphides of three sizes, and occurs in very deep water; thus it seems to be quite distinct from *Desmacella ambigua*.

Hallmann (1916), discussed the genera *Desmacella* and *Biemna* after a survey of the species allocated to these genera up to that time. He compared species with tylostyles or subtylostyles as megascleres, i.e., *Desmacella*, with those in which tylostylote megascleres were absent, i.e., *Biemna*, and found that the respective microsclere complements differed. In species of *Desmacella* the microscleres frequently included toxas in addition to sigmas, but never rhaphides or microxeas, while in *Biemna*, except for one questionable exception, *D. fragilis* Kieschnick, rhaphides or microxeas were present, but never toxas. On this basis he argued that the genera were distinct and should be retained. Hallmann (1916) later established a new genus *Toxemna* for *D. fragilis* and *D. tubulata* Dendy; these sponges had toxas and trichodragmata for microscleres, and styles or tylostyles as megascleres. This seems logical considering that the alternative would be to synonymise *Desmacella* with *Biemna*.

Desmacella ambigua, like *D. fragilis* and *D. tubulata*, is difficult to fit into Hallmann's division of species between the genera *Biemna* and *Desmacella*. The marked tylostylote megascleres ally this sponge with *Desmacella*, but the presence of rhaphides is not characteristic of this genus. It is possible that toxas can be present in this species but there was no trace of them in the single specimen examined. Variability in the presence/absence of toxas has been recorded in *Microciona coccinea* Bergquist and Sinclair, 1973, and thus some caution should be expressed in stating categorically that they are absent when only a single specimen is available. If the sponge should contain toxas, it is a new species of *Toxemna*; and if it does not contain toxas a new genus will need to be established for its reception. It is tentatively placed in *Desmacella* on the basis of its tylostylote megasclere spiculation, and the diagnosis of the genus includes rhaphides for this reason.

TABLE 16. Spicule dimensions of *Desmacella ambigua*.

Locality		Large tylostyles (μm)	Medium tylostyles (μm)	Small tylostyles (μm)	Rhaphides (μm)
Clifton Beach, intertidal	$\bar{x}$	460 × 11	328 × 8	215 × 7	129
	Range	390–530 × 10–13	280–360 × 7.5–10	160–250 × 5–9	113–145

Family DESMACIDONIDAE Gray, 1872

DIAGNOSIS: Poecilosclerida either with plumose or, more typically, plumo-reticulate or reticulate skeletons which usually include fibre development. An ectosomal skeleton of spicule brushes is present. The megascleres are monactinal or diactinal, usually of one size only; occasionally the ectosomal spicules can be distinguished by their size from the choanosomal megascleres. Microscleres are abundant and diverse, including typical isochelae and sigmas, and many peculiar variants of these types.

REMARKS: The diagnosis of this family has been altered on the basis of the genera examined from New Zealand. The genus *Esperiopsis*, frequently grouped

with the Desmacidonidae, has been removed to the Mycalidae because it shows strong affinity in skeletal characters with the genus *Mycale*. *Esperiopsis* has large megascleres which structure a plumose or plumo-reticulate skeleton, large isochelae often found in rosettes near the surface of the sponge, and a distinctly mycalid morphology. The transfer of *Esperiopsis* enables clearer definition of the Desmacidonidae.

The majority of the species remaining in the family have diactinal megascleres of one size category only. The skeleton is usually reticulate, with fibre development, and microscleres are abundant throughout the sponge. Frequently the sponges exude mucous, have a fleshy exterior, and are soft and compressible. They are resilient and difficult to tear as a result of the choanosomal fibre development.

Most genera of the Desmacidonidae can be distinguished to a certain extent by their skeletal characters, but to a greater degree are defined by the type of microscleres present. For instance, *Isodictya* is very similar to *Desmacidon* but lacks fibre development and has palmate isochelae. *Plumocolumella* is related closely to both of these genera, but has a plumose skeleton without fibre development, and has unguiferate or anchorate isochelae. *Guitarra* has unusual placochelae for microscleres. *Strongylacidon* has unguiferate or anchorate isochelae but differs from *Plumocolumella* in having strongyles as the diactinal megasclere.

There is a group within the Desmacidonidae in which monactinal megascleres occur, hence the inclusion of this character in the family diagnosis. Lévi (1973) listed genera with monactinal megascleres separately from those with diactinal megascleres but did not feel that they warranted separate family status. This group includes genera such as *Monanchora, Tetrapocillon, Echinostylinos, Neofolitispa* and *Crambe*, all of which have plumose or irregularly reticulate skeletons, dermal brushes of spicules, and some may have choanosomal fibre development. The microscleres are abundant, include isochelae, and can be very unusual, e.g., tetrapocilli as found in *Tetrapocillon*. Some of these genera have two sizes of monactinal megascleres, for example, *Echinostylinos*, hence the expansion of the familial diagnosis to include this character.

Desmacidon Bowerbank, 1864

DIAGNOSIS: Desmacidonidae with a reticulate fibre skeleton. The fibres are cored by diactinal megascleres of uniform size, usually oxeas. Microscleres are arcuate or anchorate isochelae which may be accompanied by sigmas.

TYPE SPECIES: *Spongia fruticosa* Montagu, 1818

REMARKS: The original description of this genus by Bowerbank (1864) was very broad; he described the skeleton but did not describe the megascleres or mention the presence of microscleres. Ridley and Dendy (1887) redefined the genus to include sponges with a fibrous reticulate skeleton, diactinal megascleres and isochelae, and this diagnosis is adopted here.

Desmacidon mamillatum n.sp. (Plate 12, A–E)

MATERIAL EXAMINED: NZOI Stn E268, near Cape Maria van Diemen, 44 m; North Cape, 49 m; Porae Reef, Leigh, 18–21 m; Tokatu Point, 4 m; Little Barrier Island, 73 m; Mahia Peninsula, 110 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 93.

TYPE LOCALITY: Little Barrier Island, 73 m.

DESCRIPTION: This sponge ranges in habit from a thick encrustation to massive, erect, and branching.

DIMENSIONS: For sponge dimensions *see* Table 17.

COLOUR: In life, orange yellow (10.0YR 6/8) to orange (2.5YR 6/10); in spirit, light yellow (10.0YR 7/4) to cream.

TEXTURE: The majority of the sponges are firm and elastic. The thick encrustation is soft.

TABLE 17. Sponge dimensions of *Desmacidon mamillatum*.

Locality	Habit	Height or Length (mm)	Width (mm)	Thickness (mm)	Width of oscules (mm)
Tokatu Point, 4 m	Thick encruster	75	60	17	1
NZOI Stn E268, 44 m, incomplete sponge	Massive	90	50	28	2–4
Porae Reef, Leigh, 18–21 m	Growing over algae	100	10 (branch)	3 (branch)	0.5
Mahia Peninsula, 110 m	Branching	120	20 (branch)	7 (branch)	3
Little Barrier Id, 73 m	Branching	215	135	8–12	2
North Cape, 49 m	Erect	200	65	20	5

SURFACE: The surface is covered with a fine membrane; where this has been removed there is a reticulate pattern visible. Oscules in the erect sponges are aligned along the edges of the branches (Plate 12, A). In the encrusting specimen they are scattered over the surface. Mucous is exuded from these sponges after removal from the water, rendering the surfaces noticeably sticky.

SKELETON: The skeleton is a well-developed square-meshed reticulation of fibres cored with oxeas (Plate 12, B). The fibres are invested with copious spongin and range from 210–250 μm in width. The Porae Reef specimen did not have well-developed fibre. Oxeas, sigmas and isochelae are found in abundance scattered interstitially. In one specimen (NZOI Stn E268) there was considerable foreign material incorporated into the skeleton. The ectosomal skeleton consists of erect brushes of oxeas (Plate 12, C).

SPICULES (Plate 12, D, E):
Megascleres: Oxeas that are hastate, smooth and straight, or slightly curved. The ends may have a slight swelling above the points, otherwise they taper to sharp points.
Microscleres: Anchorate isochelae with strongly recurved alae and a large size range (Plate 12, E). Sigmas that are C- or hook-shaped forms of large size range.
For spicule dimensions *see* Table 18.

TABLE 18. Spicule dimensions of *Desmacidon mamillatum*.

Locality		Oxeas (μm)	Sigmas (μm)	Isochelae (μm)
Little Barrier Id, 73 m	x̄	169 × 6	23	16
	Range	145–185 × 5–8	18–29	15–20
Mahia Peninsula, 110 m	x̄	165 × 11	20	16
	Range	155–175 × 5–7	17–30	14–24
NZOI Stn E268, 44 m	x̄	194 × 6	24	18
	Range	175–203 × 5.5–6.5	18–33	15–23
North Cape, 49 m	x̄	188 × 6	27	18
	Range	178–200 × 5–7.5	18–38	12.5–23
Tokatù Point, 4 m	x̄	168 × 5	19	22
	Range	152–180 × 4.5–6.5	11–30	20–23
Porae Reef, Leigh, 18–21 m	x̄	156 × 6	20	19
	Range	138–170 × 5–7.5	15.5–31	15–25

REMARKS: This species approaches *Desmacidon minor* Dendy, from Kattiawar, in habit and skeletal organisation, but differs from the latter in spicule complement and dimensions.

Strongylacidon Lendenfeld, 1897

DIAGNOSIS: Desmacidonidae with plumose or plumoreticulate fibres cored by strongyles. The fibres terminate in dermal brushes at the surface of the sponge. The megascleres are strongyles and the microscleres are unguiferate isochelae.

TYPE SPECIES: *Strongylacidon sansibarensis* Lendenfeld, 1897

REMARKS: Burton (1934) redefined this genus to include only species with a skeleton of strongyles and unguiferate isochelae as microscleres. Van Soest (1984) extended the definition again to include anchorate isochelae, as he considered the distinction between anchorates and unguiferates to be unimportant at the generic level. This opinion cannot be properly evaluated since only one New Zealand species of *Strongylacidon* has been examined.

This genus differs from *Desmacidon* in the type of megasclere and isochelae present; unguiferate isochelae in *Strongylacidon* compared to arcuate or anchorate isochelae in *Desmacidon*. The construction of the skeleton and the pronounced fibre development affirms a close affinity between the two genera.

Strongylacidon conulosa n.sp.

(Plates 12, F; 13, A–C)

MATERIAL EXAMINED: Kaikoura Peninsula, 4 m; NZOI Stn Q739, Milford Sound, 35 m; Harrington Point, Dunedin, 12 m (3 specimens); Papanui Beach, Dunedin, 4 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 94.

TYPE LOCALITY: NZOI Stn Q739, 44°36.13′S, 167°49.4′E, Dale Point, Milford Sound, 35 m.

DESCRIPTION: The sponge is erect and massive with a fleshy dermal skin raised into thin conules.

DIMENSIONS: Holotype: height 65 mm; width 48 mm; thickness 25 mm. The remaining specimens are pieces of the whole sponges.

COLOUR: In life, fawny-grey to blue-grey exterior (10.0YR 7/2–10.0YR 6/2), yellow interior (10.0YR 7/10); in spirit, light brown (10.0YR 7/4).

TEXTURE: A soft and compressible sponge that cannot be torn easily.

SURFACE: The surface is covered by a fleshy dermal skin ⩽ 0.5 mm thick. The skin is raised into conules where the fibres of the choanosome reach the surface; some fibres extend beyond the skin and produce an

obvious hispid surface. Oscules, 1.0–2.0 mm wide, are scattered over the sponge exterior.

SKELETON: The choanosomal skeleton consists of a large square-meshed reticulation of fibres cored with strongyles. The primary fibres are slightly sinuous and the secondary fibres which form the reticulation are not abundant (Plate 12, F). The strongyles form spicule brushes in the ectosome, while the conules extend above a primary fibre which has fanned into many spicule brushes (Plate 13, A). Microscleres are abundant interstitially and in the ectosome.

SPICULES (Plate 13, B, C):
Megascleres: Smooth strongyles which may have faintly tylote heads.
Microscleres: Very small unguiferate isochelae with reduced alae (Plate 13, C).
For spicule dimensions *see* Table 19.

REMARKS: This species is characterised by the small size and shape of the unguiferate isochelae. It is similar to *Strongylacidon plicatum* (Hentschel) from West Australia, which differs in having two sizes of strongyles.

TABLE 19. Spicule dimensions of *Strongylacidon conulosa*.

Locality		Strongyles (μm)	Isochelae (μm)
NZOI Stn Q739, Milford Sound, 35 m	$\bar{x}$	172 × 3.5	13
	Range	123–200 × 2–4.5	11.5–16.5
Harrington Pt, Dunedin, 12 m specimen 3	$\bar{x}$	147 × 2	14
	Range	108–190 × 1.5–3.5	12.5–15
Papanui Beach, Dunedin, 4 m	$\bar{x}$	154 × 3	15
	Range	105–213 × 2–4.5	12–16
Harrington Pt, Dunedin, 12 m specimen 1	$\bar{x}$	165 × 3	14
	Range	111–193 × 2.5–4.5	12.5–15
Harrington Pt, Dunedin, 12 m specimen 2	$\bar{x}$	166 × 3	13
	Range	115–202 × 2–4.5	12.5–14

*Strongylacidon inaequalis (Hentschel)

Batzella inaequalis Hentschel, 1911: 325, fig. 20.
Strongylacidon inaequalis. Burton 1959: 242.
Cacochalina truncatella var. *mollissima* Lendenfeld, 1887: 763, pl. xxvii fig. 27.

REMARKS: Lendenfeld (1887) recorded this species as *Cacochalina truncatella* var. *mollissima* from Port Chalmers, Dunedin. Burton (1959) synonymised this sponge with *Strongylacidon inaequalis*. Lendenfeld's specimen cannot be located in order to permit this synonymy to be checked, but it must be noted as being a very doubtful record.

DISTRIBUTION: Port Chalmers, New Zealand; South West Australia; Great Barrier Reef, Australia.

Isodictya Bowerbank, 1864

Homoeodictya Ehlers, 1870

DIAGNOSIS: Desmacidonidae with a reticulate or plumo-reticulate skeleton. The diactinal megascleres are of uniform size and the microscleres are palmate isochelae.

TYPE SPECIES: *Spongia palmata* Lamarck, 1814.

REMARKS: There is some confusion over the validity of the two genera *Homoeodictya* and *Isodictya*. Lévi (1973) synonymised *Isodictya* with *Homoeodictya*. Dendy (1924) synonymised *Homoeodictya* with *Isodictya*. Following Dendy (1924) and Boury Esnault and van Beveren (1982) the name *Isodictya* is retained.

Dendy (1924) explained that Bowerbank had named two type species of *Isodictya, I. palmata* and *I. normani*. As the latter is an *Esperiopsis* with monactinal megascleres, Dendy regarded the former species as the type. When Ehlers (1870) established *Homoeodictya* he cited *I. palmata* as a synonym of his type species *Spongia digitata* Ehlers, and therefore under the rules of priority *Homoeodictya* falls to *Isodictya*.

This genus can be distinguished from *Desmacidon* by the presence of palmate isochelae.

*Isodictya cavicornuta Dendy (Plate 13, D, E)

Isodictya cavicornuta Dendy, 1924: 335, pl. x figs 2, 3.

MATERIAL EXAMINED: BM(NH) 26.10.26.319, Three Kings Islands (type).

DESCRIPTION: Dendy described the sponge as funnel-shaped, or horn-like to tubular-cylindrical. Only small thin fragments of the sponge remain (Plate 13, D).

DIMENSIONS: Largest fragment: length 20 mm; width 7 mm; thickness 2 mm.

COLOUR: In life, not recorded by Dendy; in spirit, khaki yellow (5.0Y 6/6).

TEXTURE: Firm but friable.

SURFACE: The surface is hispid and perforated by pores. The pores on one surface are smaller (0.7 mm) than those on the opposing surface (1.0 mm).

SKELETON: The skeleton is an irregular reticulation of oxeas. The sponge is a dry specimen, and more skeletal detail is not possible because of the poor state of preservation.

SPICULES (Plate 13, E):
Megascleres: Smooth thick oxeas, curved or straight, the ends gradually but sharply pointed.
Microscleres: Palmate isochelae of normal form, occasionally with one alae slightly twisted (Plate 13, E). Smooth thin toxas, almost straight, slightly flexed centrally.
For spicule dimensions *see* Table 20.

REMARKS: Dendy (1924) mentioned "shorter and much more slender oxea, sometimes toxiform" in his description of *Isodictya cavicornuta.* He suggested that these were young forms of the larger oxeas. These spicules are found throughout the choanosome and are toxas. Thinner oxeas are also present and these may be developmental forms of the large oxeas.

TABLE 20. Spicule dimensions of *Isodictya cavicornuta.*

Locality		Oxeas (μm)	Isochelae (μm)	Toxas (μm)
Three Kings Is Dendy (1924)		650 × 32	64	
TYPE remeasured	x̄	639 × 25	68	259 × 5
	Range	570–725 × 16–40	58–72	240–270 × 4.5–5

Plumocolumella Burton, 1929

DIAGNOSIS: Desmacidonidae in which the skeleton is composed of plumose tracts of oxeas which terminate in dermal brushes at the surface of the sponge. Branching and anastomosing of the tracts may occur, but a regular reticulation is not formed. Megascleres of one size only. Microscleres unguiferate or anchorate isochelae, which may be accompanied by sigmas.

TYPE SPECIES: *Fibulia carnosa* Carter, 1886

REMARKS: Burton (1929) established this genus for species of Desmacidonidae which lacked the regular fibre reticulation characteristic of *Desmacidon. Plumocolumella* has unguiferate or anchorate isochelae while *Desmacidon* has arcuate or anchorate isochelae.

Plumocolumella novaezealandiae (Brøndsted) (Plates 13, F; 14, A–C)

Desmacidon novae zealandiae Brøndsted, 1924: 460, fig. 17a–d.
Plumocolumella novaezealandiae. Burton 1929: 425.

MATERIAL EXAMINED: Cape Karikari, 55 m.

DESCRIPTION: An irregular and thin encrusting sponge (Plate 13, F).

DIMENSIONS: Length 30 mm; width 20 mm; thickness 3 mm.

COLOUR: In life, pale yellow; dry specimen, yellow-brown (2.5Y 8/6).

TEXTURE: The dry specimen is firm and leathery.

SURFACE: The surface is irregular and elevated ⩽ 0.2 mm where clusters of spicules extend beyond the surface.

SKELETON: The skeleton consists of sinuous plumose tracts (⩽ 250 μm across) of oxeas that extend from the centre of the sponge to the surface, where they fan into dermal brushes (Plate 14, A). No regular reticulation is found. Oxeas and isochelae are scattered interstitially.

SPICULES (Plate 14, B, C):
Megascleres: Smooth straight oxeas with long tapering points.
Microscleres: Unguiferate isochelae.
For spicule dimensions *see* Table 21.

REMARKS: The recently collected specimen has thicker oxeas than those described by Brøndsted (1924), but is otherwise identical to the type specimen.

OTHER RECORDS: New Plymouth, New Zealand, 15 m.

TABLE 21. Spicule dimensions of *Plumocolumella novaezealandiae.*

Locality		Oxeas (μm)	Isochelae (μm)
Desmacidon novaezealandiae Brøndsted (1924)		350 × 6	12–14
Cape Karikari, 55 m	x̄	325 × 13	12
	Range	290–360 × 9–16	11–12.5

Guitarra Carter, 1874

DIAGNOSIS: Desmacidonidae in which the choanosomal skeleton is a reticulation of oxeas, and brushes of oxeas are present at the surface. Megascleres of one size category only. The characteristic microscleres are placochelae, which may be accompanied by equally-ended bipocilli.

TYPE SPECIES: *Guitarra fimbriata* Carter, 1874

Guitarra fimbriata Carter (Plates 14, D–F; 15, A–C)

Guitarra fimbriata Carter, 1874: 210, pl. xiii figs 2–5, pl. xv fig. 34; Burton 1929: 426.
Guitarra bipocillifera Brøndsted, 1924: 458, fig. 16.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m; Cuvier Island, 55 m; Colville Channel, 64 m (type of *Guitarra bipocillifera*), and one other specimen from the same locality.

DESCRIPTION: A massive, rounded sponge.

DIMENSIONS: Small specimen: length 10 mm; width 8 mm; thickness 4 mm. Large specimen: length 60 mm; width 40 mm; thickness 40 mm.

COLOUR: In life, white; in spirit, grey to pink (10.0R 6/2).

TEXTURE: Soft and fragile.

SURFACE: The surface is hispid microscopically and characterised by the presence of slightly elevated circular areas with hispid fringes. No oscules or pores are visible (Plate 14, D).

SKELETON: The skeleton is a regular isodictyal reticulation of oxeas (Plate 14, E). Numerous oxeas are scattered interstitially as are placochelae and bipocilli. The choanosomal tracts of oxeas fan into brushes at the surface (Plate 14, F).

SPICULES (Plate 15, A–C):
Megascleres: Slender, smooth, slightly wavy oxeas, with long tapered points.
Microscleres: Placochelae of normal form with a large size range (Plate 15, B). Small slender bipocilli that superficially resemble sigmas, but which have small rounded caps at each end orientated at an acute angle to the shaft. They differ from the bipocilli characteristic of species of *Iophon* in being equally-ended (Plate 15, C).
For spicule dimensions *see* Table 22.

REMARKS: Burton (1929) synonymised *Guitarra bipocillifera* Brøndsted with *Guitarra fimbriata* Carter. He examined the type specimen of *G. fimbriata* and found that bipocilli of a type and size range described by Brøndsted (1924) for *G. bipocillifera* were present in *G. fimbriata*, and that the placochelae and oxeas of *G. fimbriata* were similar in size to those of *G. bipocillifera*.

The type specimen and another of Brøndsted's specimens of *G. bipocillifera* have been examined. The spicules are of a similar size to those quoted for *G. fimbriata* by Burton (1929). Two additional sponges have been collected from New Zealand and these also conform to the redescription of *G. fimbriata* (Table 22).

OTHER RECORDS: Atlantic.

*Guitarra antarctica var. novaezealandiae Dendy

Guitarra antarctica var. *novae zealandiae* Dendy, 1924: 336; Lévi, 1963: 25.
Guitarra fimbriata. Burton 1929: 426.

REMARKS: *Guitarra antarctica* var. *novaezealandiae* was described by Dendy (1924) from Cape Maria van Diemen. Dendy found only one size of placochelae in this variety. The type has not been re-examined and the sponge has not been recollected.

Burton (1929) commented that *Guitarra antarctica*

TABLE 22. Spicule dimensions of *Guitarra fimbriata*.

Locality		Oxeas (μm)	Large placochelae (μm)	Small placochelae (μm)	Bipocilli (μm)
TYPE of *G. fimbriata* remeasured by Burton (1929)		310 × 5	90–100	40–50	10–11
G. bipocillifera Colville Channel, 64 m Brøndsted (1924)		⩽450 × 9	40–100	2 sizes not differentiated	10–14
TYPE of *G. bipocillifera* remeasured	x̄	388 × 9	79	2 sizes not differentiated	12
	Range	350–425 × 6–10	40–101		10–13
Colville Channel, 64 m	x̄	378 × 7	77	2 sizes not differentiated	11.5
	Range	350–400 × 4.5–8	38–95		10.5–12
Three Kings Is, 55–110 m	x̄	364 × 7	88	2 sizes not differentiated	12
	Range	332–395 × 5.5–8	41–100		10–13
Cuvier Island, 55 m	x̄	366 × 7	63	2 sizes not differentiated	12
	Range	320–410 × 6–8	23–95		10.5–13

var. *novaezealandiae* and *G. indica* Dendy, 1916 were indistinguishable. He referred both species to *G. fimbriata*, but noted the presence of smaller oxeas and the absence of large placochelae in both.

Lévi (1963) described a sponge from South Africa as *G. fimbriata* subsp. *indica*. This sponge has placochelae no longer than 50 μm, and lacks the large size category of these microscleres, as found in *G. fimbriata*. The oxeas in subspecies *indica* are slightly smaller than those in *G. fimbriata*.

As there are obvious differences in the descriptions of the New Zealand specimens of *G. fimbriata* and *G. antarctica* var. *novaezealandiae*, the use of a subspecific category is adopted until the type specimen of *G. antarctica* var. *novaezealandiae* can be examined.

DISTRIBUTION: New Zealand; Kattiawar.

Chondropsis Carter, 1886

Sigmatella Lendenfeld, 1889

DIAGNOSIS: Desmacidonidae with a skeleton that incorporates varying degrees of sand and foreign material. Spongin fibre development frequently accompanies the foreign material and the skeleton organisation overall is plumose or plumo-reticulate. The spicule skeleton is always reduced quantitatively. Megascleres are diactinal and may be accompanied by microscleres. Most commonly the microscleres are sigmas, but unguiferate isochelae can occur.

TYPE SPECIES: *Chondropsis arenifera* Carter, 1886

REMARKS: The genus *Chondropsis* has been included in the Desmacidonidae on the basis of the skeletal arrangement, which is plumose or plumo-reticulate, the megascleres which are diactinal, microscleres that, if present, are isochelae and/or sigmas, and on the presence of spongin fibre in some cases. *Chondropsis* is characterised by having a skeleton that incorporates sand and foreign material and as a consequence has a reduced spicule complement. Of the two species recorded from New Zealand, *Chondropsis kirkii* has sigmas as microscleres, while *C. topsentii* lacks microscleres, and these are the only New Zealand species of the Desmacidonidae that lack isochelae. A spicule preparation of *C. wilsoni* Dendy from southeastern Australia has been examined; this sponge has small unguiferate isochelae typical of desmacidonid genera such as *Strongylacidon*. *Chondropsis wilsoni* differs from *Strongylacidon* in incorporating massive amounts of sand in columns which take over the structural role of megascleres; the latter are greatly reduced in number and occur interstitially.

Carter (1886) described *Chondropsis arenifera* as having both diactinal and monactinal spicules, without microscleres. The sponge incorporated grains of sand in the ectosome and choanosome. Carter designated a new group, "Chondropsina", for sponges such as *C. arenifera*.

Lendenfeld (1889) established the genus *Sigmatella* for sponges with a skeleton composed of a network of arenaceous fibres, rod-shaped spicules and very small sigmas. Dendy (1894) synonymised *Sigmatella* with *Chondropsis* and noted that the generic name *Sigmatella* was preoccupied. Neave (1940) still listed *Sigmatella* as a sponge genus. However, the name *Chondropsis* has clear date priority over *Sigmatella*, and the synonymy is upheld.

Dendy (1894) defined *Chondropsis* as having a "skeleton composed largely of sand and other foreign bodies, usually (? always) arranged in distinct fibres or columns. Spicular skeleton greatly reduced. Megascleres diactinal, strongyla or tylota. Microscleres nearly always present in the form of sigmata" and he observed that the styles recorded by Carter in *Chondropsis*, and by Lendenfeld in *Sigmatella*, were abnormal or accidental. This is to be expected, given the amount of foreign debris in these sponges. Dendy recognised two related genera for sponges with spicules and foreign material in the skeleton: *Phoriospongia* Marshall, 1880 for species with monactinal megascleres, and *Chondropsis* Carter for species with diactinal megascleres.

George and Wilson (1919) referred *Chondropsis (Sigmatella)* and *Psammochela* Dendy to *Phoriospongia*. They considered that distinction on the basis of megasclere type was an insufficient reason to retain both *Chondropsis* and *Phoriospongia*. In support of their argument, they mentioned three species of *Sigmatella* described by Lendenfeld (1889) that had styles, tylotes or oxeas in addition to strongyles in the skeletons. Further, they noted that *Psammochela* had styles, strongyles or both types of megasclere. Dendy (1924) accepted the synonymy of *Chondropsis* with *Phoriospongia*, but retained *Psammochela*, probably because chelae are included in the microsclere complement, while *Phoriospongia* had only sigmas.

De Laubenfels (1936) synonymised *Phoriospongia* with *Psammascus* Marshall, *Sigmatella* with *Holopsamma* Carter, which also received the type species of *Chondropsis*, while eight other species of *Chondropsis*, including *C. kirkii*, were referred to *Psammascus*. He established a new family, Psammacidae, for sponges characterised by having skeletons that are chiefly composed of sand grains. This family as de Laubenfels construed it incorporated dictyoceratid sponges as well as species such as *C. kirkii*, which are poecilosclerid. Carter (1885) had established *Holopsamma* for sponges with skeletons formed of sand grains without fibre; he made no mention of the presence of spicules. De Laubenfels' action is difficult to uphold since the type species of *Sigmatella* and *Chondropsis* had been clearly described as having both megascleres and microscleres. Lendenfeld (1889) referred the type species of *Holopsamma, H. crassa*, to *Psammopemma* Marshall, but noted that other species placed in *Holopsamma* by Carter did not belong in *Psammopemma*. This view can be sustained

in part, since examination of type specimens of some species of *Holopsamma* reveals that *H. laminaefavosa* does possess some megascleres and belongs in *Echinoclathria, H. turbo* is a species of *Esperiopsis* and *H. fuliginosa* is a species of *Pseudoceratina.* Examination of the syntype of *Holopsamma crassa* (BM(NH) 86.12.15.484) indicates that it is probably an *Echinoclathria.* It has very few spicules indeed, and certainly none which resemble those of species assigned to *Chondropsis. Chondropsis*, which is a well-characterised genus, is thus retained for sponges with diactinal megascleres and a skeleton that incorporates foreign material. *Phoriospongia* is retained for sponges with monactinal megascleres and a skeleton that incorporates foreign material. This is consistent with the tendency in other Desmacidonidae to separate genera on the basis of megasclere complement. In genera like *Chondropsis* where the spicule content is significantly reduced, the presence or absence of sigmas is not considered to be a useful generic character.

Both New Zealand species of *Chondropsis* have diactinal megascleres and *Chondropsis kirkii* has a plumo-reticulate skeleton very similar to that seen in species of *Strongylacidon* and *Desmacidon. Chondropsis* differs from other desmacidonid genera in having the spicule skeleton reduced quantitatively in favour of incorporated foreign material. The skeletal arrangement and megasclere complement are typical of the family.

Chondropsis kirkii Carter

(Plates 15, D–F; 16, A, B)

RESTRICTED SYNONYMY:
Dysidea kirkii Carter, 1881: 374.
Sigmatella corticata var. *papillosa* Lendenfeld, 1889: 620, pl. 40 fig. 2.
Chondropsis kirkii. Dendy 1894: 251.
Gelliodes strongylofera Brøndsted, 1924: 448, fig. 7a–b.
Phoriospongia kirkii. Dendy 1924: 363.
Psammascus kirkii. de Laubenfels 1936: 99.

MATERIAL EXAMINED: BM(NH) 23.10.1.144, Stn 134, near Spirits Bay, 20–37 m; Spirits Bay, 35 m; NZOI Stn E367, near North Cape, 29 m; Cape Karikari, 30 m; Little Barrier Island, 20 m; Sponge Garden sand flats, Leigh, 18 m; Tokatu Point, 7 m.

DESCRIPTION: The sponge varies from encrusting with pronounced turrets, to a massive digitate sponge with erect lobes. One specimen has thin erect branches.

DIMENSIONS: For sponge dimensions *see* Table 23.

COLOUR: In life, brick red to pinkish brown (5.0YR 6/6); in spirit, fawn to grey (10.0YR 7/2).

TEXTURE: Firm and compressible, exuding mucous on removal from the water.

SURFACE: The surface is covered by a thin dermal membrane and is microscopically hispid. Beneath the membrane a fine reticulation is apparent.

SKELETON: The choanosomal skeleton consists of plumo-reticulate or reticulate tracts of strongyles, which have sand grains or foreign spicules incorporated to varying degrees (Plate 15, D, E). Spongin fibre development occurs in some of the specimens. The primary tracts are up to 150 μm wide, and near the surface of the sponge they fan into irregular brushes of strongyles. Above these brushes lie sand grains and foreign spicules which form a dermal crust of varying thickness (Plate 15, F). Sigmas are abundant throughout the choanosome.

SPICULES (Plate 16, A, B):
Megascleres: Smooth, straight strongyles, of large size range.
Microscleres: Small sigmas, usually hooked or C-shaped.
For spicule dimensions *see* Table 24.

TABLE 23. Sponge dimensions of *Chondropsis kirkii.*

Locality	Growth form	Height (mm)	Width (mm)	Thickness (mm)	Width of oscules (mm)
Cape Karikari, 30 m	Erect, thin branches	230	7 (single branch)	4 (single branch)	
Spirits Bay, 35 m	Thick encruster	20	25 (piece only)	20 (piece only)	2
NZOI Stn E367, near North Cape, 29 m	Thick encruster	25	65	25	3
Little Barrier Id, 20 m	Massive with lobes	60	47	12	5
Sponge Garden, Leigh, 18 m	Massive with lobes	35	42	15	3
Tokatu Point, 7 m	Massive with lobes	60	30 (piece only)	12	1

TABLE 24. Spicule dimensions of *Chondropsis kirkii*.

Locality		Strongyles (μm)	Sigmas (μm)
near Spirits Bay, 20–37 m BM(NH)23.10.1.144	x̄	175 × 4	14
	Range	140–175 × 2.5–4	12–17
Cape Karikari, 30 m	x̄	170 × 7	14
	Range	158–182 × 5–8	12.5–15.5
Spirits Bay, 35 m	x̄	136 × 4	11
	Range	130–145 × 3.5–4.5	10–12.5
NZOI Stn E367, near North Cape, 29 m	x̄	158 × 5	14
	Range	140–182 × 4–5.5	12.5–15.5
Little Barrier Id, 20 m	x̄	167 × 6	13
	Range	148–178 × 3.5–7.5	11.5–14
Sponge Garden, Leigh, 18 m	x̄	154 × 5	14
	Range	145–163 × 4–6	12.5–14.5
Tokatu Point, 7 m	x̄	151 × 5	15
	Range	145–160 × 4.5–8	13–17

OTHER RECORDS: Bass Strait; Port Phillip, Australia; Okhamandal, Indian Ocean.

Chrondropsis topsentii Dendy (Plate 16, C–F)

Chondropsis topsentii Dendy, 1894: 254.

MATERIAL EXAMINED: Anchor Bay, Tokatu, 5 m; Sponge Garden, Leigh, 16 m; Leigh Reef, 20 m; Harrington Point, Dunedin, 12 m; Papanui Beach, Dunedin, 2–3 m.

DESCRIPTION: An encrusting sponge of variable thickness. The surface is reticulate where the external layer of sand grains is absent. Oscules are flush with the surface, or in the centre of mounds that project up to 200 mm above the surface.

DIMENSIONS: For sponge dimensions *see* Table 25.

COLOUR: In life, yellow (2.5Y 7/6); in spirit, brown (10.0YR 4/2–10.0YR 6/8).

TEXTURE: Coarse and brittle, easily pulled apart.

SURFACE: The surface is faintly corrugated due to the arenaceous choanosomal reticulation. In some parts of the surface, sand grains fill in the reticulation and the surface is flat and even.

SKELETON: The skeleton consists of plumose tracts of sand grains running vertically to the surface (Plate 16, C); there is no spongin fibre development. Strongyles may form short tracts, but generally are found in clusters or scattered interstitially. Pigment cells are present throughout the sponge (Plate 16, D). At the surface there is a thick spongin layer with sand grains embedded in it. Loose tufts of strongyles may be present at the surface (Plate 16, E). Microscleres are absent.

SPICULES (Plate 16, F):
Megascleres: Small, slender smooth strongyles, which usually have one end slightly tylote.
Microscleres: None.
For spicule dimensions *see* Table 26.

TABLE 25. Sponge dimensions of *Chondropsis topsentii*.

Dimensions	Large specimen (mm)	Small specimen (mm)
Length	80	60
Width	80	40
Thickness (including oscule mounds)	45	20
Height of oscular turrets	20	10
Width of oscules	5	3

TABLE 26. Spicule dimensions of *Chondropsis topsentii*.

Locality		Strongyles (μm)
TYPE Port Phillip, Australia Dendy (1894)		140 × 2
Harrington Point, Dunedin, 12 m	x̄	129 × 2.2
	Range	113–138 × 2–2.5
Papanui Beach, Dunedin, 2–3 m	x̄	132 × 2.1
	Range	120–149 × 2–2.5
Sponge Garden, Leigh, 16 m	x̄	135 × 2.6
	Range	126–148 × 2–3
Leigh Reef, 20 m	x̄	142 × 2.1
	Range	127–151 × 2–2.5
Anchor Bay, Tokatu, 5 m	x̄	146 × 2.5
	Range	131–160 × 2–3

REMARKS: This species is characterised by the slender strongyles, plumose tracts of sand grains, and thick encrusting habit. The species is brown in spirit, and coarse and friable to touch. The surface mounds with central oscules are found in all the specimens, although oscules can also be flush with the surface.

OTHER RECORDS: Port Phillip, Australia.

Chondropsis sp.

REMARKS: Another species of *Chondropsis* has been found in New Zealand, but only one worn specimen has been collected from Muriwai Beach, hence full description cannot be undertaken at present. The sponge is encrusting, grey in spirit, with no oscules apparent. The skeleton is arenaceous, with abundant sand grains packing the matrix. Strongyles ($\bar{x}$ = 134 × 3.1 μm) are scattered throughout the choanosome, and form loose tufts in the ectosome where they are most abundant. Foreign material, finer than found in the choanosome, lies above the spicule tufts. There is no spongin development and no microscleres are present. This sponge could be *Chondropsis arenifera* Carter. Dendy (1894) redescribed this Australian species and the New Zealand sponge differs only in the absence of both oscules and microscopic algae in the skeleton.

Psammopemma Marshall, 1880

DIAGNOSIS: Desmacidonidae lacking a spicule skeleton and possessing instead a skeleton composed of sand grains and other detritus, the elements of the skeleton being partly joined together by slender spongin fibres.

TYPE SPECIES: *Psammopemma densum* Marshall, 1880

REMARKS: The genus has been placed in the Desmacidonidae until such time as the species described from New Zealand are recollected. It will then be possible to establish whether the genus *Psammopemma* belongs in the Desmacidonidae, or even within the Poecilosclerida.

***Psammopemma** sp.a Brøndsted

Psammopemma sp.a Brøndsted, 1926: 296.

REMARKS: This species was not fully described by Brøndsted, the type specimen is lost, and no new material has been collected.

DISTRIBUTION: North-west of Cape Maria van Diemen, 91 m.

***Psammopemma** sp.b. Brøndsted

Psammopemma sp.b Brøndsted, 1926:297.

REMARKS: This species was not fully described by Brøndsted, the type specimen is lost, and no new material has been collected.

DISTRIBUTION: North-west of Cape Maria van Diemen, 91 m.

***Psammopemma crassum** (Carter)

Holopsamma crassa Carter, 1885: 211.
Psammopemma crassum. Lendenfeld 1889: 634, 638; Brøndsted 1926: 322.

REMARKS: *Psammopemma crassum*, as stated earlier, is the type species of *Holopsamma* Carter, 1885, which Lendenfeld (1889) referred to *Psammopemma* Marshall. The species has not been recollected and Brøndsted's specimen is lost, so the record cannot be verified.

DISTRIBUTION: Port Phillip, Australia; Port Jackson, Australia; Port Chalmers, New Zealand.

Echinostylinos Topsent, 1927

DIAGNOSIS: Desmacidonidae with distinct ectosomal and choanosomal monactinal megascleres. The skeleton consists of plumose tracts of spicules, occasionally echinated by smooth megascleres of the same size. Microscleres are arcuate isochelae and sigmas.

TYPE SPECIES: *Echinostylinos reticulatus* Topsent, 1927

REMARKS: Topsent (1928) noted that the familial position of *Echinostylinos* was unclear. Certainly the presence of two distinct sizes of megascleres, some of which echinate the spicule tracts, is not characteristic of Desmacidonidae. However, the arragement of the skeleton and the short toothed isochelae are typical of the Desmacidonidae, and the genus is left in that group following Topsent (1928) and Lévi (1973).

Echinostylinos reticulatus Topsent (Plate 17, A–D)

Esperiopsis polymorpha Topsent, 1892a: 91, pl. vi figs 1–3.
Echinostylinos reticulatus Topsent, 1927: 8; 1928: 207, pl. ii fig. 21, pl. vii figs 15, 16.

MATERIAL EXAMINED: NZOI Stn B93, Three Kings Islands, 55–110 m (two specimens).

DESCRIPTION: A ramose sponge. The larger specimen is a folded lamella attached along the base, with finger-like processes arising from the sides and apex (Plate 17, A).

DIMENSIONS: Length of base 40 mm; length above base 110 mm; width 30–70 mm; thickness 30 mm.

COLOUR: In life, light yellow (2.5Y 8/4); dry specimen, light brown (10.0YR 6/4).

TEXTURE: The texture is compressible and elastic.

SURFACE: The surface is coarsely reticulated. The dermal membrane is thin and smooth and adheres to the underlying tissues, sinking into the spaces between the reticulation.

SKELETON: The choanosomal skeleton consists of plumose tracts of subtylostyles, forming a loose reticulation (Plate 17, B). The same size of subtylostyles may occasionally echinate the primary tracts. Fine subtylostyles occur tangentially in the ectosome, and occasionally are organised into erect spicule brushes (Plate 17, C). Sigmas are found throughout the sponge while isochelae are mainly confined to the ectosome.

SPICULES (Plate 17, D):
Megascleres: Two sizes of subtylostyles – long smooth forms, frequently wavy and usually stylote, and small thin wavy forms, usually subtylostyles.
Microscleres: Arcuate isochelae with three short alae. Sigmas of normal form and in two size categories.
For spicule dimensions *see* Table 27.

REMARKS: The spicules of the New Zealand specimens are characteristically shorter and finer than those in specimens from the Atlantic Ocean. There is close correspondence in spicule shape, habit and skeletal arrangement. This is the first record of this genus from the Southern Hemisphere, and the disjunct distribution may argue for specific distinction when more material is obtained.

OTHER RECORDS: Azores Archipelago.

Tetrapocillon Brøndsted, 1924

DIAGNOSIS: Desmacidonidae with an irregular reticulation of monactinal megascleres. The primary tracts form spicule brushes at the surface, and the characteristic microscleres are tetrapocilli, which are accompanied by palmate isochelae.

TYPE SPECIES: *Tetrapocillon novaezealandiae* Brøndsted, 1924

REMARKS: Brøndsted (1924) established this genus for sponges with tetrapocilli as microscleres. Lévi (1963) has recorded *Tetrapocillon novaezealandiae* from South Africa.

Tetrapocillon novaezealandiae Brøndsted
(Plates 17,E, F; 18,A, B)

Tetrapocillon novae zealandiae Brøndsted, 1924: 457, fig. 15a–f; Lévi, 1963: 25, fig. 25, pl. iij.

MATERIAL EXAMINED: Barren Arch, Poor Knights Islands, 15 m; Anchor Bay, Tokatu, 5 m; Goat Island Bay, Leigh, intertidal.

DESCRIPTION: A thick encrusting sponge that forms spreading mats with a smooth, velvety, external surface.

DIMENSIONS: Length 100–120 mm; width 30–50. mm; thickness 10–15 mm.

COLOUR: In life, jet black exterior, bright orange-yellow interior (10.0YR 6/6); in spirit, black exterior, brown-yellow interior (10.0YR 4/4).

TEXTURE: Soft and velvety to touch, firm and pliable in the dermal region, more crumbly below.

SURFACE: Oscules are visible in the live state, flush with the surface, and measuring 0.5–0.8 × 0.2–0.4 mm. On fixation the oscules tend to disappear. The surface is granular in appearance, and rendered hispid microscopically by projecting dermal styles oriented at an acute angle to the surface.

SKELETON: The choanosomal skeleton consists of styles or subtylostyles which form an irregular reticulation (Plate 17, E). The primary tracts branch at the surface, each forming two or three spicule brushes. There are subdermal spaces directly beneath the dermal membrane, which is packed with pigment cells (Plate 17, F). Tetrapocilli are abundant throughout the sponge.

SPICULES (Plate 18, A, B):
Megascleres: Styles that tend towards subtylostylote forms, and are of uniform size. They are rarely straight, usually undulate, tapering to a sharp point.
Microscleres: Small palmate isochelae of normal form. Tetrapocilli (Plate 18, B).
For spicule dimensions *see* Table 28.

TABLE 27. Spicule dimensions of *Echinostylinos reticulatus*.

Locality		Large subtylostyles (μm)	Small subtylostyles (μm)	Isochelae (μm)	Sigmas (2 sizes) (μm)
Azores, 919 & 927 m Topsent (1927)		500–560 × 26–30	245–280 × 3	27–43	15 22
NZOI Stn B93, Three Kings Is, 55–110 m specimen 1	x̄	506 × 12	278 × 5	36	31 and 16
	Range	484–530 × 10–13	242–299 × 4–6	33–40	29–36 and 15–18
NZOI Stn B93, Three Kings Is, 55–110 m specimen 2	x̄	403 × 10	248 × 4	29	23 and 16
	Range	387–450 × 8–11	202–300 × 3–5	28–30	22–26 and 15–17

TABLE 28. Spicule dimensions of *Tetrapocillon novaezealandiae*.

Locality		Styles (μm)	Isochelae (μm)	Tetrapocilli (μm)
TYPE Slipper Island Brøndsted (1924)		260–325 × 10	15	40–80 Average 50
Knysna Estuary, South Africa Lévi (1963)		275–325 × 5–7	7–18 Average 10	2 sizes 50–52 21–24
Goat Island Bay, intertidal	x̄	316 × 7	11	10
	Range	300–330 × 5–9	9–13	6–18.5
Barren Arch, Poor Knights Is, 15 m	x̄	280 × 6	11	8
	Range	273–290 × 5–7	10–13	6–10
Anchor Bay, Tokatu, 5 m	x̄	270 × 7	14	39
	Range	230–290 × 6–8.5	11–18	25–55

REMARKS: *Tetrapocillon novaezealandiae* is one of the more striking and common members of the intertidal and subtidal fauna. It occurs on moderately to extremely exposed coasts along the north-eastern part of the North Island of New Zealand.

OTHER RECORDS: Slipper Island, New Zealand; Knysna Estuary, South Africa.

Family COELOSPHAERIDAE Hentschel, 1923

DIAGNOSIS: Poecilosclerida that are massive or encrusting, frequently spherical, always with specialised tubular oscular and poral fistules. The ectosomal and choanosomal skeletons are sharply differentiated; the ectosome is an easily separable dense crust of tangentially oriented megascleres. The same megascleres occur in the choanosome and are usually diactinal, i.e., tylotes, strongyles or oxeas. In some genera more than one type or size category of megasclere occurs. The choanosomal structure tends to collapse when removed from water and is generally described as pulpy; in life it consists of tracts of megascleres augmented by scattered spicules. Microscleres, if present, include arcuate isochelae, birotulate isochelae, sigmas, microxeas, and toxas.

REMARKS: Genera referred to the family Coelosphaeridae have been distinguished here primarily on microsclere complement. The genus *Coelosphaera* has arcuate isochelae accompanied by sigmas, *Amphiastrella* has birotulate isochelae, while *Inflatella* lacks microscleres. The genus *Histodermella* is characterised by the presence of a second category of megascleres that are acanthose diacts. Apart from spicule complement, the genera are very similar in external morphology and skeletal arrangement.

Van Soest (1984) suggested that fistulose form is an adaptive character and cannot be used to define higher taxa such as families. He argued that the family Coelosphaeridae is artificial and may eventually be fitted into the Myxillidae (subfamily Tedaniidae). This argument ignores the consistent association of specialised fistules, particular megasclere spiculation, and skeletal organisation in coelosphaerids. Affinity with the Myxillidae is difficult to argue when considering these features in conjunction. Van Soest is suggesting that fistulose habit, clearly a requirement for sponges which occupy certain habitats, is equivalent regardless of the morphology of the fistule produced. This view is simplistic and unsustainable when considering the spectrum of sponges which have a fistulose habit, e.g., *Orina* (order Haplosclerida), *Polymastia* (order Hadromerida), *Ciocalypta* (order Halichondrida), and *Monosyringia* (order Choristida). These sponges are clearly divergent in skeletal arrangement, megasclere spiculation and reproductive characters, and could not be associated solely on habit. The Coelosphaeridae are not considered a coherent group on fistulose habit alone; the co-occurrence of morphologically similar fistules, a particular skeletal organisation, and spicule complement, characterise the family.

Coelosphaera Wyville Thomson, 1873

Histoderma Carter, 1874

DIAGNOSIS: Coelosphaeridae that are massive or encrusting with erect fistules. The choanosomal skeleton consists of poorly developed tracts and scattered spicules. The ectosomal skeleton consists of a compact crust of spicule layers orientated tangentially to the surface. The megascleres are of one type only and may be tylotes or strongyles. Microscleres are arcuate isochelae accompanied by sigmas. Trichodragmata may occur.

TYPE SPECIES: *Coelosphaera tubifex* Wyville Thomson, 1873

REMARKS: This diagnosis is adapted from the redescription of the genus *Histoderma* by Lundbeck (1910). The description has been extended to include trichodragmata found in *Coelosphaera hechteli* van Soest, 1984.

Coelosphaera globosa Bergquist (Plate 18,C, D)

Coelosphaera globosa Bergquist, 1961b: 176, fig. 5a–d.

MATERIAL EXAMINED: Stn 59, Chatham Rise, 531 m; Papanui Canyon, 480–550 m; Karitane Canyon, 540–720 m.

DESCRIPTION: The sponge body is spherical, with

numerous open fistules scattered over the surface and with branched stolons spreading from the base (Plate 18, C).

DIMENSIONS: Diameter of body 7–22 mm, diameter of fistules 2–5 mm, length of stolons up to 9 mm.

COLOUR: In life, white; in spirit, grey-white.

TEXTURE: Stiff and firm, but fragile.

SURFACE: The surface is smooth and raised into low inverted cones up to 3 mm high around the pore areas. Inside each fistule is a pore membrane subdivided by inward extensions of the fistule wall.

SKELETON: The choanosome is pulpy with no spicule organisation remaining in the preserved specimens. Loose spicule tracts presumably exist in the choanosome of the living sponge. Tylotes, isochelae and sigmas are all abundant. The ectosome is a compact rind, 1.5 mm thick, composed of tangentially disposed tylotes and scattered isochelae.

SPICULES (Plate 18, D):
Megascleres: Slightly wavy tylotes, which can be subtylote or have a secondary expansion immediately behind the head. Strongyles occur as rare modifications of the tylotes.
Microscleres: Arcuate isochelae with an evenly curved shaft and the central tooth at each end reduced to one quarter the length of the laterals. Sigmas of normal form.
For spicule dimensions *see* Table 29.

REMARKS: *Coelosphaera globosa* is distinguished from other species of *Coelosphaera* by its white colour in conjunction with the spicule dimensions and the globose shape.

Coelosphaera calcifera (Burton) (Plate 18, E)

Histoderma calcifera Burton, 1934: 548, fig. 8a–c.

MATERIAL EXAMINED: Campbell Plateau, 84 m.

DESCRIPTION: The sponge is a thin encrustation growing on a piece of basalt.

DIMENSIONS: Thickness 2 mm.

COLOUR: In life, white; in spirit, grey.

TEXTURE: Delicate and easily torn.

SURFACE: The surface is almost covered with fine shell debris. Two fistules 0.8 mm in diameter arising from the surface have clean, smooth dermal regions.

SKELETON: The choanosomal skeleton is confused and composed of smooth tylotes. The same tylotes are found in the ectosome where they are tangentially disposed in a compact layer 0.5 mm deep. Isochelae and sigmas are abundant throughout the sponge.

SPICULES (Plate 18, E):
Megascleres: Straight tylotes of slightly uneven diameter, with heads sharply set off from the shaft.
Microscleres: Arcuate isochelae, of normal form. Sigmas that are C- or S-shaped forms.
For spicule dimensions *see* Table 30.

REMARKS: The type description of *Coelosphaera calcifera* Burton, 1934 is very brief and does not include a full description of the arrangement of the skeleton, hence detailed comparison of the present specimen and the holotype is not possible. Spicule morphology, dimensions, and the characters of the sponge surface are very similar, and leave little doubt as to the identity of the two specimens.

OTHER RECORDS: Great Barrier Reef, Australia, 51 m.

Coelosphaera transiens n.sp. (Plates 18, F; 19, A)

MATERIAL EXAMINED: Takapuna Reef, intertidal; Narrow Neck Reef, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 122.

TYPE LOCALITY: Takapuna Reef, Auckland, intertidal.

DESCRIPTION: A thin encrusting sponge, found on rocks in mid-tidal pools, often growing under and through more robust encrusting sponges, or mingled with *Corallina*. The sponge is obvious only when it develops fistules. This species is very short lived on the shore, appearing in November, reproducing in March or April, and presumably overwintering in deeper water or in a gemmulate stage.

DIMENSIONS: Thickness 1–1.5 mm; height of fistules 0.5–5 mm.

COLOUR: In life, orange (5.0YR 6/12); in spirit, white.

TABLE 29. Spicule dimensions of *Coelosphaera globosa*.

Locality		Tylotes (μm)	Isochelae (μm)	Sigmas (μm)
Chatham Rise, 531 m	$\bar{x}$	696 × 18	26.3	36
	Range	600–725 × 18	25–28	25–40

TABLE 30. Spicule dimensions of *Coelosphaera calcifera*.

Locality		Tylotes (μm)	Isochelae (μm)	Sigmas (μm)
TYPE Great Barrier Reef, 51 m Burton (1934)		350 × 7	20–26	28–70 or more
Campbell Plateau, 84 m	$\bar{x}$	264 × 4.4	29.5	57
	Range	256–300 × 3.6–5	26–34	36–72

TEXTURE: Crisp.

SURFACE: The surface has a smooth dermal membrane over it except around the fistules, where it is wrinkled and folded. There are no specialised pore areas.

SKELETON: The choanosomal skeleton consists of loose tracts of tylotes which fan out where they intersect the ectosome. The ectosomal skeleton is composed of tangentially aligned tylotes supplemented by numerous isochelae. Foreign material is present throughout the sponge (Plate 18, F). Sigmas and isochelae occur in the choanosome.

SPICULES (Plate 19, A):
Megascleres: Smooth, straight tylotes with oval heads.
Microscleres: Arcuate isochelae with stout shafts and the middle tooth slightly shorter than the laterals, abundant. Sigmas that are C- or S-shaped and are not abundant.
For spicule dimensions *see* Table 31.

REMARKS: This species is differentiated from others in *Coelosphaera* by the shape of the isochelae in conjunction with the encrusting habit and orange colouration. It is closest to *C. encrusta* Kumar, 1925 from India, which is similar in habit and colour but which differs in spicule complement. *Coelosphaera encrusta* has two sizes of tylotes, this is not the case in *C. transiens*. It should be noted that Kumar described the isochelae of *C. encrusta* as palmate but figures them as arcuate.

TABLE 31. Spicule dimensions of *Coelosphaera transiens*.

Locality		Tylotes (μm)	Isochelae (μm)	Sigmas (μm)
Takapuna Reef, intertidal	$\bar{x}$	258 × 5	23	40
	Range	179–280 × 3–5.5	18–28	30–44

Histodermella Lundbeck, 1910

Hiltonus de Laubenfels, 1936

DIAGNOSIS: Coelosphaeridae usually of spherical shape with erect fistules. The choanosomal skeleton consists of irregular tracts or scattered diactinal spicules, typically tylotes or strongyles. The ectosomal skeleton contains the same spicules orientated in a thick tangential layer. Acanthoxeas or acanthostrongyles form a layer at right angles to the ectosomal diacts, and are found scattered in the choanosome. Microscleres, if present, are arcuate isochelae, which may be accompanied by sigmas and trichodragmata.

TYPE SPECIES: *Histodermella ingolfi* Lundbeck, 1910

REMARKS: Lundbeck (1910) established *Histodermella* primarily because of the presence of a second category of megascleres, the acanthose diacts which were orientated at right angles to the tangential crust of smooth diacts. The spicule complement is otherwise identical to that of *Coelosphaera*. The diagnosis includes species without microscleres, as Lundbeck described *H. coriacea*, which does not have microscleres, at the same time as he described the type species, *H. ingolfi*.

De Laubenfels (1936) established the genus *Hiltonus* for *Histodermella australis*, which he described as having diactinal megascleres that vary from tylotes to strongyles, supplemented by echinating acanthostyles, with sigmas for microscleres. *Histodermella australis* was the only species allocated to *Hiltonus* and as de Laubenfel's description of *H. australis* bears little relationship to the original, the use of *Hiltonus* is not sustained.

Histodermella australis Dendy (Plate 19, B–F)

Histodermella australis Dendy, 1924: 373, pl. xv figs 24–27.
Hiltonus australis. de Laubenfels 1936: 71.

MATERIAL EXAMINED: NZOI Stn E271, west of Cape Maria van Diemen, 134 m.

DESCRIPTION: A small spherical sponge with elongate fistules (Plate 19, B).

DIMENSIONS: No data.

COLOUR: In life, unknown; in spirit, creamy-white.

TEXTURE: The outer layer is firm and tough.

SURFACE: The surface is smooth.

SKELETON: The choanosomal skeleton has collapsed away from the ectosome, and consists of scattered tylotes forming an irregular mesh; in places the tylotes are in short tracts suggesting a more structured organisation in life. The ectosomal skeleton consists of dense layers of tylotes orientated tangentially (Plate 19, C, D) and, arrayed at right angles to these, the acanthoxeas form a compact palisade.

SPICULES (Plate 19, E, F):
Megascleres: Two sizes of tylotes which do not have any specific localisation in the skeleton; they are long, smooth, usually slightly curved, with well-developed oval heads. Short, straight acanthoxeas covered with sharp spines except at the apices, which are smooth and sharply pointed.
Microscleres: Small arcuate isochelae (Plate 19, F). Fine sigmas of normal form.
For spicule dimensions *see* Table 32.

REMARKS: Dendy (1924) noted that in *Histodermella australis* isochelae were rare and possibly contaminants; he therefore separated *H. australis* from *H. ingolfi*. The type specimen of *H. australis* (BM(NH) 23.10.1.155) has been re-examined and isochelae are present but rare. They are identical with the isochelae

found in the specimen from Stn E271, and in all other respects, the two sponges are identical. The New Zealand specimens are very similar to descriptions of *H. ingolfi* by Lundbeck (1910) and Lévi (1963). *Histodermella australis* is retained on the basis of the difference in width of the acanthoxeas, 28–36 μm as compared with the type description of *H. ingolfi*, 8–14 μm.

OTHER RECORDS: Three Kings Islands, New Zealand.

Amphiastrella Dendy, 1895

Xytopsene de Laubenfels, 1936

DIAGNOSIS: Coelosphaeridae with a massive body that has erect fistules over the surface. The choanosomal skeleton consists of diactinal megascleres which are strongyles or tylotes, forming an irregular mesh. The same megascleres form a compact dermal layer orientated tangentially to the surface. Characteristic microscleres are birotulate isochelae.

TYPE SPECIES: *Phloeodictyon birotuliferum* Carter, 1886

REMARKS: Dendy established this genus as a means of distinguishing *P. birotuliferum* from other species of *Phloeodictyon* which had quite different skeletal organisation. *Amphiastrella* is typically coelosphaerid in external form, skeletal arrangement, and spicule complement, and is characterised by the presence of birotulate isochelae.

Lévi and Lévi (1983) included *Amphiastrella* in the family Cornulidae, but this view is not upheld, because *Amphiastrella* lacks palmate isochelae, otherwise a consistent feature of the Cornulidae, and in all characters the genus is typical of the Coelosphaeridae.

De Laubenfels (1936) established *Xytopsene* for sponges with tylotes and palmate isochelae, and referred *Cornulum novaezealandiae* to this genus. *Cornulum novaezealandiae* is a synonym of *Amphiastrella kirkpatricki* and the palmate chelae reported by Brøndsted are in fact birotules. Thus *Xytopsene* becomes a synonym of *Amphiastrella.*

Amphiastrella kirkpatricki Dendy

(Plate 20, A–E)

Amphiastrella kirkpatricki Dendy, 1924: 371, pl. ix fig. 2, pl. xv figs 28–31; de Laubenfels 1936: 71.
Cornulum novae zealandiae Brøndsted, 1924: 473, fig. 26a–d.
Xytopsene novae zealandiae. de Laubenfels 1936: 54.

MATERIAL EXAMINED: BM(NH) 23.10.1.153, Three Kings Islands (type); NZOI Stns E269, near Cape Maria van Diemen, 59 m; E271, west of Cape Maria van Diemen, 134 m; J969, off Cape Brett, 70–106 m. Type specimen of *Cornulum novaezealandiae* (Copenhagen Museum).

DESCRIPTION: This species is spherical with long tapering fistules extending from the surface (Plate 20, A). It is common along the north-eastern coast of New Zealand on coarse shell or rocky sea floor.

DIMENSIONS: Diameter 50–105 mm; height (largest specimen) 60 mm; height of fistules 20 mm.

COLOUR: In life, rose red (7.5R 6/8); in spirit, cream to fawn.

TEXTURE: Papery and easily collapsed.

SURFACE: The surface is smooth, produced at intervals into tapering fistules, each of which is terminated by a button-like expansion differentiated as either a poral or an oscular sieve.

SKELETON: On collection the choanosome always collapses away from the ectosome (Plate 20, B). It is composed of a loose weft of branching and anastomosing tracts, 0.4–1.8 mm in diameter, and made up of tylotes. The ectosome is 0.2–0.6 mm thick, compact and composed of several layers of tangential tylotes (Plate 20, C).

TABLE 32. Spicule dimensions of *Histodermella australis.*

Locality		Large tylotes (μm)	Small tylotes (μm)	Acanthoxeas (μm)	Isochelae (μm)	Sigmas (μm)
Three Kings Is, 183 m Dendy (1924)		⩽ 700 × 20		170 × 34		⩽68
TYPE remeasured	x̄	601 × 18	317 × 12	179 × 23	28	41
	Range	500–700 × 12–20	290–375 × 10–20	152–200 × 15–30	20–38 rare	30–70
NZOI Stn E271, W. of Cape Maria van Diemen, 134 m	x̄	773 × 17	325 × 9	255 × 32	24	37 rare
	Range	530–1100 × 12–21	285–355 × 8–11	240–275 × 28–36	20–26	

SPICULES (Plate 20, D, E):
Megascleres: Long, smooth, wavy tylotes, of variable thickness. They have weakly demarcated oval heads.
Microscleres: Birotulate isochelae with umbrella-shaped heads consisting of six to ten pointed, slightly recurved teeth (Plate 20, E).
For spicule dimensions *see* Table 33.

REMARKS: Body form, spicule shape, and skeletal construction, are identical in *Amphiastrella kirkpatricki* and *Cornulum novaezealandiae*; they are seemingly small and large specimens of the same species. Brøndsted (1924) described the chelae in *Cornulum novaezealandiae* as being palmate, but examination of the type specimen (Copenhagen Museum) shows that they are birotules identical to those found in *A. kirkpatricki*. The spicule dimensions exhibit quite a wide range in the specimens examined (Table 33), but the external characters, skeletal construction, and spicule shape, are consistent.

Dendy (1924) noted that *A. kirkpatricki* resembled *Inflatella spherica* and *I. belli* in external appearance. Burton (1929) synonymised *A. kirkpatricki* with *I. belli* and suggested that the former was a form of *I. belli* which had a full complement of spicules. Burton's synonymy overlooked the fact that the megascleres are oxeas in *Inflatella* and tylotes in *Amphiastrella*, and that no microscleres are present in *Inflatella*, while *Amphiastrella* always possesses birotules.

TABLE 33. Spicule dimensions of *Amphiastrella kirkpatricki*.

Locality		Tylotes (μm)	Birotules (μm)
Three Kings Is, 183 m Dendy (1924)		800 × 20	32
TYPE of *A. kirkpatricki* remeasured	x̄	710 × 18	32
	Range	615–800 × 12–30	30–34
Cape Maria van Diemen, 91 m Brøndsted (1924)		870 × 15	27
TYPE of *C. novaezealandiae* remeasured	x̄	679 × 15	25
	Range	620–770 12–20	23–27
NZOI Stn J969, off Cape Brett, 70–106 m	x̄	474 × 10	19
	Range	385–550 × 7–14	17–20
NZOI Stn E269, near Cape Maria van Diemen, 59 m	x̄	776 × 20	30
	Range	675–850 × 17–22	27–33
NZOI Stn E271, W. of Cape Maria van Diemen, 134 m	x̄	601 × 13	29
	Range	440–740 × 11–18.5	26–33

Inflatella Schmidt, 1875

Joyeuxia Topsent, 1892a
Pyloderma Kirkpatrick, 1908

DIAGNOSIS: Coelosphaeridae with massive, frequently spherical shape, and with erect fistules. The choanosomal skeleton consists of thin tracts or scattered spicules. The ectosomal skeleton consists of a compact crust of spicule layers oriented tangentially to the surface. The diactinal megascleres are of one type only, and may be tylotes, strongyles, or oxeas. Microscleres are absent.

TYPE SPECIES: *Inflatella pellicula* Schmidt, 1875

REMARKS: Lundbeck (1910) redescribed *Inflatella* stating that the megascleres are strongyles, while Hentschel (1923) referred *Pyloderma latrunculioides*, a species with oxeas, to this genus. Dendy (1924) defined *Inflatella* as having strongylote to oxeote megascleres and included *I. spherica*, a species with oxeas, in the genus. The present diagnosis includes diactinal megascleres that are tylotes, strongyles or oxeas; thus the genus is distinguished from *Coelosphaera* by the absence of microscleres. Lundbeck (1910) noted this factor and suggested that the validity of the genus *Inflatella* was doubtful. Generic separation on the presence or absence of microscleres, or on the type of microsclere present occurs throughout this family. Since many specimens of *Inflatella* have been collected and the absence of microscleres is consistent, the genus is retained.

Van Soest (1984) commented that because of the absence of microscleres and the large size of megascleres, *Inflatella* was not a typical coelosphaerid genus. *Inflatella spherica* is a typical coelosphaerid and is similar to *Coelosphaera* in external morphology, skeletal arrangement, and megasclere complement. Comparison of the size of the megascleres of New Zealand coelosphaerids (Table 34) shows that the dimensions of the oxeas of *I. spherica* are not excessive for this family.

Inflatella spherica Dendy (Plates 20, F; 21, A–C)

Inflatella spherica Dendy, 1924: 373, pl. ix fig. 3.

MATERIAL EXAMINED: BM(NH) 23.10.1.154, Three Kings Islands, 183 m (type); NZOI Stn J954, western continental slope, Northland, 192–204 m.

DESCRIPTION: The sponge is spherical, with a basal stem and apical fistules. Some of the fistules are tapered towards the end, others expand into a wide trumpet shape.

DIMENSIONS: Height of overall sponge 34 mm; length of stem 15 mm; diameter of sphere 25 mm; length of fistules 1–6 mm.

COLOUR: In life, blood red; in spirit, yellow (5.0Y 7/6).

TABLE 34. Comparison of megasclere sizes in New Zealand Coelosphaeridae.

Species	*Inflatella spherica*	*Amphiastrella kirkpatricki*	*Histodermella ingolfi*	*Coelosphaera globosa*	*Coelosphaera calcifera*	*Coelosphaera transiens*
Megasclere type	Oxeas	Tylotes	Tylotes	Tylotes	Tylotes	Tylotes
$\bar{x}$ (μm)	833 × 25	776 × 20	773 × 17	696 × 18	264 × 4.4	258 × 5
Range (μm)	700–925 × 21–29	675–850 × 17–22	530–1100 × 12–21	600–725 × 18	256–300 × 3.6–5	179–280 × 3–5.5

TEXTURE: Exterior is parchment-like and coarse (Plate 20, F).

SURFACE: The surface is smooth, but rendered rough to the touch by tangential spicules.

SKELETON: The choanosome has collapsed into a small pulpy ball. The choanosomal skeleton consists of oxeas which tend to run in tracts towards the surface. Other oxeas overlap the tracts at various angles to form an irregular mesh (Plate 21, A). The ectosomal skeleton consists of thick layers of tangential oxeas, with some spicules disposed at right angles to these layers (Plate 21, B).

SPICULES (Plate 21, C):
Megascleres: Long smooth oxeas, usually wavy along their length, and with short, sharp points.
Microscleres: None.
For spicule dimensions *see* Table 35.

REMARKS: This species is closely related to a sponge described as *Inflatella belli* by Boury-Esnault and van Beveren (1982) from Kerguelen. The Kerguelen sponge is spherical with some trumpet-shaped fistules, and has megascleres which are oxeas with short, rounded or lanceolate points. The dimensions of the oxeas are 695–838 × 10–19 μm. The original description of *I. belli* Kirkpatrick, 1907 defined the megascleres as strongyles and the spicules are figured as having blunt ends. These spicules measured 850 × 13 μm. In all other characters, i.e., external morphology, skeletal arrangement and spicule dimensions, this sponge is identical to the Kerguelen and New Zealand specimens. However, the oxeas of *I. spherica* do not have rounded points. It is possible that *I. spherica* should be synonymised with *I. belli*, but both species should be retained until the type specimen of *I. belli* can be examined and the degree of difference between the megascleres ascertained.

TABLE 35. Spicule dimensions of *Inflatella spherica*.

Locality		Oxeas (μm)
TYPE Three Kings Is, 183 m Dendy (1924)		850 × 20
TYPE BM(NH)23.10.1.154 remeasured	$\bar{x}$	803 × 22
	Range	600–950 × 20–25
NZOI Stn J954, 192–204 m	$\bar{x}$	833 × 25
	Range	700–925 × 21–29

Manawa n.gen.

DIAGNOSIS: Coelosphaeridae of spherical shape with fistulose inhalent and exhalent surface structures. The ectosomal skeleton is a compact crust of oxeote spicules orientated tangentially to the surface. Megascleres are oxeas only, accompanied by isochelae as microscleres.

TYPE SPECIES: *Pyloderma demonstrans* Dendy, 1924

ETYMOLOGY: *Manawa* is the Maori generic term for the Three Kings Islands, near to which Dendy's specimen was collected.

*Manawa demonstrans (Dendy)

(Plates 21, D–F; 22, A)

Pyloderma demonstrans Dendy, 1924: 370, pl. ix fig. 4, pl. xv figs. 22–23b.
Anchinoe latrunculioides Burton, 1929: 439.

REMARKS: This species has not been recollected, but the type specimen (BM(NH) 23.10.1.152) has been re-examined to establish whether the species is correctly placed within the Coelosphaeridae, or whether Burton (1929) was correct in urging that it is a reduced myxillid. The former view is adopted here on the basis of external morphology, the ectosomal tangential lamellae composed of oxeas (Plate 21, D), and the pulpy collapsed choanosome (Plate 21, E). The spicule complement of oxeas and isochelae (Plates 21, F; 22, A) necessitates establishing a new genus for this sponge. *Inflatella* is closely related in having oxeote megascleres, but it lacks microscleres. *Coelosphaera* has isochelae and sigmas for microscleres accompanied by tylote or strongylote megascleres.

Dendy (1924) was in error when he placed this spe-

cies in *Pyloderma* on the basis of a similarity to *P. latrunculioides*, from which it differed in having microscleres. Kirkpatrick (1908) established the genus *Pyloderma* and designated the type as *Halichondria latrunculioides* Ridley & Dendy, 1887. This sponge had oxeas as megascleres, no microscleres, a parchment-like easily separated dermal membrane, and both distinct pore areas and oscules on conical projections. Kirkpatrick wished to distinguish this distinct morphological type from other species of *Halichondria* with confused internal skeletons made up of oxeas; he had, however, no clear view on the affinities of the genus. Hentschel (1914) synonymised *P. latrunculioides* with *Inflatella* on the basis that the oxeote megascleres found in *P. latrunculioides* were not sufficient reason to warrant a generic separation from *Inflatella*. As *I. spherica* has oxeas for megascleres, Hentschel's synonymy is supported here. This necessitates the removal of *P. demonstrans* from *Inflatella* because of the presence of microscleres in the former.

Burton (1929) synonymised *P. demonstrans* with *Anchinoe latrunculioides* suggesting that these species were "successive stages in the reduction of a typical *Anchinoe* by the loss of one or more categories of spicules." Burton's 'Discovery' specimen of *A. latrunculioides* (BM(NH) 28.2.15.745) has been examined and from the skeletal arrangement this sponge appears to be a *Halichondria*. Kirkpatrick's specimen of *P. latrunculioides* (BM(NH) 08.2.5.199) has also been examined and this is a typical *Inflatella*. The two specimens should never have been identified as the same species. Burton (1929) was apparently trying to place genera in the Myxillinae by demonstrating reduction series of skeletal elements. This is the same problem as mentioned previously with regard to *Amphiastrella* and *Inflatella*.

DISTRIBUTION: East of North Cape, New Zealand, 128 m.

Family CORNULIDAE Lévi & Lévi, 1983

DIAGNOSIS: Poecilosclerida of massive or encrusting growth form which incorporates erect surface fistules. The ectosomal skeleton is a cortex of tangential spicules, the choanosomal skeleton consists of tracts of megascleres and scattered interstitial spicules. The megascleres are monactinal or diactinal and may be acanthose, and more than one size category or type of megasclere may occur. Microscleres are palmate isochelae, sometimes accompanied by toxas.

REMARKS: This family was separated from the Coelosphaeridae by Lévi and Lévi (1983) primarily because of the uniform occurrence of palmate isochelae among the microscleres. Two of the New Zealand species referred to this family have the fistulose habit typical of the Coelosphaeridae. The two remaining species are small fragments of encrusting sponges and their habit cannot be described with certainty until complete specimens are collected. All the species from New Zealand have more than one type of megasclere although they are not strictly localised within the sponge.

Cornulum Carter, 1876

Coelosphaerella de Laubenfels, 1934

DIAGNOSIS: Cornulidae of massive or encrusting form, with erect fistules or pronounced pore areas. The choanosomal skeleton consists of tracts of megascleres and scattered interstitial spicules. The diactinal megascleres may be of one or two sizes and are oxeas or strongyles. Monactinal megascleres may be present in some species. The ectosomal skeleton consists of a compact crust of spicule layers orientated tangentially to the surface. Microscleres are palmate isochelae which may be accompanied by toxas.

TYPE SPECIES: *Cornulum textile* Carter, 1876

Cornulum strepsichela Dendy (Plate 22, B)

Cornulum strepsichela Dendy, 1921: 105, pl. 16 fig. 3a–b; Vacclet, Vasseur & Lévi 1976: 58–59, fig. 37.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m.

DESCRIPTION: A small thin encrusting sponge of which only a fragment was collected.

DIMENSIONS: Length 5 mm; width 3 mm; thickness 0.5 mm.

COLOUR: In life, bright orange (2.5YR 7/10); in spirit, grey-white.

SURFACE: The surface is granular and not hispid.

SKELETON: The skeleton consists of long tylotes scattered interstitially, but occasionally four or five tylotes are aligned side by side. Short squat styles are arranged in a dense tangential dermal layer. Toxas and isochelae are abundant in the choanosome.

SPICULES (Plate 22, B):
Megascleres: Long, smooth tylotes, with slightly swollen ends that are microspined terminally. Short, smooth, squat styles that are strongly curved, and which have abrupt sharp points.
Microscleres: Toxas with a wide central flexure and recurved ends. Palmate isochelae with asymmetrically orientated heads, i.e., when one end is seen in face view the other end is in lateral view.
For spicule dimensions *see* Table 36.

REMARKS: The New Zealand specimen differs from the previous descriptions of this species in colour and in lacking a fistulose habit, but as only a small fragment was collected from a dredge haul, the fistules may have been broken off. The orange colour differs from the translucent white recorded by Vacelet *et al.*

TABLE 36. Spicule dimensions of *Cornulum strepsichela.*

Locality		Tylotes (μm)	Styles (μm)	Isochelae (μm)	Toxas (μm)
Cargados Carajos, Indian Ocean, 82 m Dendy (1921)		380 × 9		16.4	
Tulear, 10–15 m Vacelet *et al.* (1976)		300–325 × 5–7	130–150 × 7–8	15	
Three Kings Is, 55–110 m	$\bar{x}$	292 × 11	86 × 12	16	87 × 2
	Range	280–310 × 10–12	80–88 × 10–13	14–19	70–125 × 1–3

(1976), while Dendy (1921) did not record a colour from life. In all other characters the specimens are identical.

Dendy (1921) established the species for a thin-walled cylindrical tube which seems likely to have been a single fistule. He recorded the spicules as tylotes and palmate isochelae. Vacelet *et al.* (1976) collected a fistulose sponge with an irregular base incorporating foreign material, and recorded the presence of styles in the skeleton. They considered Dendy did not find these spicules in the holotype because the specimen was incomplete. Their preparations also contained some acanthostyles and toxas which they considered to be foreign. In the New Zealand specimen, toxas were present in the choanosome.

OTHER RECORDS: Indian Ocean, 82 m; Tulear, 10–15 m.

Paracornulum Hallmann, 1920

DIAGNOSIS: Cornulidae that are massive or encrusting with erect fistules. The choanosomal skeleton consists of irregular tracts of monactinal or diactinal spicules, with numerous megascleres found scattered interstitially. The megascleres are usually acanthose to some degree. Microscleres are palmate isochelae, which may be accompanied by toxas or microrhabds.

TYPE SPECIES: *Cornulum dubium* Hentschel, 1912

REMARKS: This diagnosis is adapted from Hallmann (1920).

Paracornulum sinclairi n.sp. (Plate 22, C–F)

MATERIAL EXAMINED: Clifton Beach, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 91.

TYPE LOCALITY: Clifton Beach, intertidal.

ETYMOLOGY: This species is named after Mrs M. Sinclair in acknowledgment of her work on the ecology and reproductive biology of members of the New Zealand sponge fauna.

DESCRIPTION: An encrusting sponge that grows in sandy-mud conditions, and has erect papillae 5 mm high (Plate 22, C).

DIMENSIONS: Breadth of mat ⩽ 80 mm; width of mat 55 mm; thickness of basal mat and sand 4 mm.

COLOUR: In life, orange brown (2.5YR 5/10); in spirit, white.

TEXTURE: Firm and compressible fistules.

SURFACE: The surface consists of sand grains except for the numerous thin papillae which extend beyond the substrate. The basal region of the sponge is not visible.

SKELETON: The skeleton is disordered and contains abundant foreign material, mainly sand grains (Plate 22, D). The choanosome has plumose columns of styles 50–80 μm wide (Plate 22, E). There is no reticulation and no fibre development. Large styles are found within the columns and shorter, curved styles are found both interstitially and within the columns. Thin subtylostyles and tylotes are found in clusters interstitially and in the dermal region. The papillae consist of a layer of the principal styles. Numerous isochelae and toxas are present throughout the sponge.

SPICULES (Plate 22, F):

Megascleres: Large, long, smooth styles, usually straight, with long tapered points. Short styles with faintly spined heads, a pronounced curve in the midline, and short sharp points. Long slender subtylostyles with faintly spined heads. Smooth tylotes with faintly spined heads and in a large range of sizes.

Microscleres: Thin toxas with a wide central flexure. A second category of toxas which are very thin and almost straight. Palmate isochelae that have alae bent towards each other.

For spicule dimensions *see* Table 37.

REMARKS: This species differs from *Paracornulum coherens* Lévi, 1963 in having toxas and subtylostyles in its spicule complement, and in lacking microrhabds; indeed, it seems likely that microrhabds are contaminants in Lévi's specimen. The diactinal megascleres of *Paracornulum sinclairi* are tylotes

TABLE 37. Spicule dimensions of *Paracornulum sinclairi.*

Locality		Large styles (μm)	Small styles (μm)	Subtylo-styles (μm)	Tylotes (μm)	Toxas (μm)	Toxas (μm)	Isochelae (μm)
Clifton Beach, intertidal	x̄	367 × 10	187 × 10	316 × 5	234 × 6	104 × 2	124	25
	Range	285–515 × 7.5–16	160–215 × 6–11	295–340 × 4–6.5	205–260 × 5.5–7	70–140 × 1–2.5	113–125	23–26

rather than strongyles, and two sizes of styles are present rather than one. These characters are considered sufficient to maintain two distinct species. The species are similar in colour, habit and structure of the skeleton.

Coelocarteria Burton, 1934

Ichnodonax de Laubenfels, 1954: 111

DIAGNOSIS: Cornulidae of massive or encrusting form with surface fistules which may have terminal expansions (Plate 23, A, B). The choanosomal skeleton consists of megascleres in tracts and scattered interstitially. The diactinal megascleres are of two sizes and are oxeas or strongyles. The ectosomal skeleton consists of a compact crust of spicule layers predominantly orientated tangentially to the surface, but some spicules lie at right angles to this plane. Microscleres are palmate isochelae.

TYPE SPECIES: *Phloeodictyon singaporense* Carter, 1883

REMARKS: Burton (1934) established *Coelocarteria* for sponges with a skeleton composed of long oxeas often modified to strongyles, short strongyles, and minute palmate isochelae. This diagnosis is expanded to include large and small megascleres that may be either oxeas or strongyles.

Bergquist (1965) synonymised *Ichnodonax* with *Coelocarteria* as the only difference between *I. kapne* and *P. singaporense* was that the oxeas were thinner in the former.

Coelocarteria is included in the Cornulidae because it has palmate isochelae for microscleres in conjunction with a fistulose habit and plumose skeleton.

Lévi and Lévi (1983) recorded a specimen from New Caledonia as *Foliolina* (?) *peltata* Schmidt. The figure of this sponge shows the hood-like fistules found in *Coelocarteria spatulosa* and in skeletal arrangement their sponge approximates the diagnosis of *Coelocarteria*, but microscleres were not recorded. There is a possibility that close examination of this sponge may reveal palmate isochelae, and that it is a third species of *Coelocarteria.*

Coelocarteria spatulosa n.sp. (Plate 23, A–E)

MATERIAL EXAMINED: NZOI Stn J975, north of Great Barrier Island, 205 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 90.

TYPE LOCALITY: NZOI Stn J975, 35°40.5′S, 175°23.6′E. North of Great Barrier Island, 205 m.

DESCRIPTION: A spreading sponge consisting of a number of spherical mounds with large, thick, erect fistules extending from them. At the top of the fistules are thin, inverted, spatula-shaped hoods attached by one side to the fistule (Plate 23, A, B).

DIMENSIONS: Length 65 mm; width 46 mm; height of mounds 35 mm; height of fistules 20 mm; diameter of fistules 30 mm.

COLOUR: In life, lemon yellow; in spirit, brown (10.0YR 4/4–3/4).

TEXTURE: Fistules are thin and papery, sponge bases are firm and incompressible, the interior is pulpy.

SURFACE: The surface is smooth with a compact ectosomal crust of spicules.

SKELETON: The choanosomal skeleton consists of tracts of large and small strongyles (Plate 23, C). Strongyles and abundant isochelae are found scattered throughout a dense choanosome. The ectosomal skeleton consists of thick compact layers of both sizes of strongyles orientated tangentially (Plate 23, D). Some strongyles are found at right angles to these layers.

SPICULES (Plate 23, E):
Megascleres: Strongyles that occur in two size ranges – long, smooth strongyles, usually slightly curved and with evenly rounded ends, the ends very faintly microspined, and short sausage-shaped strongyles, usually slightly curved and with evenly rounded ends.
Microscleres: Palmate isochelae with a curved shaft so that the alae bend toward each other.
For spicule dimensions *see* Table 38.

REMARKS: This species is clearly congeneric with *Coelocarteria singaporense* Carter as described by Dendy (1905), but is distinguished from the latter in lacking oxeas and in having curved palmate isochelae.

TABLE 38. Spicule dimensions of *Coelocarteria spatulosa.*

Locality		Large strongyles (μm)	Small strongyles (μm)	Isochelae (μm)
NZOI Stn J975, N. of Great Barrier Id, 205 m	x̄	505 × 19	142 × 16	40
	Range	480–532 × 17–23	113–164 × 13–18	33–45

Zyzza de Laubenfels, 1936

Damirina Burton, 1959

DIAGNOSIS: Cornulidae of massive or encrusting form with erect fistules or papillae. The choanosomal skeleton is irregular, with a tendency to form a reticulation which is usually isodictyal. The diactinal megascleres are of two types; the choanosomal diacts have verticillate spining, while the ectosomal diacts may have spined ends. The ectosomal skeleton consists of scattered megascleres orientated tangentially to the surface. Microscleres are palmate isochelae.

TYPE SPECIES: *Plocamia massalis* Dendy, 1921

REMARKS: This genus is retained for cornulid sponges which have megascleres with verticillate spining and microscleres which are palmate isochelae. De Laubenfels (1936) located this genus within the Phorbasidae, a family with dermal diactinal spicules. The compacted tangential dermal skeleton, irregular choanosomal skeleton, and fistulose habit, are more characteristic of the Cornulidae.

Burton (1959) established the genus *Damirina* for a fistulose sponge with verticillate-spined strongyles in the choanosome, tylotes with faintly spined heads in the ectosome, but with no microscleres. In the New Zealand specimen the microscleres are not frequent and could easily be overlooked, hence *Damirina* is synonymised with *Zyzza.*

Zyzza massalis (Dendy) (Plate 23, F)

RESTRICTED SYNONYMY:
Plocamia massalis Dendy, 1921: 78, pl. 14 fig. 5a–e.
Zyzza massalis. de Laubenfels 1936: 64.
Damirina verticillata Burton, 1959: 240, fig. 25.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m.

DESCRIPTION: A thin encrusting sponge intermingled with worm tubes, bryozoans and hydroids.

DIMENSIONS: Length 70 mm; width 40 mm; thickness 1–1.5 mm.

COLOUR: In life, dark red brown (2.5YR 3/4); in spirit, identical (2.5YR 3/4).

TEXTURE: Soft and easily torn.

SURFACE: Smooth, with occasional marked channels. The channels are indentations of the dermal membrane into subdermal spaces, and may represent grooves formed by hydroid stolons which have grown over the sponge. No oscules are visible, but the surface is damaged.

SKELETON: The choanosomal skeleton is an isodictyal, unispicular reticulation of acanthostrongyles. The reticulation becomes dense and irregular towards the base of the sponge. The dermal skeleton is composed of long, terminally roughened, acanthotylotes that lie tangentially; a few are disposed radially below them.

SPICULES (Plate 23, F):
Megascleres: Acanthostrongyles that are slightly to strongly curved, with verticillate spining usually extending over the whole spicule, sometimes absent in the middle (Plate 23, F). Slightly curved, smooth acanthotylotes, with microspining on the heads.
Microscleres: Palmate isochelae with a curved shaft; not abundant.
For spicule dimensions *see* Table 39.

REMARKS: This species is closely related to *Paracornulum atoxa* described by Vacelet *et al.* (1976). *Paracornulum atoxa* has choanosomal strongyles with verticillate spines, terminally spined tylotes and pal-

TABLE 39. Spicule dimensions of *Zyzza massalis.*

Locality		Acanthostrongyles (μm)	Acanthotylotes (μm)	Isochelae (μm)
TYPE of *Plocamia massalis* Mauritius, 183 m, Dendy (1921)		185 × 8.2	370 × 8	16.4
Damirina verticillata Zanzibar, 102 m, Burton (1959)		200 × 20	360 × 10	Absent
Three Kings Is, 55–110 m	x̄	241 × 12	385 × 9	16
	Range	217–266 × 11–14	367–402 × 6–12	15–16

mate isochelae, and is here referred to the genus *Zyzza*, as *Z. atoxa* (Vacelet, Vasseur & Lévi) Bergquist & Fromont n. comb. The two species differ in the dimensions of the tylotes, and *Zyzza massalis* lacks oxeote modifications of the strongyles.

The systematic position of *Zyzza massalis* has always been in doubt. Dendy (1921) first described this species as a *Plocamia* but commented that it was not typical of that genus, while Topsent (1928) related it to *Dendoricella* in the Myxillidae, and Burton (1935) assigned it to *Lissodendoryx*. The fistulose habit, irregular choanosomal reticulation, tangentially orientated ectosomal skeleton and presence of palmate isochelae support the placement of this species in the Cornulidae.

The verticillate spining of the acanthostrongyles is most unusual and is a feature otherwise found only in the genus *Agelas* (Order Axinellida) and in some genera of Sclerospongiae. No affinity between these sponges is suggested.

OTHER RECORDS: Mauritius, 183 m; Zanzibar, 102 m.

Family TEDANIIDAE Hentschel, 1923

Tedaniina Ridley & Dendy, 1886
Tedaniinae Ridley & Dendy, 1887

DIAGNOSIS: Poecilosclerida with a choanosomal skeleton of monactinal and/or diactinal megascleres which are organised into plumose or plumo-reticulate tracts. The ectosomal skeleton consists of diactinal megascleres which can be distinguished from the choanosomal megascleres either in morphology or size. Microscleres are onychaetes, which are long, thin, oxeote microscleres with a roughened surface.

REMARKS: This diagnosis has been expanded to include the genus *Tedaniopsis* which has diactinal megascleres in the choanosome. Bergquist (1978) defined the Tedaniidae as "Poecilosclerida with an endosomal skeleton of styles which are organised into plumo-reticulate tracts. The ectosomal megascleres are diacts, usually tylotes. Microscleres are onychaetes, which are extremely thin, long, oxeote microscleres with a roughened surface." This diagnosis excluded *Tedaniopsis turbinata* which lacks a choanosomal skeleton of styles, but which does have onychaete microscleres. These microscleres are diagnostic for the family; they occur nowhere else in the Demospongiae. Consequently the diagnosis is expanded with respect to megasclere complement, and the genus included in the Tedaniidae.

The position of this family within the Poecilosclerida is still disputed. Lévi (1973) included the Tedaniidae within the Myxillidae. The distinction between true myxillid genera and those placed within the Tedaniidae is very pronounced in New Zealand specimens. The Tedaniidae characteristically have plumose skeletons, monactinal and diactinal megascleres in the choanosome, and onychaetes as microscleres; *Tedaniopsis*, it has been noted, lacks monactinal spicules. The Myxillidae have isodictyal or square-meshed reticulate skeletons, monactinal spicules in the choanosome and isochelae among the microscleres. Some authors interpret *Tedania ignis* as having an isodictyal or renieroid skeletal reticulation, e.g., van Soest (1984), and yet other authors do not mention this reticulation at all and suggest that the spicules form tracts, e.g., Hechtel (1965). Obviously this influences their placement of the genus as van Soest (1984) placed *Tedania* in the Myxillidae, while Hechtel (1965) recognised the family Tedaniidae. To resolve this problem study of the Northern Hemisphere species, and particularly the variation in skeleton within *T. ignis* is necessary.

Tedania Gray, 1867

Trachytedania Ridley, 1881

DIAGNOSIS: Tedaniidae in which the choanosomal skeleton consists of plumose tracts of monactinal and diactinal megascleres, which may have spined heads. The ectosomal skeleton consists of diactinal megascleres forming erect spicule brushes. Microscleres are onychaetes.

TYPE SPECIES: *Reniera digitata* Schmidt, 1862

REMARKS: This diagnosis has been expanded to include *Tedania spinostylota*, which has spining on the heads of the styles. This brings *Trachytedania* Ridley, 1881, established for species of *Tedania* with spined styles, into synonymy.

Species of the genus *Tedania* have always been difficult to differentiate clearly. Burton and Rao (1932) synonymised thirteen species with *Tedania nigrescens* Schmidt, including sponges of vastly different colour, growth form and skeletal organisation under this name. Under their concept of this species the main skeleton could be isodictyal, sub-isodictyal or irregularly confused, while the ectosomal skeleton could be in brushes at right-angles to the surface, irregularly scattered, or forming a tangential layer. The tornotes making up this ectosomal skeleton could be either strongylote or tylote, and have smooth or spined ends. The onychaetes could have a slight swelling near one end. None of these parameters were considered to be of systematic importance. Burton and Rao took this action because they could not correlate any of the variations of the spicules with external form, ecological or geographical distribution. They were mistaken in attempting to deal on a broad geographic scale and to establish distributions from patchy, inconsistent data.

Dendy (1924) described *Tedania cristi-galli* from northern New Zealand. Re-examination of the type specimen (BM(NH) 23.10.1.147) has failed to confirm the presence of onychaetes; Dendy noted that they

were not very abundant. There are slender smooth oxeas present. Burton (1932) removed this species to the Axinellidae, transferring it to the genus *Acanthella*, but as Bergquist (1970) noted, *T. cristi-galli* has no axial skeleton. The skeleton appears to be halichondroid with the styles mainly parallel to the surface, occasionally forming tracts, but more often they are irregular in spacing and orientation. At present the generic allocation of *Tedania cristi-galli* is uncertain, but categorically it is not a member of the Tedaniidae.

Tedania connectens (Brøndsted) (Plate 24, A–E)

Tedanione connectens Brøndsted, 1924: 472, fig. 25a–d.
Tedania connectens. Burton 1932: 345.

MATERIAL EXAMINED: Three Kings Islands, 91 m; NZOI Stn E268, near Cape Maria van Diemen, 44 m; Barren Arch, Poor Knights Islands, 15 m.

DESCRIPTION: A thick encrusting sponge with conical projections, which produce, overall, an unevenly ridged surface (Plate 24, A).

DIMENSIONS: Length 45 mm; width 15 mm; height 30 mm.

COLOUR: In life, flesh coloured (2.5YR 8/4); in spirit, creamy-fawn (2.5Y 8/4) to white.

TEXTURE: Compressible and quite firm, rather fleshy.

SURFACE: The surface is covered by a thin membrane which is attached firmly to the subdermal tissue. This membrane is formed of tangential tylotes, which also project outwards at right angles to the surface of the sponge, giving it a microscopically hispid surface.

SKELETON: The ectosomal skeleton is comprised of a thick palisade of tylotes aligned at right angles to the surface (Plate 24, B). Beneath this in the choanosome are numerous onychaetes, the large ones forming tracts at right angles to the surface. The choanosomal skeleton consists of plumose tracts of styles approximately 70 μm wide, which may intersect, but which do not form a reticulation (Plate 24, C). Dispersed styles lie at right angles to these tracts. Tylotes are also present in the choanosomal tracts.

SPICULES (Plate 24, D, E):
Megascleres: Long, thick styles, curved behind the head and generally with a well-defined elongate point. Long, slender tylotes, with elongate heads with apical spines.
Microscleres: Onychaetes with roughened surfaces, occurring in two sizes, the smaller ones usually with unequal ends (Plate 24, E).
For spicule dimensions *see* Table 40.

REMARKS: Brøndsted (1924), in his original description of this sponge, considered it to be a species of *Tedanione* Wilson, 1894 because of the abundance of tylotes in the main skeleton, but felt it was closely related to *Tedania* because of the presence of some styles. Unfortunately the type specimen cannot be found, but in other specimens of this species the styles are a more significant component of the skeleton than Brøndsted implies, hence the referral of this species to *Tedania* following Burton (1932).

De Laubenfels (1936) placed *Tedanione* Wilson in the family Desmacidonidae on the grounds that it had smooth rhaphides. This character is not shown in *Tedania connectens* where the onychaetes are typically roughed and indistinguishable from those of other species of *Tedania*.

Tedania connectens most closely compares to descriptions of *T. ignis* Duchassaing & Michelotti, *T. digitata* Dendy, and *T. reticulata* Thiele in spiculation. However, the dimensions of the spicules are greater than in these three species.

TABLE 40. Spicule dimensions of *Tedania connectens*.

Locality		Styles (μm)	Tylotes (μm)	Large onychaetes (μm)	Small onychaetes (μm)
Little Barrier Id, 55 m Brøndsted (1924)		⩽430 × 11	300 × 6	⩽200 × 1	
Three Kings Is, 91 m	$\bar{x}$	388 × 9	312 × 5	291	84
	Range	355–430 × 5–10	280–340 × 4–5.5	270–308	70–95
Barren Arch, Poor Knights Is, 15 m	$\bar{x}$	321 × 7	268 × 5	150	55
	Range	280–350 × 5.5–7	255–285 × 3.5–5	125–165	48–65
NZOI Stn E268, near Cape Maria van Diemen, 44 m	$\bar{x}$	329 × 7	258 × 5	165	45.5
	Range	310–340 × 5–7.5	240–275 × 4.5–6	150–185	38–50

Another species of *Tedania* which has tylotes with terminal spines has been found in New Zealand. The spicules are smaller than those in *T. connectens* and are comparable to descriptions of *T. anhelans*, as is the skeletal detail and external appearance. However, only one specimen has been studied so far and until more collecting is done in the locality where it was found (Portobello, Dunedin) the sponge cannot be described.

OTHER RECORDS: Little Barrier Island, 55 m.

Tedania diversirhaphidiophora Brøndsted
(Plates 24, F; 25, A–D)

Tedania diversirhaphidiophora Brøndsted, 1923: 133, fig. 15a–e; Bergquist 1961b: 183.
Tedania placentaeformis Brøndsted, 1923: 135, fig. 16a–d.

MATERIAL EXAMINED: NZOI Stn E367, near North Cape, 29 m; Cape Brett, 40 m; Leigh Reef, 20 m; Cuvier Island, 55–73 m; Carnley Harbour, Auckland Islands, 82 m (portions of specimens labelled TYPE in Zoology Museum, Copenhagen).

DESCRIPTION: A thick encrusting sponge, growing into a rounded mound. Three of the specimens form mounds over bivalve shells, while the Leigh specimen is rounded and has incorporated a quantity of small stones and algae (Plate 24, F).

DIMENSIONS: Length 70 mm; height up to 50 mm.

COLOUR: In life, orange-red (5.0YR 6/8); in spirit, from white or cream (5.0Y 8/4), to creamy-beige (10.0YR 7/4), to fleshy-pink (2.5R) and pale red-brown (7.5YR 6/4).

TEXTURE: Soft and compressible due to a pulpy, somewhat gelatinous choanosome; the sponge exudes mucous when collected.

SURFACE: The surface is covered by a membrane (1.0 mm thick) firmly attached to the underlying choanosomal region. It is smooth to the touch but microscopically hispid.

SKELETON: The choanosomal skeleton consists of plumose tracts of styles which extend from the base of the sponge to fans of tylotes in the ectosome. The tracts are approximately 50–100 μm wide and follow a meandering course to the surface of the sponge, only occasionally intersecting (Plate 25, A). The ectosomal skeleton consists of evenly spaced fans of tylotes oriented at right angles to the surface of the sponge (Plate 25, B). Tylotes are also found interstitially in the choanosome and within the tracts. Onychaetes occur in both the ectosome and choanosome.

SPICULES (Plate 25, C, D):
Megascleres: Straight or gently curved styles narrowing to a short point, occasionally lumpy or spined along their length, with a distinct tylote head. Smooth, slender tylotes with slightly expanded heads, frequently strongylote. In some specimens an abundance of developmental forms was noted.
Microscleres: Well-spined onychaetes; in two sizes (Plate 25, D).
For spicule dimensions *see* Table 41.

REMARKS: *Tedania placentaeformis* is synonymised with *T. diversirhaphidiophora* following study of both type specimens. There were no criteria on which to differentiate the two species other than a slight colour difference in alcohol. A similar colour difference has been noted in other specimens studied, for instance, the three specimens growing over bivalve shells range in colour from white through cream to flesh pink.

Brøndsted (1923) described the surface membrane of *T. diversirhaphidiophora* as being thin and clear. Certainly on the piece of the type specimen examined it is as thick as that of *T. placentaeformis*. Both had microscopically hispid surfaces although Brøndsted mentioned that in *T. placentaeformis* spicules did not pierce the dermal membrane. In *T. diversirhaphidiophora* Brøndsted noted the presence of numerous oscules but queried their presence in *T. placentaeformis* They were not noted in either type specimen, or in other specimens studied. Unfortunately Brøndsted mentioned consistency only for *T. diversirhaphidiophora* so it is not known what the consistency of *T. placentaeformis* should be. The choanosome has very similar characteristics in both specimens, being pulpy and easily compressed, with a dispersed skeleton.

The ectosomal skeletons were identical in both specimens and consisted of tufts of tylotes, in some areas forming a continuous palisade. The choanosomal skeleton is composed of tracts of spicules, mainly styles, with onychaetes and tylotes found interstitially. No trichodragmata were noted, although Brøndsted described these in *T. diversirhaphidiophora*.

The spiculation of the two specimens cannot be distinguished. The styles are of similar length and shape, the tylotes have only slightly expanded heads and therefore appear strongylote. The onychaetes are of two sizes in both specimens, and have identical degrees of spining.

OTHER RECORDS: Chatham Rise, 402 m.

Tedania spinostylota n.sp.
(Plate 25, E, F; 26, A, B)

MATERIAL EXAMINED: Wahine Bay, Hen and Chickens Islands, 13 m; Mayor Island, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 95.

TYPE LOCALITY: Mayor Island, intertidal.

DESCRIPTION: A flat compact encrusting sponge, in both cases overgrown by a filamentous alga on the upper surface.

DIMENSIONS: Extent of small fragments 10 × 20 mm; thickness 5 mm.

TABLE 41. Spicule dimensions of *Tedania diversirhaphidiophora*.

Locality		Styles (μm)	Tylotes (μm)	Tylotes (μm)	Large onychaetes (μm)	Small onychaetes (μm)
T. diversirhaphidophora Carnley Harbour, 82 m Brøndsted (1923)		360 × 9–10	280 × 8		190	50
TYPE of *T. diversirhaphidophora* remeasured	x̄	351 × 8	342 × 6	244 × 4.7	151	52
	Range	330–400 × 6.5–10	310–360 × 5–7	215–280 × 4.5–5	138–168	45–68
T. placentæformis Carnley Harbour, 82 m Brøndsted (1923)		400 × 12 styles and strongyles	occasionally found		50–300	
TYPE of *T. placentæformis* remeasured	x̄	347 × 8	322 × 5		150	39
	Range	320–400 × 6.5–9	290–365 × 4.5–6		135–193	33–48
Chatham Rise, 402 m		250–320 × 3–6	180–325 × 2.5–3		100–150 × 1	50–70 × 0.5
Cuvier Island, 55–73 m	x̄	285 × 6	275 × 5		125	56
	Range	240–315 × 5–7	230–300 × 4.5–5.5		113–143	45–70
Cape Brett, 40 m	x̄	349 × 7	336 × 6	256 × 4.4	134	51
	Range	340–360 × 5.5–8	305–360 × 5–7.5	240–280 × 4–5	110–143	45–60
NZOI Stn E367, near North Cape, 29 m	x̄	286 × 6	290 × 5		138	46
	Range	240–320 × 5–7	250–320 × 4–5		115–153	38–53
Leigh Reef, 20 m	x̄	276 × 5	286 × 4		125	46
	Range	240–300 × 3–5	220–330 × 3.5–4.5		110–135	40–53

COLOUR: In life, red (5.0R 5/12); in spirit, creamy-white.

TEXTURE: A firm compact sponge, elastic and compressible.

SURFACE: The surface is difficult to distinguish from the alga, but the surface membrane is visible in some areas and is closely adherent to the underlying choanosome.

SKELETON: The ectosomal skeleton consists of an uneven palisade of small tylotes lying predominantly at slight angles to the surface, occasionally tangentially (Plate 25, E). The choanosomal skeleton consists of plumose tracts of spicules, the organisation of which can be obscured by foreign material and algae (Plate 25, F). Near the surface the tracts consist of tylotes, but in deeper regions of the choanosome styles are also visible in the tracts. Both sizes of onychaetes are aggregated in bundles in basal areas of the sponge, but as with the tylotes and styles, they also occur interstitially.

SPICULES (Plate 26, A, B):
Megascleres. Straight or occasionally slightly curved styles that are usually thicker and shorter than the tylotes. They have spined heads and spining which extends a short distance down the shaft. There is a short, distinct terminal point, but strongylote variations occur. Smooth, straight and slender tylotes, of two sizes, both with slightly elongate tylote heads.
Microscleres. Onychaetes of two sizes (Plate 26, B).
For spicule dimensions *see* Table 42.

REMARKS: *Tedania spinostylota* is the only New Zealand species of *Tedania* which always has spining on the heads of the styles. The genus *Trachytedania* was proposed by Ridley (1881) for species of *Tedania* in which the styles were partly or entirely spined. Ridley and Dendy (1887) noted that "It is, however, an open question whether this character is in itself sufficient to separate the two genera." In view of the occasional occurrence of spining in specimens of several New Zealand species examined this appears insuf-

TABLE 42. Spicule dimensions of *Tedania spinostylota.*

Locality		Styles (μm)	Ectosomal tylotes (μm)	Choanosomal tylotes (μm)	Large onychaetes (μm)	Small onychaetes (μm)
Mayor Island, intertidal	x̄	235 × 5	197 × 3	253 × 5	124	44
	Range	215–260 × 4–6.5	180–220 × 2.5–3.5	230–280 × 4–5	115–133	38–50
Hen and Chickens Islands, 13 m	x̄	230 × 4.7	184 × 3	256 × 4.4	137	52
	Range	190–250 × 4–5	169–200 × 2–4	240–280 × 3.5–6	125–143	35–72

ficient grounds on which to maintain the genus *Trachytedania.*

A survey of the literature shows that few species of *Tedania* have been described which have spined styles. *Tedania bispinata* Hentschel is one, *T. spinata* (Ridley) another, and *T. fuegiensis* Thiele has occasional spined styles. However, the diactinal megascleres of *T. fuegiensis* and *T. spinata* are tornotes, not tylotes, and in *T. bispinata* all spicules are considerably smaller than those found in *Tedania spinostylota.*

Tedania battershilli n.sp.

(Plates 26, C–F; 27, A, B)

MATERIAL EXAMINED: Middle Arch, Poor Knights Islands, 15 m; Goat Island, 12 m and 18 m; Maori Island, 18 m; Porae Reef, Leigh, 21 m; Leigh, 10 m; Sponge Garden, Leigh, 18 m; Ti Point, Leigh, 8 m; Outer Waterfall Reef, Leigh, 12 m; Cuvier Island, 15 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 96.

TYPE LOCALITY: Maori Island, 18 m.

ETYMOLOGY: This species is named after Dr C. Battershill in acknowledgment of his contribution to the study of sponge ecology in New Zealand.

DESCRIPTION: An encrusting sponge. Three specimens were found overgrowing barnacles, others have a filamentous red alga attached to them. The majority of the specimens encrust over rock (Plate 26, C).

DIMENSIONS: Maximum observed extent of spread 20 × 20 to 40 × 60 mm; thickness 5–15 mm.

COLOUR: In life, bright orange (7.5R 5/12); in spirit, bright orange (7.5R 5/12) to pale orange (2.5YR 7/10–2.5YR 8/4).

TEXTURE: A firm sponge, which is slimy and exudes mucous when compressed.

SURFACE: The surface of the sponge is smooth or faintly ridged and is slimy to touch due to the presence of mucous. No oscules are visible. An ectosomal membrane (1.0 mm thick) is attached firmly to the underlying choanosomal skeletal network. The surface is microscopically hispid where tracts of tylotes extend through the surface membrane.

SKELETON: The choanosomal skeleton consists of plumose tracts of styles and tylotes approximately 100 μm wide, running to the surface of the sponge (Plate 26, D). There is no reticulation; the tracts meander to the surface where they fan out into the brushes of tylotes that form part of the ectosomal skeleton (Plate 26, E). Between the tracts, spicules of all three categories lie throughout the choanosome, usually aligned at right angles to the surface of the sponge. Occasionally in the choanosome the onychaetes form into loose bundles with thin tylotes. The ectosomal skeleton is a specialised region of tylotes dispersed at right angles to the surface, very closely packed to form a continuous palisade. The choanosomal tracts intersect this region at intervals. Onychaetes are also found in the ectosome.

SPICULES (Plates 26, F; 27, A, B):
Megascleres: Smooth, slightly curved or straight styles, with well-defined short points and small rounded heads. Smooth, straight and slender tylotes with slightly elongate tylote heads, occasionally polytylote. There is a large size range, with the dermal tylotes smaller than the choanosomal ones.
Microscleres: Faintly and evenly spined onychaetes of two sizes (Plate 27, A, B).
For spicule dimensions *see* Table 43.

REMARKS: *Tedania battershilli* is a well characterised species. Its distinctive external characteristics are the bright orange colour, compact texture, smooth surface and mucous production. The skeleton is typical for *Tedania* species, with brushes of tylotes in the ectosome, meandering plumose tracts in the choanosomal skeleton, and onychaetes throughout. Both categories of megascleres are of similar length; the styles range in size from 200–320 μm while the tylotes range from 160–310 μm. The styles are generally thicker than the tylotes. Both types of megasclere are smooth but occasional spicules have expansions along the shaft.

TABLE 43. Spicule dimensions of *Tedania battershilli*.

Locality		Styles (μm)	Tylotes (μm)	Large onychaetes (μm)	Small onychaetes (μm)
Maori Island, 18 m	x̄	272 × 5	273 × 5	136	53
	Range	255–300 × 4.5–6.5	240–280 × 3.5–5	115–163	33–65
Goat Island, 18 m	x̄	260 × 6	269 × 5	136	50
	Range	220–300 × 4.5–7	240–295 × 4–5.5	113–150	43–60
Goat Island, 12 m	x̄	268 × 5	259 × 4.5	122	55
	Range	240–315 × 4–5	215–275 × 3.5–5	105–138	48–70
Porae Reef, Leigh, 21 m	x̄	266 × 6	279 × 5	139	52
	Range	245–295 × 5–7	220–310 × 3.5–5	120–155	45–63
Sponge Garden, Leigh, 18 m	x̄	263 × 5	257 × 4	138	47
	Range	200–300 × 4–6	185–290 × 3–5	125–153	42–55
Outer Waterfall Reef, Leigh, 12 m	x̄	246 × 5	269 × 4	133	52
	Range	215–280 × 4–6.5	225–290 × 3.5–5	125–150	45–73
Leigh, 10 m	x̄	252 × 5	242 × 4	134	50
	Range	215–300 × 4–6.5	205–270 × 3–5	108–155	45–63
Ti Point, Leigh, 8 m	x̄	252 × 4.6	267 × 4	137	51
	Range	235–270 × 4–5	255–280 × 3–4	120–150	48–57
Cuvier Island, 15 m	x̄	284 × 4.5	280 × 5	135	52
	Range	260–305 × 4–5	240–300 × 3.5–5	125–143	43–62
Middle Arch, Poor Knights Is, 15 m	x̄	251 × 5	258 × 4.5	136	45
	Range	225–300 × 3.5–5	230–290 × 3.5–5	130–145	30–60

This species is close to *T. diversirhaphidiophora*. Certainly when comparing spicule sizes (*T. diversirhaphidiophora* has styles 240–400 μm and tylotes 180–365 μm) an overlap between the spicule sizes is obvious. However, external morphology, distinctive habit, and spicule shape afford clear distinguishing characters. *Tedania battershilli* is distinct from *T. spinostylota* in external features and style morphology. *Tedania digitata* Schmidt is massive, orange in life and similar in spiculation to *T. battershilli* but the former species has terminally spined tylotes. *Tedania ignis* differs from *T. battershilli* in having smaller spicules and terminally spined tylotes, and *T. rubicunda* Hallmann, while comparable in colour, surface characteristics, skeletal detail and spiculation, has consistently spined tylotes.

Tedania purpurescens n.sp. (Plate 27, C–F)

MATERIAL EXAMINED: Middle Arch, Poor Knights Islands, 18 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 97.

TYPE LOCALITY: Middle Arch, Poor Knights Islands, 18 m.

DESCRIPTION: A thin encrusting sponge, growing on shaded rock faces (Plate 27, C).

DIMENSIONS: Extent of spread 20 × 30 mm; thickness 2 mm.

COLOUR: In life, dark purple (7.5RP 3/2); in spirit, pale purple (7.5RP 4/2).

TEXTURE: Soft and pulpy, tending to remain compressed when squeezed. A small amount of mucous is present over the surface.

SURFACE: There is a thin ectosomal skin that can be peeled from the pulpy choanosome. The surface is smooth apart from a few microscopically hispid areas where the end of a skeletal tract produces a fan of spicules that extend through the membrane.

SKELETON: The ectosomal skeleton consists of clusters of tylotes that fan out from the plumose tracts of styles and tylotes which form the choanosomal skeleton. Onychaetes are scattered interstitially. The choanosomal tracts are compact, 50 μm wide, and often intersect, but do not form a regular reticulation. Near the surface of the sponge the tracts become spreading and the majority of the spicules within them are tylotes (Plate 27, D).

SPICULES (Plate 27, E, F):
Megascleres: Slender, straight or gently curved styles often slightly expanded along the shaft, and tending towards tylostyles with a faint terminal swelling. Long, thin, straight tylotes with pronounced heads, occasionally polytylote and usually smooth.
Microscleres: Onychaetes that are equally ended or with one end slightly expanded, in two sizes (Plate 27, F). A larger onychaete is also present, but is not as common as the two types mentioned. It has a subterminal swelling at one end.
For spicule dimensions *see* Table 44.

REMARKS: *Tedania purpurescens* is characterised by its thin encrusting habit, the deep purple colour in life, a texture that is slimy and pulpy, an ectosomal skin that retracts from the underlying choanosome, and a category of onychaetes with sub-terminal expansions. The skeleton is of typical *Tedania* form, as is the spiculation, but no other species of *Tedania* have been described that are purple in colour.

Tedaniopsis Dendy, 1924

DIAGNOSIS: Tedaniidae in which the choanosomal skeleton consists of tracts of diactinal megascleres which are strongyles or tylotes. An irregular reticulation may be formed. The ectosomal skeleton consists of a sub-isodictyal reticulation of diactinal megascleres that are smaller than the choanosomal diacts. Microscleres are onychaetes, frequently with a sub-terminal expansion.

TYPE SPECIES: *Tedaniopsis turbinata* Dendy, 1924

REMARKS: In his original description of *Tedaniopsis* Dendy (1924) stated that: "The main skeleton is a reticulation of spicular fibre composed of stout diacts (strongyla, tylota) held together by spongin. There is also a dermal (or subdermal) skeleton of slender diacts (tornota, tylota, strongyla) in radially arranged brushes. Tylorhaphides may be present in addition to simple rhaphides." He also noted that the presence or absence of tylorhaphides should probably not be regarded as a ground for generic distinction as they occurred in several tedaniid genera. We consider that on the basis of the spicule complement and skeletal characteristics, there are grounds for separating this species at the generic level from *Tedania*. This is contrary to the view of Burton (1932). The tylorhaphides are typical *Tedania* onychaetes with a subterminal swelling. However, *Tedaniopsis* lacks monactinal megascleres, and the choanosomal skeleton is made up of large tylotes. The skeleton is a more organised network than in any other *Tedania* species, and the ectosomal skeleton is a sub-isodictyal reticulation rather than the usual palisade of tylotes. The external form is tubular and very different from the massive or encrusting forms characteristic of other New Zealand species of *Tedania*, and indeed most *Tedania* species worldwide.

Dendy (1924) stated that: "The genus *Tedaniopsis* differs from *Tedanione* Wilson, 1894, in the presence of the main skeleton of stout strongyles or tylotes, reminiscent of *Plocamia*." Further study and examination of the type specimen of *Tedanione* may support synonymy of the two genera, but at this stage they are treated as separate on the basis of Dendy's statement and because of the reported occurrence of smooth rhaphides in *Tedanione*. Burton (1932) con-

TABLE 44. Spicule dimensions of *Tedania purpurescens*.

Locality		Styles (μm)	Tylotes (μm)	Large onychaetes (μm)	Small onychaetes (μm)	Onychaetes with terminal bulb (μm)
Middle Arch, Poor Knights Is, 18 m	$\bar{x}$	261 × 5	280 × 4	124	49	240
	Range	230–300 × 4–6.5	270–300 × 3–5	110–133	45–55	208–270

sidered *Tedaniopsis* and *Paratedania* Burton to be synonymous, but in view of differing spicule complement and skeletal structure, both genera are retained.

Van Soest (1984) suggested that *Tedaniopsis* Dendy was synonymous with *Hemitedania*, but he cited the type species of *Tedaniopsis* as *Tedania charcoti* Topsent, 1907 when in fact it is *Tedaniopsis turbinata* Dendy. The type specimen of *Amorphina anonyma* Carter, 1886, type species of *Hemitedania*, has been re-examined. It has oxeas and onychaetes. The two sponges are quite distinct in spiculation and are best retained as separate genera of the Tedaniidae.

Tedaniopsis turbinata Dendy (Plate 28, A–D)

Tedaniopsis turbinata Dendy, 1924: 367, pl. xi figs 2–3, pl. xiv figs 31–35.
Tedania turbinata. Burton 1932: 346.

MATERIAL EXAMINED: BM(NH) 23.10.1.148, Three Kings Islands, 183 m (type); NZOI Stns J953, western Northland continental slope, 260–270 m; J974, north of Great Barrier Island, 152 m.

DESCRIPTION: Small tapering tubes expanding at the uppermost edge (Plate 28, A). Some choanosomal material is within the tubes at their bases, but diminishes at the apex.

DIMENSIONS: Largest specimen: length 5 mm; width at base 3 × 3 mm; width at apex 1 × 1 mm.

COLOUR: In life, white; in spirit, creamy-white to yellow-brown (2.5Y 7/8).

TEXTURE: A compressible sponge, the choanosome is pulpy and the uppermost edges of the tubes are easily torn. The sponge produces excessive mucous on removal from water and the internal structure collapses.

SURFACE: The surface is covered by a smooth membrane 0.5 mm thick.

SKELETON: The ectosomal skeleton consists of an irregular sub-isodictyal reticulation of tylotes (Plate 28, B), with long sub-terminally bulbed onychaetes beneath, sometimes occurring in bundles. Strongyles are occasionally present and lie tangential to the surface. In the choanosome, tylotes are found in irregular tracts, with many other tylotes scattered interstitially. Onychaetes are in short tracts or scattered interstitially.

SPICULES (Plate 28, C, D):
Megascleres: Thick smooth tylotes, frequently with a pronounced central curve. Slender smooth strongyles, frequently inequiended, one end more pointed or tylote than the other.
Microscleres: Two types of onychaetes; long, thin spicules with a roughened surface and subterminal bulb at one end (Plate 28, D), and shorter spicules without the bulb but with a roughened surface.
For spicule dimensions *see* Table 45.

REMARKS: *Tedaniopsis turbinata* is distinctive within the Tedaniidae in external growth form and spicule complement. Lévi (1963) recorded two species of *Tedania* from South Africa which possessed large thick styles (> 15 μm wide), comparable in thickness to the tylotes of *T. turbinata*.

Family HYMEDESMIIDAE Topsent, 1928

DIAGNOSIS: Poecilosclerida with a permanently encrusting growth form. The principal and accessory choanosomal spicules are acanthostyles which are orientated vertically; they are inserted at the base into

TABLE 45. Spicule dimensions of *Tedaniopsis turbinata*.

Locality		Tylotes (μm)	Strongyles (μm)	Large onychaetes (μm)	Small onychaetes (μm)
TYPE Three Kings Is, 183 m Dendy (1924)		500 × 25	340 × 6	600 × 4	180 × 2
TYPE remeasured	x̄	478 × 24	309 × 5	590	108
	Range	400–510 × 13–30	250–350 × 4.5–5.5	530–640	65–195
NZOI Stn J953, 260–270 m	x̄	504 × 16	343 × 5	552	82
	Range	420–600 × 11–20	280–415 × 4–7	520–590	65–130
NZOI Stn J974. 152 m	x̄	464 × 16	318 × 5	593	170
	Range	325–600 × 10–21	255–375 × 4–6	530–635	70–300

a spongin layer which overlies the substrate. The ectosomal spicules are diactinal, orientated vertically or occurring without organisation throughout the thin body. They are usually more slender than the principal spicules. The surface frequently has specialised areolate oscular and pore areas. Microscleres include arcuate or unguiferate isochelae, sigmas, and other unusual forms which serve to characterise the genera.

REMARKS: This diagnosis is adapted from Bergquist (1978). There are two genera of this family represented in New Zealand waters, *Hymedesmia* and *Stylopus*.

Hymedesmia anisostrongyloxea n.sp. has ectosomal spicules with unequal ends; one end is frequently more pointed than the other and they could be considered to be monactinal spicules. The family diagnosis has not been expanded to include monactinal spicules in the ectosome because of the irregularity of this condition in *H. anisostrongyloxea*. Most of the ectosomal spicules would be termed anisostrongyloxeas.

Because there is insufficient generic representation of this family within New Zealand no further systematic discussion will be undertaken.

Hymedesmia Bowerbank, 1864

DIAGNOSIS: Hymedesmiidae in which the choanosomal skeleton consists of vertically orientated acanthostyles attached by their bases to the substrate. Ectosomal megascleres form brushes that support a dermal membrane usually densely packed with isochelae, and these brushes may extend into the choanosome in skeletal columns. Microscleres are arcuate isochelae and sigmas.

TYPE SPECIES: *Hymedesmia zetlandica* Bowerbank, 1864

REMARKS: Topsent (1892b) established the genus *Leptosia* and included in it the species *Hymedesmia zetlandica*. However, Thiele (1905) synonymised *Leptosia* with *Hymedesmia* because *H. zetlandica* had been named the type of *Hymedesmia* by Bowerbank (1864). Topsent (1917) maintained the two genera *Leptosia* and *Hymedesmia* on the basis of their microsclere complement. He considered *Leptosia* to have anchorate isochelae and *Hymedesmia* to have arcuate isochelae. The genus *Hymedesmia* contains many species and subdivision of these species on the basis of microsclere types present would assist in reducing the size of the genus. However, without examination of a series of species of both genera, no conclusion can be reached on the validity of this separation.

The three species of *Hymedesmia* which occur in New Zealand are thin encrustations and orange-brown in colour. They can be readily distinguished from each other by their ectosomal spiculation: *Hymedesmia lundbecki* Dendy has strongyles, *H. microstronglya* n.sp. has strongyloxeas, and *H. anisostrongyloxea* n.sp. contains anisostrongyloxeas.

Hentschel (1914) described five species of *Hymedesmia* from the southern oceans, all of which have considerably longer spicules than the New Zealand species.

Hymedesmia lundbecki Dendy

Hymedesmia lundbecki Dendy, 1924: 358, pl. xiv fig. 28–30c.

MATERIAL EXAMINED: NZOI Stn B93, north-east of Three Kings Islands, 55–91 m (2 specimens); Tokatu Channel, 18 m.

DESCRIPTION: A thin encrusting sponge, growing in one case on *Glycymeris laticostata*, and in another on *Petrosia australis*.

DIMENSIONS: Length 10–34 mm; width 10–23 mm; thickness 1.2–1.8 mm.

COLOUR: In life, dull orange (2.5YR 5/10); in spirit, dark brown to black.

TEXTURE: Soft, easily torn.

SURFACE: The surface is granular. Oscules 0.3–0.6 mm in diameter are scattered at irregular intervals over the surface.

SKELETON: The skeleton consists of stout columns of strongyles 200–250 μm wide running almost at right angles to the surface, where they break up into brushes which support the dermal membrane. Strongyles and acanthostyles also occur interstitially. The dermal membrane is 0.15 mm thick and densely packed with arcuate isochelae, many developmental forms of which occur in the choanosome.

SPICULES:
Megascleres: Smooth, straight strongyles with evenly rounded ends, occasionally pinched just below the head, thus appearing faintly tylote. Two sizes of acanthostyles: large forms, straight or slightly curved, with very few spines on the shaft, but with long recurved spines on the head; and small forms, always straight and evenly spined, but with the spines on the head longer and recurved.
Microscleres: Arcuate isochelae with stout, strongly curved shafts, and short hemispherical teeth. Developmental forms occur and these resemble stout sigmas with small terminal expansions.
For spicule dimensions *see* Table 46.

REMARKS: *Hymedesmia lundbecki* can be distinguished by spicule complement from the two new species of *Hymedesmia* described below. *Hymedesmia lundbecki* has strongyles in the ectosomal skeleton which are not found in the other species. It also has large arcuate isochelae.

OTHER RECORDS: Three Kings Islands, 183 m.

TABLE 46. Spicule dimensions of *Hymedesmia lundbecki*.

Locality		Strongyles (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
TYPE Three Kings Is, 183 m Dendy (1924)		600 × 12	250–470 × 12 2 sizes not differentiated		60 × 8
Tokatu Channel, 18 m	x̄	570 × 8.9	420 × 8.4	192 × 6.2	41 × 6
	Range	380–720 × 6–10	342–460 × 7–10	120–230 × 5–8	28–50
NZOI Stn B93, Three Kings Is, 55–91 m	x̄	233 × 5	Broken, so not measured	99 × 8	43 × 7.5
	Range	185–270 × 4–5.5		90–110 × 7–10	43–45 × 5.5–10

Hymedesmia microstrongyla n.sp. (Plate 28, E, F)

MATERIAL EXAMINED: Clifton Beach, Auckland, intertidal; Tatara Beach, Taranaki, intertidal (two specimens).

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 99.

TYPE LOCALITY: Tatara Beach, Taranaki, intertidal.

DESCRIPTION: A thin encrustation spreading on rock.

DIMENSIONS: Thickness 1 mm.

COLOUR: In life, orange-brown (7.5YR 5/8); in spirit, yellow-grey (2.5Y 6/2) to mauve-grey.

TEXTURE: A soft sponge which is easily torn. No further detail can be ascertained because of the extreme thinness of the sponge.

SURFACE: Under low magnification the surface is quite transparent and rendered hispid by a projecting layer of spicules which form a continuous palisade. The dermal membrane is closely adherent to the underlying choanosome and cannot be separately described.

SKELETON: The skeleton consists of large acanthostyles with heads embedded at the base of attachment and extending slightly beyond the surface. Smaller acanthostyles lie basally between the larger ones and stand erect. In the Clifton Beach specimen they aggregate around the base of the large acanthostyles, forming clusters of spicules (Plate 28, E). In the other specimens the acanthostyles are more evenly spaced. The chelae are concentrated in a thick surface layer and a basal layer, and are also dispersed throughout the choanosome. The strongyloxeas lie near the surface of the sponge and are disposed tangentially. They also lie horizontally at the base of the sponge, over the acanthostyles.

SPICULES (Plate 28, F):
Megascleres: Straight, slender strongyloxeas, usually with one end thicker than the other and with a blunter point. Two sizes of acanthostyles: large forms with few spines on the shaft, faint spining near the head, and heaviest spining on the head itself; and small forms spined all over, but with most spines on the head.
Microscleres: Arcuate isochelae with bowed shafts, some of a slightly smaller size group with thinner shafts.
For spicule dimensions *see* Table 47.

REMARKS: *Hymedesmia microstrongyla* is a very thin encrusting sponge characterised by small strongyloxeas. It is close to *Leptosia dichela* Hentschel, 1911 except for the small size of the ectosomal spicules and in possessing only one category of arcuate isochelae. There are a number of acanthostyles of intermediate size in this species, producing an overlap between the two size ranges of these spicules; the categories are still quoted separately as intermediates are not common.

Hymedesmia anisostrongyloxea n.sp.
(Plate 29, A–C)

MATERIAL EXAMINED: Leigh Reef, 27 m; Tokatu Point, 8 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 98.

TYPE LOCALITY: Tokatu Point, 8 m.

DESCRIPTION: A thin encrusting sponge, one specimen growing over a large bivalve shell, the other over a solitary ascidian.

DIMENSIONS: No data.

COLOUR: In life, orange to orange-brown (10.0R 5/10–5.0YR 5/10); in spirit, identical.

TEXTURE: A soft sponge which is easily torn. No further detail can be ascertained because the sponge is extremely thin.

SURFACE: An almost transparent ectosomal membrane can be seen under low magnification, through

TABLE 47. Spicule dimensions of *Hymedesmia microstrongyla*.

Locality		Strongyloxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
Tatara Beach, Taranaki, intertidal specimen 1	x̄	130 × 4.2	214 × 9.4	88 × 5.4	26
	Range	113–145 × 3–5	155–260 × 7–11	70–113 × 5–7	22.5–30 × 4–5
Tatara Beach, Taranaki, intertidal specimen 2	x̄	126 × 5	183 × 9	84 × 7	24 × 4.5
	Range	103–145 × 4–5	118–260 × 7.5–10.5	70–108 × 5–8	23–28 × 3.5–5
Clifton Beach, Auckland, intertidal	x̄	125 × 3.5	187 × 6.5	77 × 5.4	21
	Range	108–143 × 3–4.5	118–260 × 5–7.5	53–100 × 4.5–7	18–24

which the underlying choanosome is visible. The surface is hispid in patches.

SKELETON: The skeleton consists of a basal palisade of upright acanthostyles. The large acanthostyles extend beyond the surface of the sponge and give the hispid appearance to the surface (Plate 29, A). The anisostrongyloxeas form tracts running to the surface, lie horizontally over the bases of the acanthostyles, and are strewn haphazardly at the surface of the sponge. Isochelae are organised into a thin ectosomal layer.

SPICULES (Plate 29, B, C):
Megascleres: Anisostrongyloxeas that tend towards stylote forms. They are long, thin and smooth, usually tapering to a point at one end, blunt at the other end. Occasionally they are blunt at both ends, but one end is invariably more tapered. They may have a faintly tylote head. Two sizes of acanthostyles: large forms that are long and roughened over most of the shaft, with most spining on the head; and small forms that are short and spined all over.
Microscleres: Arcuate isochelae with bowed shafts, thinner than those in *Hymedesmia microstrongyla* n.sp. and with smaller, less elaborate ends (Plate 29, C).
For spicule dimensions *see* Table 48.

REMARKS: *Hymedesmia anisostrongyloxea* is a very thin crust, and is characterised by the presence of anisostrongyloxeas that tend toward the shape of styles. Only a few species of *Hymedesmia* have inequiended ectosomal spicules, and no description of existing species accommodate this sponge. *Leptosia grisea* Hentschel, 1911 from West Australia has styles for ectosomal spicules and is similar to *H. anisostrongyloxea* but the spicules in the New Zealand species are notably longer.

The acanthostyles fall into two readily identified categories in this species; however, the acanthostyles of the Tokatu Point specimen were more heavily spined that those of the Leigh specimen.

Stylopus Fristedt, 1885

DIAGNOSIS: Hymedesmiidae with basally attached acanthostyles orientated vertically to the base and

TABLE 48. Spicule dimensions of *Hymedesmia anisostrongyloxea*.

Locality		Aniso-strongyloxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
Tokatu Point, 8 m	x̄	272 × 4.5	253 × 7	111 × 6	31
	Range	235–300 × 3–5	190–275 × 6–8	100–123 × 5–7.5	28–33
Leigh Reef, 27 m	x̄	279 × 5	293 × 7	114 × 6	26
	Range	245–320 × 4.5–6.5	270–315 × 6.5–7.5	95–125 × 5–7.5	24–28

extending into the choanosome. Ectosomal megascleres form plumose tracts throughout the choanosome and at the surface they expand into brushes which support the dermal membrane. No microscleres.

TYPE SPECIES: *Stylopus coriaceus* Fristedt, 1885

Stylopus lissostyla n.sp. (Plate 29, D–F)

MATERIAL EXAMINED: Smuggler's Bay, Mayor Island; Leigh.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 105.

TYPE LOCALITY: Smuggler's Bay, Mayor Island.

DESCRIPTION: A thin encrusting sponge often growing around frondose algae.

DIMENSIONS: Thickness 1–2 mm.

COLOUR: In life, orange-red (7.5R 5/10); in spirit, white to cream.

TEXTURE: Firm, but the sponge tears very easily.

SURFACE: The upper surface of the sponge is overgrown by algae but is otherwise smooth. The ectosome adheres closely to the underlying choanosome.

SKELETON: The ectosomal skeleton is composed of smooth styles arranged in bundles oriented at right angles to the surface and disposed around pore areas (Plate 29, D). The choanosome consists of meandering tracts (10 μm wide) of smooth styles. At the base of the sponge are upright acanthostyles with points directed toward the upper surface of the sponge (Plate 29, E).

SPICULES (Plate 29, F):
Megascleres: Smooth, straight, slender styles. Two sizes of acanthostyles: large forms spined only over the upper third, with long tapered points and a slight curvature; and small forms generally spined or roughened all over, straight, with a long tapering point.
Microscleres: None.
For spicule dimensions *see* Table 49.

REMARKS: This species most closely approaches *Leptosia oculifer* Hentschel from West Australia. However, the styles of *Stylopus lissostyla* are consistently smaller and thinner, and the acanthostyles are of two distinct size categories, whereas in *L. oculifer* there is an overlap between the two categories of acanthostyles. These factors afford sufficient reason to recognise two species.

Stylopus australis n.sp. (Plate 30, A–E)

MATERIAL EXAMINED: NZOI Stn E268, near Cape Maria van Diemen, 44 m; Whangarei Heads; Whatapuke Island, Hen and Chickens Islands, 30 m; Maori Island, 18 m; Sponge Garden, Leigh, 18 m; Canyons, Leigh, 18 m; Outer Waterfall Reef, Leigh, 12 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 106.

TABLE 49. Spicule dimensions of *Stylopus lissostyla*.

Locality		Styles (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)
Smuggler's Bay	$\bar{x}$	222 × 3	270 × 6	125 × 5
	Range	190–250 × 3–3.5	230–300 × 4.5–8	105–145 × 3.5–5.5
Mayor Island	$\bar{x}$	219 × 3.5	260 × 9	124 × 7
	Range	200–235 × 3–4.5	220–290 × 7–10	100–140 × 5–9
Leigh	$\bar{x}$	212 × 3	303 × 6	130 × 5
	Range	202–223 × 3	255–360 × 5–7.5	118–145 × 4–6

TYPE LOCALITY: Maori Island, 18 m.

DESCRIPTION: A thick, encrusting sponge, which is solid and compact. It is found spreading over rock faces.

DIMENSIONS: Most specimens are at least 3 mm thick, the thickest can reach 12 mm.

COLOUR: In life, orange (2.5YR 6/10, 10.0R 4/10), but once removed from the water the sponge rapidly turned a deep navy-blue; in spirit, dark purple (2.5RP 2/4, 7.5P 2/2).

TEXTURE: A compact sponge that is readily compressed and easily pulled apart.

SURFACE: In life the sponge has pronounced round areolate pore-fields (Plate 30, A). When preserved, the sponge has a smooth but rather wrinkled surface with localised areas where it is microscopically hispid. An ectodermal skin firmly adheres to the underlying choanosome.

SKELETON: The deep purple pigmentation makes it difficult to investigate the structure of the skeleton. The acanthostyles form an erect basal skeleton, the pointed ends extending toward the upper surface of the sponge. However, this part of the skeleton is much reduced. The remainder of the choanosomal skeleton consists of tracts (40–80 μm wide) of smooth megascleres extending to the surface (Plate 30, B, C). The ectosomal skeleton consists of smooth megascleres scattered randomly over the surface; these are emphasised around the pore areas.

SPICULES (Plate 30, D, E):
Megascleres: Very slender strongyles, smooth and straight, the ends rounded, occasionally one end more so than the other. Two sizes of acanthostyles: slender, long forms roughened at the head end and smooth or faintly roughened over the rest of the shaft, usually gently curving, occasionally straight; and slender, shorter forms spined or roughened over their entire length, with a small tylostylote head.

Microscleres: None.
For spicule dimensions *see* Table 50.

REMARKS: This species is characterised by the orange colour in life and the pronounced areolate pore-fields over the surface. Once removed from seawater the sponge colour changes to a deep navy-blue, while the specimens in spirit remain deep purple. The spicules differ a little in shape between specimens. The ectosomal spicules vary from strongyles (Leigh specimens and Whatapuke Island (Plate 30, D)), to tylotes with faint, short heads (Whangarei Heads), to tylotes with faint, elongate heads (near Cape Maria van Diemen (Plate 30, E)). The width of the acanthostyles is also variable. The external appearance and colour of the specimens are very consistent and are sufficient to distinguish the species.

This species is most like *Leptosia australiensis* Hentschel from West Australia. However, *L. australiensis* consistently has tylotes that are smaller than the ectosomal diacts of *Stylopus australis*. Hentschel (1911) only gave measurements for the smaller category of acanthostyles, and this makes detailed comparison difficult. Given the known geographic ranges of the two species, it is almost certain that they are distinct.

Family PHORBASIDAE de Laubenfels, 1936

Anchinoidae Topsent, 1928

DIAGNOSIS: Poecilosclerida with diactinal ectosomal megascleres and with the choanosomal skeleton arranged in plumose or plumo-reticulate columns. The basal regions of the columns are composed of acanthostyles or, occasionally, styles. In some genera the ectosomal skeleton is differentiated and diactinal spicules are present in the choanosomal columns. Microscleres are isochelae and sigmas. There are specialised areolate pore-fields on the surface and ectosomal spicule brushes form an organised palisade around them.

REMARKS: This diagnosis is adapted from Lévi (1973), who followed Topsent (1928) in using the family name

TABLE 50. Spicule dimensions of *Stylopus australis*.

Locality		Strongyles (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Description of ectosomal spicules (μm)
Maori Island, 18 m	x̄	281 × 4.6	305 × 7	118 × 6	
	Range	260–325 × 4–5	260–340 × 6–9	110–130 × 4.5–6.5	
Canyons, Leigh, 18 m	x̄	294 × 6	307 × 8	125 × 6.5	
	Range	250–310 × 4.5–7	285–330 × 7–10	110–135 × 5–7.5	
Sponge Garden, Leigh, 18 m	x̄	275 × 5	299 × 7	113 × 6	
	Range	255–310 × 3.5–5.5	250–330 × 6.5–10	100–120 × 5–6.5	
Outer Waterfall Reef, Leigh, 12 m	x̄	296 × 4.4	285 × 7	107 × 5	
	Range	250–335 × 3.5–5	215–320 × 6–8.5	100–120 × 4.5–6	
Whatapuke Id, 30 m	x̄	289 × 3.4	281 × 4.7	96 × 4	Strongyles and large acanthostyles thin
	Range	270–320 × 2.5–4	240–330 × 3.5–5	83–113 × 3.5–5	Small acanthostyles short
Whangarei Heads	x̄	Tylotes 262 × 4.5	282 × 7	114 × 5	Tylotes with faint short heads
	Range	230–285 × 3–6	205–320 × 5–9	90–140 × 4–6	
NZOI Stn E268, near Cape Maria van Diemen, 44 m	x̄	Tylotes 304 × 4.8	339 × 9	116 × 5.4	Tylotes with faint elongate heads
	Range	260–360 × 4.5–5	285–390 × 7.5–12	110–125 × 4.5–7.5	

Anchinoidae. Van Soest (1984) synonymised *Anchinoe* Gray, 1867 with *Phorbas* Duchassaing & Michelotti, 1864 because he could not differentiate between the description of the type species of *Anchinoe, Hymeniacidon perarmatus* Bowerbank, 1866, and that of the type species of *Phorbas, P. amaranthus* Duchassaing & Michelotti, 1864. Bowerbank's description of *H. perarmatus* conforms very closely to a British Museum specimen of *P. amaranthus* (BM(NH) 1938.6.30.16) identified by Burton, and this specimen has been re-examined and compared with van Soest's redescription of the holotype of *P. amaranthus*. The specimens were found to be identical, thus supporting the view that the two genera are synonymous and that the older family name, Phorbasidae, has priority.

Phorbas Duchassaing & Michelotti, 1864

Anchinoe Gray, 1867

DIAGNOSIS: Phorbasidae in which the choanosomal skeleton consists of plumose tracts, predominantly of acanthostyles, with which some diactinal spicules can occur. Ectosomal diactinal spicules form fans disposed at right angles to the surface and occasionally also lie tangentially. There is frequently a dermal layer of isochelae. Microscleres are arcuate isochelae and sigmas.

TYPE SPECIES: *Phorbas amaranthus* Duchassaing & Michelotti, 1864

Phorbas intermedia Bergquist
(Plates 30 F; 31, A, B)

Phorbas intermedia Bergquist, 1961a: 36, fig. 5a, b.

MATERIAL EXAMINED: Rangitoto Island, intertidal; Narrow Neck Reef, intertidal; Back Beach, Coromandel, intertidal.

DESCRIPTION: An irregular, massive to encrusting sponge.

DIMENSIONS: Length 30 mm; width 23 mm; thickness 19 mm. Encrusting specimens are very thin, up to 0.8 mm.

COLOUR: In life, rich yellow (10.0YR 7/10); in spirit, pale creamy yellow to fawny brown.

TEXTURE: The sponge is soft and compressible and quite elastic.

SURFACE: The surface is smooth with a thick dermal membrane that undulates where aggregations of ectosomal tylotes form elevations. The membrane is firmly adherent to the underlying choanosome.

SKELETON: The ectosomal skeleton consists of a palisade of tylotes disposed at right angles to the surface of the sponge (Plate 30, F). Occasional small acanthostyles are also found in the ectosome. The underlying choanosomal skeleton is made up of plumose tracts 25–50 μm wide and composed of tylotes and large acanthostyles. The tracts may anastomose, but no coherent reticulation is formed and there is no fibre development. All the types of megascleres and microscleres present occur interstitially in the choanosome.

SPICULES (Plate 31, A, B):
Megascleres: Two sizes of acanthostyles: large forms which are mainly smooth except for short spines on the head and point, these grading to a tylote condition when the point is not defined sharply (Plate 31, A); and small forms which are spined all over, with evenly tapered points and with most spining on the head. Smooth, straight or slightly curved tylotes with pronounced well-rounded and spined heads.
Microscleres: Small, usually C-shaped sigmas, but sometimes hook- or S-shapes. Abundant rhaphides with sharply pointed ends. Arcuate isochelae of normal form (Plate 31, B).
For spicule dimensions *see* Table 51.

REMARKS: *Phorbas intermedia* is a very well characterised species. The presence of tylotes as the ectosomal diacts and the absence of isochelae from the ectosome makes it quite different from other species of *Phorbas*. The presence of three microsclere types and their abundance is also unusual within the family. The skeletal organisation is typical for the genus.

OTHER RECORDS: Rangitoto Island; Karaka Bay, Auckland.

Phorbas areolata n.sp. (Plate 31, C–F)

MATERIAL EXAMINED: NZOI Stn E367, near North Cape, 29 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 107.

TYPE LOCALITY: NZOI Stn E367, 34°25.01′S, 173°05.0′E, near North Cape, 29 m.

DESCRIPTION: A thick encrusting sponge.

DIMENSIONS: Length 60 mm; width 35 mm; thickness 15 mm.

COLOUR: In life, not recorded; in spirit, fawny-brown (7.5R 8/4).

TEXTURE: The sponge is firm and slightly compressible.

SURFACE: The surface is marked by many small areolate pores with slightly elevated rims (Plate 31, C). The dermal membrane is closely adherent to the underlying choanosome and is smooth apart from a hispid fringe around the rims of the pores.

SKELETON: The ectosomal skeleton consists of diactinal megascleres orientated at right angles to the surface and forming a palisade around each pore area. Isochelae are abundant in the ectosome. The choanosomal skeleton consists of plumose, frequently anastomosing tracts approximately 50 μm wide that are composed of strongyles. Acanthostyles are found in

TABLE 51. Spicule dimensions of *Phorbas intermedia*.

Locality		Large acanthostyles (μm)	Small acanthostyles (μm)	Tylotes (μm)	Sigmas (μm)	Rhaphides (μm)	Isochelae (μm)
TYPE Rangitoto Id, intertidal Bergquist (1961)		170–220 × 5–7	90 × 4	150 × 4–6	17–21	40–70	40 × 4.5
TYPE remeasured	x̄	185 × 6.5	84 × 5.5	152 × 5.6	24	45	33
	Range	140–210 × 5–8	70–100 × 4.5–7	130–165 × 5–6.5	20–27	40–55	18–38
Narrow Neck Reef, intertidal	x̄	185 × 7	88 × 5	156 × 5	25	46	34
	Range	165–200 × 5.5–9	82–100 × 4.5–6.5	130–180 × 4.5–6	20–28	43–50	26–39
Back Beach, Coromandel, intertidal	x̄	219 × 6.5	85 × 5	153 × 5.5	25	46	35
	Range	145–203 × 5–8	73–93 × 4–6	133–180 × 4.5–6.5	18–38	43–48	25–43

the tracts and interstitially in the choanosome. Isochelae are abundant in the choanosome (Plate 31, D).

SPICULES (Plate 31, E, F):
Megascleres: Strongyles with occasional oxeote modifications. Frequently the two ends are unequal, one end bluntly pointed, one end rounded. Acanthostyles with roughened edges only, lacking pronounced spines, and having tylote heads (Plate 31, E).
Microscleres: Arcuate isochelae with short alae (Plate 31, F).
For spicule dimensions *see* Table 52.

REMARKS: Few described species of *Phorbas* have a spicule complement comparable to *P. areolata*. *Phorbas fictitius* Bowerbank, 1866 has two sizes of acanthostyles and isochelae of a similar size range, but has tornotes as the diactinal megascleres rather than strongyles.

The distinguishing features of *P. areolata* are the areolate pores with elevated rims, and the spicule complement. It differs from *P. intermedia* in having strongyles instead of tylote diactinal megascleres, and rhaphides and sigmas are absent. The skeletal organisation is typical for the genus.

TABLE 52. Spicule dimensions of *Phorbas areolata*.

Locality		Strongyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
NZOI Stn E367, near North Cape, 29 m	x̄	264 × 3.5	145 × 4	22
	Range	250–285 × 3–4	125–165 × 3–5	20–24

Pronax Gray, 1867

Plumohalichondria Carter, 1876
Stylostichon Topsent, 1892a

DIAGNOSIS: Phorbasidae in which the choanosomal skeleton consists of acanthostyles of two distinct types while the ectosomal skeleton is constituted of diactinal spicules. The large acanthostyles are incorporated into plumose tracts which in the basal regions of the sponge are fibrous; the small acanthostyles echinate the tracts. The ectosomal diacts form fans at right angles to the surface. Microscleres are isochelae and sigmas.

TYPE SPECIES: *Pronax plumosa* Gray, 1867

REMARKS: Lévi (1963, 1973) used *Pronax* for sponges with the organisation described above. Gray (1867), in his description of *Pronax plumosa*, mentioned all the spicule types which were present but did not comment on organisation of the skeleton. The interpretation of the genus adopted in this work follows Lévi, as no type material was available for examination.

Carter (1876) described the type species of *Plumohalichondria, P. microcionides*, as having the spicule complement of *Pronax* with fibre development and echinating acanthostyles. This clearly is identical to *Pronax* and must fall into synonymy. However, not all species assigned to *Plumohalichondria* conform to this description and a careful revision of many of these species is needed. Two of Carter's species, *Plumohalichondria arenacea* and *P. mammillata*, have been re-examined (BM(NH) 86.12.15.80 and BM(NH) 87.5.2.6. respectively), and neither conform to the

description of the type species. Both have a dermal crust of acanthostyles, a feature which places them in the family Crellidae or possibly in the Myxillidae (cf. *Ectyomyxilla*).

Topsent (1892a) discussed *Plumohalichondria* and noted that sponges with differing skeletal construction had been included in it. He redefined *Plumohalichondria* as having a skeleton of plumose columns enclosing spicules that are smooth diacts (for example, as in *P. mammillata*, and established a new genus *Stylostichon* for species with a skeleton of plumose columns enclosing spiny monacts (as in *P. microcionides*, the type species of *Plumohalichondria*. Lundbeck (1909) realised Topsent's error and suggested that *Stylostichon dendyi*, a species described by Topsent at the same time as he established the genus, be made the type of the genus, thereby retaining the name *Stylostichon*. However, it is not possible for a later author to name a new type species when the original author designated a type species, and *Stylostichon* must fall into synonymy with *Plumohalichondria*.

Pronax anchorata n.sp. (Plate 32, A–E)

MATERIAL EXAMINED: Maori Island, 18 m; Canyons, Leigh, 18 m; Sponge Garden, Leigh, 18 m (2 specimens).

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 100.

TYPE LOCALITY: Canyons, Leigh, 18 m.

DESCRIPTION: A flat, usually thick, encrusting sponge, which exudes mucous when compressed.

DIMENSIONS: Length 54 mm; width 34 mm; thickness 3–6 mm.

COLOUR: In life, orange to dull orange (2.5YR 6/10–10.0R 4/10); in spirit, orange brown to pale brown (5.0YR 4/4–10.0YR 5/4).

TEXTURE: A soft and easily compressed sponge; it is slimy and easily pulled apart.

SURFACE: The surface folds into furrows on preservation and is marked by many areolate pores which lie in the surface plane. It is microscopically hispid with a distinct dermal membrane 0.5 mm thick that tends to be more deeply pigmented than the interior of the sponge. This membrane is firmly adherent to the underlying tissues.

SKELETON: The ectosomal skeleton consists of oxeas, often in thick palisades around pore areas and orientated at right angles to the surface. The vertical organisation is less marked away from the pore areas (Plate 32, B). Beneath the ectosomal region there are marked subdermal spaces with the tracts of the choanosomal skeleton running between adjacent spaces to intersect the ectosomal skeleton (Plate 32, C). At the base of the sponge plumose tracts are composed of large acanthostyles; smaller acanthostyles echinate the tracts (Plate 32, A). The tracts are approximately 20 μm wide, very close together (± 50 μm), and often anastomose. Fibre formation is noticeable in basal regions of the sponge.

SPICULES (Plate 32, D, E):
Megascleres: Short and smooth oxeas with abruptly pointed ends, sometimes with an end pinched subterminally so the head is slightly tylote although still pointed (Plate 32, D). Two sizes of acanthostyles: large forms, usually slightly curved and with the main spining on the basal two-thirds of the shaft; and small forms which are shorter, thinner and spined all over.
Microscleres: Anchorate isochelae with long alae (Plate 32, E). Hook-shaped sigmas.
For spicule dimensions *see* Table 53.

REMARKS: This species has been placed in the genus *Pronax* because it has fibre development in parts of the sponge, echinating small acanthostyles, a tendency for the large acanthostyles to form the main skeleton in the base of the sponge, and for the ectosomal diacts to be incorporated into the tracts nearer the surface.

Lévi (1963) described four species of *Pronax* from South Africa. All are similar in skeletal complement to *Pronax anchorata* but in all cases there are differences sufficient to sustain specific separation. *Pronax dives* Topsent has both isochelae and sigmas but differs in having tornotes as the ectosomal diacts.

Pronax fulva n.sp. (Plates 32, F; 33, A, B)

MATERIAL EXAMINED: Middle Arch, Poor Knights Islands, 15 m; Sponge Garden, Leigh, 18 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 101.

TYPE LOCALITY: Sponge Garden, Leigh, 18 m.

DESCRIPTION: A small, very thin, encrusting sponge growing over rocks or bryozoans. Somewhat slimy and very attractive to fish; when the sponge is scraped from the rocks, fish gather to eat it.

DIMENSIONS: Thickness ± 1 mm.

COLOUR: In life, yellow (2.5Y 7/8) to yellow-brown (7.5YR 3/2); in spirit, creamy-white to chocolate brown (7.5YR 3/2).

TEXTURE: A very soft sponge, easily collapsed when pulled apart.

SURFACE: The surface is microscopically hispid in some areas, otherwise smooth with a transparent, detachable dermal membrane.

SKELETON: Near the surface oxeas occur in the choanosomal tracts which support an ectosomal skeleton of fans of oxeas bounded by a surface layer of large isochelae (Plate 32, F). The choanosomal skeleton consists of tracts about 20 μm wide in which both oxeas and large acanthostyles are incorporated. The large and small acanthostyles also echinate the skeletal columns and in some areas extend beyond the surface of the sponge. In the basal areas of the sponge there is spon-

TABLE 53. Spicule dimensions of *Pronax anchorata*.

Locality		Oxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)	Sigmas (μm)
Canyons, Leigh, 18 m	x̄	176 × 6	215 × 7.5	96 × 6.5	25	24
	Range	165–180 × 3.5–7	190–235 × 7–8.5	85–105 × 4.5–8	23–28	20–28
Maori Island, 18 m	x̄	167 × 5	223 × 8.6	99 × 7	24	26
	Range	140–185 × 4.5–6.5	165–265 × 6.5–10	88–112 × 6–9	23–25	21–29
Sponge Garden, Leigh, 18 m specimen 1	x̄	176 × 6	214 × 8	101 × 6.6	25	26
	Range	170–190 × 5–8	200–230 × 5.5–11	90–115 × 4.5–9	23–28	23–29
Sponge Garden, Leigh, 18 m specimen 2	x̄	172 × 5	197 × 8	96 × 6.5	25	26
	Range	165–180 × 5–6	155–220 × 6–10	90–100 × 4–7.5	24–28	21–29

gin fibre development (Plate 33, A). Sigmas and isochelae are abundant throughout.

SPICULES (Plate 33, B):
Megascleres: Smooth, very slender oxeas with short pointed ends, occasionally with a slight sub-terminal swelling at each end and a tendency toward a strongyloxeote form. Two sizes of acanthostyles, both spined all over, but some of the longer spicules can be smooth at the distal end (Plate 33, B).
Microscleres: Arcuate isochelae of two size categories are found throughout the sponge. Extremely thin and hook-like sigmas.
For spicule dimensions *see* Table 54.

REMARKS: *Pronax fulva* differs from *P. anchorata* in colour, in thin encrusting habit, and in the type of isochelae present. *Pronax fulva* also has pronounced fibre development in the basal region and abundant echinating acanthostyles. The spicule complement is similar in the two species but there are significant differences in size. *Pronax fulva* has two categories of isochelae and smaller oxeas and acanthostyles than *P. anchorata*. These New Zealand species resemble each other more than they do any other described species of *Pronax*.

Hamigera Gray, 1867

DIAGNOSIS: Phorbasidae in which the choanosomal skeleton consists of plumose tracts of smooth subtylostyles and/or substrongyles. The ectosomal diactinal spicules form fans around areolate pore areas. The ectosomal skeleton may be amplified, in which case diactinal spicules are present in the choanosomal columns. Microscleres are arcuate isochelae.

TYPE SPECIES: *Hamigera hamigera* Gray, 1867

REMARKS: The description of the genus *Hamigera* by Gray (1867) mentions the characteristic surface pore

TABLE 54. Spicule dimensions of *Pronax fulva*.

Locality		Oxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Large isochelae (μm)	Small isochelae (μm)	Sigmas (μm)
Middle Arch, Poor Knights Is, 15 m	x̄	139 × 2.2	148 × 5	86 × 4.5	28	10.5	16
	Range	128–147 × 2–2.5	135–160 × 4–7	78–98 × 4–5	23–35	9–12	13–20
Sponge Garden, Leigh, 18 m	x̄	135 × 3	154 × 6.4	88 × 5.8	29	13	14
	Range	118–145 × 2.5–3.5	120–180 × 5–7.5	60–102 × 5–7	24–38	11–16	12.5–16

areas and the presence of two types of spicules: "1. Simple. 2. Equibianchorate, with three spines at each end." This inadequate description was elaborated on by Dendy (1921) who noted that the main skeleton was composed of smooth monactinal megascleres. Shaw (1927) described a species of *Hamigera* from Tasmania where monactinal megascleres were almost entirely absent and, on this basis, she expressed doubt as to whether the species *Hamigera dendyi* should be included in the genus. Few other species of *Hamigera* have been described, but the genus is well characterised by the presence of surface areolate pore areas, smooth megascleres, and a skeletal design typical within the family Phorbasidae. *Hamigera* lacks the echinating acanthostyle component found in *Pronax*.

Hamigera macrostrongyla n.sp.
(Plates 33, C–F; 34, A)

MATERIAL EXAMINED: Slipper Island, Bay of Plenty, 30 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 102.

TYPE LOCALITY: Slipper Island, 30 m.

DESCRIPTION: A thick encrusting sponge with pore areas over the surface and occasional short projections (Plate 33, C).

DIMENSIONS: Thickness 7 mm; height of turrets 14 mm.

COLOUR: In life, bright orange (5.0YR 6/12); in spirit, creamy-yellow.

TEXTURE: Firm but compressible.

SURFACE: A smooth surface with a membrane adhering to the underlying choanosome. Pore areas are raised on pronounced surface projections, 10 mm high.

SKELETON: The ectosomal skeleton consists of a layer of isochelae lying in the dermal membrane, with diactinal megascleres in vertical columns beneath (Plate 33, D). In some areas these megascleres can also lie tangentially. The surface projections are supported by diactinal megascleres which project beyond the surface (Plate 33, E). The choanosomal skeleton consists of plumose columns of styles approximately 50 μm wide. These may anastomose but no coherent reticulation is formed. Isochelae are found throughout the sponge.

SPICULES (Plates 33, F, 34, A):
Megascleres: Smooth, slender, usually straight styles, the rounded end slightly thinner than the main shaft, the short points not well defined. These spicules are not abundant. Smooth, thin strongyles that tend towards anisostrongyloxeas and are therefore often difficult to distinguish from the styles.
Microscleres: Arcuate isochelae (Plates 33, F, 34, A).
For spicule dimensions *see* Table 55.

REMARKS: *Hamigera macrostrongyla* is characterised within the genus by the large size of the spicules. An ectosomal layer of isochelae is also found in *Hamigera dendyi* Shaw but the spicules of *H. dendyi* are considerably smaller.

TABLE 55. Spicule dimensions of *Hamigera macrostrongyla*.

Locality		Styles (μm)	Strongyles (μm)	Isochelae (μm)
Slipper Island, Bay of Plenty, 30 m	$\bar{x}$	440 × 8.5	423 × 8	53
	Range	360–490 × 5–10	370–460 × 7–10	49–56

Hamigera tarangaensis n.sp. (Plate 34, B–F)

MATERIAL EXAMINED: Hen and Chickens Islands, 30 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 103.

TYPE LOCALITY: Hen and Chickens Islands, 30 m.

ETYMOLOGY: This species name is derived from "Taranga", which is the Maori name for Hen Island, the locality from which the type specimen was collected.

DESCRIPTION: An encrusting sponge with numerous pronounced, generally round, areolate pore areas raised about 0.5 mm above the surface of the sponge (Plate 34, B).

DIMENSIONS: Thickness 7 mm.

COLOUR: In life, orange-red (10.0R 6/10) to yellow (5.0YR 6/12); in spirit, cream.

TEXTURE: A firm but elastic sponge, readily compressed.

SURFACE: The surface is invested by a dermal membrane that closely adheres to the choanosome and is microscopically hispid, especially fringing the pore areas.

SKELETON: The ectosomal skeleton consists of diactinal megascleres in a palisade around the pore areas but less organised away from these regions (Plate 34, C, D). In the surface view the long thin strongyles are seen to form tangential tracts or to be dispersed singly. The choanosomal skeleton consists of plumose tracts of diactinal spicules orientated mainly at right angles to the surface. The tracts are 20–40 μm wide, and between them megascleres are found interstitially (Plate 34, E).

SPICULES (Plate 34, F):
Megascleres: Strongyles with many shape variations, often becoming oxeote, occasionally stylote. A large size range occurs and the spicules are long, thin and occasionally curved.
Microscleres: Arcuate isochelae with short alae (Plate 34, F).
For spicule dimensions *see* Table 56.

TABLE 56. Spicule dimensions of *Hamigera tarangaensis*.

Locality		Strongyles (μm)	Isochelae (μm)
Hen & Chickens Is, 30 m	$\bar{x}$	323 × 5	47
	Range	210–440 × 3.5–7	23–60

REMARKS: *Hamigera tarangaensis* differs from *H. macrostrongyla* in lacking an ectosomal layer of isochelae and in the detail of spicule structure. It has the characteristic areolate pore areas and the plumose skeletal tracts of the genus *Hamigera*, although it lacks clearly categorised monactinal megascleres. The strongyles are highly variable and include stylote forms. On balance the species is best placed in the genus *Hamigera* where it compares closely to *H. dendyi* Shaw. *Hamigera tarangaensis* differs from *H. dendyi* in the size and shape of its isochelae and the absence of a dermal layer of isochelae.

Discussion of the Families Hymedesmiidae and Phorbasidae

These two families are associated for several reasons. Both tend to have diactinal spicules in the ectosome, often with a dermal microsclere crust above them. The diactinal megascleres are very thin, usually quite long, and invariably inequiended. The ectosomal spicules form brushes or fans at right angles to the surface, as well as being tangentially disposed. The external surface of sponges of both families have highly structured pore areas, slightly elevated above the surface and fringed with diacts. These areolate pore areas are very contractile and quite distinctive in life.

The most interesting parallel between the two families is seen in the range of skeletal patterns represented. It has been considered previously (Topsent 1928) that the orientation of acanthostyles erect upon the substrate seen in hymedesmiid sponges precludes any thickening of the sponge; they are considered obligatory encrusters. Lundbeck (1910) noted that "the dermal skeleton may sometimes be strongly developed, giving the sponge some thickness." The skeletons of both hymedesmiid genera considered here support this idea (Fig. 7a–d). Both species of *Hymedesmia* are very thin encrustations and their choanosomal skeleton is made up only of acanthostyles. In *Hymedesmia anisostrongyloxea* the skeleton is comprised of large acanthostyles embedded in basal spongin with smaller acanthostyles, also with their bases embedded in spongin, dispersed evenly in between. In *Hymedesmia microstrongyla* there is some aggregation of the acanthostyles into columns. The small acanthostyles tend to be congregated at the base of the larger acanthostyles. Both of these sponges are approximately 1.0 mm thick.

In *Stylopus* the dermal skeleton is more strongly developed and in one species the sponge is thicker than either of the *Hymedesmia* species (Fig. 7d). However, *Stylopus lissostyla* has increased development of the dermal skeleton with little corresponding increase in the thickness of the sponge (Fig. 7c). *Stylopus australis* has increased development of the dermal skeleton to the extent where the erect acanthostyles form little more than a thin base to the skeleton, and the sponge is much thicker.

Species of the Phorbasidae have similar skeletal structure (Fig. 7e, f). However, in these species there has been some fibre development at the base of the tracts, and acanthostyles echinate these tracts, while also retaining erect basal disposition. One species, *Pronax fulva*, is as thin as the *Hymedesmia* species. One cannot therefore argue that greater development of the dermal skeleton will lead necessarily to an increase in the thickness of the sponge. It appears that the fibres seen in the *Pronax* species have arisen as vertical outgrowths of the basal spongin layer and echinating acanthostyles have been incorporated as the basal components follow the upward growth of the spongin fibre.

Van Soest (1984) noted the similarity of skeletons in these two families. Certainly the New Zealand species of *Pronax* are very close to some members of the family Hymedesmiidae. All species retain the ectosomal skeleton, but in the two *Phorbas* species the plumose tracts anastomose and there is no fibre development. The acanthostyles are found within these tracts or loose in the matrix, not echinating. *Hamigera macrostrongyla* has a plumose choanosomal skeleton, anastomoses occur but no coherent reticulation is formed, there is no fibre development, and acanthostyles are absent.

The close similarity of the skeletons of these phorbasid genera with some Hymedesmiidae certainly argues for a close affinity. Van Soest (1984) suggested that the hymedesmiids as a whole are comparable to the leptoclathriid condition of many Clathriidae and that the encrusting habit and associated constraints on organisation are thus not valid characters on which to base familial distinction. Before this argument is accepted, careful study, including ecological study, of many species of both the Phorbasidae and Hymedesmiidae is essential.

Family CRELLIDAE Hentschel, 1923

DIAGNOSIS: Poecilosclerida with a principal skeleton of diactinal or, occasionally, monactinal megascleres, arranged in plumose or plumo-reticulate tracts, usually fibrous, often echinated by acanthostyles. The dermal skeleton is a dense layer of acanthose spicules, monactinal or diactinal. In some genera, basal acan-

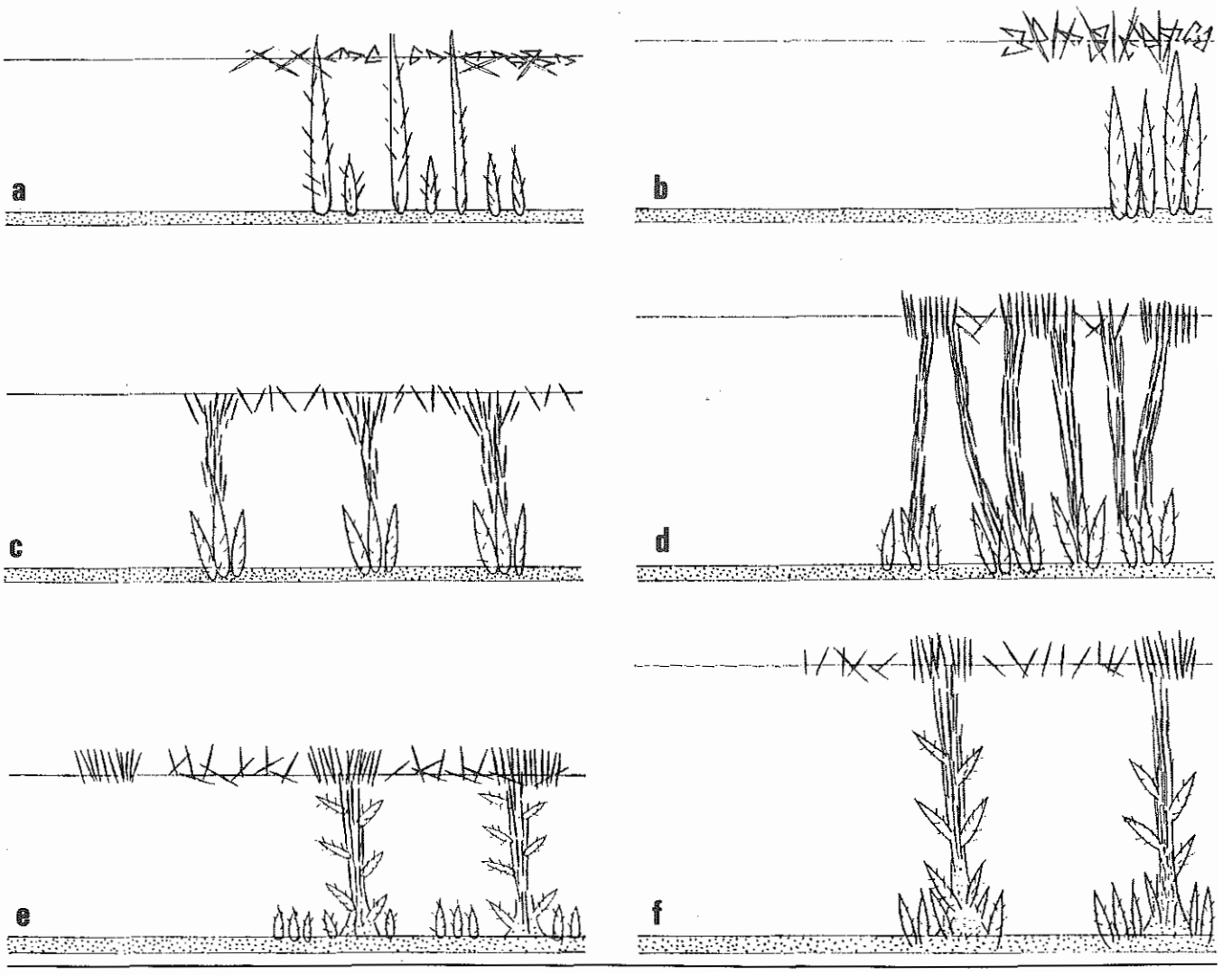

FIG. 7. Skeletal organisation in the family Hymedesmiidae as compared to the family Phorbasidae. a–d, family Hymedesmiidae: a, *Hymedesmia anisostrongyloxea* n.sp.; b, *Hymedesmia microstrongyla* n.sp.; c, *Stylopus lissostyla* n.sp.; d, *Stylopus australis* n.sp. e, f, family Phorbasidae: e, *Pronax fulva* n.sp.; f, *Pronax anchorata* n.sp.

thostyles are disposed vertically on to the substrate. Microscleres, if present, are arcuate isochelae and sigmas.

REMARKS: This diagnosis is adapted from Bergquist (1978).

Crella Gray, 1867

Pytheas Topsent, 1890

DIAGNOSIS: Crellidae with fibres cored by diactinal megascleres, frequently with echinating acanthostyles. An upright layer of acanthostyles at the base of attachment is most frequent in encrusting forms. The ectosomal skeleton consists of a tangential layer of acanthostyles or acanthoxeas. Microscleres, if present, include arcuate isochelae.

TYPE SPECIES: *Cribrella elegans* Schmidt, 1862.

REMARKS: The genus *Cribrella* as construed by Schmidt is heterogeneous and all species described in it need to be allocated individually to correct genera. The type species of *Cribrella, C. hamigera*, is the type species of the genus *Hamigera*.

The main problem with the New Zealand representatives of *Crella* is to decide whether the three species should be assigned to this genus or to *Pytheas*. Lévi (1973) retains both genera, defining *Crella* as having no isochelae and some basal acanthostyles, and *Pytheas* as having basal acanthostyles and isochelae. Other authors, for example, Lundbeck (1909) and van Soest (1984), have synonymised *Pytheas* with *Crella*.

Van Soest argued that retention of two genera, one with chelae and one without, seemed superfluous.

Gray (1867) established the genus *Crella* and Schmidt (1862) described the type species. Neither author mentioned microscleres nor gave a description of the skeletal organisation. Topsent (1925) noted that Schmidt's description was incomplete, but that from the description it could be concluded that *Crella* did not possess microscleres. Topsent, when examining the type specimen, found this to be true. He also examined *Cribrella papillosa* Schmidt, and *Yvesia pertusa* Topsent and found arcuate isochelae to be present. He referred *Y. pertusa* to *Crella* on the basis of skeletal arrangement and spiculation and then redefined the genus *Crella* as "Ectyoninae with megascleres of three sorts: 1, always spined monacts or diacts in the superficial region of the body, positioned tangentially, 2, smooth, diactinal megascleres disposed in fascicules in the choanosome, 3, basal acanthostyles. Microscleres arcuate isochelae and sigmas." Topsent did not at that time mention *Pytheas*, which had been established in 1890. This genus was for species with echinating and basal acanthostyles while in *Crella* these spicules could be absent or present. The only clear difference between the two genera was the presence or absence of microscleres, and as Topsent (1925) redefined *Crella* to include microscleres, *Pytheas* clearly became a synonym of *Crella*.

The genus *Yvesia* was established by Topsent (1890) for species lacking echinating or basal acanthostyles, in which microscleres were present or absent. Topsent's position with respect to *Pytheas* and *Crella* is inconsistent with his treatment of *Yvesia*. In 1925, however, he suggested that genera such as *Grayella* and *Yvesia*, which are described as having no basal acanthostyles, may have been based on incomplete specimens in which the basal layer was not collected. This remains a real possibility and while examination of the type specimens of these related genera could alleviate confusion over usage of the generic names, it could reveal that the specimens are incomplete. At present, following Lundbeck (1909) and van Soest (1984), *Pytheas* is accepted as synonymous with *Crella*. If species without basal acanthostyles and without microscleres are consistently found, then the genera *Crella* and *Pytheas* could be separated and the New Zealand species would belong to the genus *Pytheas*.

Crella incrustans (Carter) (Plates 35, A–F; 36, A)

RESTRICTED SYNONYMY:
Echinonema incrustans Carter, 1885: 353.
Plumohalichondria mammillata Carter, 1885: 355; Ridley & Dendy 1887: 156, pl. xxx figs 4, 4a, pl. xlvii figs 4, 4a.
Echinonema laevis Lendenfeld, 1888: 220.
Clathria australis Lendenfeld, 1888: 222.
Clathria macropora Lendenfeld, 1888: 221.
Crella incrustans. Hallmann 1912: 164.
Anchinoe novae-zealandiae Dendy, 1924: 360, pl. xii fig. 2, pl. xv figs 9–11; Brøndsted 1924: 466; Bergquist, 1961b: 179, fig. 6a–e.

MATERIAL EXAMINED: BM(NH) 23.10.1.142, North Cape, 26–55 m (type); Middle Arch, Poor Knights Islands, 15 m; Canyons, Goat Island, 18 m; Sponge Garden, Leigh, 18 m; Outer Waterfall Reef, Leigh, 12 m; Leigh Reef, 18 m; Ti Point, 4 m; North of Tokatu Point, 4 m; Devonport Wharf, intertidal; Harrington Point, Dunedin, 12 m; Chatham Islands, 60 m.

DESCRIPTION: This species may be either encrusting, massive, ramose (Plate 35, A), or lamellate. In the latter case it may be narrow to the base, or be attached along the whole length.

DIMENSIONS: For sponge dimensions *see* Table 57.

COLOUR: In life, bright red to orange-yellow (7.5R 5/10–2.5YR 5/8); in spirit, dark red-brown to yellow-white (7.5YR 4/4–2.5YR 5/8–2.5Y 7/4).

TEXTURE: Compressible, but fibrous and tough.

SURFACE: The surface is smooth where the dermal membrane is intact, but where it is missing the underlying fibres present an extremely rough surface.

TABLE 57. Sponge dimensions of *Crella incrustans*.

Locality	Habit	Height (mm)	Width (mm)	Thickness (mm)
North Cape Dendy (1924)	Narrowed basally	142	94	10
Chatham Islands Bergquist (1961b)	Massive, erect	110	65	12
Devonport Wharf, intertidal	Erect, lamellate	120	160	2–5
Harrington Point, Dunedin	Massive	80	85	20
Leigh Reef, Leigh	Ramose, upright	55	60	up to 14
Canyons, Leigh	Encrusting			4

SKELETON: The ectosomal skeleton consists of a loose meshed layer of small curved acanthostyles lying at variable angles but most frequently tangentially to the surface. Beneath these is a region of oxeas organised as dispersed brushes supporting the acanthostyle crust; some also lie tangentially (Plate 35, B). A system of subdermal spaces is evident and thick bands of oxeas run through this region to the fibre skeleton in the choanosome (Plate 35, C). The fibre skeleton ends at the subdermal spaces. Large acanthostyles from the ends of the fibres extend into this subdermal region. The choanosomal skeleton consists of spongin fibre forming plumose, often anastomosing tracts approximately 100 μm wide and cored by oxeas (Plate 35, D). The core of oxeas is usually 50 μm wide, so approximately 20 μm of spongin fibre surrounds this central core. The fibres are echinated profusely by small and

TABLE 58. Spicule dimensions of *Crella incrustans*.

Locality		Oxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)	Growth form
TYPE North Cape, 26–55 m Dendy (1924)		176 × 5	150 × 4 (not divided into distinct categories)		16	
TYPE remeasured	x̄	174 × 5.3	141 × 8.7	83 × 7	15.3	
	Range	160–197 × 5–6	130–155 × 7.5–9.5	58–100 × 5.5–8	14–17	
Wellington Harb., 10–20 m Brøndsted (1924)		200–210	In all other respects agrees with Dendy's description			
Chatham Islands, 60 m Bergquist (1961b)		190 × 8	165 × 13	100 × 11	16	Large, irregularly lobate
Canyons, Leigh, 18 m	x̄	174 × 5.4	140 × 8	79 × 6.6	17	Encrusting, 4 mm thick
	Range	152–192 × 4.5–6.5	130–158 × 6.5–10	65–102 × 5–9	16–19	
Middle Arch, Poor Knights Is, 15 m	x̄	180 × 4.6	136 × 7	84 × 6	17	Encrusting, 7 mm thick
	Range	162–198 × 4–5.5	130–142 × 6–9	55–100 × 4–7.5	16–18	
Ti Point, 4 m	x̄	168 × 5.5	146 × 8	79 × 6	18	Encrusting, 10 mm thick
	Range	148–185 × 4.5–6.5	140–160 × 6.5–9	60–92 × 5–7	16–22	
Outer Waterfall Reef, Leigh, 12 m	x̄	168 × 5	139 × 7	82 × 6	17	Encrusting with lobes
	Range	150–190 × 4–6.5	128–158 × 6–8.5	62–100 × 4.5–7	15–19	
N. of Tokatu Pt, 4 m	x̄	177 × 5	146 × 7.4	89 × 6.7	18	Massive, 25 mm thick
	Range	165–192 × 4–5.5	130–160 × 6.5–9	63–110 × 5–8	16–20	
Harrington Pt, Dunedin, 12 m	x̄	181 × 5	152 × 6.6	92 × 6	17	Massive, with lamella 20 mm thick
	Range	165–200 × 3–5.5	140–162 × 5–8.5	74–110 × 4–7.5	14–18	
Sponge Garden, Leigh, 18 m	x̄	166 × 5	136 × 8	82 × 6.4	17	Ramose, with erect lobes 5 mm thick
	Range	150–175 × 4–6	130–145 × 7.5–9.5	65–110 × 4.5–8.5	16–18	
Leigh Reef, 18 m	x̄	174 × 5	147 × 7	86 × 6	17	Ramose, with interconnecting branches up to 14 mm thick
	Range	166–190 × 4.5–6	140–160 × 6–7.5	65–100 × 4.5–7.5	15–19	
Devonport Wharf, intertidal	x̄	160 × 5.6	147 × 9	89 × 6	17	Large frondose specimen attached by basal stems 2–5 mm thick
	Range	150–172 × 5–7	135–160 × 7–10	70–112 × 5–9.5	15–18	

large acanthostyles. Oxeas, acanthostyles and isochelae occur interstitially. In some sponges the base of the sponge has a layer of spongin approximately 20–25 μm thick from which the choanosomal fibres extend. This basal spongin layer supports a row of upright choanosomal acanthostyles and is most often found in encrusting specimens where this region has been collected intact (Plate 35, E).

SPICULES (Plates 35, F; 36, A).
Megascleres: Oxeas with hastate ends, smooth, usually inequiended. Two sizes of acanthostyles: choanosomal spicules with a large size range, sparsely spined and smooth at the pointed end, and generally straight; small acanthostyles evenly and profusely spined all over. The latter are the curved acanthostyles that form the dermal crust and the smaller of the choanosomal acanthostyles.
Microscleres: Small, slender arcuate isochelae (Plate 36, A).
For spicule dimensions *see* Table 58.

REMARKS: *Crella incrustans* is an extremely common sponge throughout New Zealand in the intertidal and subtidal regions, and has been recorded to a depth of 66 metres. When it occurs in the intertidal region this sponge is usually thickly encrusting to lamellate. It is bright red-orange in colour and found in deeply shaded places, for example, on the roofs of caves and under rocks with considerable overhang. The growth form or depth of occurrence has little or no correlation with variations in spicule dimensions.

This species was placed in the genus *Crella* by Hallmann (1912), who noted that Thiele (1903b) had expressed the opinion that *Plumohalichondria incrustans* (Carter) should be placed in the genus *Pytheas*, a synonym of *Crella*. Lundbeck (1909), when relegating *Pytheas* to synonymy under *Crella*, gave no explanation of his action. All the New Zealand specimens of *C. incrustans* examined in which the basal region is intact have basal acanthostyles and isochelae, i.e., they conform to the description of the genus *Pytheas*.

Hallmann (1912) described six varieties of *Crella incrustans*. In two of these varieties he described some type of basal layer. For instance, for *C. incrustans* var. *pumila* he stated: "The basal layer of spongin, with which the sponge covers the substratum, is densely echinated with vertically-standing acanthostyles." Both varieties in which a basal layer was described are encrusting; in these it is more likely that the basal layer will be collected than in ramose or massive specimens where a large piece of sponge can be taken but the basal layer excluded.

Dendy (1924) does not mention any basal layer of acanthostyles in his description of *Anchinoe novaezealandiae*, but this is an erect sponge collected by dredging. Dendy followed Topsent (1913) and Stephens (1921) in regarding *Plumohalichondria* as synonymous with *Anchinoe*. This view is not upheld here. The type species of *Plumohalichondria* lacks a dermal crust of acanthostyles, and it has the spicule complement of *Pronax* with which it is here regarded as synonymous (*see* REMARKS under the genus *Pronax*). Sponges with two types of dermal construction have been described under *Plumohalichondria*: those with dermal diacts, e.g., *P. microcionides*, and those with dermal crusts of acanthostyles, e.g., *P. mammillata* and *P. arenacea*. Both of the latter species have fibre development, echinating acanthostyles and isochelae, and clearly belong in the family Crellidae.

From published descriptions *Anchinoe novaezealandiae* appears to be synonymous with *Echinonema incrustans* Carter and the correct generic assignment for the species is in *Crella*. Vacelet *et al.* (1976) referred *A. novaezealandiae* to *A. clathrodes* Dendy, 1921. Their description of *A. clathrodes* differs from *A. novaezealandiae* in major ways: in *A. clathrodes* ectosomal acanthostyles are absent, there are two sizes of isochelae, and strongyles are present among the diacts. It is unlikely that this synonymy is correct.

For spicule dimensions of some species referred to *Crella incrustans see* Table 59.

OTHER RECORDS: S.E. Australia; New Zealand - off North Cape, 28–60 m; Wellington Harbour 10–20 m; Little Barrier Island, 60 m; New Plymouth 6–20 m; Queen Charlotte Sound, 6–10 m; Paterson Inlet (Stewart Island), 10–13 m; Chatham Islands, 66 m.

Crella fristedi (Dendy) (Plate 36, B–E)

Anchinoe fristedi Dendy, 1924: 359, pl. xv figs 5–8.

MATERIAL EXAMINED: BM(NH) 23.10.1.141, near Three Kings Islands, 183 m (type); NZOI Stn B93, Three Kings Islands, 55–110 m; Barren Arch, Poor Knights Islands, 15 m.

DESCRIPTION: An encrusting sponge with a very uneven surface covered by a thin ectosomal membrane. Pieces of coralline algae and bryozoa are incorporated into the Poor Knights specimen. One Three Kings specimen was growing upon a shell fragment, the other upon a long oscular tube of *Petrosia australe*.

DIMENSIONS: The Poor Knights specimen was collected entire and covered an area approximately 80 × 45 mm in extent and up to 15 mm thick.

COLOUR: In life, orange (7.5R 5/10); in spirit, pale brown (2.5Y 6/4) to dark maroon (10.0R 3/4).

TEXTURE: Soft and elastic, easily torn.

SURFACE: The surface is sporadically conulose and microscopically hispid, covered by a thin ectosomal membrane.

SKELETON: The choanosomal skeleton consists of plumose to plumo-reticulate fibres up to 200 μm wide (Plate 36, B). Numerous small acanthostyles echinate the fibres, which are cored by diactinal megascleres. Large acanthostyles echinate from the ends of the fibres and are occasionally seen coring the fibres in basal areas of the sponge. There is a basal layer of spongin from which the fibres arise and which supports a row of upright choanosomal acanthostyles. A quantity of foreign material is incorporated into the choanosomal skeleton, chiefly bryozoan fragments (Plate 36, C). The diactinal megascleres are also found lying tangentially or at various angles, along with numerous isochelae, in the ectosomal skeleton. Above

TABLE 59. Spicule dimensions of some species referred to *Crella incrustans*.

Species		Oxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
Clathria australis TYPE	x̄	159 × 6.6	148 × 9.1	68 × 5	16
	Range	144–197 × 4.6–7	117–160 × 8–10.2	58–77 × 4.6–5.3	12–17.2
Clathria macropora TYPE	x̄	165 × 5.7	140 × 8.9	69 × 5.1	15.9
	Range	158–174 × 4.6–6.6	100–158 × 8–10	62–78 × 4.4–5.7	13–16.8
Echinonema laevis TYPE	x̄	170 × 6.2	158 × 9.7	70 × 5.2	16
	Range	147–186 × 4.4–8	140–168 × 8.3–10.6	57–82 × 4.6–5.7	14–16.8
Echinonema incrustans (Carter)		190 × 5	90 × 6	90 × 7	16–25
Anchinoe novaezealandiae TYPE	x̄	174 × 5.3	141 × 8.7	83 × 7	15.3
	Range	160–197 × 5–6	130–155 × 7.5–9.5	58–100 × 5.5–8	14–17

these is a tangential layer of small acanthostyles interspersed with isochelae.

SPICULES (Plate 36, D, E):
Megascleres: Thin and hastate oxeas. These spicules tend to be inequiended, one end more tylote than the other. Two sizes of acanthostyles: large and slightly curved forms, spined basally with a very rounded stylote end; small forms evenly spined all over.
Microscleres: Arcuate isochelae (Plate 36, E).
For spicule dimensions *see* Table 60.

REMARKS: Dendy (1924) noted an abundance of foreign material, chiefly gorgonian spicules, in the skeleton of this species. The Poor Knights specimen incorporates bryozoan pieces into its skeleton. The spiculation of both specimens compares closely with that of the type. *Crella fristedi* differs from other New Zealand species of *Crella* chiefly in having larger spicules, in its habitat, and in consistently incorporating debris into the skeleton.

Crella affinis (Brøndsted)

(Plates 36, F; 37, A–C)

Anchinoe affinis Brøndsted, 1924: 467, fig. 22a–e.

MATERIAL EXAMINED: Slipper Island, 31 m; off New Plymouth, 14 m (spicule slide only); BM(NH) 27.5.19.3, Wellington Harbour, 9 m (type).

DESCRIPTION: An encrusting to sub-spherical sponge covered with low crater-like oscules.

DIMENSIONS: Encrusting specimens 1 mm thick. One growing over the tubes of *Pomatoceros caeruleus* is 26 mm long × 20 mm wide.

COLOUR: In life, red (5.0R 4/10); in spirit, cream (2.5Y 8/4) to brown (7.5YR 5/6).

TEXTURE: Soft but elastic.

SURFACE: The surface is smooth except where it is raised into low ridges.

SKELETON: The dermal membrane is granular and very thin, packed with small tangentially disposed acanthostyles and containing some isochelae. Fibres are present, but in this encrusting sponge are poorly developed. Smooth diactinal spicules form a core to the fibres which are echinated by the larger acanthostyles, while terminal brushes of diactinal spicules expand from the fibres and support the dermal membrane (Plate 36, F). A basal layer of acanthostyles is present (Plate 37, A).

SPICULES (Plate 37, B, C):
Megascleres: Variously ended diactinal spicules; in the type specimen they are usually strongylote, in the New Plymouth specimen oxeote, while all diactinal varieties including tylotes can be found in all specimens. The oxeas often look like styles because of the unequal points. Two sizes of acanthostyles: dermal forms of very uniform size, and profusely spined; and choanosomal forms which are larger, stouter and sparsely spined.
Microscleres: Arcuate isochelae (Plate 37, C).
For spicule dimensions *see* Table 61.

REMARKS: One new specimen of this species has been collected, but as it was overgrowing a rough rock surface and is very thin, it is difficult to define the skeletal construction precisely. A small piece of the type specimen has been examined; only a spicule preparation

TABLE 60. Spicule dimensions of *Crella fristedi.*

Locality		Oxeas (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
TYPE Three Kings Is, 183 m Dendy (1924)		216 × 4	430 × 25	84 × 16	24
TYPE remeasured	x̄	229 × 4	348 × 20	94 × 7.5	25
	Range	212–242 × 3–4.5	190–520 × 14–24	78–108 × 5–10	23–28
NZOI Stn B93, Three Kings Is, 55–110 m	x̄	180 × 3	322 × 15	127 × 9	26
	Range	164–220 × 2–3	230–372 × 10–17	72–189 × 8–10	23–31
Barren Arch, Poor Knights Is, 15 m	x̄	195 × 3	284 × 12	104 × 8	23
	Range	188–208 × 2.5–4	240–330 × 9–14	65–145 × 6–10	18–26

TABLE 61. Spicule dimensions of *Crella affinis.*

Locality		Strongyles (μm)	Large acanthostyles (μm)	Small acanthostyles (μm)	Isochelae (μm)
Wellington Harbour, 9 m Brøndsted (1924)		320 × 5–6	90–180 × 13–14		26
TYPE BM(NH)27.5.19.3 remeasured	x̄	280 × 6	289 × 7.5	141 × 6	25
	Range	258–290 × 5–7	250–315 × 7–8	125–153 × 5–7	22–27
New Plymouth, 14 m Brøndsted specimen remeasured	x̄	296 × 7	232 × 10	82 × 8	22
	Range	280–315 × 5–7.5	170–270 × 8–10	75–85 × 6–10	20–23
Slipper Island, 31 m	x̄	315 × 6.5	257 × 8.9	85 × 7.4	21
	Range	272–330 × 5.5–8	210–295 × 6.5–12	72–95 × 5.5–10	20–23

could be made from this. The spicule measurements of the New Plymouth and Slipper Island specimens are not in close agreement with Brøndsted's published measurements or with those of the type specimen. Only collection of more specimens will permit better description of this species.

Naniupi de Laubenfels, 1950

DIAGNOSIS: Crellidae with a principal skeleton of monactinal megascleres in plumose tracts which may be echinated by acanthostyles. The base of the sponge may have an upright layer of acanthostyles. The ectosomal skeleton consists of a crust of acanthostyles or acanthoxeas orientated vertically or tangentially. Microscleres include arcuate isochelae.

TYPE SPECIES: *Naniupi ula* de Laubenfels, 1950

REMARKS: The diagnosis has been refined from de Laubenfels (1950) description of the genus. He emphasised the presence of ectosomal acanthoxeas; however, in many Crellidae the acanthostyles tend to grade into acanthoxeas even within the same sponge, so this distinction cannot be upheld. The type speci-

men of *Naniupi ula* was reported to contain peculiar sigmoid microscleres, but these were lacking in a second specimen. The illustration of these spicules most recalls the sigmaspires of *Rhabderemia*. They are not sigmas and must be considered as contaminants in this sponge.

Vacelet *et al.* (1976) relegated *Naniupi* to synonymy under *Pytheas* and referred their Tulear specimen to de Laubenfels species. They argued that the only character separating *Naniupi* from *Pytheas* was the presence in the former of ectosomal acanthoxeas in lieu of the acanthostyles. They overlooked the presence of monactinal rather than diactinal principal megascleres in *Naniupi* and it is this character which is emphasised here in upholding the genus. *Pytheas* is regarded as a synonym of *Crella*, which also has principal diactinal megascleres. The sponge described by Vacelet *et al.* (1976) is a species of *Naniupi* as it has monactinal megascleres.

Crella cyathophora Dendy, 1921 has a main skeleton of monactinal megascleres which are long styles or tylostyles (300 × 5 μm) accompanied by a dense feltwork of superficial tangentially arranged acanthoxeas (120 × 5 μm). There are no microscleres, and Dendy noted the similarity of this species to *Crella elegans*, probably because both lacked microscleres. De Laubenfels (1950) established a genus *Quindesmia* "for sponges with special ectosomal acanthoxeas and endosomal smooth monaxons echinated by acanthostyles, but without microscleres." *Crella cyathophora* is clearly referable to *Quindesmia* if presence or absence of microscleres alone is considered to be a valid generic character in this family. If this is not considered adequate reason for generic separation, then *Quindesmia* becomes a synonym of *Naniupi* and *C. cyathophora* represents a further species of that genus.

Naniupi uovaezealaudiae n.sp.
(Plates 37, D–F; 38, A, B)

MATERIAL EXAMINED: North Cape, 49 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 104.

TYPE LOCALITY: North Cape, 49 m.

DESCRIPTION: A thin encrusting sponge with small raised tubes approximately 4 mm high over the surface (Plate 37, D).

DIMENSIONS: No data.

COLOUR: In life, bright red; in spirit, white to cream.

TEXTURE: The sponge is soft and tends to break up if squeezed.

SURFACE: There is a thin dermal membrane firmly adherent to the underlying soft choanosome. The surface is microscopically hispid.

SKELETON: Above the region where the sponge is attached to the rock is a layer of upright, small, spiny acanthostyles. Extending from here are tracts of smooth styles reaching to the upper surface, and sparsely echinated by small acanthostyles (Plate 37, E). There is no spongin fibre development, and large styles and small acanthostyles also occur interstitially. The ectosome consists of a thick upright palisade of acanthostyles generally pointing outwards from the sponge. Beneath the membrane smooth styles lie in clusters, supporting the ectosomal membrane (Plate 37, F).

SPICULES (Plate 38, A, B):
Megascleres: Smooth and generally straight styles, occasionally flexed, a wide range of sizes, some with smooth heads, the majority with faint evenly spined heads. Short and well-spined acanthostyles.
Microscleres: Arcuate isochelae (Plate 38, B).
For spicule dimensions *see* Table 62.

REMARKS: This specimen agrees with the description of *Naniupi ula* de Laubenfels, 1950 in colour and in being a thin encrustation. However, the ectosomal acanthostyles form an upright layer in this sponge while *N. ula* has a felted mass of tangentially arranged acanthoxeas. *Naniupi novaezealandiae* is distinguished by the great range in length of the principal styles, the majority of which have spined heads. The presence of a dermal layer of acanthose spicules places this genus within the Crellidae; the tangential or vertical orientation is not considered significant. For comparison of the spicule dimensions of *N. novaezealandiae* and *N. ula see* Table 62.

Family MYXILLIDAE Topsent, 1928

DIAGNOSIS: Poecilosclerida with a regular reticulate skeleton, generally isodictyal, composed of monactinal megascleres which are styles and acanthostyles to which echinating acanthostyles may be added. The dermal spicules are diactinal or monactinal. The characteristic microscleres are chelae, which can be arcuate, anchorate, unguiferate, birotulate, palmate isochelae or anisochelae. These may be accompanied by sigmas, bipocilli and toxas.

REMARKS: This diagnosis has been expanded to include the genus *Antho* which some authors, e.g., Lévi (1973) had placed previously in the Clathriidae. Justification for including *Antho* in the Myxillidae rests primarily upon the presence in that genus of an isodictyal reticulation of monactinal megascleres in the choanosome.

Van Soest (1984) postulated a subdivision of the Myxillidae based upon the occurrence of tylote as opposed to oxeote/strongylote ectosomal megascleres. Under this scheme the subfamily Myxillinae would include *Myxilla. Ectyomyxilla* and *Ectyodoryx* which have oxeote or strongylote ectosomal megascleres, while the subfamily Tedaniinae would include *Tedania, Iophon, Acarnus, Forcepia* and *Lissodendoryx* with tylote ectosomal megascleres.

TABLE 62. Spicule dimensions of *Naniupi novaezealandiae* and *N. ula*.

Locality		Styles (μm)	Styles (μm)	Acanthostyles (μm)	Isochelae (μm)
Naniupi novaezealandiae North Cape, 49 m	x̄	272 × 7.5	507 × 11	76 × 6.5	18
	Range	240–300 × 5–10	350–640 × 9–13	55–105 × 4–7.5	11–20
Naniupi ula de Laubenfels Hawaii, 2 and 50 m		190 × 4		Dermal acanthoxeas 110 × 4 Echinating acanthostyles 130 × 7	21 Curious sigmas 80 × 1.5
Pytheas ula Vacelet *et al.* Tulear		230–275 × 3–5		Dermal acanthoxeas 125–135 × 2.5–4 Acanthostyles 90–100 × 4–5	25–30

In this study primary emphasis in family diagnosis is placed on skeletal structure. An arbitrary division within the Myxillidae, justified by distinguishing within the spectrum of diactinal megasclere types, is considered unsustainable.

Myxilla Schmidt, 1862

Dendoryx Gray, 1867
Burtonanchora de Laubenfels, 1936
Pseudomyxilla Koltun, 1955

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal reticulation of smooth or spined styles, without accessory spicules. The ectosomal spicules are diactinal, orientated both tangentially and as vertical spicule brushes. The microscleres are anchorate or unguiferate isochelae and sigmas.

TYPE SPECIES: *Halichondria rosacea* Lieberkuhn, 1859

REMARKS: *Dendoryx* Gray, 1867 was established for sponges with oxeas, acanthostyles, anchorate isochelae and sigmas; a spicule complement typical of *Myxilla*.

The genus *Burtonanchora* de Laubenfels, 1936 was established for species formerly in *Myxilla* but distinctive within that genus in having only smooth spicules. De Laubenfels (1950) referred *M. novaezealandiae* Dendy to *Burtonanchora*. He noted that there were perplexing intermediate sponges that showed only very slight spining of the spicules; yet for convenience he maintained the division. Later authors, e.g., Lévi (1963), have used *Burtonanchora* for species with smooth choanosomal styles. The type description of *Myxilla* Schmidt, 1862, after Lundbeck (1905), describes the styles as most frequently spined, sometimes smooth, with anchorate isochelae as microscleres. In view of the common occurrence of intermediate states of spiculation, *Burtonanchora* is considered to be a synonym of *Myxilla*.

Pseudomyxilla was established by Koltun (1955) for sponges with an irregular or diffuse choanosomal network of fibres, bundles of spicules and separate spicules. The choanosomal megascleres were acanthostyles, the dermal spicules strongyles or tylotes, while the microscleres were unguiferate isochelae. Koltun noted that this genus was close to *Myxilla* but differed chiefly in the presence of unguiferate isochelae as opposed to the spatuliferous anchorates typical of *Myxilla*. *Pseudomyxilla* was further characterised by strongylote and tylote ectosomal megascleres while *Myxilla* had tornote ectosomal megascleres. The diagnosis of the genus *Myxilla* Schmidt, 1862, after Lundbeck (1905), stated that the diactinal megascleres could be strongyles, tornotes, tylotes or similar forms, hence *Pseudomyxilla* cannot be differentiated from *Myxilla* on this basis. *Pseudomyxilla* was distinguished from *Myxilla* by the presence of unguiferate isochelae as microscleres; however, the microsclere complement of *Myxilla novaezealandiae* includes both unguiferate and anchorate isochelae and hence the two genera cannot at present be differentiated.

*Myxilla novaezealandiae** Dendy (Plate 38, C, D)

Myxilla novae zealandiae Dendy, 1924: 361, pl. x fig. 6, pl. xv figs 12–15b.
Burtonanchora novaezealandiae. de Laubenfels 1950: 17.

MATERIAL EXAMINED: BM(NH) 23.10.1.143, east of North Cape, 128 m (type).

MATERIAL EXAMINED: A thin lamellate sponge with uneven surfaces forming irregular ridges; only a small dried piece was examined.

DIMENSIONS: Thickness 3 mm; extent of spread 10 × 10 mm.

COLOUR: In life, not recorded; dried specimen, pale yellow-brown.

TEXTURE: Crisp and friable.

SURFACE: In some areas the thin dermal membrane is intact and the surface is smooth.

SKELETON: The choanosomal skeleton is an irregular isodictyal reticulation of styles in which one to five spicules make up the width of each section, which is one spicule in length (Plate 38, C). Strongyles and the thinner styles are scattered interstitially. The ectosomal skeleton consists of strongyles lying both tangentially (Plate 38, D) and in vertical brushes. Isochelae are present in the dermal membrane.

SPICULES:
Megascleres: Large, smooth styles, usually gently curved with gradually tapering points; and smooth styles, similar in length but much thinner. They may be expanded along the shaft and have a sharp point. Small strongyles that are inequiended, one end rounded sometimes with one or two short spines, while the other end is truncated with one or two short spines.
Microscleres: Two sizes of anchorate isochelae with some overlap in size ranges and with curved shafts. Extremely small unguiferate isochelae.
For spicule dimensions *see* Table 63.

REMARKS: *Myxilla novaezealandiae* is characterised by having minute unguiferate isochelae, as well as the spatuliferate anchorate isochelae which are typically found in species of *Myxilla*. The presence of these isochelae is not sufficient reason to establish a new genus, particularly since their small size means that they are easily overlooked. All other skeletal and spicule characters of *M. novaezealandiae* accord with those of *Myxilla*.

Myxilla columna n.sp. (Plates 38, E, F; 39, A)

MATERIAL EXAMINED: Three Kings Islands, 55–110 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 109.

TYPE LOCALITY: Three Kings Islands, 55–110 m.

DESCRIPTION: A massive, erect, sparsely branched sponge, growing upon a basalt boulder (Plate 38, E).

DIMENSIONS: Height 410 mm; width 55 mm at the base, 150 mm at the top; thickness of base 45 mm; diameter of branches 30–50 mm.

COLOUR: In life, pale yellow (7.5YR 8/6); in spirit, pale greenish-white (2.5GY 8/2).

TEXTURE: Solid, incompressible; brittle when dry, internal consistency crumbly.

SURFACE: The surface is corrugated, raised into small ridges up to 1.6 mm high and 20 mm long. Oscules and pores are abundant over the whole surface. There is no recognisable alignment of oscules.

SKELETON: The choanosomal skeleton consists of a loose isodictyal reticulation of smooth styles, often forming thick bands five to ten spicules across (Plate 38, F). Microscleres are found interstitially and tylotes lie in brushes at right angles to the surface membrane, which is fine and transparent, 0.1 mm thick, and contains numerous sigmas and some unguiferate isochelae.

SPICULES (Plate 39, A):
Megascleres: Smooth styles with the head slightly thinner than the main shaft, and with well-defined points. Small smooth tylotes with slightly expanded heads.
Microscleres: Sigmas of normal and contort forms. Unguiferate isochelae with a gently curved shaft and much reduced alae. These are easily mistaken for sigmas under 100 × magnification.
For spicule dimensions *see* Table 64.

REMARKS: This species is unusual in not having either arcuate isochelae, which would place it in *Lissodendoryx*, or typical spatuliferous anchorate isochelae, which would place it in *Myxilla*. Unguiferate chelae are considered to be a variant of anchorate isochelae (Lundbeck 1905), hence the species is described in *Myxilla*.

In all other respects *Myxilla columna* is a typical *Myxilla*. The choanosomal skeleton is an isodictyal reticulation without accessory spicules, the ectosomal skeleton is made up of clusters of tylotes, and there is a crust of microscleres. The presence of smooth choanosomal styles could be considered unusual by some authors. Most frequently species of *Myxilla* have

TABLE 63. Spicule dimensions of *Myxilla novaezealandiae*.

Locality		Large styles (μm)	Thin styles (μm)	Strongyles (μm)	Large anchorate isochelae (μm)	Small anchorate isochelae (μm)	Unguiferate isochelae (μm)
TYPE East of North Cape, 128 m Dendy (1924)		470 × 20		240 × 8	76 with intermediates	20	10
TYPE remeasured	x̄	441 × 22	400 × 10	218 × 7.5	36	24.5	9.5
	Range	380–490 × 18–27	360–440 × 8.5–13	202–240 × 6.5–8.5	30–41 overlap in ranges	20–30	7–11

TABLE 64. Spicule dimensions of *Myxilla columna*.

Locality		Styles (μm)	Tylotes (μm)	Sigmas (μm)	Isochelae (μm)
TYPE	x̄	391 × 20	308 × 12	39	32
Three Kings Is, 55–110 m remeasured	Range	360–420 × 18–24	290–340 × 10–13	36–42	29–37

spined styles while species of *Lissodendoryx* have smooth styles. However, this character has not been applied consistently in the literature and is highly variable.

The characteristics of the chelae and the distinctive habit are the main reasons for distinguishing this sponge as a new species.

Lissodendoryx Topsent, 1894

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal reticulation of smooth or spined styles, without accessory spicules. The ectosomal spicules are diactinal, orientated tangentially and also forming spicule brushes. The microscleres are arcuate isochelae and sigmas.

TYPE SPECIES: *Halichondria isodictyalis* Carter, 1882

REMARKS: *Lissodendoryx* is closely related to *Myxilla* in skeletal arrangement and megasclere complement but differs in microsclere content.

Van Soest (1984) redefined the genus *Lissodendoryx* to include sponges with monactinal or diactinal choanosomal megascleres and assigned two species with diactinal spicules in the choanosome, *L. strongylata* n.sp. and *L. sigmata* (de Laubenfels) to the genus. Wiedenmayer (1977) figured the mucronate tylotes of *L. sigmata*, which he considered may be transitional to a subtylostyle. It is possible that the species have been incorrectly placed in *Lissodendoryx* and specimens of both need to be re-examined to assess their generic placement. There is little purpose in widening the diagnosis of *Lissodendoryx* to include species with diactinal megascleres in the choanosome without full consideration of the impact of such a move on the definition of other myxillid genera, and indeed of the family itself.

De Laubenfels (1936) included the genera *Lissodendoryx* and *Acarnus* in the family Tedaniidae because both had smooth monactinal principal spicules. Simpson (1968) studied the histology of *Tedania ignis, Lissodendoryx carolinensis* and *L. isodictyalis*, and argued that the three species conformed closely and should all be placed in the Tedaniidae. This suggestion was premature as only a small number of species were considered and typical myxillid species were not studied. The skeletal architecture of tedaniid sponges is very different from that of myxillid sponges and in this respect *Lissodendoryx* belongs in the Myxillidae. Lundbeck (1905), Bergquist (1978) and Lévi (1973) all placed *Lissodendoryx* in the family Myxillidae and this view is supported here.

Lissodendoryx isodictyalis (Carter) (Plate 39, B–D)

RESTRICTED SYNONYMY:
Halichondria isodictyalis Carter, 1882: 285.
Lissodendoryx isodictyalis. Topsent 1897: 456; Lundbeck 1905: 154; Hartman 1958: 41, tab. 12, fig. 11; Simpson 1968: 81, pl. 16 figs 11, 12; Wiedenmayer 1977: 135, figs 141, 142, pl. 29 fig. 2; van Soest 1984: 54, fig. 19.

MATERIAL EXAMINED: Clifton Beach, intertidal.

DESCRIPTION: A thin encrusting sponge with an irregular surface.

DIMENSIONS: Thickness 1–2 mm; extent of spread 20 × 30 mm.

COLOUR: In life, pale orange (7.5YR 7/8); in spirit, pale cream.

TEXTURE: Soft and easily compressed.

SURFACE: The surface is covered by a thin membrane which adheres closely to the underlying skeleton.

SKELETON: In surface view the dermal membrane is seen to support tangential tylotes interspersed with isochelae and sigmas (Plate 39, B). Some tylotes are at right angles to the surface and are interspersed with styles to form ectosomal brushes. The choanosomal skeleton is an irregular reticulation of styles with some tylotes present (Plate 39, C). The reticulation is framed by one to five spicules, and ranges from a triangular to a square-meshed reticulation. Microscleres occur throughout the sponge.

SPICULES (Plate 39, D):
Megascleres: Short, smooth styles, straight or slightly curved behind the head. They have smooth rounded heads and occasional expansions along the shaft. Smooth, straight tylotes with pronounced well-rounded heads.
Microscleres: Large sigmas, S-, C-, or hooked shapes. Arcuate isochelae.
For spicule dimensions *see* Table 65.

REMARKS: The New Zealand specimen of *L. isodictyalis* compares closely with previous descriptions. Hartman (1958) examined many specimens of this species and the two recorded in Table 65 were both encrusting over rocks. The spicule sizes of the New Zealand specimen, also encrusting, are closer to these specimens than to the spicule dimensions of the massive specimen examined by Simpson (1968). Simpson examined two species of *Lissodendoryx, L. isodictyalis*, a massive form, and *L. carolinensis*, an encrusting sponge. These two species had been merged by Hartman (1958) and Wells *et al.* (1960) on the basis of identical skeletal morphology. However, Simpson drew attention to non-skeletal differences particularly

TABLE 65. Spicule dimensions of *Lissodendoryx isodictyalis*.

Locality		Styles (μm)	Tylotes (μm)	Sigmas (μm)	Isochelae (μm)
TYPE Acapulco, Mexico Carter (1882)		168 × 6.3	200 × 6.3	17	25
Double Beach, Connecticut Hartman (1958)		148–176–197 × 6.2–7.5–8.2	164–183–197 × 4.1–5.0–6.6	21–26–43	16–22–25
Double Beach, Connecticut Hartman (1958)		139–163–185 × 6.1–7.6–8.2	148–174–205 × 4.5–5.2–7.4	21–28–43	16–22–25
Bahamas Simpson (1968)		153.9–174.7–192.4 × 2.9–4.0–4.8	199.7–220.5–243.4 × 2.4–2.6–3.6	14.3–31.4–39.3	9.5–20.7–28.6
Western Bahamas Wiedenmayer (1977)		130–180 × 2–5	180–233 × 2–4	18–29 × 1.5	20–27
Carribean Van Soest (1984)		146–165.3–198 × 3.5–4.7–6	156–183–212 × 2–3.1–4	23–34.7–45	19–24.6–34
				11–16.5–20	8–10.3–16
Clifton Beach, intertidal	$\bar{x}$	178 × 7	194 × 6	34.5	23.4
	Range	155–190 × 5–8.5	173–220 × 4–6	30–40	17–27

in the presence/absence of certain cell types. No further work along these lines has been done on poecilosclerid sponges and thus at present it cannot be evaluated as a species discriminator. *Lissodendoryx isodictyalis* is a common harbour-dwelling sponge and approaches a cosmopolitan distribution.

OTHER RECORDS: Mexico; Bahamas; Caribbean; Connecticut and Florida Keys to Woods Hole; West Indies; Mediterranean Sea; East Indies.

Ectyomyxilla Lundbeck, 1909

Crellomyxilla Dendy, 1924

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal or square-meshed reticulation of smooth or spined styles, with accessory acanthostyles that may echinate the tracts. The ectosomal spicules are acanthostyles orientated tangentially, and diactinal spicules beneath this layer are orientated both tangentially and as erect spicule brushes. Microscleres are anchorate isochelae, which may be accompanied by sigmas.

TYPE SPECIES: *Ectyomyxilla kerguelensis* Hentschel, 1914

REMARKS: Lundbeck (1909) established *Ectyomyxilla* and *Ectyodoryx* for Myxillidae with a reticulate skeleton, echinated, more or less sparingly, by accessory spicules. The two genera were distinguished by microsclere complement, the former genus having anchorate isochelae while the latter had arcuate isochelae. The two species of *Ectyomyxilla* from New Zealand have accessory spicules, i.e., spicules additional to the primary skeleton, but few are found echinating the tracts.

Dendy (1924) established the genus *Crellomyxilla* to accommodate a new species, *C. intermedia*. The genus was characterised by having a main skeleton that is an isodictyal or sub-isodictyal reticulation of acanthostyles, without special echinating spicules and without distinct fibres. The dermal skeleton was a feltwork of smaller acanthostyles lying tangentially in the dermal membrane and supported by brushes of oxeas. Microscleres were tridentate isochelae to which sigmas could be added. Dendy considered the genus to be identical with *Myxilla* except for the invasion of the dermal membrane by spiny megascleres otherwise considered to be characteristic only of the Crellidae. Dendy was thus suggesting an intermediate position for this genus between the Myxillidae and Crellidae.

Lundbeck (1909) had established the genus *Ectyomyxilla* to receive species of *Myxilla* with a reticulate skeleton, accessory spicules and anchorate isochelae. De Laubenfels (1936) designated *Ectyomyxilla kerguelensis* Hentschel as the type species of this genus. In his description of this sponge Hentschel noted an abundance of smaller acanthostyles in the dermal skeleton, and a choanosomal skeleton that is a network of large acanthostyles. Tornotes radiated beneath the dermal acanthostyles. From this description it is obvious that *Crellomyxilla* is a synonym of *Ectyomyxilla* as suggested by Burton (1929) and Lévi (1963).

De Laubenfels (1936), in maintaining *Crellomyxilla*, stressed the presence of spiny dermal diacts, echinating spicules and two sorts of arcuate isochelae. The original description of *Crellomyxilla* emphasised the lack of echinating spicules and did not mention the presence of spiny dermal diacts; there is therefore no argument on these grounds for maintaining the genus. De Laubenfels (1936) also described *Ectyomyxilla* as having only anchorate isochelae for microscleres. Lundbeck (1909) did not make his intention clear on this point, but it is logical to interpret *Ectyomyxilla* as being for sponges with anchorate isochelae among other microscleres in comparable fashion to Lundbeck's treatment of *Ectyodoryx*, i.e., with arcuate isochelae solely or together with other forms.

The presence of acanthostyles in the ectosome is a good generic character for *Ectyomyxilla* within the family Myxillidae, and the lack of choanosomal diactinal megascleres clearly removes it from the Crellidae.

Ectyomyxilla kerguelensis Hentschel
(Plates 39, E, F; 40, A, B)

RESTRICTED SYNONYMY:
Ectyomyxilla kerguelensis Hentschel, 1914: 103, pl. iv fig. 10, pl. viii fig. 10; Burton 1929: 437; Lévi 1963: 35, fig. 38.
Crellomyxilla intermedia Dendy, 1924: 364, pl. xv figs 16–21; Brøndsted 1924: 469.
Myxilla tornotata Brøndsted, 1923: 142, fig. 21a–d.
Crellomyxilla kerguelensis Boury-Esnault & van Beveren 1982: 83, pl. xiv fig. 24f–m.

MATERIAL EXAMINED: BM(NH), Three Kings Islands, 183 m (type of *Crellomyxilla intermedia*); North Channel, Kawau Island, 12 m; Cape Colville, 10 m; Slipper Island, Bay of Plenty, 30 m.

DESCRIPTION: All the specimens examined were massive. The surface is porous and covered by a thin dermal membrane, which is finely reticulate (Plate 39, E). Dendy described his specimen as having elongate, subcylindrical branches about 7 mm in diameter, attached to a main body of compressed, flabellate form, while Brøndsted describes encrusting specimens and lump-shaped forms.

DIMENSIONS: Thickness 5–15 mm; extent of spread 40 × 55 mm.

COLOUR: In life, light yellow (10.0YR 7/8) to dull red (7.5R 5/6); in spirit, cream to very pale yellow (5.0Y 8/4) to pinkish (10.0R 6/4) or reddish brown (5.0YR 4/2).

TEXTURE: Firm, incompressible, and brittle.

SURFACE: The surface is covered by a thin external membrane 0.5 mm thick, and perforated by small pores 1 mm wide.

SKELETON: The choanosomal skeleton is a very regular isodictyal reticulation of acanthostyles with little surrounding spongin fibre (Plate 39, F). Isochelae and sigmas surround the tracts of acanthostyles. Generally one to five acanthostyles form the sides of the reticulation, which can include occasional smooth spicules. The ectosomal skeleton is a layer of acanthostyles generally orientated tangentially (Plate 40, A). Smooth oxeas are also found in the ectosome.

SPICULES (Plate 40, B):
Megascleres: Two size categories of acanthostyles – large, thick, straight forms that predominate the choanosomal skeleton and have spines evenly spread over the shaft, and small, thin, slightly curved, evenly spined forms which are predominantly found in the ectosomal skeleton. Smooth hastate oxeas with tapered points, usually slightly flexed.
Microscleres: Sigmas of variable shape. Anchorate isochelae of two size categories, the smaller the most common.
For spicule dimensions *see* Table 66.

REMARKS: Boury-Esnault and van Beveren (1982) described a specimen from Kerguelen with arcuate isochelae as *Crellomyxilla kerguelensis*. Dendy (1924) described the type species of *Crellomyxilla* as having anchorate isochelae, as did Hentschel (1914) for *Ectyomyxilla kerguelensis*. If the specimen from Kerguelen does have arcuate isochelae then the generic and species assignment is incorrect. If the isochelae are anchorate, this sponge could be correctly placed in *E. kerguelensis*. It is not infrequent that the terms anchorate and arcuate have been confused.

OTHER RECORDS: Kerguelen; Auckland Islands; McMurdo Sound, Antarctica; South Africa.

Ectyomyxilla ramosa n.sp.
(Plates 40, C–F; 41, A–C)

MATERIAL EXAMINED: Poor Knights Islands, 1–3 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 108.

TYPE LOCALITY: Poor Knights Islands, 1–3 m.

DESCRIPTION: A massive specimen that has overgrown *Carpophyllum maschalocarpum*. The thick base of the sponge extends into three branches that lie opposed to each other (Plate 40, C).

DIMENSIONS: Height 330 mm; base of sponge 60 × 50 mm; individual branch thickness 40 × 30 mm.

COLOUR: In life, bright orange-red (10.0R 5/10); in spirit, cream.

TEXTURE: The sponge is firm, slightly compressible, not easily torn.

SURFACE: An examination of the surface membrane under a compound microscope shows the pores to be in groups of three or four, scattered over the surface (Plate 40, D). Between the small pores lie smooth oxeas and small acanthostyles which form the surface skeleton.

SKELETON: The ectosomal skeleton is a dense layer of small acanthostyles disposed both vertically and tan-

TABLE 66. Spicule dimensions of *Ectyomyxilla kerguelensis*.

Locality		Large acanthostyles (μm)	Small acanthostyles (μm)	Oxeas (μm)	Sigmas (μm)	Large isochelae (μm)	Small isochelae (μm)
TYPE Kerguelen Hentschel (1914)		176–225 × 14	56–75 × 5–6	152–184 × 5–6	17–22		12.5–19
TYPE of *C. intermedia* Three Kings Is, 183 m Dendy (1924)		220 × 17	100 × 12	210 × 7	36	28	16
TYPE of *M. tornotata* E. of Auckland Is Brøndsted (1923)		90–140 × 8		Av. 154 130–156 × 4	32 × 2	10–26	
C. intermedia Hen and Chickens Is Colville Channel Brøndsted (1924)		Size range agrees with TYPE	Size range agrees with TYPE	up to 260	Size agrees with TYPE	up to 40	12
South Africa Lévi (1963)		190–220	100–120 × 7	170–175 × 5	45 × 1–2	25	12–13
Boury-Esnault and van Beveren (1982)		150–258 × 8–20	Accessories 105–243 × 2–10 Ectosomal 37–120 × 3–12 Av. 67.5 × 8.1	114–235 × 5–12 Av. 204 × 8.2	Av. 23.2 12–32	Av. 17.8 10–25	
TYPE of *C. intermedia* remeasured	$\bar{x}$	229 × 14	114× 7.5	206 × 6.5	38	29	15
	Range	210–240 × 12.5–15	90–135 × 7–8.5	190–220 × 5.5–7	33–43	25–32	13–19
Slipper Island, 30 m	$\bar{x}$	202 × 12	124 × 6.5	204 × 7	39	42	13
	Range	190–220 × 7–15	120–130 × 5–8	185–212 × 6–7.5	31–43	40–46	11.5–14
North Channel, Kawau Island, 12 m	$\bar{x}$	184 × 8	120 × 5	191 × 4.8	38	40	13
	Range	170–210 × 6.5–11	108–130 × 5–6	175–205 × 4–5	35–40	38–43	11.5–18
Cape Colville, 10 m	$\bar{x}$	163 × 9	107 × 6	210 × 5	40	42	15.5
	Range	143–178 × 6.5–11	90–113 × 5–7	198–223 × 3.5–6.5	37–48	40–43	13–18

gentially (Plate 40, E). The hastate oxeas beneath this layer are upright or orientated tangentially to the surface. The choanosomal skeleton is a regular reticulation consisting of a lattice work of acanthostyles that are packed tightly and encased in spongin fibre (Plates 40, F; 41, A). The meshes of the skeleton range from 50–350 μm across. Between the fibres dispersed small acanthostyles are abundant. In deeper parts of the choanosome the mesh becomes less regular.

SPICULES (Plate 41, B, C):
Megascleres: Small, smooth hastate oxeas with well-tapered points; sometimes slightly flexed. Small acanthostyles, the spining irregular with a tendency to have more spines just above the point. The head is squarish and some spicules are slightly curved (Plate 41, B).
Microscleres: Thin sigmas in a variety of shapes. Anchorate isochelae (Plate 41, C).
For spicule dimensions *see* Table 67.

REMARKS: The skeletal construction of *Ectyomyxilla ramosa* with square-sided meshes differs markedly from the isodictyal reticulation seen in *Ectyomyxilla kerguelensis*. The main tracts forming the reticulation are about ten spicules across, with strong spongin fibre investment. Pronounced spongin fibre development is not seen in *E. kerguelensis*. The ectosomal skeleton is very similar in both species, consisting generally of tangential acanthostyles and smooth diactinal megascleres lying beneath. The small size of both the acan-

TABLE 67. Spicule dimensions of *Ectyomyxilla ramosa.*

Locality		Acantho-styles (μm)	Oxeas (μm)	Sigmas (μm)	Isochelae (μm)
Poor Knights Is, 1–3 m	x̄	80 × 4	91 × 3.5	22	11
	Range	73–88 × 2.5–5	78–103 × 3–4.5	17–25	10–25

thostyles and isochelae further distinguishes *Ectyomyxilla ramosa* within the genus.

Ectyodoryx Lundbeck, 1909

Merriamium de Laubenfels, 1936

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal or square-meshed reticulation of smooth or spined styles, with accessory acanthostyles that may echinate the tracts. The ectosomal spicules are diactinal, orientated tangentially and also forming spicule brushes. The microscleres are arcuate isochelae, which may be accompanied by sigmas.

TYPE SPECIES: *Hastatus foliatus* Fristedt, 1887

REMARKS: This genus differs from *Ectyomyxilla* in lacking an ectosomal layer of acanthostyles and in having arcuate isochelae in its microsclere complement.

Lundbeck (1909) gave the following generic diagnosis for *Ectyodoryx*: "Sponges with a reticulate skeleton, echinated, more or less sparingly, by accessory spicules. The skeleton spicules spined or smooth styles, the accessory spicules smaller, spined styles; the dermal spicules diactinal; microscleres isochelae arcuate solely or together with other forms." De Laubenfels (1936) established a new genus, *Merriamium*, for sponges with "myxillid dermal diacts, endosomal more or less spiny monactinal spicules, accompanied by arcuate isochelae." Apart from mention of the accessory spicules, these two diagnoses are the same. De Laubenfels established *Merriamium* because he considered the genus *Ectyodoryx* to have arcuate isochelae and sigmas. In the same paper he failed to uphold this distinction and placed *Myxilla crelloides* Brøndsted in *Ectyodoryx* despite the fact that it has only arcuate isochelae as microscleres.

*Ectyodoryx crelloides (Brøndsted)
(Plates 41, D–F; 42, A)

Myxilla crelloides Brøndsted, 1924: 468, fig. 23a–d.
Ectyodoryx crelloides. de Laubenfels 1936: 84.

MATERIAL EXAMINED: East of North Cape, 100 m (holotype, Zoology Museum, Copenhagen).

DESCRIPTION: A branching sponge with thin, round, firm branches, the branches occasionally coalescing.

DIMENSIONS: Height 60–80 mm; each branch approximately 2 mm diameter.

COLOUR: In life, not recorded by Brøndsted; in spirit, pale chocolate brown.

TEXTURE: Firm, incompressible but easily broken.

SURFACE: Covered by a fine ectosomal membrane.

SKELETON: The choanosomal skeleton is a regular isodictyal reticulation of acanthostyles, each side of the mesh being formed by two to five spicules (Plate 41, D). Acanthostyles occur interstitially between the meshes as do tylotes. The dermal membrane contains isochelae and is supported by an ectosomal skeleton of smooth tylotes disposed in all planes, from tangential to vertical to the surface (Plate 41, E).

SPICULES (Plates 41, F; 42, A):
Megascleres: Acanthostyles that are usually gently curved, with a large size range. The smaller ones tend to be spined all over, the larger ones are quite frequently spined only over the head. Thin, smooth, straight tylotes, expanded along the shaft.
Microscleres: Arcuate isochelae with the shaft curved to a C-shape (Plate 42, A). Specimen contaminated with small sigmaspires.
For spicule dimensions *see* Table 68.

REMARKS: It is difficult to state that there are echinating accessory spicules in *Ectyodoryx crelloides.* The skeleton is very compact and each arm of the reticulation is usually only one spicule in extent. There may be an occasional echinating acanthostyle, but most are strewn in the sponge matrix. *Ectyodoryx crelloides* is retained in *Ectyodoryx* primarily because of the skeletal composition.

TABLE 68. Spicule dimensions of *Ectyodoryx crelloides.*

Locality		Acanthostyles (μm)	Tylotes (μm)	Isochelae (μm)
TYPE E. of North Cape, 100 m Brøndsted (1924)		Av. 145 90–210 × 12	260 × 4	28
TYPE remeasured	x̄	173 × 12	237 × 4	32
	Range	140–230 × 7–17	225–255 × 3–5	29–35

Iophon Gray, 1867

Alebion Gray, 1867
Pocillon Topsent, 1893
Iophonopsis Dendy, 1924

DIAGNOSIS: Myxillidae in which the choanosomal

skeleton consists of an isodictyal, round, or square-meshed reticulation of smooth or spined styles. Accessory styles may be present and echinate the tracts. The ectosomal spicules are diactinal, typically with spined heads, orientated both tangentially and in erect spicule brushes. The microscleres are palmate anisochelae and inequiended bipocilli.

TYPE SPECIES: *Halichondria scandens* Bowerbank, 1866

REMARKS: Dendy (1924) established *Iophonopsis* for species of *Iophon* without echinating spicules, as he noted that *Halichondria scandens* had echinating acanthostyles. This distinction alone is not considered adequate for generic diagnosis.

This genus is characterised by a microsclere complement of anisochelae and inequiended bipocilli.

Iophon proximum (Ridley) (Plate 42, B–D)

RESTRICTED SYNONYMY:
Alebion proximum Ridley, 1881: 119, pl. x fig. 3.
For synonymy up to 1932 *see* Burton 1932: 296.
Iophon proximum. Burton 1932: 296; Lévi 1963: 38, fig. 42, pl. vc f, g; Boury-Esnault & van Beveren 1982: 89.
Iophon semispinosus Bergquist, 1961b: 180, fig. 7a, b, c.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m; Waiheke Island, 37 m; Chatham Islands, 46 m (type of *I. semispinosus*).

DESCRIPTION: The sponge ranges from a thin encrustation (Plate 42, B) to a ramose or massive growth form.

DIMENSIONS: All the specimens are variable in shape and dimensions. The encrusting form from the Chatham Islands was the most complete specimen examined; thickness 22 mm; extent of sponge 42 × 38 mm.

COLOUR: In life, dark brown to black (10.0YR 6/6–5.0R 1/2); in spirit, brown or black (10.0YR 3/4).

TEXTURE: Soft and compressible, somewhat crumbly.

SURFACE: The surface is smooth where the dermal membrane is intact, otherwise it is very corrugated.

SKELETON: The choanosomal skeleton is in the form of a weak isodictyal reticulation of acanthostyles with little, if any, spongin (Plate 42, C). Thin acanthostyles may echinate the reticulation. The ectosomal skeleton is made up of stout brushes (80–100 μm wide) of acanthotylotes, ascending to the surface and supporting the dermal membrane, which contains tangential acanthotylotes.

SPICULES (Plate 42, D):
Megascleres: Stout acanthostyles with variable degrees of spining on the shaft (Plate 42, D). A thin form of similar shape also occurs. Slender, smooth tylotes with spined heads.
Microscleres: Palmate isochelae of normal form. Inequiended bipocilli of typical *Iophon* form.
For spicule dimensions *see* Table 69.

REMARKS: *Iophon proximum* in New Zealand occurs in two distinct forms. One form possesses straight, evenly spined acanthostyles of two sizes, while the other form has slender sparsely spined acanthostyles of one size category. This latter form was established as a new species, *I. semispinosus*, by Bergquist (1961b). It is here synonymised with *I. proximum* because of the close agreement in skeletal arrangement, morphology and all other aspects of the spiculation.

TABLE 69. Spicule dimensions of *Iophon proximum*.

Locality		Large acanthostyles (μm)	Thin acanthostyles (μm)	Tylotes (μm)	Anisochelae (μm)	Bipocilli (μm)
Burton (1932) restatement of species limits		140–440 × 7–18	84–140	140–315 × 4–9	9–36	7–20
I. semispinosus Bergquist (1961a)		150–170 × 6	Absent	185–200 × 5	15 × 5	8–10
Chatham Islands, 46 m	x̄	154 × 6	Absent	197 × 5	15	9.6
	Range	150–170 × 5–7		185–200 × 4–6	13–17	8–10
Three Kings Is, 55–110 m	x̄	226 × 15	95 × 5	256 × 7	20	11
	Range	220–233 × 12–15	90–120 × 4–6	247–258 × 6–8	13–23	8–12
Waiheke Island, 37 m	x̄	230 × 16	108 × 4	249 × 7	21	10
	Range	200–250 × 12–17	100–130 × 4–5	220–260 × 6–8	15–25	8–12

OTHER RECORDS: Kerguelen; Cape of Good Hope; Tristan de Cunha; Patagonia; Chile; Galapagos Islands; South Africa.

Iophon laevistylus Dendy

(Plates 42, E, F; 43, A–D)

Iophon laevistylus Dendy, 1924: 347, pl. x fig. 1a; Burton 1932: 348; Bakus 1966: 484.
Iophonopsis major Brøndsted, 1924: 461, fig. 18.
Iophonopsis major var. *tenuis* Brøndsted, 1924: 462.

MATERIAL EXAMINED: Rakitu Island, 10 m; Colville Channel, 64 m (type of *I. major*, Zoology Museum, Copenhagen); Dunedin, 110 m; NZOI Stn Q743, South-west Arm, George Sound, Fiordland, 37 m; Fantail Bay, 33 m (two specimens).

DESCRIPTION: A flat sponge with many branches anastomosed to form a sheet with occasional branches or lobes protruding. The Rakitu Island specimen is an erect sponge with branches consisting of cylindrical hollow tubes with oscules opening at the tip of each tube (Plate 42, E).

DIMENSIONS: Length 70 mm; width of branch 10 mm; thickness 5 mm. Rakitu Island specimen: length 230 mm; width of tube 20 mm; thickness of tube walls 1–5 mm.

COLOUR: In life, creamy-yellow (2.5Y 8/4); in spirit, a range of brown, from yellow-brown (10.0YR 5/4), mid-brown (10.0YR 3/4) and (2.5Y 4/4) to dark brown (2.5YR 2/2).

TEXTURE: Smooth and compressible, easily torn.

SURFACE: A thin dermal membrane is visible over some parts of the exterior. Where this is no longer present the choanosomal reticulation is visible. Oscules may or may not be obvious.

SKELETON: The ectosomal skeleton is a tangential layer of tylotes. Beneath the ectosomal skeleton tylotes form spicule brushes at the ends of the choanosomal spicule tracts or fibres. The choanosomal skeleton varies slightly between the specimens studied. Generally it is a loose sub-isodictyal reticulation (Plate 42, F), but it can be more regular and become round or square-meshed in some specimens (Plate 43, A). The arms of the meshes are one spicule length in extent and no clear, wide primary tracts or fibres are distinguished except in the Fiordland specimen, where some tracts are significantly larger. All specimens have spicules occurring interstitially.

SPICULES (Plate 43, B–D):
Megascleres: Smooth styles with a sharp point, gently curving behind the head, which is usually narrowed or subtylote. Some specimens have a second, thinner category of style. Slender tylotes, smooth except for light spining on the head. Small, straight, evenly tapered acanthostyles which vary in abundance between specimens.
Microscleres: Palmate anisochelae which in some specimens appear to occur in two size categories (Plate 43, C). Inequiended bipocilli of typical *Iophon* form (Plate 43, D).
For spicule dimensions *see* Table 70.

REMARKS: *Iophon* is a genus credited with an origin on the European side of the North Atlantic (Burton 1932), and a later southward migration with accompanying speciation. New Zealand specimens have previously been referred to *I. laevistylus* by Burton (1932). This is an endemic species specialised in having a predominance of smooth styles. Burton construed this species to be an offshoot of the very variable *I. proximum* in which the styles are variable, but never quite smooth. In New Zealand both species are often obtained in the same dredge haul in northern and southern localities. No intermediate types have been found and it therefore appears that *I. laevistylus* is a good species.

Iophon laevistylus is distinguished from *I. proximum* in having long smooth styles comprising the choanosomal skeleton; acanthostyles are accessory spicules only. Bakus (1966) considered this difference to be inadequate as a basis for maintaining *I. laevistylus* as separate from *I. proximum*. However, this difference is consistent when specimens of the two species are compared. Although spining does vary considerably in some myxillid genera, e.g., *Lissodendoryx* and *Myxilla*, in the present case in *I. proximum* the main styles are consistently spined while those in *I. laevistylus* are not. This, supported by other differences in habitat and morphology, provides a sound basis for separation of the two species.

OTHER RECORDS: East of North Cape, 128 m; Little Barrier Island, 55 m; Stewart Island, 46 m.

Iophon minor (Brøndsted)

(Plates 43, E, F; 44, A–C)

Iophonopsis minor Brøndsted, 1924: 462.
Iophon minor. Burton 1932: 348.

MATERIAL EXAMINED: Cape Karikari, 55 m (two specimens); Hen Island, 20 m; Sponge Garden, Leigh, 18 m; Leigh Reef, 27 m (six specimens); Porae Reef, Leigh, 21 m; Leigh, 30 m; Tokatu Point, 11–18 m; North Channel, Kawau Island, 10 m; Colville Channel, 64 m (Brøndsted specimen, Zoology Museum, Copenhagen); Wellington Harbour, 9–18 m (type, Zoology Museum, Copenhagen).

DESCRIPTION: A ramifying sponge in which the branches tend to fuse to form a sheet from which lobes and branches extend. Small specimens invest the upper surface of bivalve shells and extend short lobes from the encrusting base (Plate 43, E).

DIMENSIONS: Length 100 mm; width of branch or lobes 20–40 mm; thickness 15 mm. Large Cape Karikari specimen: height 500 mm.

COLOUR: In life, yellow (2.5Y 8/12) to orange exterior

TABLE 70. Spicule dimensions of *Iophon laevistylus*.

Locality		Large styles (μm)	Small styles (μm)	Tylotes (μm)	Acanthostyles (μm)	Abundance of acanthostyles	Anisochelae (μm)	Bipocilli (μm)
TYPE E. of North Cape, 128 m Dendy (1924)		320 × 12		264 × 8	136 × 12		28	8
TYPE of *I. major* Brøndsted (1924)		260 × 10		260 × 10	100 × 6		14–20	6–8
TYPE of *I. major* remeasured	x̄	237 × 8.3		231 × 6	108 × 5	Common	17	8
Colville Channel	Range	230–250 × 7–10		210–270 × 5–7	90–120 × 5–6		13–22	all 8
Dunedin, 110 m	x̄	249 × 8		228 × 7	117 × 5	Rare	15.6	7.5
	Range	225–260 × 7–9		190–255 × 5–7.5	113–121 × 5		11.5–28	5–8.5
NZOI Stn Q743, George Sound, Fiordland, 37 m	x̄	209 × 8		205 × 6	113 × 6	Uncommon	17	8
	Range	195–228 × 7–8		195–213 × 5–7.5	108–125 × 5–7.5		13–22	7–9
Fantail Bay, 33 m specimen 1	x̄	164 × 7	159 × 4.5	153 × 5	105 × 3	Common	16.4	8.6
	Range	150–175 × 6–7.5	150–165 × 3–5	140–163 × 4–6	83–120 × 2.5–3		13–20	8–10
Rakitu Island, 10 m	x̄	168 × 7.5		177 × 6	120 × 5		16	8.5
	Range	155–180 × 5–9		160–190 × 5–7			11.5–20	7.5–10.5
Fantail Bay, 33 m specimen 2	x̄	165 × 5.5		161 × 5	105 × 5.6	Rare	18	9.4
	Range	145–178 × 4–7.5		150–168 × 4–6	85–140 × 5–6		15–20	8–10

(5.0YR 6/12), occasionally cream (10.0YR 7/6), and maroon interior (2.5R 5/6); in spirit, a range of brown from yellow-brown (10.0YR 5/4) to mid brown (7.5YR 4/2) to dark brown (5.0Y 2/2).

TEXTURE: Usually smooth and compressible, although larger branching specimens are quite firm and pliable.

SURFACE: A thin ectosomal membrane invests the surface. Where this is damaged the choansomal skeletal network is visible. Oscules are visible at the upper edges of the lamellae or along the sides of the branches or lobes.

SKELETON: The ectosomal skeleton is a tangential layer of tylotes supported by vertical brushes of tylotes at the ends of the primary fibres (Plate 43, F). The choanosomal skeleton consists of primary fibres cored by ten to fifteen styles running vertically to the surface and spaced generally two spicule lengths apart. A regular reticulation is formed by secondary fibres cored by five to ten styles and disposed at right angles to the primary fibres (Plate 44, A). In some sponges, for instance the Cape Karikari specimen, the reticulation is more irregular. Most specimens have accessory spicules occurring interstitially.

SPICULES (Plate 44, B, C):
Megascleres: Small stout styles which are smooth, slightly narrowed and curved near the head. A thinner category of style can occur. Slender tylotes, usually with well-demarcated, spined heads.
Microscleres: Anisochelae (Plate 44, C) and bipocilli of normal *Iophon* form.
For spicule dimensions *see* Table 71.

REMARKS: Burton (1932) relegated Brøndsted's three New Zealand species of *Iophonopsis* to *Iophon laevistylus*. We maintain that *Iophon minor* is a distinct species of *Iophon* as it has solid, rounded branches in contrast to the hollow branches of *I. laevistylus*. The styles of *I. minor* are considerably smaller and stouter than those found in *I. laevistylus* and the tylotes have well-defined spines on the heads and are shorter than the tylotes found in specimens of *I. laevistylus*. There are also differences in skeletal construction with *I. minor* having a less compact reticulation with commonly a square or round mesh, while *I. laevistylus* has a triangular meshed reticulation. All specimens of *I. minor* examined lacked acanthostyles but retained smooth styles as accessory spicules.

TABLE 71. Spicule dimensions of *Iophon minor*.

Locality		Large styles (μm)	Thin styles (μm)	Tylotes (μm)	Anisochelae (μm)	Bipocilli (μm)
TYPE Wellington Harbour, 9–18 m Brøndsted (1924)		150 × 8		145 × 8	10–16	6–8
Leigh, 30 m	x̄	141 × 5.2		147 × 5	17	9.5
	Range	133–148 × 4–6		128–160 × 4–6	13–20	7.5–10
Tokatu Point, 11–18 m specimen 1	x̄	149 × 6.6	139 × 3.5	149 × 5.4	17	9.7
	Range	133–180 × 5–7.5	125–145 × 2.5–5	138–168 × 5–6	12.5–20	7.5–11
Porae Reef, Leigh, 21 m	x̄	143 × 7		156 × 6	18	9
	Range	133–150 × 5–8		145–168 × 5–7.5	17.5–20	8–10
Hen Island, 20 m	x̄	144 × 5		144 × 4.5	13.5	8
	Range	133–158 × 4–5		135–150 × 3–5	13–18	all 8
North Channel, Kawau Island, 10 m	x̄	142 × 6		156 × 5.3	16	10
	Range	135–155 × 3.5–10		150–163 × 5–6	13–22	8–12
Tokatu Point, 10 m specimen 2	x̄	143 × 7		150 × 6.3	15	9.5
	Range	138–148 × 6–8		143–163 × 5–7	13–18	8–11
Cape Karikari, 55 m specimen 1	x̄	151 × 5.4		151 × 4.3	15	8.5
	Range	138–168 × 4.5–7		140–155 × 3–5	12.5–20	8–10
Cape Karikari, 55 m specimen 2	x̄	158 × 8.4		150 × 6.7	16	8.7
	Range	149–165 × 6–12		130–158 × 6–7.5	13–20	7.5–11
Colville Channel, 64 m Brøndsted specimen remeasured	x̄	144 × 6		150 × 5.3	16	9.5
	Range	130–160 × 5–7.5		123–163 × 5–6	12.5–18	10–11
Sponge Garden, Leigh, 18 m	x̄	133 × 6.4		152 × 5	15.4	10.4
	Range	125–138 × 5–7.5		138–160 × 3–6	13–18	10–12
Leigh Reef, 27 m specimen 1 (yellow)	x̄	142 × 8		157 × 7	16.4	10.2
	Range	135–150 × 6–10		143–165 × 5.5–7.5	13–20	10–12
Leigh Reef specimen 2 (cream)	x̄	137 × 7		160 × 5	16	10.2
	Range	125–150 × 6–9		150–165 × 5–6	13–17	8–12
Leigh Reef specimen 3 (yellow)	x̄	139 × 7		153 × 6	17	10.1
	Range	130–150 × 6–7.5		138–160 × 5–7.5	14–20	10–11

TABLE 71. Spicule dimensions of *Iophon minor*, continued

Locality		Large styles (μm)	Thin styles (μm)	Tylotes (μm)	Anisochelae (μm)	Bipocilli (μm)
Leigh Reef specimen 4 (yellow)	x̄	143 × 7		155 × 5	19	10
	Range	130–158 × 5–8		138–163 × 5–7.5	13–20	9–11
Leigh Reef specimen 5 (yellow)	x̄	142 × 7		154 × 6	17	10.2
	Range	133–150 × 5.5–7.5		140–163 × 5–7.5	15–20	10–12
Leigh Reef specimen 6 (yellow)	x̄	142 × 6		151 × 5	16	9.7
	Range	138–148 × 5–7.5		140–160 × 4–5.5	14–20	8–11

A problem of intermediate types arises when comparing *I. laevistylus* with *I. minor*. The specimens of *I. laevistylus* from Fantail Bay, Rakitu Island and Fiordland have smaller tylotes and styles than the other specimens examined. In one Fantail Bay specimen only two acanthostyles were found in one microscope slide. When examining the specimens of *I. minor* the two Cape Karikari specimens proved to have longer styles than all the others but no acanthostyles. These species, if considered solely on spicule complement, could be thought to overlap, but when considerd in conjunction with gross morphology, colour and skeleton organisation, sufficient difference exists to justify recognition of both species. Two *I. minor* specimens were found in which acanthostyles were present, the type specimen from Wellington Harbour, and another from Brøndsted's collection from Colville Channel. The Colville Channel specimen is certainly contaminated by foreign spicules, as large oxeas were also found, and it is likely that the few acanthostyles in the Wellington Harbour specimen are foreign as well. Bergquist (1970) has noted another instance of contamintion of Brøndsted's specimens where spinispirae from *Trachycladus stylifer* were found in *Latrunculia spinispiraefera* after they had been preserved together in formalin. This problem occurs with all of Brøndsted's specimens where they still exist.

Other workers, e.g., Brøndsted (1924), Dendy (1924), Burton (1932) and Bakus (1966) have noted the difficulty of defining species within the genus *Iophon*. Bakus (1966) suggested that present information leads to the speculation that there are perhaps no more than four extant species of *Iophon* worldwide. The broad interpretations of specific characters implied by these workers are unhelpful and not supported by observations of living and well-preserved material.

OTHER RECORDS: North Channel, Kawau Island, 18 m; Little Barrier Island, 55 m.

Sigmarotula n.gen.

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal reticulation of smooth styles, with thinner stylote forms occurring interstitially. The ectosomal spicules are diactinal, orientated tangentially and also as sparse spicule brushes. The microscleres are sigmas and birotulate isochelae.

TYPE SPECIES: *Sigmarotula lamellata* n.sp.

REMARKS: This genus is closely related to *Iotrochota*, which also has birotulate isochelae, but differs in having a typical myxillid isodictyal skeletal reticulation, and in the addition of sigmas to the microsclere complement.

De Laubenfels (1950) established the genus *Hiattrochota* for sponges with smooth strongyles as ectosomal spicules, smooth styles as choanosomal megascleres, and birotulate chelae for microscleres. Another genus, *Iotaota*, has birotulate and unguiferate isochelae, smooth choanosomal styles and ectosomal tylotes. Both genera were placed by de Laubenfels in the Tedaniidae because of their megasclere content. De Laubenfels placed within the Myxillidae two genera with typical myxillid megascleres and birotulate microscleres. One, *Hymetrochota* Topsent, 1904, was established for sponges with acanthostyles, tornotes and birotules, while *Iotroata* de Laubenfels, 1936, had anchorate isochelae and distinct birotules. The present species is quite distinct from all of these forms.

Sigmarotula lamellata n.sp.

(Plates 44, D–F; 45, A–D)

MATERIAL EXAMINED: NZOI Stn J970, off Cape Brett, 86–91 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 110.

TYPE LOCALITY: NZOI Stn J970, 35°08.6'S, 174°21.1'E, off Cape Brett, 86–91 m.

DESCRIPTION: Flat lamellate pieces of sponge with a porous surface (Plate 44, D).

DIMENSIONS: Thickness 2–6 mm; extent 45 × 70 mm.

COLOUR: In life, bright orange-red (7.5R 5/12); dried specimen, fawn to light brown.

TEXTURE: Compressible, firm but friable.

SURFACE: A fine dermal membrane covers the surface and is perforated by numerous pores. The surface is flat with occasional irregular ridges.

SKELETON: The dermal membrane is packed with birotulate chelae and sigmas and contains some tangential tylotes (Plate 44, E). The tylotes are also found in weak spicule brushes supporting the membrane (Plate 44, F). The choanosomal skeleton consists of smooth styles which form an isodictyal skeleton organised as a triangular reticulation with one to four spicules making up each intercept (Plate 45, A). Thin styles, birotulae and sigmas occur interstitially.

SPICULES (Plate 45, B–D):
Megascleres: Smooth styles, either straight or gently curved and with tapering points. Thinner styles of the same shape also occur but are less common. Small tylotes, which are often slightly flexed and which have elongate tylote heads; the ends can be unequal.
Microscleres: Large sigmas of all shapes and abundant. Birotulate isochelae that are extremely small and very abundant (Plate 45, D).
For spicule dimensions *see* Table 72.

REMARKS: In spiculation and in skeletal organisation *Sigmarotula lamellata* comes closest within the Myxillidae to *Iotrochota*. Study of a specimen of *I. baculifera* Ridley (BM(NH) 82.10.17.98–100) showed the skeleton in this species to be a square-meshed reticulation of styles, five to fifteen across within the fibre tracts. Occasionally the reticulation was irregular and styles also occurred interstitially. The ectosomal skeleton could not be examined because of the poor preservation of the sponge. Microscleres were birotulae only. *Sigmarotula lamellata* has an isodictyal reticulation with triangular meshes, a condition frequent within other myxillid genera, for example, *Myxilla, Ectyomyxilla* and *Ectyodoryx*. Therefore, in skeletal arrangement this sponge is more typical of the Myxillidae than is *Iotrochota*. The addition of sigmas to the birotulate microsclere complement, and pigmentation, further distinguish the genera. *Iotrochota* species are yellowish to dark brown or purple, bleed pigment and turn black on death, and this character is invariable. *Sigmarotula lamellata* is bright orange-red in life, does not bleed pigment, and fades only slightly when preserved.

There has been some discussion as to whether species of *Iotrochota* have any specialised ectosomal skeleton. Van Soest (1984) did not find any such specialisation, while Bergquist (1965) had noted a dermal spicule crust. It is possible that there are two subgroups within this genus – Indo-Pacific species such as *I. baculifera* which have dermal specialisation and Caribbean species such as *I. birotulata* which do not. A large number of specimens from many localities would need to be studied to resolve this issue.

Van Soest (1984) placed *Iotrochota* in the family Esperiopsidae because he did not find a special category of diactinal ectosomal spicules and did not consider it to be a typical myxillid in other characters. He also felt that it was not typical of the esperiopsids. Lévi (1973) placed *Iotrochota* in the family Myxillidae, but noted that it was not a typical genus. His decision is upheld here.

Allocia Hallmann, 1920

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal reticulation of acanthostyles interspersed with vertical columns of smooth styles which may be echinated by acanthostyles. The ectosomal spicules are diactinal, orientated both tangentially and in erect spicule brushes. The microscleres are palmate isochelae.

TYPE SPECIES: *Spanioplon chelifera* Hentschel, 1911

REMARKS: This genus is characterised by a typical myxillid isodictyal reticulation with ectosomal diactinal spicules accompanied by palmate isochelae as microscleres.

Hentschel (1911) expressed doubt as to the generic allocation of *Spanioplon chelifera*. He noted an affinity to the genus *Ectyodoryx* except in relation to microsclere content and skeletal development. He also

TABLE 72. Spicule dimensions of *Sigmarotula lamellata*.

Locality		Large styles (μm)	Thin styles (μm)	Tylotes (μm)	Sigmas (μm)	Birotules (μm)
NZOI Stn J970, off Cape Brett, 86–91 m	$\bar{x}$	404 × 17	388 × 9.5	217 × 5	44	14.5
	Range	360–425 × 13.5–20	350–410 × 7.5–11	210–225 × 4–5	36–50	12–16.5

suggested an affinity with *Clathria*, and Dendy (1921) agreed with the latter view.

The genus *Spanioplon* Topsent, 1892a has been placed in the family Crellidae by Lévi (1973) because of the presence of diactinal megascleres in its main skeleton, a feature not seen in *Allocia chelifera*. De Laubenfels (1936) upheld *Allocia*, interpreting it as a myxillid sponge with palmate isochelae. This view is sustained here and the sponge is considered to be close to *Ectyodoryx*, the only difference being in the type of isochelae present. *Allocia* is excluded from the Clathriidae because it has diactinal megascleres and an isodictyal skeleton, while the Clathriidae normally have only monactinal megascleres and a reticulate or plumose skeleton. The dermal microsclere crust is also not typical of the Clathriidae. However, the echinating spicules, fibre production and palmate isochelae are all characters found in clathriid sponges.

Allocia chelifera (Hentschel)

(Plates 45, E, F; 46, A–C)

Spanioplon chelifera Hentschel, 1911: 362.
Allocia chelifera. Hallmann 1920: 768.
Clathria chelifera. Dendy 1921: 70, pl. 14 fig. 3a–e.

MATERIAL EXAMINED: Three Kings Islands, 55–110 m.

DESCRIPTION: An erect, coarsely reticulate sponge in the form of three intersecting lamellae (Plate 45, E).

DIMENSIONS: Height 45 mm; width 36 mm; thickness of lamella 11 mm.

COLOUR: In life, brick red (10.0R 5/8); in spirit, yellowish brown (5.0YR 4/4).

TEXTURE: Firm and compressible, rather springy.

SURFACE: The surface is rough and hispid except where the thin transparent dermal membrane is stretched between the skeletal columns. No pores or oscules are visible.

SKELETON: The ectosomal skeleton consists of a thick layer of isochelae with tangential strongyles spread beneath them (Plate 45, F). Beneath the tangential strongyles there are dermal brushes of strongyles disposed at right angles to the surface. The choanosomal skeleton is an irregular isodictyal reticulation of acanthostyles, extending between vertical columns which are invested by spongin fibre. Smooth styles core the vertical columns, which are invested by a thin layer of spongin and sparsely echinated by acanthostyles (Plate 46, A, B).

SPICULES (Plate 46, C):
Megascleres: Smooth thick styles, gently curved, with tapering points, some smaller forms can be lightly spined. Acanthostyles of a wide range of sizes, spined overall but more strongly so at the head. Straight strongyles, smooth except for faint terminal spining, the ends unequal, one end rounded and faintly tylote, the other abruptly truncated.

TABLE 73. Spicule dimensions of *Allocia chelifera*.

Locality		Styles (μm)	Acantho-styles (μm)	Strongyles (μm)	Isochelae (μm)
West Australia Hentschel (1911)		120–144 × 3–4	72–80 × 3–5	168–200 × 3–4	7–13 × 4
Amirante Is, Indian Ocean Dendy (1921)		190 × 6.8	120 × 8.2	220 × 5	2 sizes 24 10
Three Kings Is, 55–110 m	$\bar{x}$	404 × 18	207 × 14	334 × 5	21
	Range	270–550 × 15–20	162–290 × 12.5–17	280–375 × 4–6.5	20–23

Microscleres: Palmate isochelae of uniform size and normal form.
For spicule dimensions *see* Table 73.

REMARKS: The spicules in the New Zealand specimen of *Allocia chelifera* are considerably larger than those in either the West Australian specimen or the specimen from Amirante Island. However, in morphology the spicules agree very closely with the published descriptions, as does the arrangement of the skeleton. Only a single specimen has been collected and therefore it is placed within this species until more collections permit a reliable interpretation of spicule variability.

OTHER RECORDS: West Australia; Arafura Sea; Amirante Island.

Antho Gray, 1867

Dictyoclathria Topsent, 1920

DIAGNOSIS: Myxillidae in which the choanosomal skeleton consists of an isodictyal reticulation of acanthostyles united by a variable quantity of spongin. Smooth styles are found at the nodes of the network and adjacent to the surface. The ectosomal spicules are monactinal, found in erect spicule brushes with some orientated tangentially.

TYPE SPECIES: *Myxilla involvens* Schmidt, 1864

REMARKS: This genus has a typical myxillid isodictyal skeleton, but is characterised also by having ectosomal monactinal spicules, and palmate isochelae and toxas as microscleres. It was placed in the family Clathriidae by Lévi (1960, 1973) but it is anomalous within that family in having a marked isodictyal skeletal reticulation. This is not found in any other clathriid sponge. *Antho* is viewed here as belonging to the family Myxillidae where it is closely related to *Allocia* and *Acarnus*, which also have palmate isochelae in their microsclere complement.

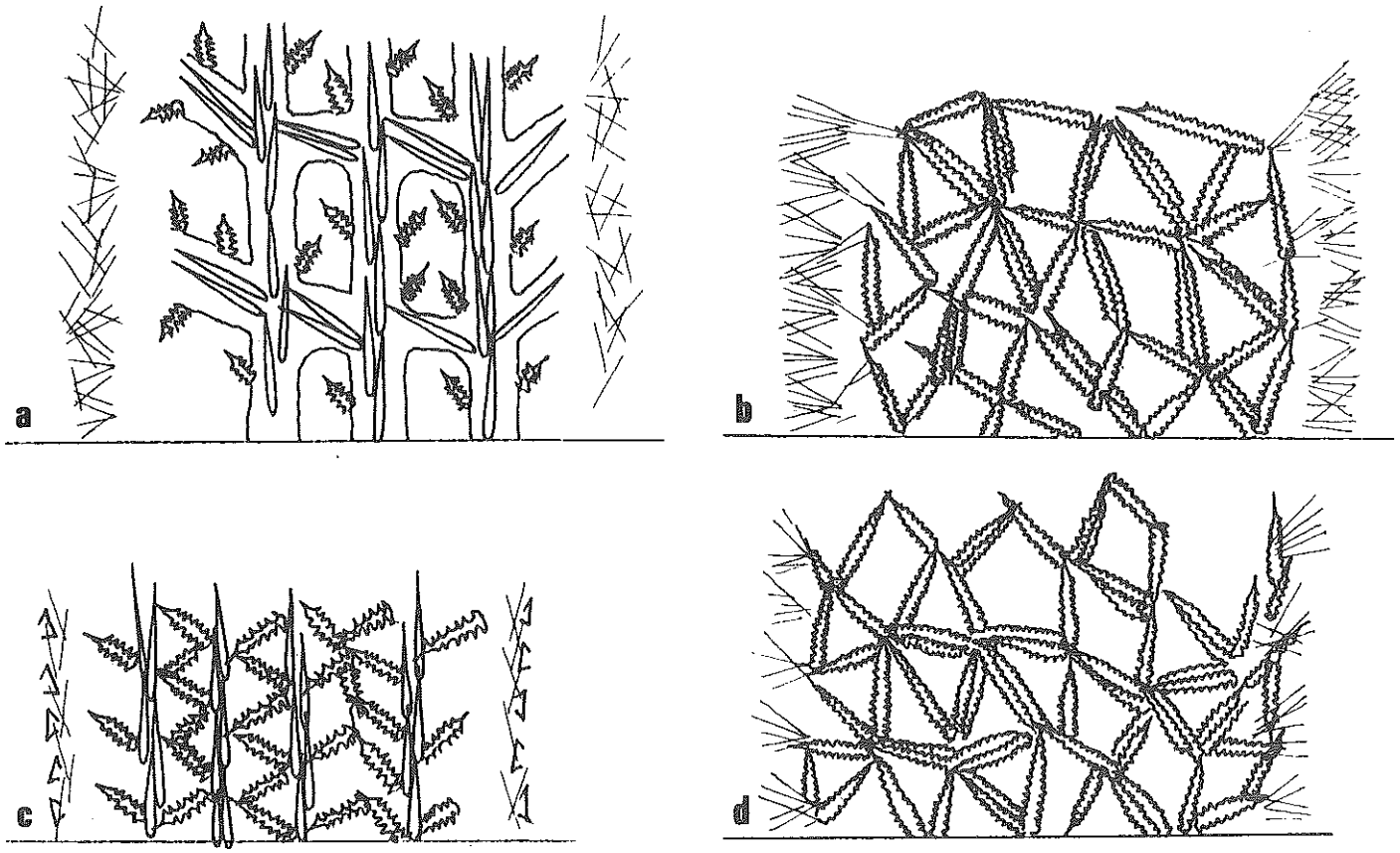

FIG. 8. Skeletal organisation in the family Clathriidae as compared to the family Myxillidae. a, typical clathriid fibre reticulation. b–d, myxillid isodictyal reticulation: b, *Antho brondstedi* n.sp.; c, *Allocia chelifera* (Hentschel); d, *Ectyomyxilla kerguelensis* Hentschel.

Acarnus was placed in the Clathriidae by Lévi (1973), and *Allocia* was related to the genus *Clathria* by Hallmann (1920). Both genera have ectosomal diacts as mentioned above and are here considered to be more correctly located in the Myxillidae.

The difficulty we have emphasised in allocating this group of genera between the Myxillidae and Clathriidae perhaps suggests a close relationship between these groups. Figure 8 compares a typical reticulate clathriid skeleton with the isodictyal reticulation typical of myxillid genera. In this instance a microsclere complement typical of the Clathriidae, i.e., palmate isochelae and toxas, which occurs in *Allocia* and *Antho*, is given less emphasis in deciding familial location than is skeletal arrangement.

Antho brondstedi n.sp. (Plates 46, D–F; 47, A–C)

MATERIAL EXAMINED: Off Cape Karikari, 15 m; south of Auckland Island, 73 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 111.

TYPE LOCALITY: Off Cape Karikari, 15 m.

ETYMOLOGY: This species is named after Professor H.V. Brøndsted, who contributed significantly to the study of the New Zealand sponge fauna.

DESCRIPTION: One specimen is an erect sponge that forms compact cylindrical branches of consistent diameter, but narrowing at the tip (Plate 46, D), the other specimen is a small encrusting mound.

DIMENSIONS: Erect sponge: height 65 mm (piece of a branch); diameter of a single branch 10 mm. Encrusting sponge: thickness 4 mm; length 5 mm.

COLOUR: In life, watery orange; in spirit, fawn.

TEXTURE: A compact sponge, but compressible.

SURFACE: Microscopically hispid with occasional pores 0.5 mm wide.

SKELETON: The choanosomal skeleton is an isodictyal (triangular) network formed of acanthostyles in groups of one to five (Plate 46, E). There is some faint fibre development around parts of the skeleton and subtylostyles form occasional tracts in the choanosome, at right angles to the surface. Erect subtylostyles also form a thick ectosomal skeleton (500 μm across) of confused brushes (Plate 46, F). Beneath the subtylo-

styles, large styles are found extending from the ends of the tracts. In the encrusting specimen these large styles are found in groups of one to three throughout the choanosome, at right angles to the base of the sponge. A basal layer of acanthostyles was also visible in this specimen.

SPICULES (Plate 47, A–C):
Megascleres: Smooth, thick styles, usually slightly curved, with a smooth pinched head and thicker shaft which tapers to a long sharp point. Thick, consistently spined acanthostyles, straight or slightly curved. Long slender subtylostyles with smooth or faintly spined heads.
Microscleres: Palmate isochelae of normal form. Long toxas with a wide central flexure.
For spicule dimensions *see* Table 74.

REMARKS: Although the two specimens are quite different in gross morphology, one encrusting, one branching, the spiculation is very similar. The major difference lies with the skeletal construction. The encrusting specimen has large styles throughout the choanosomal skeleton, whereas the erect specimen has subtylostyles in the same position. They are treated here as one species because only pieces of branches of the erect specimen were available, and the area of choanosomal skeleton with large styles could be basal and absent in this specimen. More material is required to resolve whether there are two species represented here, in which case both would be new species.

Few species of *Antho* have been described from the Southern Hemisphere. Lévi (1963) recorded *Antho involvens* Schmidt from South Africa, but this species had acanthostrongyles in its skeleton and is quite distinct from the New Zealand specimens.

Family CLATHRIIDAE Hentschel, 1923

DIAGNOSIS: Poecilosclerida with plumose, plumo-reticulate or reticulate skeletons. The megascleres are monactinal and are styles or acanthostyles. These are organised into spicule tracts that include variable quantities of spongin and which support echinating spicules. One group of genera, those related to *Plocamia*, have monactinal and diactinal spicules in the choanosomal skeleton. The ectosomal skeleton is variably developed and consists of monactinal spicules orientated in vertical brushes. The microscleres are palmate isochelae and toxas, which may occur separately or together.

REMARKS: This family is quite homogeneous and most of the genera included are readily recognised as clathriid. Generic differences are primarily based on skeletal arrangement in conjunction with spicule complement, and the genera fall into three sub-groups.

The first sub-group includes sponges with plumose, plumo-reticulate or reticulate skeletons with smooth monactinal principal megascleres and spiny echinating monactinal spicules. Common examples are *Microciona* and *Clathria*. In these two genera the spicule complements are similar, but *Microciona* has a plumose skeletal arrangement and species tend to remain encrusting throughout their life, while species of *Clathria* have reticulate skeletons and tend to be massive or branching sponges. *Pseudanchinoe* is similar to the genus *Clathria* in skeletal arrangement, but lacks isochelae. *Rhaphidophlus* is characterised by the presence of a pronounced ectosomal skeleton that reinforces a thick dermal skin. The choanosomal skeleton is plumose or plumo-reticulate. *Dictyociona* is characterised by having principal and accessory spicules of identical morphology, usually with faint spining on the head, a reticulate skeleton, palmate isochelae and toxas.

The clathriid specimens of this sub-group collected in New Zealand to date can be assigned to a genus without difficulty. The *Microciona* species have varying degrees of fibre development and column branching, and differ in the quantity of echinating spicules, but all have clear plumose skeletons (Fig. 9a, b, c). The skeletons of the two species assigned to *Dictyociona* have primary fibres, and echinating spicules aligned at right-angles to the columns. These are connected to form a weak reticulation suggestive of the condition in *Clathria* (Fig. 9d). However, in the *Dictyociona* species the principal and accessory spicules

TABLE 74. Spicule dimensions of *Antho brondstedi*.

Locality		Styles (μm)	Acanthostyles (μm)	Subtylostyles (μm)	Toxas (μm)	Isochelae (μm)
Cape Karikari, 15 m	$\bar{x}$	324 × 18	211 × 14	280 × 7	97	24
	Range	300–400 × 13–23	185–230 × 11.5–20	215–332 × 5.5–8.5	40–160	22–25.5
Auckland Is, 73 m	$\bar{x}$	340 × 22	200 × 15	362 × 5	108	21
	Range	265–440 × 17–25	190–220 × 13–20	202–525 × 3.5–6.5	65–201	16–23

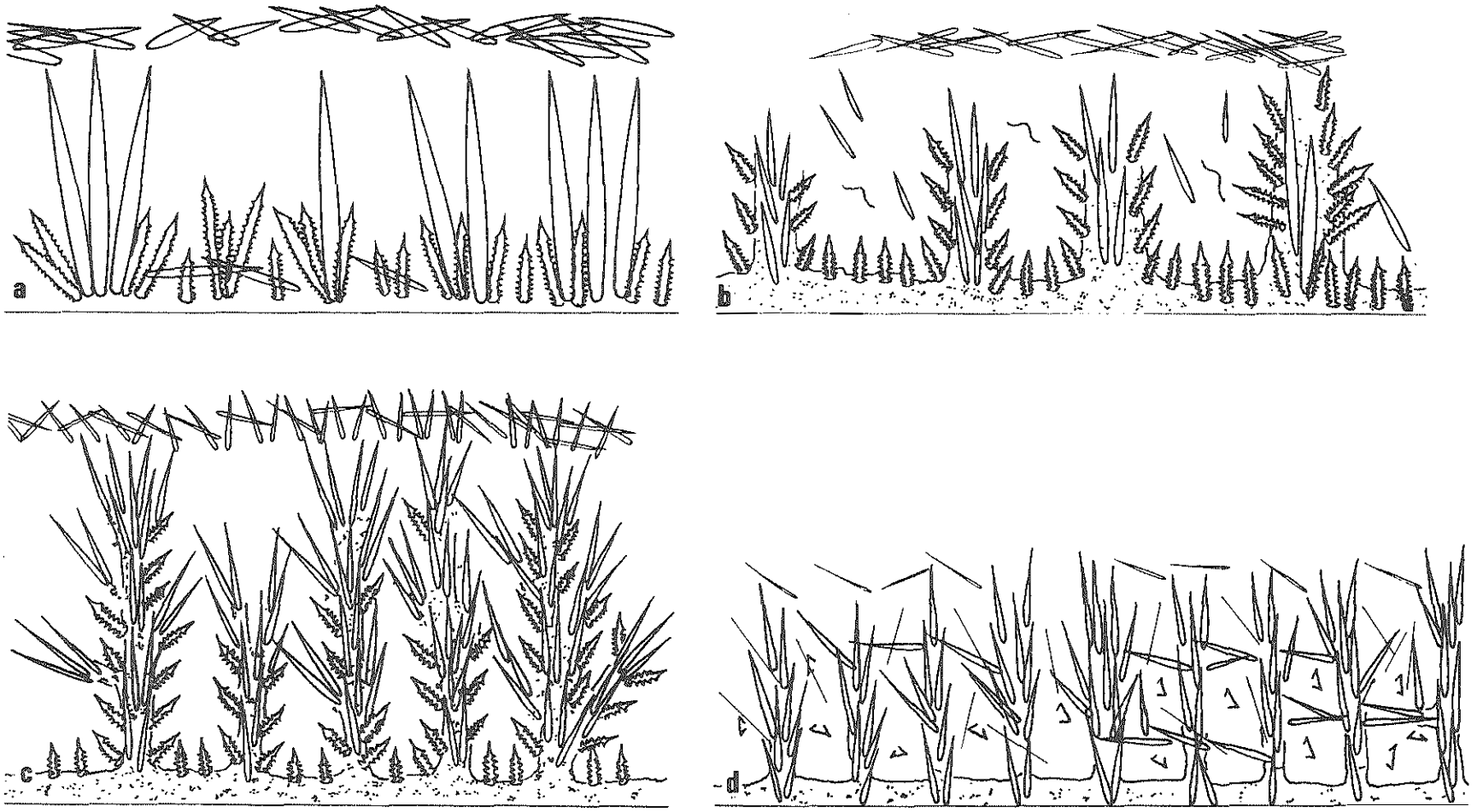

FIG. 9. Skeletal organisation in some New Zealand species of *Microciona* and *Dictyociona* (family Clathriidae). a, *Microciona dendyi* n.sp.: plumose; b, *Microciona coccinea* Bergquist: plumose with fibre; c, *Microciona rubens* Bergquist: branching and plumose with fibre; d, *Dictyociona contorta* n.sp.: connected branches, with fibre.

are identical. *Clathria mortensenii* has a similar skeleton to *Dictyociona* but the reticulation is well-defined and the echinating spicules are morphologically distinct from the principal spicules (Fig. 10b). The other two species of *Clathria* have a definite reticulation with varying degrees of fibre development (Fig. 10a, c). The species of *Rhaphidophlus* represented in this collection has a pronounced dermal crust greatly emphasised over the dermal skeletons seen in the species of *Microciona, Dictyociona*, and *Clathria* (Fig. 10e).

The second sub-group includes clathriid sponges with plumo-reticulate or reticulate skeletons with smooth monactinal megascleres and smooth echinating monactinal megascleres. A typical example is *Ophlitaspongia*, which has these characters and also lacks palmate isochelae. *Isociella* has a reticulate skeleton with reduced spongin fibre development, a pronounced ectosomal skeleton, and palmate isochelae which may be accompanied by toxas. *Axociella* has pronounced fibre development, a reduced ectosomal skeleton, palmate isochelae and toxas. The genus *Artemisina* has an irregular choanosomal reticulation without spongin fibre development, a pronounced ectosomal skeleton, but is characterised by the presence of toxas with terminal spines in its spicule complement.

The third sub-group is distinctive within the Clathriidae in having diactinal megascleres in the spicule complement, hence the inclusion of this character in the family diagnosis. Two species from this sub-group, *Plocamia novizelanicum* and *P. prima*, occur in New Zealand and have been included in the Clathriidae because of the presence of an ectosomal skeleton of monactinal megascleres, a reticulate choanosomal skeleton with echinating spicules, and microscleres that are palmate isochelae and toxas.

The genus *Antho* has previously been placed in the Clathriidae, primarily because it had a microsclere complement of palmate isochelae and toxas (Lévi 1960, 1973). Microsclere complement must be viewed in conjunction with skeletal organisation, which, in the case of *Antho*, is an isodictyal reticulation. This contrasts with the plumose to rectangular reticulation of other clathriid genera and argues for affinity of *Antho* with the Myxillidae.

Microciona Bowerbank, 1862

DIAGNOSIS: Encrusting sponges of variable thickness. The skeleton consists of a basal plate from which arise short, plumose columns. Principal monactinal spicules form the columns, which may be echinated by acanthostyles and enclosed in spongin fibre. The ectosomal skeleton consists of dispersed monactinal spicules which form a surface layer aligned vertically, tangentially, or strewn without order. Microscleres are typically palmate isochelae and toxas.

TYPE SPECIES: *Microciona atrasanguinea* Bowerbank, 1862

REMARKS: The primary distinction between the genera *Microciona* Bowerbank and *Clathria* Schmidt is that the skeleton of *Microciona* is plumose, whereas the skeleton of *Clathria* is plumo-reticulate or reticulate. Vosmaer (1935) redefined the genus *Microciona* after concluding that *Clathria* and *Microciona* could not be separated on the basis of their skeletal architecture. He argued that both plumose columns and fibre reticulation could be found within a species depending on the age of the specimen. He then referred approximately forty species of *Clathria* to synonymy with *Microciona prolifera*. Wiedenmayer (1977) commented on the use of habit and skeletal architecture as a basis for generic separation and discussed situations where a species that is predominantly encrusting with a plumose skeleton could be occasionally ramose with a fibro-reticulated skeleton, e.g., *Microciona microchela* Hechtel, 1965. Lévi (1960) in his discussion of *Clathria* and *Microciona* suggested that much of the problem of definition stemmed from imprecise use of the terms plumose, plumo-reticulate and reticulate used to describe the skeleton. With more precise definition of these terms he argued that the distinctions between genera would become clear and he defined the terms accordingly. Lévi further suggested three possibilities for resolving the usage of the names *Clathria* and *Microciona*. The first alternative was to utilise one genus encompassing all the miscellaneous stages of growth which had been referred to as leptoclathriid, leptocionid, microcionid and clathriid; the second to maintain both *Microciona* and *Clathria, Clathria* to be retained for sponges with a reticulate skeleton in which ascending fibres anastomose. The third alternative was to combine the two genera, interpreting *Microciona* as an intermediate stage of *Clathria*, which is the final stage of growth. Lévi preferred to utilise the second of the three alternatives, and this position is upheld here.

Van Soest (1984) proposed to emphasise the degree of ectosomal specialisation, and to use it for classifying species of the *Clathria–Microciona–Thalysias–Rhaphidophlus* group. He thus synonymised *Microciona* and *Clathria*, which do not have the well-defined dermal crust of *Rhaphidophlus*. He also restricted the use of *Microciona*, regarding it as a convenient subgeneric name for encrusting forms. This follows Lévi's third proposal.

Based on the study of the New Zealand clathriid fauna, the second proposal suggested by Lévi (1960) is considered to be the most appropriate. Both *Microciona* and *Clathria* are maintained and species that have reticulate skeletons are referred to *Clathria*.

Microciona dendyi n.sp. (Plate 47, D, E)

MATERIAL EXAMINED: Slipper Island, 31 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 114.

TYPE LOCALITY: Slipper Island, 31 m.

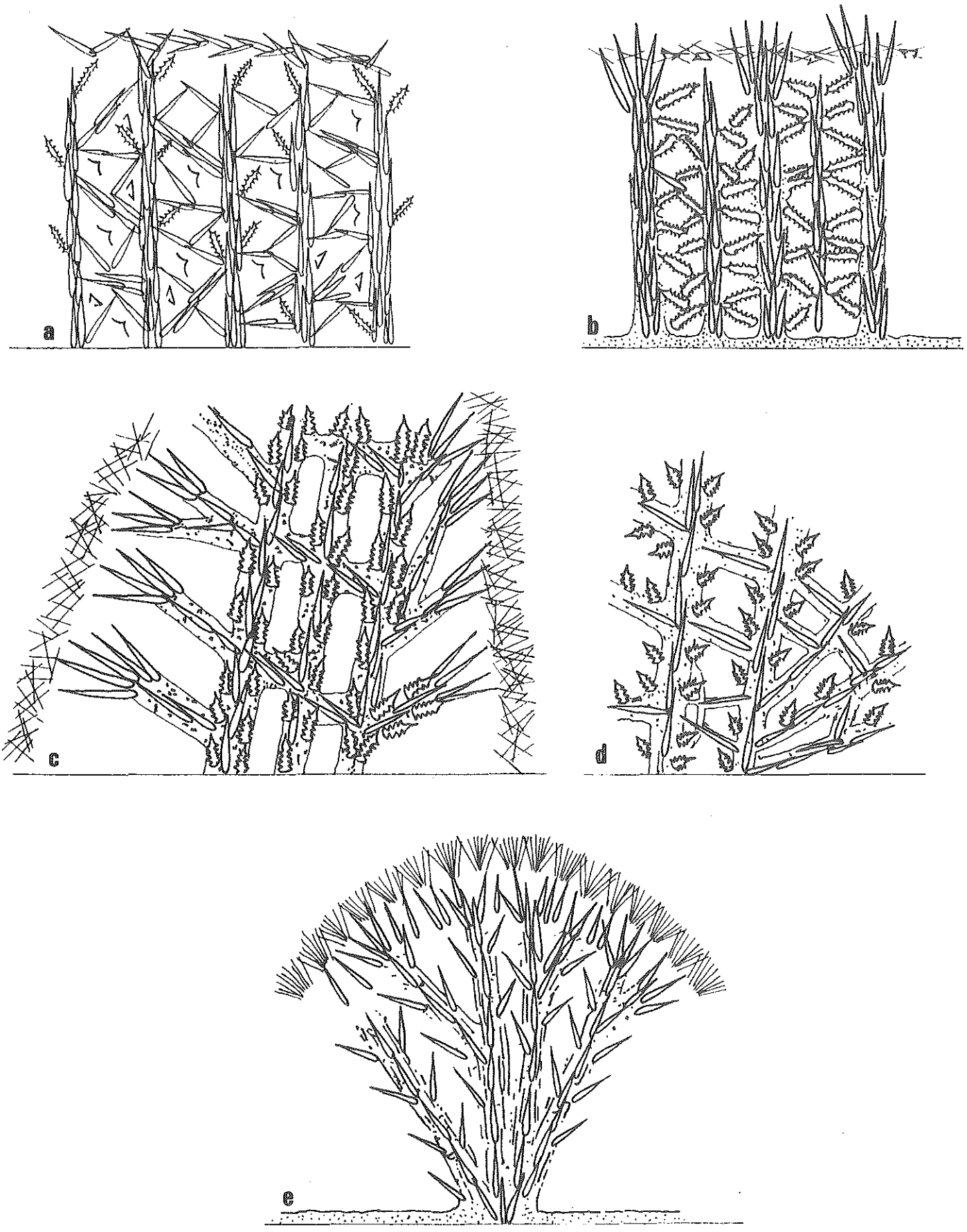

FIG. 10. Skeletons of New Zealand species of *Clathria, Pseudanchinoe* and *Rhaphidophlus* (family Clathriidae). a, *Clathria lissosclera* n.sp.: spicule reticulation without fibre; b, *Clathria mortensenii* (Brøndsted): plumose fibres with reticulation; c, *Clathria terraenovae* Dendy: fibroreticulate; d, *Pseudanchinoe scotti* Dendy: fibroreticulate; e, *Rhaphidophlus coriocrassus* n.sp.: plumose branching fibres.

TABLE 75. Spicule dimensions of *Microciona dendyi*.

Locality		Styles (μm)	Acanthostyles (μm)	Subtylostyles (μm)	Isochelae (μm)	Toxas (μm)
Slipper Island, 3 m	$\bar{x}$	414 × 19	154 × 12	238 × 5	8	56
	Range	280–465 × 15–22	100–220 × 7.5–15	170–310 × 4.5–6.5	7.5–9	43–70

ETYMOLOGY: This species is named after Professor Arthur Dendy, who contributed significantly to the study of the New Zealand sponge fauna.

DESCRIPTION: A thin encrusting sponge overgrowing a bryozoan.

DIMENSIONS: Thickness < 1 mm; extent approximately 30 × 30 mm.

COLOUR: In life, dull orange; in spirit, pale fawn.

TEXTURE: Soft and compressible.

SURFACE: The surface is microscopically hispid, flat and even. The sponge is quite transparent, and the pores of the bryozoan can be clearly seen through the sponge tissue.

SKELETON: The choanosomal skeleton is very simple, consisting of tracts of one to three large styles extending from the base to the surface of the sponge (Plate 47, D). From these tracts two or three more styles fan out and extend up to or beyond a thin dermal layer of erect and tangential subtylostyles. Subtylostyles are also found parallel to the choanosomal columns and lying tangentially to the columns at the base of the sponge. Small acanthostyles echinate the columns beneath the fans of styles, and also stand erect at the base of the sponge. There is no spongin fibre development. Larvae are present at the base of the sponge and contain many developing acanthostyles (90–140 × 5–7 μm).

SPICULES (Plate 47, E):
Megascleres: Long, thick styles with a smooth or roughened shaft and spined head. Small acanthostyles, straight or slightly curved, and with spines that recurve towards the head, in which region the spining is most marked. Slender subtylostyles, smooth and straight, sometimes with faint spining on the head.
Microscleres: Small palmate isochelae of normal form. Small toxas with a high, well-rounded centre flexure.
For spicule dimensions *see* Table 75.

REMARKS: This species is characterised by a very simple microcionid skeleton with little, if any, fibre development. Both valid species of *Microciona* described previously from New Zealand, *M. coccinea* and *M. rubens*, have plumose skeletons with pronounced fibre development. The spicules of *Microciona dendyi* are very large and are closest to those of *M. rubens* in dimensions, but differ considerably in the size range of the acanthostyles.

Microciona coccinea Bergquist (Plates 47, F; 48, A)

Microciona coccinea Bergquist, 1961a: 39, fig. 8a, b.

MATERIAL EXAMINED: Takapuna Reef, intertidal (2 specimens); Clifton Beach, intertidal.

DESCRIPTION: A thin encrusting sponge, often occurring under intertidal rocks, beneath coralline algae, or upon the shell of *Herpetopoma bella*.

DIMENSIONS: Variable according to substrate, never forming large mats; thickness 1–3 mm.

COLOUR: In life, scarlet (7.5R 4/10) to orange red (10.0R 5/10 and 2.5YR 4/8); in spirit, grey-brown (7.5Y 7/2).

TEXTURE: Soft and brittle.

SURFACE: The surface is uneven, granular, and slightly hispid. Under low magnification a dermal membrane is visible but is closely adherent to the underlying choanosome.

SKELETON: The basal layer of the sponge consists of spongin which supports erect small acanthostyles (Plate 47, F). The basal spongin plate produces fibres which are cored sparsely by large styles and echinated profusely by small acanthostyles. Very large styles extend from the apices of the fibres and project through the dermal subtylostyles, thus producing a hispid surface. The vertical fibres may branch, but do not anastomose. Both microscleres and megascleres occur interstitially. The ectosomal skeleton consists of a loose irregular layer of subtylostyles.

SPICULES (Plate 48, A):
Megascleres: Large, stout styles, spined basally and occasionally along the shaft, with the anterior third usually curved. Stout, straight acanthostyles, spined all over but most intensively on the head. Slender, usually straight subtylostyles with a few terminal, inconspicuous spines, and a shaft tapering to a long fine point.
Microscleres: Palmate isochelae which are usually abundant. Toxas which may be abundant, rare or absent, and are hair-like with a steep central flexure and slightly reflexed spined tips.
For spicule dimensions *see* Table 76.

TABLE 76. Spicule dimensions of *Microciona coccinea*.

Locality		Styles (μm)	Acanthostyles (μm)	Subtylostyles (μm)	Isochelae (μm)	Toxas (μm)
Stanley Bay and Waiheke Island, intertidal Bergquist (1961a)		240–400 × 12–16	80–210 × 7–14	140–280 × 3–4	13–17	50–70
Takapuna Reef, intertidal specimen 1	x̄	314 × 12	114 × 8	197 × 4	9	36
	Range	245–380 × 7–17.5	85–140 × 6–11	130–265 × 3–4.5	8–9.5	20–55
Takapuna Reef, intertidal specimen 2	x̄	334 × 15	143 × 12	216 × 5	8	65 Uncommon
	Range	200–420 × 10–18	95–173 × 8–14	152–280 × 4.5–6	7–10	60–80
Clifton Beach, intertidal	x̄	263 × 11	118 × 8.4	195 × 4.5	9	Absent
	Range	145–385 × 7–17	70–150 × 7.5–10	120–250 × 3.5–5	8–10	

REMARKS: A typesetting error in the description of *Microciona coccinea* Bergquist, 1961a resulted in there being no mention of the isochelae. *Microciona coccinea* has not previously been collected below low tide level or outside the inner Hauraki Gulf. Two subtidal sponges have been found at the Poor Knights Islands and Leigh that compare very closely with *M. coccinea* in skeletal morphology, spicule complement and dimensions. However, the specimens are too small for a detailed examination which would indicate whether they represent a new species or a sub-tidal record of *M. coccinea*.

Microciona rubens Bergquist (Plate 48, B, C)

Microciona rubens Bergquist, 1961a: 38, fig. 9a, b.

MATERIAL EXAMINED: Sponge Garden, Leigh, 16 m; Ti Point, 5 m; Tokatu Point, 12 m; Narrow Neck Reef; Devonport Wharf; Waitawa Bay, Clevedon, 4 m (type).

DESCRIPTION: The sponge is always encrusting but is variable in thickness.

DIMENSIONS: Never large and spreading, usually about 25 × 20 mm; the thickness can range from 1 mm up to 5 mm.

COLOUR: In life, orange red (7.5R 5/12) to bright red (7.5R 4/12); in spirit, creamy-yellow (5.0Y 8/4) to fawny-brown (2.5Y 7/4).

TEXTURE: Quite firm but compressible.

SURFACE: The species has an uneven surface which is hispid microscopically.

SKELETON: A basal spongin plate supports a layer of erect acanthostyles. Large styles with spined heads form plumose tracts which branch occasionally, and which extend from the base of the sponge to spreading fans of spicules near the surface (Plate 48, B). There is some spongin fibre development along these tracts, especially near the base of the sponge. The tracts are echinated by acanthostyles. Subtylostyles form an irregular dermal skeleton, sometimes in organised vertical brushes but also often disposed tangentially. The subtylostyles are also associated loosely with the fibres. The large styles extend beyond the dermal subtylostyles and produce the hispid surface.

SPICULES (Plate 48, C):
Megascleres: Styles with somewhat tylote spined heads, long tapered points, and a thick, smooth, usually gently curved shaft. Straight, smooth, slender subtylostyles with poorly demarcated, faintly spined heads. Short acanthostyles with recurved spines on the shaft and most dense spining on the head.
Microscleres: Palmate isochelae of normal form. Sharply flexed toxas which are absent in some specimens.
For spicule dimensions *see* Table 77.

REMARKS: This species is always found below low tide level.

***Microciona novaezealandiae** Brøndsted, 1924

Microciona novae zealandiae Brøndsted, 1924: 463, fig. 19a–e.
Wetmoreus novaezealandiae. de Laubenfels 1936: 112.

REMARKS: De Laubenfels (1936) established *Wetmoreus* to receive *M. novaezealandiae* Brøndsted. This species is anomalous among the Clathriidae in its possession of arcuate isochelae. De Laubenfels quoted these chelae as being "... peculiar sigmoid chelas that perhaps are to be regarded as extensively modified arcuate forms." Brøndsted's description contained no indication that there was anything abnormal about

TABLE 77. Spicule dimensions of *Microciona rubens*.

Locality		Styles (μm)	Subtylostyles (μm)	Acanthostyles (μm)	Isochelae (μm)	Toxas (μm)
Waitawa Bay, Clevedon, 4 m Bergquist (1961a)		140–530 × 21	110–280 × 3	90–110	8	40–70
TYPE remeasured	x̄	324 × 20	195 × 5	89 × 10	10	58 Common
	Range	200–470 × 15.5–25	138–250 × 4–5.5	78–105 × 8–12	9–11	50–70
Devonport Wharf	x̄	324 × 17	189 × 3	84 × 8	9	Very rare
	Range	200–430 × 14–20	120–270 × 2–4	75–93 × 6.5–10	7.5–10	
Narrow Neck Reef	x̄	287 × 14	164 × 4	82 × 7	10	
	Range	180–430 × 10–17.5	125–212 × 3–4.5	73–93 × 5–8	8–10	
Tokatu Point, 12 m	x̄	259 × 11	226 × 5	82 × 8	10	
	Range	180–318 × 9–14	200–300 × 4.5–7	62–95 × 6.5–10.5	10–11	
Sponge Garden, Leigh, 16 m	x̄	259 × 12	225 × 5	81 × 8	10	Rare
	Range	155–340 × 9–15	160–280 × 3–6	60–90 × 6–10	10–11	
Ti Point, 5 m	x̄	331 × 13	236 × 5	84 × 8	10	57
	Range	192–450 × 9.5–15.5	150–265 × 3.5–8	72–90 × 6.5–9	9–11.5	45–70

these chelae other than their presence in a sponge genus where their occurrence was unexpected. Unfortunately the holotype lodged at the Copenhagen Museum appears to be lost, and no new material has been collected, so the status of the species cannot be resolved.

DISTRIBUTION: Slipper Island (low water).

*Microciona pyramidalis Brøndsted, 1924

Microciona pyramidalis Brøndsted, 1924: 466, fig. 21a–d.
Dictyociona pyramidalis. de Laubenfels 1936: 110.

REMARKS: From Brøndsted's description it is apparent that this species belongs to either *Hymedesmia* or *Pronax* and is certainly not a clathriid. He described the skeleton as having "... acanthostyli standing isolated with the base on the stratum of the sponge-attachment, and pointing vertically upwards ...". The sponge also has tornotes and arcuate isochelae, which are anomalous among the Clathriidae. Further collections, or access to the type specimen, would permit a better description and resolve this question. However, the type specimen cannot be located. De Laubenfels (1936) transferred this sponge to *Dictyociona* Topsent on the basis that the principal spicules were somewhat spined. This, however, it not a feature which diagnoses *Dictyociona*. All available information on its skeletal arrangement and morphology suggest that the sponge is not a clathriid.

DISTRIBUTION: Slipper Island (low water).

Dictyociona Topsent, 1913

DIAGNOSIS: Clathriidae with a skeleton composed of primary fibres cored by principal monactinal spicules, and echinated by monactinal spicules which connect the primary fibres to form a skeletal network. The echinating spicules are identical in appearance to the principal spicules except in dimensions. There is a reduced dermal skeleton of subtylostyles. Microscleres are typically palmate isochelae and toxas.

TYPE SPECIES: *Microciona discreta* Thiele, 1905

REMARKS: This diagnosis is adapted from Topsent (1913), who established the genus primarily for clathriids with principal and echinating megascleres of the same type. In his description of *Dictyociona discreta* he noted the poorly developed dermal skeleton. Both New Zealand species also have poorly developed dermal skeletons and consequently this feature has been included in the generic diagnosis. Few authors have used *Dictyociona*. Burton (1932, 1940) referred *Clath-*

ria terraenovae to *Dictyociona* and de Laubenfels (1936) transferred nine species to the genus. De Laubenfels (1953, 1954) described two new species of *Dictyociona*, one from the Gulf of Mexico, the other from the West Central Pacific.

Dictyociona contorta n.sp. (Plate 48, D–F)

MATERIAL EXAMINED: Manukau Harbour, 6–10 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 115.

TYPE LOCALITY: Manukau Harbour, 6–10 m.

DESCRIPTION: A flat encrustation covering both surfaces of a *Fellaster* skeleton.

DIMENSIONS: Up to 2 mm thick, covering an area 85 × 80 mm.

COLOUR: In life, dull red; in spirit, light brown.

TEXTURE: Firm, but compressible; easily torn.

SURFACE: The surface is flat and even, and microscopically hispid.

SKELETON: The choanosomal skeleton consists of large styles which form primary tracts one to three spicules across, which pierce the surface. Shorter styles of the same type echinate the primary fibres, in many instances standing at right angles to the fibres, thus forming a skeletal network (Plate 48, D). Many of these echinating spicules are invested in spongin fibre. Thin subtylostyles lie in the choanosome parallel to the large styles and at various angles to the surface. They are not in aggregates. Occasional acanthostyles occur at the base of the primary fibres, and larvae occur at the base of the sponge between the primary fibres.

SPICULES (Plate 48, E, F):
Megascleres: Thick, smooth styles with spined or roughened heads, tapering to a long well-defined point, and usually curved in the anterior third. Both the echinating and principal styles are of this type. Straight, slender subtylostyles, sparsely spined and with only a faintly subtylote head. Short thick acanthostyles, lightly spined all over, and uncommon.
Microscleres: Short, thin toxas, with a rounded central curve. Palmate isochelae, usually of normal form, but in some the shaft is twisted (Plate 48, F).

Larval spiculation: Numerous thin styles which have roughened surfaces. Toxas of adult form.
For spicule dimensions *see* Table 78.

REMARKS: This species is characterised as a *Dictyociona* by its spicule complement and skeletal organisation. The echinating styles are shorter and more curved than the principal spicules but the two sizes are identical morphologically. The sponge skeleton consists of primary tracts cored by principal styles and surrounded by spongin fibre. The primary fibres are bridged by the echinating styles, which tend to lie at right angles to the tracts. There is a reduced dermal skeleton consisting of sparse subtylostyles lying tangentially.

Dictyociona contorta differs from the only other New Zealand species of the genus in having unusual twisted palmate isochelae and in the dimensions of the megascleres.

Dictyociona atoxa n.sp. (Plate 49, A–C)

MATERIAL EXAMINED: Tokatu Point, 12 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 116.

TYPE LOCALITY: Tokatu Point, 12 m.

DESCRIPTION: This sponge is a thin encrustation over a gastropod shell.

DIMENSIONS: Thickness $\leqslant$ 1 mm; extends over the shell approximately 30 × 60 mm.

COLOUR: In life, brick-red (7.5R 4/8); in spirit, fawn brown (10.0YR 7/4).

TEXTURE: Soft and slightly compressible.

SURFACE: The surface is hispid microscopically, finely porous, flat and even.

SKELETON: The choanosomal skeleton consists of primary tracts 200–500 μm wide consisting of one to five large styles (Plate 49, A). These tracts extend beyond the surface of the sponge and render the surface hispid. The tracts are echinated by shorter styles, generally at right angles, in groups of one to four spicules (Plate 49, B). There is strong spongin fibre development around the primary tracts and some development around the echinating spicules. Subtylostyles are

TABLE 78. Spicule dimensions of *Dictyociona contorta*.

Locality		Principal styles (μm)	Echinating styles (μm)	Subtylostyles (μm)	Acanthostyles (not common) (μm)	Isochelae (μm)	Toxas (μm)	Larval styles (μm)
Manakau Harbour, 6–10 m	$\bar{x}$	416 × 23	245 × 21	277 × 6.3	98 × 10	20	52	98 × 5
	Range	315–520 × 18–32	220–270 × 14–24	205–320 × 4–10	80–110 × 8–12.5	18–23	48–60	90–110 × 4–5.5

not common and are found lying tangentially in a reduced dermal skeleton and parallel to the primary tracts in the choanosome. Larvae are present at the base of the sponge between the primary tracts.

SPICULES (Plate 49, C):
Megascleres: Styles of two sizes, corresponding in the skeleton to principal and echinating spicules. Both forms are usually curved in the anterior third, more sharply so in the echinating forms, have slightly subtylote spined heads, long well-defined points, and are thick and smooth. Slender, long, smooth subtylostyles.
Microscleres: Palmate isochelae of normal form.
Larval spiculation: Fine roughened styles and isochelae similar to those seen in the adult.
For spicule dimensions *see* Table 79.

REMARKS: This species has the skeleton network typical of *Dictyociona*. It has echinating styles that are the same morphologically as the principal styles, but a different size. *Dictyociona atoxa* differs from *D. contorta* in the shape of the styles and subtylostyles, in lacking toxas, and in having palmate isochelae of normal form.

Neither of the two New Zealand species are closely related to other described *Dictyociona* species. *Dictyociona contorta* has similar spiculation to *Microciona rarispinosa* Hechtel, 1965, but the skeletal organisation is completely different. *Dictyociona atoxa* is most closely related to *D. discreta* (Thiele) but lacks toxas, and shows no spining on the shafts of the styles.

Clathria Schmidt, 1862

Quizciona de Laubenfels, 1936

DIAGNOSIS: Clathriidae that are generally massive or erect. The skeleton is plumo-reticulate or reticulate with spongin fibre development. Principal monactinal spicules core the fibres, which are echinated by acanthostyles. The ectosomal skeleton consists of dispersed monactinal spicules arranged tangentially and at right angles to the surface; there is no tangential crust of dermal spicules. Microscleres are palmate isochelae and toxas.

TYPE SPECIES: *Clathria compressa* Schmidt, 1862

REMARKS: This genus has been discussed in conjunction with the genus *Microciona*.

Clathria lissosclera n.sp. (Plate 49, D–F)

MATERIAL EXAMINED: Mayor Island, 4 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 112.

TYPE LOCALITY: Mayor Island, 4 m.

DESCRIPTION: A massive low lying sponge. The upper surface is convex and the sponge becomes a thin encrustation at the margins.

DIMENSIONS: Extent of spread: 120 × 100 mm; thickness: up to 40 mm.

COLOUR: In life, deep yellow (10.0YR 7/8); in spirit, yellow-brown (5.0Y 6/4).

TEXTURE: Compact but crumbly.

SURFACE: Circular oscules are scattered over the surface of the sponge (Plate 49, D). They range in diameter from 1.0–3.2 mm, and are slightly elevated ($\leqslant$ 0.5 mm) above the surface. The surface is hispid microscopically from the projecting styles of the subdermal brushes.

SKELETON: The skeleton is a disorganised reticulation with tracts cored and echinated by styles (Plate 49, E). The primary tracts are six to eight spicules wide, the secondary tracts forming the reticulation, one to five spicules wide. There is spongin fibre development at the nodes of the reticulation. Small styles with roughened surfaces echinate the tracts sparsely. Thin styles are found in clusters interstitially, as are numerous isochelae. Small slender styles, identical to the interstitial styles, are found in the dermal region, where they form brushes and lie tangentially. Isochelae form a thin layer above these styles.

SPICULES (Plate 49, F):
Megascleres: Smooth styles, which are curved or straight with short, sharp points. Small, slender acanthostyles. Very slender styles, interstitial and dermal, but not very abundant.
Microscleres: Toxas of two types – short, stout, steeply curved forms, and thin forms with a wide central flexure. Palmate isochelae of normal form.
For spicule dimensions *see* Table 80.

TABLE 79. Spicule dimensions of *Dictyociona atoxa*.

Locality		Principal styles (μm)	Echinating styles (μm)	Subtylostyles (μm)	Isochelae (μm)	Larval styles (μm)
Tokatu Point, 12 m	$\bar{x}$	304 × 12	154 × 10	241 × 3	17	55–65 × 2
	Range	215–385 × 10–16	125–188 × 9–11.5	190–300 × 3–4.5	15–18.5	

REMARKS: *Clathria lissosclera* is very distinct among the New Zealand species of *Clathria*. The skeleton does not have the regular reticulation seen in *C. mortensii* or the fibre development seen in *C. terraenovae*. The spicules of *C. lissosclera* are smaller than those found in either of the other New Zealand *Clathria* species.

The Australian species of *Clathria* described by Hallmann (1912) such as *C. caelata, C. costifera* and *C. transiens* have roughened acanthostyles similar to *C. lissosclera* but all differ in other details of spiculation, and in having significant fibre development in their skeletons.

Clathria lissosclera is characterised by the disorganised reticulation of spicules and lack of pronounced spongin fibre, the reduced skeleton made up of only faintly spined acanthostyles, and in having two categories of toxas.

Clathria mortensenii Brøndsted (Plate 50, A—C)

Clathria mortensenii Brøndsted, 1923: 143, fig. 22a–d.
Microciona mortensenii. De Laubenfels 1936: 111; Burton, 1940: 111.
Microciona heterospiculata Brøndsted, 1924: 465, fig. 20a–m; Bergquist 1961a: 39.
Quizciona heterospiculata. de Laubenfels 1936: 111.

MATERIAL EXAMINED: Ladies Bay Reef (2 specimens); Westmere Reef; Clifton Beach, intertidal; BM(NH) 38.8.24.3, Karaka Bay; BM(NH) 01.12.26.1, Auckland Island, 18 m; Perseverance Harbour, Campbell Island, 37 m (type of *Clathria mortensenii*, Copenhagen Museum).

DESCRIPTION: An extremely thin, encrusting sponge, either growing on the sides and undersurface of rocks or upon shells of *Elminius modestus*. Never forming large mats.

DIMENSIONS: Thickness 0.3–0.5 mm.

COLOUR: In life, bright red (5.0YR 5/10–6/10) to pale fawn (7.5YR 7/4); in spirit, reddish-brown (5.0YR 4/6) to mauvy-grey.

TEXTURE: Incompressible, crisp and brittle.

SURFACE: Microscopically hispid, and finely porous.

SKELETON: The dermal skeleton consists of a thin layer of subtylostyles, both tangential and at right angles to the surface. Large styles at the apices of primary spicule tracts extend beyond the layer of subtylostyles to produce the hispid surface (Plate 50, A). Plumose tracts begin at the base of the sponge and consist of large styles usually one to three spicules wide. There is some basal fibre development and occasional upright acanthostyles at the base of the sponge. The majority of the acanthostyles, which echinate the tracts, form a reticulation linking the primary tracts by one or two spicule lengths (Plate 50, B). The dermal tylostyles and isochelae are found interstitially. Isochelae may form a thin intermittent dermal layer.

SPICULES (Plate 50, C):
Megascleres: Basally spined acanthosubtylostyles. These spicules are the main components of the spicule tracts and have a characteristic shape. They are expanded just behind the head, which bears rounded knob-like spines. From their widest point immediately behind the head, they taper evenly in a gradual curve to a sharp point. Small, straight acanthostyles, evenly but sparsely spined. Slender, straight subtylostyles with well-marked rounded heads, and with a few small apical spines.
Microscleres: Palmate isochelae of normal form.
For spicule dimensions *see* Table 81.

REMARKS: *Microciona heterospiculata* is placed in synonymy under *Clathria mortensenii*. Both species were described by Brøndsted (1923, 1924) as being encrusting over shell. In *C. mortensenii* Brøndsted noted a hispid surface and described the skeleton as "... composed of only slightly developed and rather ill-defined skeleton-fibres, which are passing from surface of attachment to the free surface; so they are very short, on account of the very insignificant thickness of the sponge, only a few spicules long; from these fibres radiate at right angles numerous small spined styli." From the description of *M. heterospiculata* the skeleton appears to be more plumose. "The skeleton consists of spicula-tufts, rising perpendicularly from the body of attachment; they are built of acanthostyli, the bases of which are imbedded in short stout spongin-columns; the tufts are standing so close to one another, that the spicules often overlap one another from neighbouring columns ..." The overlap between

TABLE 80. Spicule dimensions of *Clathria lissosclera*.

Locality		Large styles (μm)	Small dermal styles (μm)	Acanthostyles (μm)	Short toxas (μm)	Isochelae (μm)	Thin toxas (μm)
Mayor Island, 4 m	$\bar{x}$	181 × 8	153 × 2.8	88 × 4	51	23	59
	Range	170–190 × 6–9.5	140–165 × 2.5–3.5	85–110 × 3–5.5	40–60	21–25	48–73

TABLE 81. Spicule dimensions of *Clathria mortensenii*.

Locality		Styles (μm)	Subtylostyles (μm)	Acanthostyles (μm)	Isochelae (μm)	Toxas (μm)
C. mortensenii Campbell Id, 37 m Brøndsted (1923)		2 sizes 260 and 450 × 20 (182–520)	Notes presence of thin developmental styles only	143 × 15–18	16–19	100
TYPE of *C. mortensenii* remeasured	x̄	406 × 20	339 × 6	148 × 13	21	95
	Range	240–625 × 17–23	288–400 × 4–7	132–168 × 12–14.5	19–23	80–110
M. heterospiculata Colville Channel Brøndsted (1924)		These were grouped with the acanthostyles	⩽320 × 4	80–400 commonly 300 and ⩽14 thick	10–15	
BM(NH)38.8.24.3 Karaka Bay	x̄	303 × 13	236 × 5.6	136 × 11	15	Absent
	Range	225–430 × 10.5–16.5	122–310 × 4.5–7	115–160 × 7.5–14	15–17.5	
BM(NH)01.12.26.1 Auckland Island, 18 m	x̄	321 × 17	323 × 4.7	135 × 13	20	Rare and broken
	Range	183–525 × 15–22	210–430 × 3–6	110–165 × 10–17.5	16–23	
Ladies Bay Reef specimen 1	x̄	277 × 13	229 × 4	124 × 11	17	70
	Range	170–370 × 11–15	145–345 × 3–5	112–132 × 10–12.5	13–18	50–80
Ladies Bay Reef specimen 2	x̄	254 × 14	228 × 4	132 × 11	18	80 Uncommon
	Range	170–340 × 10–16.5	170–290 × 3.5–5	105–150 × 9–13	16–19	65–100
Westmere Reef, intertidal	x̄	271 × 15	250 × 4.5	129 × 11	17	Absent
	Range	178–398 × 12–20	160–350 × 3–5	120–140 × 8–12	17–19	
Clifton Beach, intertidal	x̄	286 × 16	248 × 4.4	109 × 11	18	70
	Range	170–405 × 11.5–19	170–320 × 3–5.5	80–130 × 8–13	15–20	33–100

the columns may constitute the reticulation noted in *C. mortensenii*. Brøndsted figured small acanthostyles and two sizes of basally spined styles for each species but does not record their dimensions separately in *M. heterospiculata* (*see* Table 81). He figured long wispy subtylostyles in *C. mortensenii* but considered them to be developmental forms of the styles and did not record their dimensions. However, the type material of *C. mortensenii* has subtylostyles that compare closely with Brøndsted's measurement for the comparable spicules in *M. heterospiculata*. It seems probable that Brøndsted separated these species on the basis of the abnormal chelae in *M. heterospiculata* and the presence of toxas in *C. mortensenii*.

Presence or absence of toxas in the Clathriidae has been found to be extremely variable, but toxa morphology remains consistent within a species. Bergquist and Sinclair (1973) noted for *M. coccinea* that "it is possible that these microscleres can be produced or not produced on a quite individual and random basis." In specimens of *C. mortensenii* that did have toxas the morphology was consistent.

De Laubenfels (1936) referred *C. mortensenii* to *Microciona* but gave no reason for this action. He also established a new genus *Quizciona* to receive *M. heterospiculata* on the grounds that the abnormal isochelae were a new category of microsclere. This genus is not adopted as no abnormal isochelae were found.

With a reticulate skeleton this species conforms to the diagnosis of the genus *Clathria* although the sponge is encrusting.

OTHER RECORDS: Colville Channel, New Zealand; Argentina.

Clathria terraenovae Dendy

(Plates 50, D–F; 51, A)

Clathria terrae novae Dendy, 1924: 353, pl. xii fig. 5, pl. xiv figs 9–13.
Dictyociona terraenovae. Burton 1932: 324; Burton 1940: 112, fig. 3a–i, pl. 5 figs 3, 4.

MATERIAL EXAMINED: East of North Cape, 128 m (type); Rangitoto Channel, 9 m; Manukau Harbour, 4 m; specimen washed up on Cheltenham Beach.

DESCRIPTION: An erect sponge with many longitudinally grooved branches which anastomose to the extent where the larger specimens have a solid bush-like appearance (Plate 50, D). Smaller specimens are encrusting mats with erect nodes scattered over the surface.

DIMENSIONS: *See* Table 82.

COLOUR: In life, variable, from bright orange (5.0YR 6/10) to orange red (2.5YR 5/8) to yellowish (10.0YR 5/8), with the different colours sometimes occurring on different branches of the same specimen; in spirit, greyish-yellow (2.5Y 4/2).

TEXTURE: Soft, rather elastic, with a firm core to all branches.

SURFACE: The surface is granular, marked by longitudinal grooves and occasional nodules representing unformed branches. Microscopically hispid.

SKELETON: The skeleton is composed of stout, ascending, anastomosing, plumose columns of large styles echinated by small acanthostyles (Plate 50, E). The central axis of each branch contains five or six such ascending columns, each of which is copiously invested by spongin, and joined to form a reticulation. The fibres range from 80–170 μm ($\bar{x}$ = 115 μm) in diameter. Arising in oblique fashion from the primary fibres are secondary branches, which narrow as they approach the surface and eventually, 800 μm below the surface, spongin disappears and two or three spicules extend beyond the surface (Plate 50, F). Each fibre terminates in a brush of five to six stout styles which is surmounted by a tract of auxiliary subtylostyles. The subtylostyles extend to the dermal membrane and merge with a radially disposed layer of similar spicules which support the dermal membrane. The dermal membrane is 100 μm thick and contains a few isochelae and tangential styles.

TABLE 82. Sponge dimensions of *Clathria terraenovae.*

Locality	Shape	Height (mm)	Width (mm)	Diameter of branches (mm)
TYPE E. of North Cape, 128 m	Erect and bushy	160	90	3 Stem: 7
Rangitoto Channel, 9 m	Erect and bushy	75	40	2–4
Manakau Harbour, 4 m	Encrusting with nodes	25 Crust: 2	Crust: 100	2–4
Cheltenham Beach	Encrusting with erect branches	20 Crust: 1	Crust: 50	2–5

SPICULES (Plate 51, A):
Megascleres: Large, stout basally spined styles, occasionally roughened on the shaft, and slightly curved. Small stout acanthostyles with a large size range, smooth well-tapered points, recurved spines on the shaft, and well-spined heads. Straight, slender subtylostyles which are smooth or lightly spined basally.
Microscleres: Palmate isochelae of normal form. Toxas of variable size and shape.
For spicule dimensions *see* Table 83.

REMARKS: Burton (1932) transferred *Clathria terraenovae* Dendy to *Dictyociona* on the basis of the variability of the spining of the main megascleres. Topsent (1913) established the genus *Dictyociona* for Ectyoninae with principal megascleres and echinating megascleres that are no different from each other morphologically, but which may have different dimensions. The type species of the genus is *Microciona discreta* Thiele. Thiele figured the megascleres in his description (1905, fig. 65a, b); the two groups of styles are spined identically, and the principal styles are larger than the echinating ones.

The principal styles of *Clathria terraenovae* are basally spined and occasionally roughened on the shaft, while the echinating acanthostyles are thickly covered with spines. The two types are quite distinct. The variability of the spining of the megascleres discussed by Burton is not a characteristic of *Dictyociona.* This variability is common in other clathriid species, for example, *C. mortensenii* and *M. coccinea. Clathria terraenovae* falls within the diagnosis of a *Clathria* in having a plumo-reticulate skeleton.

OTHER RECORDS: South Georgia, 970 m; Argentina.

***Clathria intermedia** Kirk

Clathria intermedia Kirk, 1911: 579, fig. 5; Fell 1950: 11, pl. 1 fig. 2.
Thalysias intermedia. De Laubenfels 1936: 105.

REMARKS: Hartman (1955) proposed that *Thalysias* be placed in synonymy under *Microciona,* since the two distinguishing characteristics noted by de Laubenfels (1936) intergrade. These characters were a branching colony form versus an encrusting form, and a distinct dermal specialisation versus little such specialisation. *Clathria intermedia* has not been recollected, and thus the original generic name is retained until the species can be accurately assigned to either *Clathria* or *Microciona.* The type material cannot be located in New Zealand.

TABLE 83. Spicule dimensions of *Clathria terraenovae*.

Locality		Styles (μm)	Acanthostyles (μm)	Subtylostyles (μm)	Isochelae (μm)	Toxas (μm)
TYPE E. of North Cape, 128 m Dendy (1924)		⩽600 × 24	120 × 17 to 360 × 25 (incl. spines)	⩽400 × 8	8	80
South Georgia, 970 m Burton (1932)		420 × 15	180–270 × 3	105 × 8	11	65–90
TYPE remeasured	x̄	474 × 19	176 × 12	279 × 6	8	69
	Range	370–550 × 16–22	120–235 × 8–15	173–345 × 5–8.5	7.5–9	50–90
Rangitoto Channel, 9 m	x̄	347 × 18	159 × 14	223 × 6	8.6	60
	Range	245–490 × 15.5–21	90–210 × 9–21	118–305 × 3–7.5	7.5–10	40–78
Manakau Harbour, 4 m	x̄	326 × 15	146 × 12	199 × 5.5	11	49
	Range	230–480 × 11.5–18.5	85–210 × 9–18	128–290 × 3.5–8	7.5–13	30–70
Cheltenham Beach	x̄	345 × 18	133 × 10.5	209 × 5	9	57
	Range	250–420 × 12.5–22	90–200 × 9–13	115–265 × 3.5–6.5	7.5–10	40–75

DISTRIBUTION: Denham Bay, Kermadec Islands.

*Clathria macropora Lendenfeld

Clathria macropora Lendenfeld, 1888: 221.
Crella incrustans var. *levis* Hallmann, 1914: 267.

REMARKS: Hallmann (1914) was doubtful as to whether the specimen examined was a genuine example of the species. From Lendenfeld's (1888) description this sponge is not a member of the Clathriidae as it contains both oxeas and styles. The sponge has not been recollected and it is very doubtful whether the New Zealand and Australian specimens are the same species.

DISTRIBUTION: Port Stephens, New South Wales, Australia; Nelson Bay, New Zealand.

Pseudanchinoe Burton, 1929

DIAGNOSIS: Clathriidae with a reticulate fibre skeleton cored by styles and echinated by acanthostyles. The ectosomal skeleton consists of monactinal spicules arranged tangentially and/or erect. Microscleres are toxas; there are no palmate isochelae.

TYPE SPECIES: *Stylostichon toxiferum* Topsent, 1917

REMARKS: Burton (1929), in establishing *Pseudanchinoe*, stated that palmate isochelae were present in this genus. The original description of *Stylostichon toxiferum* Topsent, 1917, nominated by Burton as the type species, makes it clear that this species does not have palmate isochelae. *Pseudanchinoe* is in effect a typical *Clathria* without isochelae.

Pseudanchinoe scotti (Dendy) (Plate 51, B–D)

Clathria scotti Dendy, 1924: 352, pl. x fig. 1, pl. xiv figs 5–8.
Pseudanchinoe scotti. de Laubenfels 1936: 109.

MATERIAL EXAMINED: NZOI Stn B93, Three Kings Islands, 55–110 m; BM(NH) 23.10.1.128, East of North Cape, 128 m (type).

DESCRIPTION: The sponge is an erect, stalked, much branched lamella. The branching is quite irregular and a compact anastomosis is formed (Plate 51, B). Individual branches are very thin and irregular in outline.

DIMENSIONS: Diameter 5–15 mm; height 35 mm and 85 mm; width of lamella 15 mm and 35 mm; thickness of lamella 8–11 mm; thickness of branches 5–15 mm.

COLOUR: In life, bright red (7.5R 5/10); in spirit, dull red-brown (5.0YR).

TEXTURE: The lamella is soft and compressible; the stalk is hard.

SURFACE: The surface is deeply corrugated owing to the mode of branching, and is visibly hispid. The dermal membrane is not apparent and thus no pores or oscules were seen.

SKELETON: The skeleton is an irregular reticulation of spongin fibres cored by smooth styles and echinated

TABLE 84. Spicule dimensions of *Pseudanchinoe scotti*.

Locality		Styles (μm)	Acanthostyles (μm)	Subtylostyles (μm)	Toxas (μm)
TYPE E. of North Cape, 128 m Dendy (1924)		527 × 25	100 × 16	360 × 6	Up to 500
TYPE remeasured	x̄	398 × 16	96 × 10	296 × 5	270
	Range	292–540 × 11.5–22	80–110 × 8.5–11.5	185–425 × 3–7.5	140–370
NZOI Stn B93, Three Kings Is, 55–110 m	x̄	530 × 20	97 × 14	322 × 6	489
	Range	497–600 × 19–23	82–110 × 12–15 (incl. spines)	280–375 × 5.6–7.2	220–580

by acanthostyles (Plate 51, C). The dissected and irregular type of fibre is a reflection of the habit of the sponge; the skeleton is made up of ascending plumo-reticulate tracts. The ectosomal skeleton and the superficial region of the ascending tracts consist of brushes of slender subtylostyles. The toxas in the sponge are large and abundant, occurring as ectosomal and interstitial spicules.

SPICULES (Plate 51, D):

Megascleres: Thick, smooth styles with an evenly rounded base and gradually tapering point. Short, straight, abundantly spined acanthostyles. Slender, straight, smooth subtylostyles, with smooth heads and a tapered, sharp point.

Microscleres: Long, slender, hair-like toxas with a very open angle, so that the two limbs tend to lie almost on the same straight line.

For spicule dimensions *see* Table 84.

REMARKS: De Laubenfels (1936) transferred *Clathria scotti* to *Pseudanchinoe* on the basis that isochelae were absent. This species is close to *Pseudanchinoe costifera* Hallmann, 1912 from Bass Strait in habit, skeletal arrangement and spicule complement, but the styles and acanthostyles of *P. scotti* are considerably larger.

Rhaphidophlus Ehlers, 1870

Tenacia Schmidt, 1870
Echinonema Carter, 1875

DIAGNOSIS: Clathriidae with a plumose, plumo-reticulate or reticulate skeleton in which the auxiliary monactinal spicules are disposed to make up a dermal skeleton organised as a continuous palisade of erect spicule brushes.

TYPE SPECIES: *Spongia cratitia* Esper, 1797

REMARKS: This diagnosis is adopted from Lévi (1960) who advocated maintaining *Rhaphidophlus*. Dendy (1895, 1905) recommended abandoning the genus on the grounds that the single feature distinguishing it from *Clathria* showed such variation that no cut-off point could be defined between the two genera. In the New Zealand species assigned to *Rhaphidophlus* the superficial skin constituted by the spicule palisade is much more pronounced than any dermal development seen in species of *Microciona* or *Clathria*.

It is interesting to note that most authors who have published descriptions of *Rhaphidophlus* species have recorded subtylostyles as occurring in two size categories. Van Soest (1984) suggested that "the category of thin, short subtylostyles perhaps constitutes only the juveniles of the larger subectosomal subtylostyles, in which case there is distinct localisation of juvenile and adult spicules." Hallmann (1912) suggested that the differentiation of size categories could be a basis for generic distinction (two size categories of subtylostyles were found in the New Zealand species), but it would be necessary to study many more species before this could be evaluated as a diagnostic character.

There has been some discussion over priority of generic names affecting species assigned to *Rhaphidophlus*. Wiedenmayer (1977) stated that "*Rhaphidophlus sensu* Lévi would be a synonym of *Thalysias sensu* de Laubenfels, 1954." More recently, however, van Soest (1984) noted that all de Laubenfels' actions with respect to *Thalysias* are invalid in view of Carter's earlier designation of a type species, and this view is upheld here. Consequently, following Lévi (1960) and van Soest (1984), the name *Rhaphidophlus* is retained for species of the Clathriidae which have a pronounced and well-organised dermal skeleton.

Rhaphidophlus coriocrassus n.sp.

(Plates 51, E, F; 52, A, B)

MATERIAL EXAMINED: Barren Arch, Poor Knights Islands, 21–24 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 113.

TYPE LOCALITY: Barren Arch, Poor Knights Islands, 21–24 m.

DESCRIPTION: A thick encrusting mat with a smooth skin-like dermal layer (Plate 51, E).

DIMENSIONS: Thickness 4 mm; thickness of dermal layer 0.2 mm; dimensions of portion of sponge 20 × 20 mm.

COLOUR: In life red; in spirit, chocolate brown (7.5YR 4/2).

TEXTURE: Firm and slightly compressible, quite brittle.

SURFACE: The surface is covered by a thick, smooth skin. When preserved this layer is lighter in colour than the choanosome of the sponge. No pores or oscules are visible.

SKELETON: The dermal skeleton is a continuous palisade (130 μm thick) of fans of subtylostyles extending slightly above the sponge surface (Plate 51, F). Subtylostyles also occur interstitially, occasionally organised into tracts, especially on either side of the fibres. Small acanthostyles, which are not very abundant, stand erect at the base of the sponge and also echinate the fibres. The choanosomal skeleton consists of fibrous, branching, plumose tracts, 50–100 μm wide, cored by large styles (Plate 52, A).

SPICULES (Plate 52, B):
Megascleres: Large, thick, smooth styles that are usually curved, with long well-tapered points. The apex is frequently uneven, often subtylote. Short, spined acanthostyles, with most spining at the apex, and with spines on the shaft projecting at right angles. Slender, smooth subtylostyles that fall into two size classes. The smaller are dermal and have faintly spined heads, the larger are choanosomal with smooth heads.
Microscleres: Palmate isochelae of normal form.
For spicule dimensions *see* Table 85.

REMARKS: This is the first record of the genus *Rhaphidophlus* from New Zealand. The sponge differs from other New Zealand members of the Clathriidae in having a pronounced dermal skin in association with a well-developed ectosomal skeleton. This is a diagnostic character of the genus *Rhaphidophlus*.

Rhaphidophlus coriocrassus differs from other species of *Rhaphidophlus* in having very thick principal styles and in the absence of toxas. Species described by van Soest (1984), for instance, *R. juniperinus* or *R. schoenus*, have principal styles that average 260.5 × 8.3 μm and 352.1 × 8.0 μm, which are considerably thinner than the mean of 358 × 20 μm of *R. coriocrassus*. This species is also distinct in having a branching plumose skeleton without any form of reticulation; most described species of *Rhaphidophlus* have anastomosing or reticulate skeletons. Lévi (1963) recorded *Rhaphidophlus lissocladus* Burton from South Africa, and this species is similar to the New Zealand species. The two species differ in gross morphology: *R. lissocladus* is erect and ramifying with a reticulate skeleton, no toxas, and smooth, thick principal styles 200–260 × 18–25 μm.

***Rhaphidophlus anchoratum** (Carter)

Echinonema anchoratum Carter, 1881: 379.
Echinonema anchoratum var. *lamellosa* Lendenfeld, 1888: 220.
Wilsonella lamellosa Hallmann, 1912: 299.
Microciona anchoratum. de Laubenfels 1936: 109.
Rhaphidophlus anchoratum Lévi 1960: 54.

REMARKS: Hallmann (1912) referred *Echinonema anchoratum* Carter to *Rhaphidophlus typicus* var. *anchoratus* Carter, but noted that this synonymy did not include *E. anchoratum* var. *lamellosa* Lendenfeld, 1888, which had oxeas as principal megascleres. *Echinonema anchoratum* var. *lamellosa*, which was recorded from New Zealand, was referred by Hallmann (1912) to *Wilsonella*, a genus with monactinal and oxeote or tornote principal megascleres. Hallmann noted that Lendenfeld had referred to oxeas as styles in descriptions of other species, and queried the validity of the reference to oxeas in this case. De Laubenfels (1936) suggested *Wilsonella* was a synonym of *Microciona*, but noted that *Wilsonella* had "quasidiacts" and perhaps sigmas. Lévi (1960) relegated *Echinonema* to synonymy under *Rhaphidophlus*. Whether this synonymy applies to *E. anchoratum* var. *lamellosa* cannot be ascertained with certainty until the species is recollected. However, Hallmann noted that the type specimen appears to have been lost, and as the original description was very brief, it may not be possible to re-identify the species.

DISTRIBUTION: Port Chalmers, Dunedin.

TABLE 85. Spicule dimensions of *Rhaphidophlus coriocrassus*.

Locality		Styles (μm)	Choanosomal subtylostyles (μm)	Dermal subtylostyles (μm)	Acanthostyles (μm)	Isochelae (μm)
Barren Arch, Poor Knights Is, 21–24 m	x̄	358 × 20	266 × 7	160 × 6	136 × 10.5	21
	Range	260–590 × 18–23	225–290 × 5.5–7.5	130–200 × 5–6.5	120–155 × 8–12.5	18–24

Ophlitaspongia Bowerbank, 1866

DIAGNOSIS: Clathriidae with a plumo-reticulate or reticulate fibre skeleton cored by smooth monactinal spicules and echinated by monactinal spicules of identical morphology. Acanthostyles are absent. The ectosomal skeleton consists of dispersed monactinal spicules arranged tangentially and/or erect. These spicules are also found interstitially. Microscleres are toxas; there are no palmate isochelae.

TYPE SPECIES: *Ophlitaspongia papillosa* Bowerbank, 1866

Ophlitaspongia oxeata n.sp. (Plate 52, C–E)

MATERIAL EXAMINED: Great Barrier Island, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 117.

TYPE LOCALITY: Great Barrier Island, intertidal.

DESCRIPTION: An encrusting sponge, often growing on the shaded sides of rock pools.

DIMENSIONS: Thickness 3–6 mm; extent 25 × 30 mm.

COLOUR: In life, blood red (7.5R 4/10); in spirit, fawn (2.5Y 7/4).

TEXTURE: Firm, brittle.

SURFACE: The surface is microscopically hispid. Small pores < 0.5 mm in diameter and flush with the surface are visible.

SKELETON: The sponge has a basal spongin mat which extends into plumose fibres cored and echinated by subtylostyles (Plate 52, C). A dermal skeleton of slender subtylostyles is present. The subtylostyles lie tangentially or in brushes and are not abundant. The choanosomal subtylostyles extend beyond the dermal skeleton and produce the hispid surface (Plate 52, D). Toxas are present throughout the choanosome. Oxeote modifications of the choanosomal megascleres are commonly found at the apices of the fibres.

SPICULES (Plate 52, E):
Megascleres: Subtylostyles of two types, the first of which ranges from styles with pinched heads and a swelling sub-basally, to forms with large round tylostylote heads. The majority are subtylostyles. In addition, there are large, smooth, thick subtylostyles, slightly curved, sometimes spined or roughened on the head. The length of these spicules overlaps that of the first category. Both types are found within the fibres in the choanosome. Oxeote modifications are present but not abundant. Smooth, slender dermal subtylostyles with long tapered points and smooth heads.
Microscleres: Toxas of normal form, thin and flexed in the centre.
For spicule dimensions *see* Table 86.

REMARKS: This species is characterised by the presence of subtylostyles with terminal spines, and in having oxeote modifications of the principal megascleres, the latter being found at the ends of the fibres and extending beyond the dermal skeleton. Hallmann (1912), in his diagnosis of *Ophlitaspongia*, commented that the smooth structural styles sometimes exhibit oxeote modifications. He described oxeote modifications in *O. axinelloides*, but the small size of the main spicules and the lack of microscleres differentiate this species from *Ophlitaspongia oxeata*.

Ophlitaspongia oxeata is close to *O. pennata* as described by Bakus (1966). *Ophlitaspongia pennata* has microspining on the heads of the large subtylostyles and the skeletal organisation and spicule measurements are similar to the New Zealand species. Bakus did not record the presence of oxeote modifications of the styles.

Ophlitaspongia reticulata n.sp. (Plates 52, F; 53, A–C)

MATERIAL EXAMINED: Leigh, intertidal; Piha, intertidal; Westmere Reef, intertidal; Mayor Island, intertidal.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 118.

TYPE LOCALITY: Leigh, intertidal.

DESCRIPTION: An encrusting sponge found on shaded ledges and beneath overhanging rock.

DIMENSIONS: Thickness 3–6 mm; extent of mat 60 × 45 mm.

COLOUR: In life, deep brick red (10.0R 3/6); in spirit, brown (2.5Y 6/4).

TEXTURE: Firm, incompressible.

TABLE 86. Spicule dimensions of *Ophlitaspongia oxeata*.

Locality		Subtylostyles (μm)	Large subtylostyles (μm)	Dermal subtylostyles (μm)	Toxas (μm)	Styles with oxeote modifications (μm)
Great Barrier Id, intertidal	$\bar{x}$	336 × 14	304 × 27	286 × 4	63	387 × 14
	Range	172–485 × 12.5–17.5	255–390 × 23–30	225–360 × 3–6	40–75	290–600 × 12–17

SURFACE: The surface is microscopically hispid. Small pores 0.3 mm in diameter and flush with the surface are visible.

SKELETON: The sponge has a basal spongin mat which extends into plumose fibres cored and echinated by subtylostyles (Plate 52, F). Near the base of the sponge the fibres form a plumo-reticulation where the echinating spicules, encased in spongin, connect adjacent plumose columns. A dermal skeleton of slender subtylostyles is present. These subtylostyles lie tangentially or in brushes and are also found in the choanosome. The principal subtylostyles extend beyond the dermal skeleton and produce the hispid surface (Plate 53, A). Toxas are present throughout the choanosome.

SPICULES (Plate 53, B, C):
Megascleres: Subtylostyles which can be either styles with smooth rounded heads, styles with pinched heads and a swelling sub-basally, tylostyles or subtylostyles. There is a large size range both in length and width. Smooth, slender dermal subtylostyles with long tapered points and finely spined heads.
Microscleres: Toxas with a wide central flexure, recurved ends without terminal spining, up to 3 μm thick.
For spicule dimensions *see* Table 87.

REMARKS: *Ophlitaspongia reticulata* is characterised by having a plumose skeleton with a basal reticulation, faint spines on the heads of the dermal subtylostyles, and by the large size range of the principal megascleres. It differs from *Ophlitaspongia oxeata* in the absence of oxeote-modified styles, and in having large subtylostyles without terminal spines. The two species are alike in external appearance, skeletal organisation and spicule measurements.

Ophlitaspongia reticulata resembles *O. pennata* var. *californiana* Bakus, 1966, both species having smooth subtylostyles. However, the New Zealand sponge has consistently larger megascleres. De Laubenfels (1954) described *Ophlitaspongia mima* with large principal megascleres but did not record the dimensions of the dermal spicules.

TABLE 87. Spicule dimensions of *Ophlitaspongia reticulata*.

Locality		Subtylostyles (μm)	Dermal subtylostyles (μm)	Toxas (μm)
Leigh, intertidal	x̄	369 × 19	294 × 3	60
	Range	260–520 × 16–22	235–390 × 2.5–4	35–80
Mayor Island, intertidal	x̄	376 × 27	313 × 5	72
	Range	300–490 × 19–33	230–375 × 4–6.5	50–92
Piha, intertidal	x̄	361 × 21	257 × 3.5	62
	Range	270–490 × 15–28	180–350 × 3–4	35–90
Westmere Reef, intertidal	x̄	410 × 27	314 × 6	76
	Range	311–550 × 23–31	230–410 × 4–7	40–100

Ophlitaspongia sp. (Plate 53, D)

REMARKS: A third species of *Ophlitaspongia* has been found from Dunedin, but due to the small size of the specimen cannot be described at present.

Isociella Hallmann, 1920

DIAGNOSIS: Clathriidae in which the skeleton consists of an irregular reticulation of smooth monactinal spicules. There is no well-developed fibre. The ectosomal skeleton consists of slender monactinal spicules disposed in continuous and erect spicule brushes. Microscleres are palmate isochelae that may be accompanied by toxas.

TYPE SPECIES: *Phakellia flabellata* Ridley & Dendy, 1886.

REMARKS: This genus has a less compact dermal skeleton than *Rhaphidophlus* but the construction is similar (cf. Figs 10e and 11d). It differs from *Rhaphidophlus* in the absence of acanthose megascleres. The four genera, *Axociella, Isociella, Ophlitaspongia* and *Artemisina* all have smooth monactinal megascleres. *Isociella* can be distinguished from *Axociella* primarily by the degree of spongin fibre development; *Axociella* has fibre throughout the choanosomal skeleton whereas *Isociella* does not. Also *Isociella* has a distinct dermal skeleton, a feature not found in *Axociella*, where ectosomal spicules are not abundant (Fig. 11c). *Isociella* is very similar to *Artemisina* in skeletal construction (cf. Figs 11a and b). The toxas of the majority of the species of *Artemisina* are, however, very distinctive, with marked terminal spines. To resolve whether these genera should be synonymised, examination of the type species of both is necessary. The two *Artemisina* species found in New Zealand have terminally spined toxas, so the two genera are retained until skeletal characters of the type species can be evaluated.

Isociella incrustans Bergquist (Plates 53, E, F; 54, A, B)

Isociella incrustans Bergquist, 1961a: 43, fig. 15a, b

MATERIAL EXAMINED: Ahipara Bay, intertidal (holotype); Muriwai, intertidal; Maori Bay, intertidal; Maori Island, 19 m (two specimens); Sponge Garden, Leigh, 18 m (two specimens); Outer Waterfall Reef, Leigh 12 m; Barren Arch, Poor Knights Islands, 23 m.

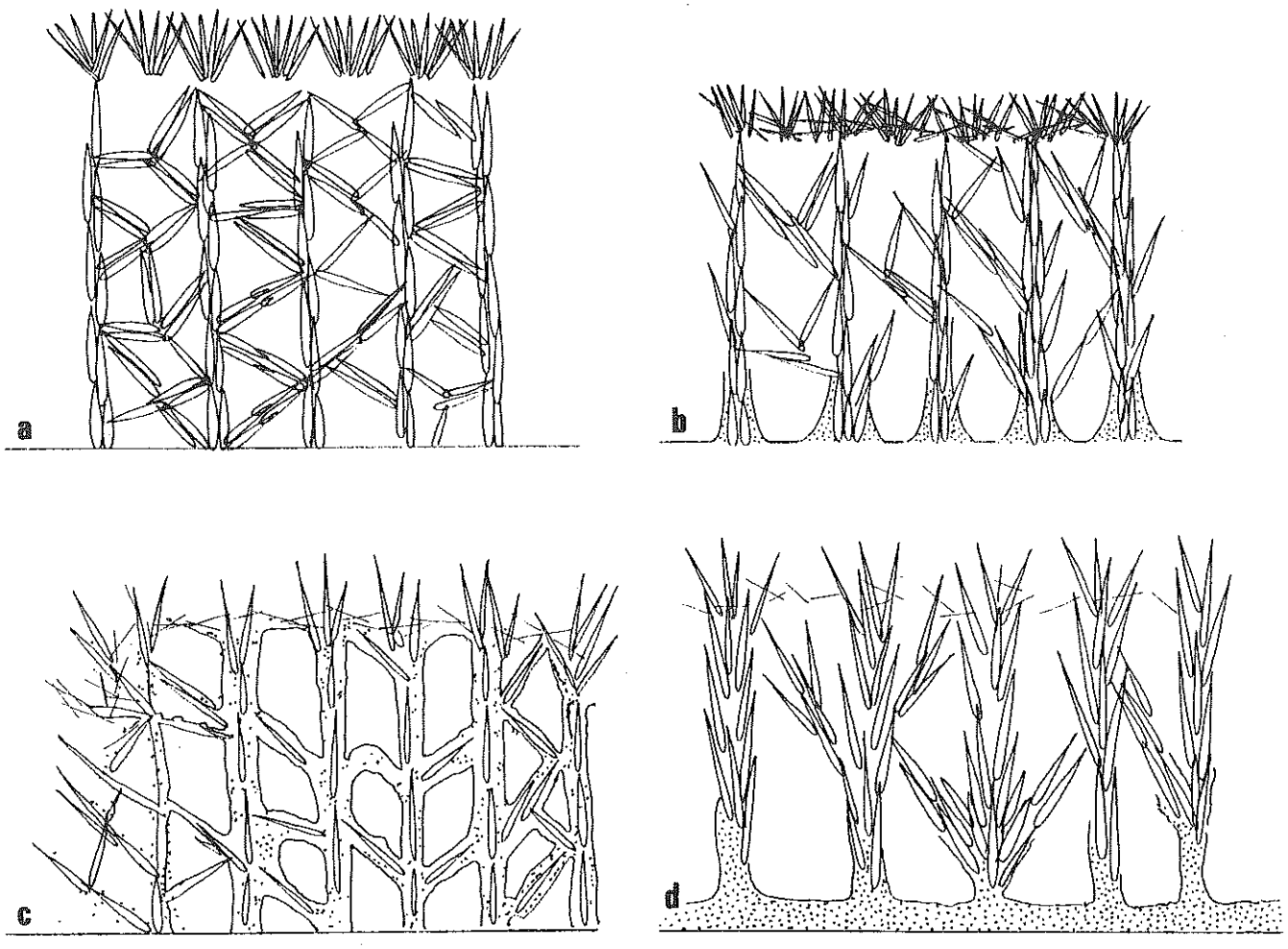

FIG. 11. Comparison of skeletal organisation in New Zealand clathriid genera with smooth principal megascleres. a, *Artemisina jovis* Dendy: irregular reticulate skeleton without fibre development; b, *Isociella incrustans* Bergquist: irregular reticulate skeleton with some fibre development; c, *Axociella toxitenuis* n.sp.: fibrous reticulate skeleton; d, *Ophlitaspongia oxeata* n.sp.: fibrous plumose skeleton.

DESCRIPTION: This sponge ranges in form from encrusting to massive and spreading.

DIMENSIONS: Length up to 52 mm; width up to 35 mm; thickness 12–28 mm.

COLOUR: In life, various shades of scarlet (10.0R 4/8, 7.5R 4/12, 5.0R 4/14); in spirit, white to pink (5.0YR 7/4) to brown (5.0YR 4/4).

TEXTURE: Firm and resilient.

SURFACE: The surface is smooth, covered with a dermal membrane up to 0.5 mm thick. Oscules are small, 0.8–1.4 mm in diameter, usually raised up to 2.0 mm above the surface and distributed without order.

SKELETON: The skeleton is an irregular reticulation of tracts 70–120 μm wide, cored and irregularly echinated by styles (Plate 53, E). Spongin fibre development is found in varying degrees in the specimens examined. Auxiliary subtylostyles occur in the choanosome, and also in the ectosomal skeleton as a compact dermal palisade (Plate 53, F).

SPICULES (Plate 54, A, B):
Megascleres: Smooth styles in two sizes, curved, with long tapered points and occasionally with a subtylote swelling behind the head. Subtylostyles in two sizes, straight and smooth, with faintly spined heads, and thinner than the principal styles.
Microscleres: Palmate isochelae of normal form (Plate 54, B). Small fine toxas, strongly flexed, variable in length and terminally smooth.
For spicule dimensions *see* Table 88.

REMARKS: All specimens had similar gross morphology, skeletal organisation and megasclere complement. The subtidal specimens had more pronounced fibre development and fewer toxas, only four or five in each spicule preparation. Bergquist and Sinclair (1973) noted that toxas can be produced or not pro-

TABLE 88. Spicule dimensions of *Isociella incrustans*.

Locality		Large styles (μm)	Small styles (μm)	Large subtylostyles (μm)	Small subtylostyles (μm)	Isochelae (μm)	Toxas (μm)
Ahipara Bay, intertidal Bergquist (1961a)	Range	320–350 × 13–14	200–240 × 7–11	280–340 × 7–11	140–230 × 3–6	11–14	
HOLOTYPE remeasured	x̄	311 × 12	207 × 9	314 × 6	201 × 5	15	
	Range	235–390 × 8–15	170–250 × 8–11	270–350 × 5–7.5	165–240 × 4–6	14–16	
Muriwai, intertidal	x̄	360 × 14	243 × 10	333 × 6	217 × 6	14	
	Range	270–415 × 10–17.5	215–280 × 8–12.5	280–400 × 5–7.5	145–245 × 4.5–7.5	12–16	
Maori Bay, intertidal	x̄	374 × 17	223 × 15	334 × 8	205 × 6	16	
	Range	310–420 × 12.5–23	175–265 × 8–18	300–370 × 6.5–8.5	175–250 × 4.5–7.5	13–17	
Maori Island, 19 m specimen 1	x̄	355 × 17	236 × 12	343 × 7	217 × 6	16	
	Range	300–440 × 14–21	175–260 × 9.5–14.5	282–430 × 5–8.5	180–275 × 5–6.5	13–17	
Maori Island, 19 m specimen 2	x̄	384 × 18	254 × 13	335 × 6	233 × 6	16	63 Rare
	Range	300–450 × 14.5–20	225–285 × 9–16	290–400 × 5.5–8	170–270 × 4.5–7.5	14–18	50–70
Sponge Garden, Leigh, 18 m specimen 1	x̄	362 × 17	266 × 13	387 × 8	226 × 7	16	92
	Range	310–440 × 16–20	235–290 × 11–17	300–450 × 4.5–9	160–300 × 5.5–8	13–17	50–140
Sponge Garden, Leigh, 18 m specimen 2	x̄	417 × 16	247 × 15	382 × 7	234 × 6	16	79 Rare
	Range	315–470 × 11–21	165–300 × 10–21	320–445 × 5.5–8	180–272 × 5–7.5	15–17	55–130
Outer Waterfall Reef, Leigh, 12 m	x̄	354 × 15	237 × 12	352 × 7	224 × 6	16	98 Rare
	Range	310–410 × 11–19	205–270 × 9–14	300–395 × 6–9	180–280 × 5–8.5	13–17	70–150
Barren Arch, Poor Knights Is, 23 m	x̄	392 × 13	249 × 11	387 × 7	248 × 6	16	72
	Range	300–510 × 10–15	190–290 × 9–13	310–430 × 4.5–10	190–280 × 3–8	15–17	45–108

duced on a quite individual and random basis in *Microciona* species and this may also be the case in *Isociella incrustans*. The megascleres and isochelae were identical in all specimens.

Isociella incrustans is included in *Isociella* because of the construction of the skeleton. It is distinguished from all species of *Axociella* found in New Zealand by the pronounced dermal skeleton, weak spongin fibre development, and in having only two categories of microsclere. It differs from the New Zealand species of *Artemisina* in lacking terminal spining on the toxas, and in having slightly stronger fibre development.

Axociella Hallmann, 1920

DIAGNOSIS: Clathriidae of erect, branching or ramose habit. The choanosomal skeleton consists of an axially condensed plumo-reticulation of well-developed spongin fibre cored by smooth monactinal spicules. The same monactinal spicules form an extra-axial reticulation invested by a light layer of spongin. The ectosomal skeleton consists of dispersed monactinal spicules arranged either tangentially or erect; these spicules are not abundant. Microscleres are palmate isochelae and toxas.

TABLE 89. Spicule dimensions of *Axociella macrotoxa*.

Locality		Styles (μm)	Subtylostyles (μm)	Large toxas (μm)	Small toxas (μm)	Isochelae (μm)
Little Barrier Id, 73 m	x̄	433 × 19	270 × 6	377 × 8	46	24
	Range	300–650 × 17–31	220–358 × 4.5–7.5	275–470 × 4.5–13	40–55	23–25
Slipper Island, 31 m	x̄	339 × 14	292 × 6	349 × 8	43	25
	Range	290–370 × 11–17.5	200–360 × 4.5–7	210–425 × 5–10.5	33–50	23–26
Poor Knights Is, 15 m	x̄	338 × 15	306 × 5	332 × 9	44	19
	Range	230–470 × 11–16	230–450 × 4–7.5	270–410 × 4.5–16	38–53	17–20

TYPE SPECIES: *Esperiopsis cylindrica* Ridley & Dendy, 1886

Axociella macrotoxa n.sp. (Plate 54, C–F)

MATERIAL EXAMINED: Poor Knights Islands, 15 m; Little Barrier Island, 73 m; Slipper Island, 31 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 119.

TYPE LOCALITY: Little Barrier Island, 73 m.

DESCRIPTION: An encrusting to massive sponge with oscules surrounded by a stellate pattern of canals (Plate 54, C). Mucous is exuded when the sponge is collected.

DIMENSIONS: Height 40 mm; width 40 mm; thickness 30 mm.

COLOUR: In life, bright red (7.5R 5/10); in spirit, cream to brown (7.5YR 4/4).

TEXTURE: Compressible.

SURFACE: Immediately on removal from water the smooth surface membrane breaks down and is shed with a mucous derived from the underlying matrix. The preserved specimens have exhalent oscules 3.0 mm wide, raised 2.0 mm above the surface. Exhalent canals form a stellate pattern around the oscules, and this gives a marked ridged appearance to the surface, which is also microscopically hispid.

SKELETON: The choanosomal skeleton consists of an axial region of well-developed spongin fibre organised into a condensed reticulation (Plate 54, D). The main tracts are cored by single styles, occasionally two or three. Near the surface of the sponge there is a reticulation of styles with weak fibre development (Fig. 54, E) and the apical styles produce a hispid surface. The dermal skeleton consists of isolated clusters of subtylostyles; these are also found in clusters in the choanosome. Large toxas are visible throughout the choanosomal skeleton, particularly contributing to the hispid surface. Small toxas and isochelae occur interstitially.

SPICULES (Plate 54, F):
Megascleres: Smooth, slightly curved styles with long tapered points and a large size range in both length and width. Smooth, slender subtylostyles, straight or slightly curved, with faint spining on the head.
Microscleres: Extremely long, smooth toxas, approximately 400 μm with a wide central flexure (Plate 54, F); also toxas of normal form, short, smooth and thin, with a wide central flexure. Palmate isochelae of normal form.
For spicule dimensions *see* Table 89.

REMARKS: There are three differences in spiculation between the Poor Knights Islands specimen and the specimens from Little Barrier and Slipper Islands. In the Poor Knights Islands specimen some of the styles have a subtylote ridge beneath the head, the isochelae are smaller, and the large toxas are variable in shape, occasionally having a swelling in the centre of the flexure, or lacking recurved ends. However, in all other characters the sponges are identical and these differences are construed to be intraspecific variation.

Axociella toxitenuis n.sp. (Plate 55, A–C)

MATERIAL EXAMINED: NZOI Stn J955, near Cape Reinga, 50 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 120.

TYPE LOCALITY: NZOI J955, 34°25.9′S, 172°34.6′E, near Cape Reinga, 50 m.

DESCRIPTION: The sponge is erect with a single elongate branch above a short compressed stem (Plate 55, A).

DIMENSIONS: Overall height 50 mm; height of stem 10 mm; width of stem 10 mm; width of frond 15 mm; thickness 10 mm.

TABLE 90. Spicule dimensions of *Axociella toxitenuis*.

Locality		Styles (μm)	Subtylostyles (μm)	Large toxas (μm)	Small toxas (μm)	Isochelae (μm)
NZOI Stn J955, near Cape Reinga, 50 m	x̄	463 × 20	403 × 5	422 × 3	48	22
	Range	370–720 × 15–28	320–510 × 4–5.5	230–530 × 2–4.5	42–53	20–24

COLOUR: In life, red (7.5R 4/10); in spirit, dull yellow (5.0Y 8/4).

TEXTURE: Firm and compressible.

SURFACE: The surface is invested by a fine dermal membrane and perforated by oscules 1.5 mm wide. Exhalent canals are visible beneath the membrane and the surface is microscopically hispid.

SKELETON: The choanosomal skeleton consists of an axial region of well-developed spongin fibre tracts, which form a condensed reticulation (Plate 55, B). Each main fibre is cored by one to four styles. Near the surface is a narrow region that consists of a reticulation of styles with weak fibre development, and above this dermal subtylostyles are found tangentially or erect but they are not abundant. Subtylostyles are abundant in the choanosome where they occur in clusters. Long fine toxas, short fine toxas, and isochelae occur interstitially.

SPICULES (Plate 55, C):
Megascleres: Smooth styles, straight or curved with short points. Smooth, slender subtylostyles, which are frequently stylote and spined on the head.
Microscleres: Toxas of two types; very long and thin with a slight central flexure, and small and fine with a wide central flexure. Palmate isochelae of normal form.
For spicule dimensions *see* Table 90.

REMARKS: This species differs primarily from *Axociella macrotoxa* in the morphology of the large toxas, colour and habit.

Axociella multitoxaformis n.sp.
(Plates 55, D–F; 56, A).

MATERIAL EXAMINED: Three Kings Islands, 108 m; NZOI Stns E269, near Cape Maria van Diemen, 59 m; J955, near Cape Reinga, 50 m.

HOLOTYPE: In collection of the National Museum of New Zealand, Wellington, type number Por. 121.

TYPE LOCALITY: Three Kings Islands, 108 m.

DESCRIPTION: The sponges are erect and branching. A firm central stem divides into ramose branches that are flattened at the point of dichotomy (Plate 55, D).

DIMENSIONS: For sponge dimensions *see* Table 91.

TABLE 91. Sponge dimensions of *Axociella multitoxaformis*.

Locality	Height (mm)	Width × thickness of stem (mm)	Width × thickness of branch (mm)
Three Kings Is, 108 m	160	30 × 16	13–30 × 8–10
NZOI Stn J955, near Cape Reinga, 50 m	85	15 × 9	7–20 × 6–12
NZOI Stn E269, near Cape Maria van Diemen, 59 m	180	18 × 6	10–16 × 6

COLOUR: In life, orange (2.5YR 6/12); in spirit, cream to brown (10.0YR 5/6).

TEXTURE: Firm and compressible.

SURFACE: The surface is hispid microscopically and oscules ⩽ 2 mm wide are present along the edges of the branches. In the preserved specimens the surface is ridged where the spicule-spongin fibre skeleton terminates at the surface.

SKELETON: The choanosomal skeleton consists of an axial region of well-developed spongin fibre forming a condensed reticulation (Plate 55, E). The fibres are cored by one to four styles. Near the surface the same reticulation occurs but with less fibre development. Styles at the apices of this reticulation form a hispid surface (Plate 55, F). The ectosomal skeleton consists of dermal subtylostyles occurring in brushes and tangentially. These spicules are also found interstitially.

SPICULES (Plate 56, A):
Megascleres: Smooth, slightly curved styles with long tapered points. There is a large range of sizes in both length and width. Smooth, slender subtylostyles, straight or slightly curved.
Microscleres: Toxas of three types – forms which have a great size range, a wide central flexure and slightly recurved ends; a form which is short, smooth, and up to 10 μm wide, and with well-defined pointed ends, having the appearance of small oxeas; and a form

TABLE 92. Spicule dimensions of *Axociella multitoxaformis*.

Locality		Styles (μm)	Subtylostyles (μm)	Toxas 1 (μm)	Toxas 2 (μm)	Toxas 3 (μm)	Isochelae (μm)
NZOI Stn E269, near Cape Maria van Diemen, 59 m	$\bar{x}$	345 × 23	249 × 4	186 × 4	172 × 9	42	22
	Range	290–440 × 14–30	140–340 × 3.5–4.5	150–220 × 3–5	135–230 × 6–16	35–48	18–25
Three Kings Is, 108 m	$\bar{x}$	348 × 19	264 × 4	178 × 4	174 × 8	39	20
	Range	280–460 × 17–23	200–330 × 3–5	150–220 × 2.5–5	170–180 × 5–10	33–43	18–23
NZOI Stn J955, near Cape Reinga, 50 m	$\bar{x}$	379 × 26	292 × 5	196 × 8	191 × 6	41	20
	Range	320–500 × 21–30	240–390 × 3.5–6.5	180–233 × 6–10	158–232 × 3–14	38–48	19–21

which is small and fine, with a wide central flexure. Palmate isochelae of normal form.
For spicule dimensions *see* Table 92.

REMARKS: The three species of *Axociella* found in New Zealand are closely related. They have similar surface characteristics but can be distinguished by fine surface detail. Their spiculation is also similar but each species is distinctive in their toxa complement and morphology.

Axociella macrotoxa is a massive sponge with large oscules raised above the surface, and with distinctive toxas 300 μm long. *Axociella multitoxaformis* has toxas similar in shape to those seen in *A. macrotoxa*, but the average length is 200 μm. *Axociella multitoxaformis* is an erect branching sponge with small oscules flush with the surface. *Axociella toxitenuis* is also an erect sponge but not branching. The oscules are small and flush with the surface. This species lacks the large toxas seen in *A. macrotoxa* or the smaller version seen in *A. multitoxaformis*. *Axociella toxitenuis* has long fine toxas not seen in the other species.

Few species of *Axociella* have been described from the Southern Hemisphere. The Australian species *A. cylindrica* Ridley & Dendy, 1886, is distinguished by short, thick toxas not seen in the New Zealand species. *Axociella nervosa* Lévi, 1963, has a flabellate growth form and three sizes of isochelae, *A. nidificata* (Kirkpatrick) does not have isochelae and *A. flabellata* (Topsent) has spined toxas of the type associated with the genus *Artemisina*.

Artemisina Vosmaer, 1885

DIAGNOSIS: Clathriidae in which the principal skeleton is an irregular reticulation of monactinal spicules. There is no spongin fibre development, and no accessory megascleres. The ectosomal skeleton consists of dermal brushes of slender monactinal spicules. Microscleres are palmate isochelae and toxas with terminal spines.

TYPE SPECIES: *Suberites arciger* Schmidt, 1870

Artemisina jovis Dendy (Plate 56, B–E)

Artemisina jovis Dendy, 1924: 343, pl. xii fig. 6; Burton 1930: 530.

MATERIAL EXAMINED: BM(NH) 23.12.1.112, east of North Cape, 128 m (type); NZOI Stn B93, Three Kings Islands, 55–110 m.

DESCRIPTION: An erect, stalked, fan-shaped sponge with a marked curving of the lamella toward the inhalent surface (Plate 56, B). This curvature produces a conspicuous hump on the exhalent surface just above the stalk.

DIMENSIONS: Height 120 mm; width across lamella 80 mm; thickness of lamella 15–30 mm (through hump); stalk width 8 mm; stalk length 55 mm.

COLOUR: In life, light orange (7.5YR 7/6); in spirit, fawn (2.5Y 7/2).

TEXTURE: The lamella is firm, the stalk hard.

SURFACE: The surfaces are differentiated into inhalent – over which the dermal membrane is finely and evenly reticulate and perforated by numerous pores – and exhalent, where the membrane is a more compact reticulation and numerous oscular turrets are present. The diameter of the turrets is 2–6 mm.

SKELETON: The choanosomal skeleton consists of irregular plumose tracts cored by styles arranged in loose bundles and fibres (Plate 56, C). The ectosomal skeleton consists of fans of styles supporting the dermal membrane (Plate 56, D).

SPICULES (Plate 56, E):
Megascleres: Smooth, thick styles, usually curved, broadly rounded at the base, well-tapered and sharply pointed at the apex. Dermal styles which are straight, slender and smooth.

Microscleres: Small palmate isochelae, and toxas with a pronounced central flexure and reflexed ends that are terminally spined (Plate 56, E).
For spicule dimensions *see* Table 93.

REMARKS: This species is characterised by its distinctive external form and the terminal spining on the toxas.

*Artemisina elegantula Dendy

Artemisina elegantula Dendy, 1924: 344; Burton 1930: 531.

REMARKS: The type specimen (BM(NH) 23.10.1.113) is a juvenile sponge 12 mm tall. It is erect with a short stalk and lamellate body. The dermal membrane is supported by spicule brushes and the spicule complement is in agreement with Dendy's description. The species has not been recollected to date.

DISTRIBUTION: Three Kings Islands, 183 m.

Plocamia Schmidt, 1870

Dirrhopalum Ridley, 1881.
Lissoplocamia Brøndsted, 1924.
Holoplocamia de Laubenfels, 1936.

DIAGNOSIS: Clathriidae with a choanosomal skeleton composed of monactinal and diactinal megascleres. Primary tracts have spongin fibre development and are cored by styles and diactinal megascleres. These tracts are echinated by diactinal megascleres which frequently form a rectangular reticulation. A sparse ectosomal skeleton of thin erect monactinal spicules is present. Microscleres are palmate isochelae and toxas.

TYPE SPECIES: *Plocamia gymnazusa* Schmidt, 1870

REMARKS: *Plocamia* and related genera such as *Plocamilla* and *Heteroclathria* are not completely typical of the Clathriidae in spiculation. They are included in the family because they share a number of characters, such as habit, ectosomal skeleton, skeletal organisation, fibre development, and microsclere types. The presence of diactinal megascleres among the principal spicules distinguishes them from all other clathriid genera. Examination of genera related to *Plocamia*, not at present available, would assist evaluation of the correct familial location of the plocamiids.

De Laubenfels (1936) established the genus *Holoplocamia* for sponges "like *Plocamia* but with spiny diactinal spicules". The degree of spining on the tylotes in the New Zealand species is variable and thus this feature is considered inadequate as a generic character.

Ridley (1881) established the generic name *Dirrhopalum* for sponges previously assigned *Plocamia*, a name he considered to be preoccupied by a genus of seaweed. According to the International Commission on Zoological Nomenclature (1961, Art. 1c) the name of an animal taxon is not to be rejected because it is the same as the name of a taxon that does not belong to the animal kingdom, hence the use of *Plocamia* is upheld.

Plocamia novizelanicum (Ridley)
(Plates 56, F; 57, A, B)

Dirrhopalum novizelanicum Ridley, 1881: 483, pl. xxix figs 8–16.
Holoplocamia novizelanicum. de Laubenfels 1936: 75.
Plocamilla novizelanicum. Lévi 1952: 54.
Plocamia novizelanica. Bakus 1966: 512.
Plocamilla novizelanica. Lévi & Lévi 1983: 965, fig. 27.

MATERIAL EXAMINED: Point Chevalier Reef, intertidal; Goat Island Bay, intertidal; Clifton Beach, intertidal; Sponge Garden, Leigh, 18 m (three specimens).

DESCRIPTION: A thin encrusting sponge, which may assume a ramose form. The ramose form has branches that are typically cylindrical, short, and separate, but which may anastomose.

TABLE 93. Spicule dimensions of *Artemisina jovis*.

Locality		Styles (μm)	Dermal styles (μm)	Interstitial styles (μm)	Isochelae (μm)	Toxas (μm)
TYPE E. of North Cape, 128 m Dendy (1924)		390 × 24	300 × 12		12	Each limb 100
TYPE remeasured	x̄	402 × 22	292 × 11	357 × 10	13	178
	Range	355–440 × 19–25	215–410 × 7.5–16	315–400 × 6–13	11–16	160–170
Three Kings Is, 55–110 m	x̄	387 × 20	356 × 12	343 × 7	13	154
	Range	275–450 × 14–24	285–440 × 10–14	320–390 × 5–9.5	11–15	110–190

DIMENSIONS: Encrusting form, up to 1.5 mm thick. Ramose form, height 28–45 mm; width apically 26–35 mm; width basally 6–9 mm; width of branches 3–8 mm.

COLOUR: In life, brick red (10.0R 5/10, 7.5R 5/10–5/12); in spirit, brown (2.5Y 4/4).

TEXTURE: Brittle.

SURFACE: The surface is extremely hispid, particularly in the ramose specimen. No pores or oscules are visible.

SKELETON: The skeleton consists of a reticulation with spongin fibre development marking the primary tracts, which are cored by one or two styles. The secondary tracts forming the reticulation consist of one or two tylotes without fibre development (Plate 56, F). Styles are present at the apices of the primary tracts and produce the hispid surface. Slender subtylostyles are found erect in the dermis but are not abundant. Toxas and isochelae occur interstitially.

SPICULES (Plate 57, A, B):
Megascleres: Short, stout, gently curved tylotes with well-rounded ends varying from slightly roughened to well-spined (Plate 57, A, B). Styles which are frequently tylostyles; these are stout spicules, slightly curved with long well-tapered points, and faintly spined heads. Straight, slender subtylostyles, faintly spined terminally.
Microscleres: Palmate isochelae of normal form and smooth toxas with a strong flexure.
For spicule dimensions *see* Table 94.

REMARKS: This species has tylotes with variable terminal spining, a feature which is more marked in intertidal specimens than in subtidal specimens. In all other aspects, including surface characters, skeletal construction, spicule complement and measurements, the specimens are very similar.

Lévi and Lévi (1983) described a South African sponge with acanthostrongyles as *Plocamilla novizelanicum*. The genus *Plocamilla* Topsent includes species with skeletons composed of an isodictyal reticulation of acanthostrongyles and acanthostyles. Lévi and Lévi were correct in describing the South African sponge as a *Plocamilla*, but after examination of New Zealand specimens of *Plocamia novizelanicum* it can be concluded that the South African and New Zealand specimens are not the same species. Lévi and Lévi figure strongyles that are spined all over, whereas *Plocamia novizelanicum* has tylotes with spining restricted to the heads. The sponge described

TABLE 94. Spicule dimensions of *Plocamia novizelanicum*.

Locality		Acanthotylotes (μm)	Styles (μm)	Subtylostyles (μm)	Isochelae (μm)	Toxas (μm)	Growth form	Degree of spining on tylotes
TYPE Bay of Islands Ridley (1881)		177 × 16	272 × 17–500 × 25	190 × 2–360 × 5	19	63 × 2	Branching	
Pt Chevalier Reef, intertidal	x̄	198 × 22	338 × 24	314 × 5	18	48	Ramose	Well-spined
	Range	172–220 × 18–26	278–415 × 19.5–28	230–365 × 3.5–6.5	15–20	20–80		
Goat Island Bay, Leigh, intertidal	x̄	166 × 14	290 × 15	244 × 4	17	55	Encrusting	Spined
	Range	145–182 × 10–17	200–365 × 12.5–17	210–295 × 3–4	16–19	35–72		
Clifton Beach, intertidal	x̄	150 × 14	290 × 13	246 × 3	16	58	Encrusting	Spined
	Range	110–165 × 12.5–15.5	228–370 × 12.5–17	205–280 × 2.5–3.5	15–17.5	40–70		
Sponge Garden, Leigh, 18 m specimen 1	x̄	202 × 19	371 × 22	305 × 4	18	55	Encrusting	Faint to smooth
	Range	170–220 × 15–22	270–470 × 17.5–25	240–350 × 3.5–6.5	15–22	28–72		
Sponge Garden, Leigh, 18 m specimen 2	x̄	193 × 19	366 × 18	281 × 5	18	60	Encrusting	Faint to smooth
	Range	160–220 × 16–23	280–500 × 11.5–25	248–330 × 4–6	16–19	30–75		
Sponge Garden, Leigh, 18 m specimen 3	x̄	192 × 18	332 × 19	288 × 4	18	64	Encrusting	Faint to smooth
	Range	168–218 × 16.5–20.5	270–460 × 17–22.5	225–380 × 3–5.5	16.5–19	50–75		

by Lévi and Lévi requires a new name, which is designated here as *Plocamilla levii* nom. nov., named after Professor Claude and Madame Pierette Lévi to acknowledge their contribution to the taxonomy of Southern Hemisphere sponges.

Plocamia novizelanicum is similar to *P. manaarensis* Ridley, 1881 and to *P. karykina* Bakus, 1966 in colour and habit, but differs in spicule dimensions.

***Plocamia prima** (Brøndsted) (Plate 57, C–E)

Lissoplocamia prima Brøndsted, 1924: 470, fig. 24a–d; Topsent 1928: 63; Lévi 1963: 63, fig. 73.

MATERIAL EXAMINED: Two miles east of North Cape, 101 m (holotype).

DESCRIPTION: A tall ramose sponge with a stiff, erect stalk slightly expanded at the base. The axis is unbranched for 50 mm; above this level the branching is frequent (Plate 57, C).

DIMENSIONS: Height 260 mm; width 70 mm (with branches compressed); axis 8–10 mm diameter; branches 4–7 mm diameter.

COLOUR: Brøndsted did not record the live colour; in spirit, dark maroon red (10.0R 3/4).

TEXTURE: Hard and incompressible in the stalk; compressible, soft and velvety in most of the branches.

SURFACE: Projecting dermal styles produce a hispid surface; no pores or oscules are visible.

SKELETON: The choanosomal skeleton consists of a central compacted reticulation of well-developed spongin fibre cored by tylotes and styles (Plate 57, D). Styles are found in the dermal region where they produce a hispid surface. Near the surface the reticulation has less spongin fibre development, and the fibres are approximately 60 μm wide compared to 180 μm in the stalk. Toxas and many foreign spicules occur interstitially.

SPICULES (Plate 57, E):
Megascleres: Stout, smooth tylotes with large, round, faintly spined heads (Plate 57, E). Smooth, stout styles, gently curved, with long well-tapered points and faintly spined heads. Long, slender styles found dermally and interstitially.
Microscleres: Smooth toxas with a slight central flexure.
For spicule dimensions *see* Table 95.

REMARKS: This sponge has not been recollected but the holotype has been examined. Lévi (1963) described a sponge from South Africa as *Lissoplocamia prima* and his specimen had palmate isochelae in the dermal membrane. The type specimen of *L. prima*, as were all of Brøndsted's specimens, was preserved in formalin and has lost the dermal membrane. Lévi is almost certainly correct in suggesting that palmate isochelae characterise this species, and in this case, *Lissoplocamia* Brøndsted becomes a synonym of *Plocamia* Schmidt.

OTHER RECORDS: South Africa, 57 m.

Axoplocamia Burton, 1935

***Axoplocamia ornata** (Dendy)

Bubaris ornata Dendy, 1924: 351, pl. xiv figs 25–27.
Plocamia ornata. Burton 1928: 129.
Axoplocamia ornata. Burton 1935: 402.

REMARKS: This species has not been recollected and no type specimen remains in the British Museum. Three slides remain and these were re-examined. There is a dense mass of basal acanthostrongyles in the skeleton and this is consistent with the basal strongyle mass as seen in *Bubaris vermiculata*. Dendy's assignment was certainly correct as to family; the sponge belongs to the Bubaridae but cannot be further described until additional material is collected. The genus *Axoplocamia* is probably a synonym of *Bubaris*.

DISTRIBUTION: Three Kings Islands, 183 m.

TABLE 95. Spicule dimensions of *Plocamia prima*.

Locality		Tylotes (μm)	Styles (μm)	Styles (μm)	Toxas (μm)	Isochelae (μm)
TYPE E. of North Cape, 101 m Brøndsted (1924)		270 × ⩽35	⩽800 × ⩽35		75 × 2	
TYPE remeasured	x̄	257 × 28	546 × 30	390 × 7	61	15 (2 isochelae found)
	Range	240–278 × 20–34	426–780 × 22–33	300–470 × 4–10	35–70	
South Africa, 57 m Lévi (1963)	Range	120–160 × 8–20	300–425 × 20–35	300–450	40–70	12

DISCUSSION

Early systematic work on sponges placed little emphasis on relationships or affinities within the phylum, apart from establishing major divisions based on the chemical nature of the skeleton. Bowerbank (1864, 1866, 1874, 1882) published a four volume monograph on the British sponges, and divided the group into the Calcarea, Silicea and Keratosa and proceeded to use the arrangement of the skeleton as his primary method of distinguishing genera and species. This was a simple system and useful, in view of the number of species described at that time.

Gray (1867) elaborated on Bowerbank's classification and established many new genera, a number of which are now grouped in the Poecilosclerida. He was one of the earliest authors to use spicule form as a diagnostic character for the allocation of sponges to orders, genera and species.

Vosmaer (1887) discussed the relationships within the phylum and the classificatory schemes that had already been established. His emphasis remained on the chemical nature of the skeleton for ordinal classification.

One of the first major taxonomic studies which attempted to define some of the relationships within the Porifera, including genera now placed in the Poecilosclerida, was the "Challenger" Expedition Report (Ridley and Dendy 1887). In this report attention was focused on the order Monaxonida, a group defined by the possession of spicules with one axis. Under this classificatory system, genera of the present Poecilosclerida were placed in two families of a suborder, Halichondrina. One family, the Heterorrhaphidae, included sponges with various types of megascleres and microscleres but in which chelae were always absent. This group included the subfamilies Tedaniinae, Desmacellinae and Hamacanthinae. The Tedaniinae was considered unusual within this family in having a megasclere spiculation and skeletal organisation reminiscent of the genus *Myxilla*. The second family, and that in which the majority of the genera now recognised to be poecilosclerid were placed, was the Desmacidonidae, characterised essentially by the presence of chelae. Ridley and Dendy considered that the complex and elaborate spicule form, the chela, was not likely to have arisen polyphyletically, and hence they grouped all genera with chelae together. The Desmacidonidae contained two subfamilies: the Esperellinae, which lacked echinating spicules, and the Ectyoninae, in which echinating spicules were present and where, in addition, there was a tendency to develop fibrous skeletons. The latter characteristic was considered to indicate a possible relationship of the Ectyoninae to the Axinellida. Ridley and Dendy realised that the two subfamilies as they construed them were not sharply defined, since, for example, the genus *Myxilla* placed in the Ectyoninae contained species with and without echinating spicules.

Topsent (1894) discussed the classification of the Monaxonida as interpreted by Ridley and Dendy, and combined the two families Heterorrhaphidae and Homorrhaphidae into a single group, the Haplosclerida. He also established a new family, the Poecilosclerida, which included the Desmacidonidae and some genera which had been included in the Heterorrhaphidae, namely, *Tedania, Desmacella* and *Hamacantha*. Most sponges within the Poecilosclerida had monactinal megascleres, but *Desmacidon*, the type genus of the Desmacidonidae *sensu* Ridley and Dendy had diactinal megascleres. Topsent introduced the new familial name largely because he considered that a genus which was exceptional within the group should not provide the family name. The Poecilosclerida contained four subfamilies, two of which corresponded with groups recognised by Ridley and Dendy, the Esperellinae for sponges without echinating spicules and with ectosomal and choanosomal megascleres that were not differentiated, and the Ectyoninae for sponges with echinating spicules that were usually spined. The two new subfamilies were the Dendoricinae for sponges lacking echinating spicules but having distinct choanosomal and ectosomal megascleres, and the Bubarinae which included sponges with rhabdostyles. Topsent recognised the possession of chelae as an important familial character, but he also noted that there were genera such as *Tedania, Desmacella* and *Hamacantha* which, although clearly related, did not have chelae. These genera he allocated to a subfamily on the basis of skeletal arrangement and the type and organisation of the megascleres.

Later authors have often introduced their works with a discussion of the classificatory scheme adopted. Lundbeck (1902) followed Ridley and Dendy in maintaining the Heterorrhaphidae, but used Topsent's family name Poecilosclerida for the Desmacidonidae. In 1905, he used the two subfamilies Ectyoninae and Esperellinae but renamed the latter Mycalinae, subdividing it into the Mycaleae and Myxilleae. Lundbeck also noted that this subfamily division was artificial and suggested that it may subsequently have to be abandoned or altered.

Topsent (1904) excluded the subfamily Bubarinae from the Poecilosclerida but retained the other three subfamilies he had earlier adopted.

Dendy (1905) discussed higher order classification and introduced a new name for the suborder Halichondrina, the Sigmatomonaxonellida, which had within it three families, the Haplosclerida, Desmacidonidae and Axinellidae. Dendy considered that Topsent's name Poecilosclerida was unnecessary and

he continued throughout his later publications to use the family name Desmacidonidae and to retain the subfamily divisions Ectyoninae, Esperellinae and Axinellinae.

A major contribution to the classification of the present Poecilosclerida was made by Hentschel (1923), who diagnosed existing groups and established several new families, the majority of which are still in use today. These included the Mycalidae, Esperiopsidae and Biemnidae in the suborder Protorhabdina, established for sponges with a simple megasclere spiculation and without spiny megascleres, and the Myxillidae, Tedaniidae, Coelosphaeridae, Crellidae, Clathriidae and five other related families which are no longer in use or have been removed from the Poecilosclerida. The latter groups were located in the suborder Poikilorhabdina, established for sponges with a complex megasclere and microsclere spiculation, and in which the megascleres frequently included spiny forms. In this work Hentschel designated many subfamilial groups of poecilosclerid genera as families, and the poecilosclerid group as a whole was treated as an order. Hentschel included the suborders Protorhabdina and Poikilorhabdina in the order Cornacuspongida. The designation originated with Vosmaer (1887), and in Hentschel's work the group was equivalent to the Monaxonida as construed by Ridley and Dendy. It fell within a group which included part of the Tetraxonida as well as all of the Cornacuspongida of Vosmaer. Hentschel abandoned the use of the groups Esperellinae and Ectyoninae, but the suborders Protorhabdina and Poikilorhabdina had distinguishing characters which were similar to those employed previously to define these subfamilies.

In 1928, Topsent published a monumental taxonomic work in which ordinal status for the Poecilosclerida was established. This action was justified by drawing attention to the great diversity of species in the group, which was characterised by being the only order with chelae for microscleres. Topsent reserved the name Desmacidonidae for a family within the Poecilosclerida, having as type genus *Desmacidon*, and being characterised by the presence of one megasclere category only. New families added at the same time included the Anchinoidae, Hymedesmiidae, Plocamiidae, and Acarnidae, and most of the families established by Hentschel (1923) were retained. The order Poecilosclerida, more or less as it is defined today, was thus established as an entity.

Most subsequent work has concentrated on descriptions of taxa and on documenting sponge faunas; the assessment of ordinal and familial relationships has received little emphasis.

De Laubenfels (1936) published a major taxonomic work which had the primary objective of defining and classifying all genera of the class Demospongiae. This treatise, which has become a major reference for later sponge taxonomists, has a note in its introduction that divisions were established purely to simplify the arrangement of the phylum and with little heed to phylogenetic relationships. De Laubenfels used the ordinal group Poecilosclerida but removed the Desmacidonidae to the Haplosclerida because, stressing diactinal spiculation, he considered the family was related to the freshwater sponges and to the genus *Haliclona*. He included the Adociidae, Agelasidae, Raspailidae and a number of lithistid families within the Poecilosclerida on the basis of assumed affinities to genera which were clearly poecilosclerid. All of these families have more recently been transferred to other orders.

Burton (1932, 1934, 1959) described a number of sponge faunas from new localities, but in all cases tended to lump the species and often the genera to the point where it appeared that most Poecilosclerida were "reduced myxillids". This intriguing concept was neither defined properly nor explained in a phylogenetic context. Burton's synonymies are of limited value and need to be assessed critically.

Two recent works in which the classification of sponges "in toto" has been approached, albeit incompletely with respect to genera, are Lévi (1973) and Bergquist (1978). Both authors followed Topsent with respect to the status of the Poecilosclerida and accepted the family status of the groups diagnosed by Hentschel and Topsent. Neither author recognised the artificial subgroupings Esperellinae and Ectyoninae.

During the course of the present study van Soest (1984) published a taxonomic work which attempted to discuss both relationships and affinities between the families of the Poecilosclerida, and the relationship of the Poecilosclerida to other orders within the Demospongidae. Van Soest's ideas will be discussed in more detail below.

In this monograph families have been ordered according to increasing structural complexity of their skeleton and no phylogenetic progression between sequentially adjacent families is implied. The first four families discussed, the Mycalidae, Cladorhizidae, Biemnidae, and Desmacidonidae, all lack special ectosomal megascleres, exhibit no regional differentiation of the skeleton, and have only one megasclere category throughout the sponge.

The Mycalidae have stylote spicules of one size, a plumose or plumo-reticulate choanosomal skeleton, and include chelae in their microsclere complement. The Cladorhizidae also have one category of monactinal megasclere and incorporate chelae in the microsclere complement. These sponges are deep-water organisms with small stalked bodies in which an axial orientation of the spicule skeleton is imposed by the stalked habit. The Biemnidae are grouped with the Mycalidae and Cladorhizidae because they lack any regional differentiation in the skeleton and have only one category of monactinal megasclere. However, species of Biemnidae lack chelae and instead have abundant microscleres which include sigmas, rhaphides, toxas, commas and spheres. None of these

microsclere types are restricted in occurrence to the Poecilosclerida. We have noted earlier that an axially condensed reticulate skeleton is present in the genus *Biemna*, and that this feature had previously been held to indicate axinellid affinities (Bergquist 1970, Hooper 1984). Detailed attention to skeletal arrangement has proved informative in this regard; the "axial" skeleton proves simply to be a condensed reticulation. This leaves no doubt as to the poecilosclerid character of true species of *Biemna*. The genus *Neofibularia* is very close to *Biemna* in skeletal composition and also has a reticulate skeleton that could not be considered axinellid. Species of *Neofibularia* produce copious mucous, a histological attribute which is rare among the Axinellida, but common within the Poecilosclerida. It is necessary to gather more reproductive and biochemical data to support or question the classification adopted here. We make the point however, that skeletal organisation rather than skeletal composition appears to be a more informative attribute in this case. The genus *Desmacella* has always been considered somewhat anomalous within the Poecilosclerida because it has tylostyles with well-defined rounded heads as megascleres and a microsclere complement typically of sigmas, occasionally accompanied by rhaphides. Sigmas of classical form, not to be confused with sigmaspires and spirophorid sigmas, are common within the subclass Ceractinomorpha; they occur also in the order Axinellida but never in the order Hadromerida (Tetractinomorpha) where tylostylote megascleres are in large measure diagnostic. Rhaphides disposed in dragmata, an organisation which requires a very distinct morphogenesis, have a poecilosclerid/axinellid distribution and do not occur in the Hadromerida. The question "where do we classify a sponge which has tylostyles and sigmas or tylostyles plus trichodragmata"? is difficult indeed to answer and certainly exemplifies the problems encountered when systematic decisions place excessive emphasis on spicule characteristics. Clearly additional biochemical and reproductive data which permits comparison of *Desmacella* with typical hadromerid genera is essential in order to assess the ordinal placement of this genus.

The family Desmacidonidae has been used previously to accommodate many species of doubtful affinity. In this study, the family has been restricted to species with plumose, plumo-reticulate or reticulate skeletons which lack any regional differentiation. The megascleres are of one category only, with the exception of the genus *Echinostylinos*, but the spicules may be diactinal or monactinal. All genera in this family have chelae, but in *Chondropsis*, where the spicule skeleton is often reduced in quantity in favour of incorporating foreign material, most species lack chelae.

The next two families considered were the Coelosphaeridae and the Cornulidae. In both there is a single megasclere category, but the skeleton shows regional differentiation, frequently having spicules of smaller size occurring as an ectosomal skeleton. The Cornulidae was established by Lévi and Lévi (1983) for sponges included previously in the Coelosphaeridae but which possess palmate isochelae as microscleres. In both families chelae make up part of the microsclere complement and all genera possess fistulose inhalent/exhalent structures. It must be stressed that fistulose surface structure is not the primary discriminator on which the Cornulidae and Coelosphaeridae are defined, the discriminator is skeletal organisation considered in conjunction with the occurrence of fistules and specialised pore areas. The families are well defined on this basis, not "suspect" as van Soest (1984) suggested. No relationship with the Tedaniidae can be, or need be, urged as that author indicated.

The Tedaniidae is a distinctive family within the Poecilosclerida. All genera lack chelae and instead have onychaetes for microscleres. This fine roughened oxeote microsclere is not found anywhere else in the Demospongiae. Tedaniid sponges further possess two megasclere categories differentiated by size and type, and show regional differentiation of the skeleton. This family is considered in conjunction with the Hymedesmiidae and Phorbasidae because all three families are characterised by having two megasclere categories and by the absence of echinating spicules. However, the Tedaniidae is considered to be quite isolated, having no obvious relationship to other orders within the Poecilosclerida.

The Hymedesmiidae and Phorbasidae are closely related. Both have dermal diactinal megascleres and choanosomal monactinal megascleres, basal acanthostyles are frequently arranged erect on the substrate, and the microsclere complement includes chelae. The two families are further characterised by the presence of areolate pore areas on the surface and by plumose skeletons. It is in the Hymedesmiidae and Phorbasidae that true acanthose spicules occur for the first time in the sequence as adopted here. This is interesting as "spiny" spicules were often held to be a poecilosclerid characteristic, yet they are absent from seven of the twelve families recognised at present.

The Phorbasidae and Hymedesmiidae are retained as separate families because in the Phorbasidae the occurrence of fibre development and anastomosing skeletons signals a more advanced level of skeletal structure.

The Crellidae have a more complex skeletal arrangement than the families already discussed and the primary skeleton is plumose or plumo-reticulate in its organisation. There are three megasclere categories present and these are localised in the primary tracts of the choanosome, in the ectosome, and as echinating spicules along the primary tracts. This family has chelae in the microsclere complement as do the remaining two families, the Myxillidae and Clathriidae, but the Crellidae are distinguished by the presence of acanthose ectosomal spicules. A similar

arrangement is however found in one other genus, *Ectyomyxilla*, in the Myxillidae.

The Myxillidae are characterised by having a choanosomal reticulation which is isodictyal, by the presence of three megasclere categories, and by regional differentiation of the skeleton. Genera of this family have monactinal choanosomal megascleres and monactinal echinating spicules. The Myxillidae previously has included only sponges with diactinal ectosomal megascleres. In this study the genera *Allocia* and *Antho*, usually associated with the Clathriidae because of the presence of palmate isochelae and monactinal ectosomal spicules, are located within the Myxillidae and the family diagnosis is extended to include forms with such monactinal ectosomal megascleres. The Myxillidae is a well-defined family; the isodictyal reticulation of the skeleton, the three megasclere categories including echinating spicules, and the regional differentiation of megascleres within the skeleton, constitute a combination of characters not found in any other family.

The Clathriidae is characterised primarily by the presence of a plumose, plumo-reticulate, or reticulate skeleton usually with echinating spicules and, with the exception of the genus *Plocamia*, by the presence of monactinal megascleres throughout the sponge. The microscleres are also characteristic, including palmate isochelae and toxas, but never sigmas. These microscleres are found in other families, but in conjunction with the clathriid skeleton and the megasclere spiculation, they serve to diagnose the Clathriidae. The genus *Plocamia* is included in the Clathriidae because it has a reticulate skeleton with echinating spicules, an ectosomal skeleton of monactinal megascleres, and microscleres that are palmate isochelae and toxas. However, the echinating megascleres are diactinal and this is not found in any other clathriid or indeed poecilosclerid genus. Although *Plocamia* is retained at present in the Clathriidae, other related genera must be examined to enable a more precise assessment of its familial placement. An argument could be made for the recognition of an additional but related family group.

The suggested affinities of the families within the Poecilosclerida are shown in Fig. 12. Van Soest (1984) ordered the Poecilosclerida on the basis of relationships and affinities he had noted between the families, and summarised these in a figure (Fig. 13). The relationships he portrayed are presumed phylogenies incorporating some cladistic characters. No cladistic relationships should be assumed from the arrangement of the families depicted in Figure 12; the format is one of convenience.

With particular reference to the systematic treatment and discussion of the Poecilosclerida by van Soest (1984), the following observations can be made. The present study supports the conclusion drawn by van Soest that the Hymedesmiidae and Phorbasidae are closely related, and that the Crellidae can be distinguished by the presence of acanthose ectosomal spicules. Van Soest grouped the Mycalidae, Esperiopsidae and Cladorhizidae together on the basis that they all lacked a special category of ectosomal megascleres. In his figure depicting relationships between the families, he also allied the Biemnidae with this group of three families. A similar interpretation is made in this study, but the further suggestion by van Soest that the families Hamacanthidae and Biemnidae are distinguished solely by the presence of diancistras in the former cannot be discussed here because there are no members of the Hamacanthidae in the New Zealand material examined.

Van Soest did not maintain the family Tedaniidae, but relegated the genus *Tedania* to the Myxillidae. This decision is not upheld here. The skeletal arrangement of the New Zealand representatives of the Tedaniidae is quite distinct from the isodictyal reticulation characteristic of New Zealand myxillid genera, and the absence of echinating spicules and occurrence of onychaetes likewise support separation of these families. What holds for New Zealand representatives of these groups applies to all other material we have examined.

Van Soest suggested an affinity between the families Coelosphaeridae and Myxillidae (subfamily Tedaninae), because he construed fistulose habit to define the Coelosphaeridae, but at the same time viewed that character as being inadequate to sustain familial separation. There are severe shortcomings in any argument which implies that fistulose habit, wherever it occurs, is equivalent regardless of the morphology of the fistule produced; this is clearly naive. Such a view in this case ignores other familial characteristics of the Coelosphaeridae such as the particular megasclere spiculation and skeletal organisation characteristic of the family. Consequently, in this study, the Coelosphaeridae and Tedaniidae are retained as distinct families.

When considering the interrelationships between orders of the Demospongiae, van Soest noted that there was a possible close phylogenetic relationship between the Poecilosclerida and certain Axinellida, and as justification he cited the distribution of acanthose megascleres. Van Soest indicated that such a view conflicts with the division of the Demospongiae into the subclass Tetractinomorpha, into which the Axinellida fall, and Ceractinomorpha, into which the Poecilosclerida fall. This subclass division was established pre-eminently upon reproductive characters and has been tested and modified significantly since its inception (Lévi 1955). There are similarities in skeletal arrangement to be seen between some members of the orders Axinellida and Poecilosclerida. For instance, in the Clathriidae fibrous skeletons comparable to those of some axinellid genera are usual. This particular parallel has been noted repetitively in the literature (Ridley and Dendy 1887, Lévi 1956, Bergquist 1978, 1980), but only accumulation of more detailed biochemical and reproductive data on representatives of both groups can allow us to take the comparison

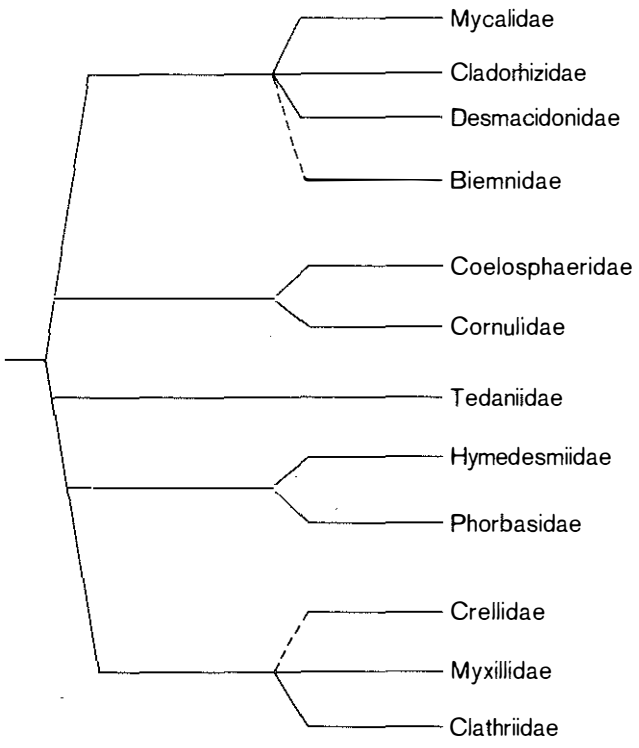

FIG. 12. Suggested relationships of the families within the order Poecilosclerida.

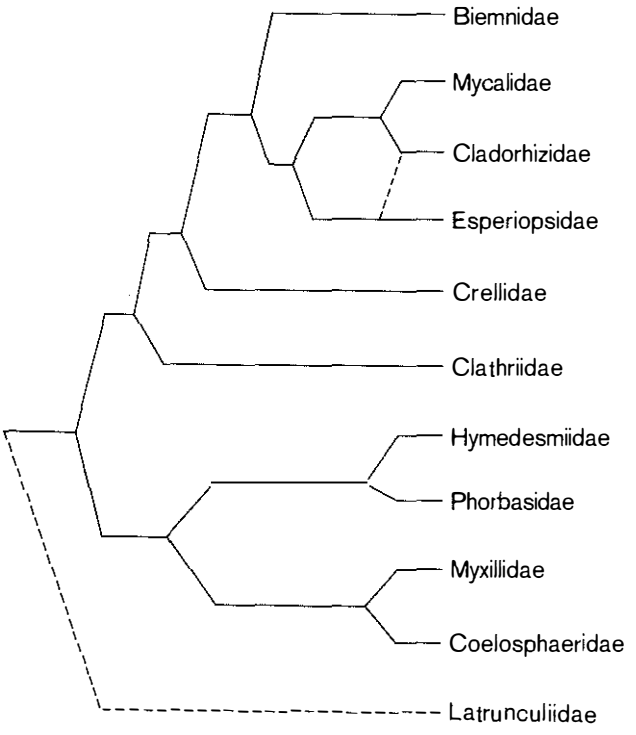

FIG. 13. Presumed phylogenetic relationships of the families within the order Poecilosclerida (from van Soest 1984).

further and to subdivide these groups which are clearly not homogeneous.

Van Soest noted that some poecilosclerid genera show similarities with haplosclerids, e.g., *Esperiopsis*, the Myxillidae, and certain clathriids, which have a reticulate, often spongin reinforced skeletal architecture. Certainly a stongly developed fibrous skeleton occurs in genera such as *Axociella* (Clathriidae) and *Callyspongia* (Haplosclerida), but the organisation of the skeleton is radically different. Such a broad descriptive character cannot be used to infer any close relationship between the genera.

In both van Soest's and the present study, an affinity of the genus *Desmacella* to the Hadromerida has been noted but, as mentioned earlier, more work is required before a firm relationship can be urged on a sound basis. Finally, van Soest incorporated the Latrunculidae "incertae sedis" within the Poecilosclerida, but this family, which is certainly difficult to place, we prefer to leave within the Hadromerida until there is sufficient information available to permit a thorough reappraisal of the relationships of the family.

Van Soest considered the occurrence of acanthose megascleres throughout the orders Poecilosclerida, Axinellida, and the class Sclerospongiae, and noted the presence of acanthose microscleres in the orders Hadromerida and Choristida, but never the occurrence of acanthose megascleres in the latter. He suggested that this might point to microsclere ancestry of the acanthose megascleres. Examination of the various types of acanthose megascleres leads us to the conclusion that many distinct structural types occur, even within one order. For instance, in *Crella*, the well-spined echinating acanthostyles and quite distinct styles with faintly spined heads, are distinct from megascleres with mucronate spined heads. It is difficult to sustain the view that these spicule types are morphogenetically identical, even more difficult when comparing them with the organised verticillate spining seen in the acanthose spicules of *Zyzza* and *Agelas*. If van Soest's idea is to be pursued, the type of acanthose megasclere being discussed requires careful qualification and the line of reasoning which leads to a suggestion of microsclere ancestry of acanthose megascleres must be documented. It is certainly not obvious.

REFERENCES

BAKUS, G.J. 1966: Marine poecilosclerida sponges of the San Juan Archipelago, Washington. *Journal of Zoology, London 149*: 415–531, 2 pls.

BERGQUIST, P.R. 1961a: A collection of Porifera from northern New Zealand, with descriptions of seventeen new species. *Pacific Science 15(1)*: 33–48.

BERGQUIST, P.R. 1961b: The Demospongiae (Porifera) of the Chatham Islands and Chatham Rise, collected by the Chatham Islands 1954 Expedition. *N.Z. Department of Scientific and Industrial Research Bulletin No. 139(5)*: 169–206, figs 1–6. [*N.Z. Oceanographic Institute Memoir 13*]

BERGQUIST, P.R. 1965: The sponges of Micronesia, Part I. The Palau Archipelago. *Pacific Science 19(2)*: 123–204.

BERGQUIST, P.R. 1968: The Marine Fauna of New Zealand : Porifera, Demospongiae, Part 1 (Tetractinomorpha and Lithistida). *N.Z. Department of Scientific and Industrial Research Bulletin No. 188* : 105 p. [*N.Z. Oceanographic Institute Memoir 37*]

BERGQUIST, P.R. 1970: The Marine Fauna of New Zealand : Porifera, Demospongiae, Part 2 (Axinellida and Halichondrida). *N.Z. Department of Scientific and Industrial Research Bulletin No. 197*: 85 p. [*N.Z. Oceanographic Institute Memoir 51*]

BERGQUIST, P.R. 1972: Deep water Demospongiae from New Zealand. *Micronesica 8(1–2)*: 126–36.

BERGQUIST, P.R. 1978: "Sponges". Hutchinson and Co., London. 268 p.

BERGQUIST, P.R. 1980: The ordinal and subclass classification of the Demospongiae (Porifera); appraisal of the present arrangement, and proposal of a new order. *N.Z. Journal of Zoology 7(1)*: 1–6.

BERGQUIST, P.R.; WARNE, K.P. 1980: The Marine Fauna of New Zealand : Porifera, Demospongiae, Part 3 (Haplosclerida and Nepheliospongida). *N.Z. Oceanographic Institute Memoir 87*: 77 p.

BERGQUIST, P.R.; LAWSON, M.P.; LAVIS, A.; CAMBIE, R.C. 1984: Fatty acid composition and the classification of the Porifera. *Biochemical Systematics and Ecology 12(1)*: 63–84.

BERGQUIST, P.R.; SINCLAIR, M.E. 1973: Seasonal variation in settlement and spiculation of sponge larvae. *Marine Biology 20(1)*: 35–44.

BOURY-ESNAULT, N.; VAN BEVEREN, M. 1982: Les Demosponges du plateau continental de Kerguelen-Heard. *Comité National Français des Researches Antarctiques (CNFRA) 52*: 175 p.

BOWERBANK, J.S. 1862: On the anatomy and physiology of the Spongiadae. *Philosophical Transactions of the Royal Society of London*: 747–829, 1087–1135.

BOWERBANK, J.S. 1864: "A Monograph of the British Spongiadae I." Ray Society, London. lxiii + 290 p., 37 pls.

BOWERBANK, J.S. 1866: "A Monograph of the British Spongiadae II". Ray Society, London. xx + 388 p.

BOWERBANK, J.S. 1874: "A Monograph of the British Spongiadae III". Ray Society, London. 384 p., 92 pls.

BOWERBANK, J.S. 1882: "A Monograph of the British Spongiadae. Edited with additions by the Rev. A.M. Norman. Vol. IV (supplementary)". Ray Society, London. xvii + 250 p., 17 pls.

BRØNDSTED, H.V. 1923: Sponges from the Auckland and Campbell Islands. Papers from Dr Th. Mortensen's Pacific Expedition 1914–16. XV. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjobenhavn 75* : 117–67.

BRØNDSTED, H.V. 1924: Sponges from New Zealand, Part I. Papers from Dr Th. Mortensen's Pacific Expedition, 1914–16. XXIII. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjobenhavn 77* : 435–83.

BRØNDSTED, H.V. 1926: Sponges from New Zealand, Part II. Papers from Dr Th. Mortensen's Pacific Expedition, 1914–16. XXXV. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjobenhavn 81* : 295–331.

BURTON, M. 1928: Report on some deep-sea sponges from the Indian Museum collected by the R.I.M.S. "Investigator". Part II. Tetraxonida (concluded) and Euceratosa. *Records of the Indian Museum 30(1)*: 109–38, pls I, II.

BURTON, M. 1929: Porifera. Part II. Antarctic Sponges. *Natural History Report. British Antarctic "Terra Nova" Expedition, 1910. Zoology 6(4)*: 393–458, 5 pls.

BURTON, M. 1930: Norwegian sponges from the Norman collection. *Proceedings of the Zoological Society, London 2*: 487–546, 2 pls.

BURTON, M. 1932: Sponges. *"Discovery" Reports 6*: 237–392, pls XLVIII–LVII.

BURTON, M. 1934: Sponges. *Scientific Reports of the Great Barrier Reef Expedition, 1928–29, 4(14)*: 513–621, 2 pls.

BURTON, M. 1935: The family Plocamiidae, with descriptions of four new genera of sponges. *Annals and Magazine of Natural History, series 10, 15*: 399–404.

BURTON, M. 1940: Las Esponjas marinas del Museo Argentino de Ciencias Naturales. (Parte 1). *Anales de Museo Argentino de Ciencias Naturales 40*: 95–121.

BURTON, M. 1959: Sponges. *Scientific Reports. John Murray Expedition, 1933–34, 10(5)*: 151–281, 41 text-figs.

BURTON, M.; RAO, H.S. 1932: Report on the shallow-water marine sponges in the collection of the Indian Museum. Part 1. *Records of the Indian Museum 34(3)*: 299–356, pl. XVIII.

CARTER, H.J. 1874: Descriptions and figures of deep-sea sponges and their spicules from the Atlantic Ocean, dredged up on board H.M.S. "Porcupine" chiefly in 1869; with figures and descriptions of some remarkable spicules from the Agulhas Shoal and Colon, Panama. *Annals and Magazine of Natural History, series 4, 14*: 207–21, 245–57.

CARTER, H.J. 1875: Notes introductory to the study and classification of the Spongida. *Annals and Magazine of Natural History, series 4, 16*: 1–40, 126–45, 177–200.

CARTER, H.J. 1876: Descriptions and figures of deep-sea sponges and their spicules, from the Atlantic Ocean, dredged up on board H.M.S. "Porcupine" chiefly in 1869 (concluded). *Annals and Magazine of Natural History, series 4, 18*: 226–324.

CARTER, H.J. 1880: Report on specimens dredged up from the Gulf of Manaar and presented to the Liverpool Free Museum by Capt. W.H. Cawne Warren. *Annals and Magazine of Natural History, series 5, 6*: 35–61.

CARTER, H.J. 1881: Supplementary report on specimens dredged up from the Gulf of Manaar, together with others from the sea in the vicinity of the Basse Rocks and from Bass's Straits respectively, presented to the Liverpool Free Museum by

Capt. H. Cawne Warren. *Annals and Magazine of Natural History, series 5, 7*: 361–85.

CARTER, H.J. 1882: Some sponges from the West Indies and Acapulco in the Liverpool Free Museum, described with general and classificatory remarks. *Annals and Magazine of Natural History, series 5, 9*: 266–301, 346–68.

CARTER, H.J. 1883: Contributions to our knowledge of the Spongida. *Annals and Magazine of Natural History, series 5, 12*: 308–29.

CARTER, H.J. 1885: Descriptions of sponges from the neighbourhood of Port Phillip Heads, South Australia. *Annals and Magazine of Natural History, series 5, 15*: 107–17, pl. IV, 196–222, 301–21; *series 5, 16*: 277–94, 347–68.

CARTER, H.J. 1886: Descriptions of sponges from the neighbourhood of Port Phillip Heads, South Australia, continued. *Annals and Magazine of Natural History, series 5, 17*: 40–53, 112–27, 431–41, 502–16; *series 5, 18*: 34–55, 126–49.

DENDY, A. 1894: Catalogue of non-calcareous sponges collected by J. Bracebridge Wilson, Esq., M.A., in the neighbourhood of Port Phillip Heads. Part I. *Proceedings of the Royal Society of Victoria, series 2, 7*: 232–60.

DENDY, A. 1895: Catalogue of non-calcareous sponges collected by J. Bracebridge Wilson, Esq., M.A., in the neighbourhood of Port Phillip Heads. Part II. *Proceedings of the Royal Society of Victoria, series 2, 8*: 14–51.

DENDY, A. 1905: Report on the sponges collected by Professor Herdman at Ceylon in 1902. Pp 59–246, pls 1–16 *in* "Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar, vol. 3". Royal Society, London.

DENDY, A. 1916: Report on the non-calcareous sponges collected by Mr James Hornell at Okhamandal in Kattiawar in 1905–6. *Report to the Government of Baroda on the Marine Zoology of Okhamandal in Kattiawar. Part 2*: 95–146, pls I–IV.

DENDY, A. 1921: Report on the Sigmatotetraxonida collected by H.M.S. "Sealark" in the Indian Ocean. *Transactions of the Linnean Society of London, Zoology 18(1)*: 1–164.

DENDY, A. 1924: Porifera. Part 1. Non-Antarctic sponges. *Natural History Report. British Antarctic "Terra Nova" Expedition, 1910. Zoology 6(3)*: 269–392, 15 pls.

DICKINSON, M.G. 1945: Sponges of the Gulf of California. *Allan Hancock Pacific Expeditions 11(1)*: 251 p.

DUCHASSAING DE FONBRESSIN, P.; MICHELOTTI, G. 1864: "Spongiaires de la mer Caraibe". Harlem, 115 p., 25 pls.

EHLERS, E. 1870: Die Esper'schen Spongien in der zoologischen Sammlung der K. Universitat Erlangen. *Druck der Universitats-Buchdruckerei von E. Th. Jacob*: 36 p.

ESPER, E.J.C. 1797: "Fortsetzungen der Pflanzenthiere in Abbildungen nach der Natur mit Farben erleuchtet nebst Beschreibungen". Erster Theil, Nürnberg. 230 p.

FELL, H.B. 1950: The Kirk collection of sponges (Porifera) in the Zoology Museum, Victoria University College. *Zoology Publications from Victoria University College No. 4*: 12 p, 1 pl.

FRISTEDT, K. 1885: Bidrag till Kannedomen om de vid Sveriges vestra Kust lefvande Spongiae. *Kungliga Svenska Vetenskapsakademiens Handlingar 21*: 1–56.

FRISTEDT, K. 1887: Sponges from the Atlantic and Arctic Oceans and the Behring Sea. *VegaExpeditionens Vetenskapsakademiens Iakttagelser (Nordenskiold) 4*: 401–71.

GEORGE, W.C.; WILSON, H.V. 1919: Sponges of Beaufort (N.C.) Harhor and vicinity. *Bulletin of the Bureau of Fisheries 36(876)*: 129–79.

GRAY, J.E. 1867: Notes on the arrangement of sponges, with the description of some new genera. *Proceedings of the Zoological Society of London, 1867*: 492–558, pls 27, 28.

GRAY, J.E. 1872: Notes on the classification of the sponges. *Annals and Magazine of Natural History, series 4, 9*: 442–61.

HALLMANN, E.F. 1912: Report on the sponges obtained by the F.I.S. "Endeavour" on the Coasts of New South Wales, Victoria, South Australia, Queensland and Tasmania. Part I. *Zoological Results of the Fisheries Experiments of the "Endeavour", Part II*: 117–300.

HALLMANN, E.F. 1914: A revision of the monaxonid species described as new in Lendenfeld's "Catalogue of the sponges in the Australian Museum". Part I. *Proceedings of the Linnean Society of New South Wales 39(2)*: 263–315. Part II. *Ibid.*: 327–76, pls XV–XXIV.

HALLMANN, E.F. 1916: A revision of the genera with microscleres included, or provisionally included, in the family Axinellidae; with descriptions of some Australian species. Part II. *Proceedings of the Linnean Society of New South Wales 41(4)*: 495–552, pls XXIX fig. 4, XXX–XXXII, XXXIII figs 1–5, XXXIV–XXXVII, XXXVIII figs 1–4.

HALLMANN, E.F. 1920: New genera of monaxonid sponges related to the genus *Clathria*. *Proceedings of the Linnean Society of New South Wales 44*: 767–92, pls XXXVI–XL.

HARTMAN, W.D. 1955: A collection of sponges from the west coast of the Yucatan Peninsula with descriptions of two new species. *Bulletin of Marine Science of the Gulf and Caribbean 5(3)*: 161–89.

HARTMAN, W.D. 1958: Natural history of the marine sponges of southern New England. *Bulletin of the Peabody Museum of Natural History 12*: 155 p., 12 pls.

HARTMAN, W.D. 1967: Revision of *Neofibularia* (Porifera, Demospongiae), a genus of toxic sponges from the West Indies and Australia. *Postilla No. 113*: 41 p.

HECHTEL, G.J. 1965: A systematic study of the Demospongiae of Port Royal, Jamaica. *Bulletin of the Peabody Museum of Natural History 20*: 94 p., 15 figs, 8 pls.

HENTSCHEL, E. 1911: Tetraxonida 2. Tiel. *In* Michaelsen, W.; Hartmeyer, R. (Eds): *Die Fauna Südwest-Australiens 3(10)*: 279–393.

HENTSCHEL, E. 1912: Kiesel-und Hornschwamme der Aru-und Kei-Inseln. *Abhandlungen Herausgegeben von der Senckenbergischen Naturforschenden Gesellschaft. Vierunddreisiggster Band 3*: 291–448.

HENTSCHEL, E. 1914: Monaxone Kieselschwamme und Hornschwamme der Deutschen Sudpolar-Expedition 1901–1903. *Deutsche Sudpolar-Expedition 1901–1903, XV, Zoology, VII*: 37–141.

HENTSCHEL, E. 1923: Porifera-Schwamme. Pp 37–141 *in* Kukenthal, W.; Krumbach, T. (Eds): "Handbuch der Zoologie. Vol. 1". Berlin and Leipzig.

HOOPER, J.N.A. 1984: *Sigmaxinella soelae* and *Desmacella itystela*, two new desmacellid sponges (Porifera, Axinellida, Desmacellidae) from the northwest shelf of Western Australia, with a revision of the family Desmacellidae. *Northern Territory Museum of Arts and Sciences, Monograph Series 2*: 46–58.

INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE 1961: "International Code of Zoological Nomenclature". (Stoll, N.R. *et al.* (Ed. Comm.)) International Trust for Zoological Nomenclature, London. 176 p.

KIRK, H.B. 1911: Sponges collected at the Kermadec Islands by Mr W.R.B. Oliver. *Transactions and Proceedings of the New Zealand Institute 43*: 574–81, pl. XXVII.

KIRKPATRICK, R. 1907: Preliminary Report on the Monaxonellida of the National Antarctic Expedition. *Annals and Magazine of Natural History, series 7, 20(117)*: 271–91.

KIRKPATRICK, R. 1908: Porifera II. Tetraxonida. *National Antarctic Expedition, 1901–1904, Natural History 4, Zoology*: 56 p, pls VIII–XXVI.

KOLTUN, B.M. 1955: [New genera and species of sponges (Spongia, Cornacuspongida) from the Okhotsk and Bering Seas.] *Trudy Zoologicheskogo Instituta Akademiya Nauk SSSR 18*: 13–18, 1 pl. [In Russian]

KUMAR, A. 1925: Report on some tetraxonid sponges in the collection of the Indian Museum. *Records of the Indian Museum 27*: 211–29.

LAMARK, J.B.; DE MONET, P.A. 1814: Sur les Polypiers empâte's. *Annales du Museum 20*: 370–86.

LAUBENFELS, M.W. DE 1934: New sponges from the Puerto Rican deep. *Smithsonian Miscellaneous Collections 91(17)*: 28 p.

LAUBENFELS, M.W. DE 1936: A discussion of the sponge fauna of the Dry Tortugas in particular and the West Indies in general, with material for a revision of the families and orders of the Porifera. *Papers of the Tortugas Laboratory, Carnegie Institution 30(467)*: 225 p., 22 pls.

LAUBENFELS, M.W. DE 1950: The sponges of Kaneohe Bay, Oahu. *Pacific Science 4(1)*: 3–36.

LAUBENFELS, M.W. DE 1953: Sponges from the Gulf of Mexico. *Bulletin of Marine Science of the Gulf and Caribbean 2(3)*: 511–57.

LAUBENFELS, M.W. DE 1954: The sponges of the West-Central Pacific. *Oregon State Monographs, Studies in Zoology, No. 7*: 1–306, 12 pls.

LENDENFELD, R. VON 1886: A monograph of the Australian sponges. Part V. *Proceedings of the Linnean Society of New South Wales 10(3)*: 282–325, pls XXVI–XXXV. Part VI. *Ibid.*: 481–553, pls XXXVI–XXXVIII.

LENDENFELD, R. VON 1887: Die Chalineen des australischen Gebietes. *Zoologischer Jahrbucher 2*: 723–828, pls XVIII–XXVII.

LENDENFELD, R. VON 1888: "Descriptive Catalogue of the Sponges in the Australian Museum, Sydney". London. xvi + 260 p., 12 pls.

LENDENFELD, R. VON 1889: "A Monograph of the Horny Sponges". Royal Society, London. 4 vols. 936 p., 50 pls.

LENDENFELD, R. VON 1897: Spongien von Sansibar. *Sonderabdruck aus den Abhandlungen der Senckenbergischen naturforschenden Gesellschaft, Band XXI, Heft 1*: 93–133.

LÉVI, C. 1952: Spongiaires de la côte du Sénégal. *Bulletin de l'Institut français d'Afrique noire 14(1)*: 34–59.

LÉVI, C. 1955: Travaux de la Station Biologique de Roscoff XXVI (VI). Les Clavaxinellides, Démonsponges Tetractinomorphes. *Archives de Zoologie Expérimentale et Générale 92(2)*: 78–87.

LÉVI, C. 1960: Les Démonsponges des côtes de France. 1. Les Clathriidae. *Cahiers de Biologie Marine 1(1)*: 47–87.

LÉVI, C. 1963: Spongiaires d'Afrique du Sud (1) Poecilosclerides. *Transactions of the Royal Society of South Africa 37(1)*: 1–72, 10 pls.

LÉVI, C. 1964a: Spongiaires des zones bathyale, abyssale et hadale. *Galathea Report 7*: 63–112, 10 pls.

LÉVI, C. 1964b: Ultrastructure de la larve parenchymella de Démonsponge 1. *Mycale contarenii* (Martens). *Cahiers de Biologie Marine 5(1)*: 97–104, 8 pls.

LÉVI, C. 1973: Systematique de la classe des Demospongiaria (Demosponges). Pp. 577–631 *in* Grasse, P.P. (Ed.): "Traite de Zoologie, Anatomie, Systematique, Biologie". Vol. 3(1). Masson, Paris.

LÉVI, C.; LÉVI, P. 1983: Démosponges bathyales récoltées par le N/O "Vauban" au sud de la Nouvelle-Calédonie. *Bulletin du Muséum National d'Histoire Naturelle, série 4, 5A(4)*: 931–97.

LIERBERKÜHN, N. 1859: Neue beitrage zur anatomie der Spongien. *Archive fur Anatomie*: 353–82, 515–29, pls IX–XL

LUNDBECK, W. 1902: Porifera (Part 1). Homorrhaphidae and Heterorrhaphidae. *Danish Ingolf-Expedition 6*: 1–108, 19 pls.

LUNDBECK, W. 1905: Porifera (Part 2). Desmacidonidae (Pars). *Danish Ingolf-Expedition 6(2)*: 219 p., 20 pls.

LUNDBECK, W. 1909: The Porifera of East Greenland. *Meddelelser om Gronland 24*: 421–466, 1 pl.

LUNDBECK, W. 1910: Porifera (Part 3). Desmacidonidae (Pars). *Danish Ingolf-Expedition 6(3)*: 124 p, 11 pls.

MARSHALL, W. 1880: Untersuchungen uber Dysideiden und Phoriospongien. *Zeitschrift für Wissenschaftlich Zoologie 35*: 88–129, pls VI–VIII.

MUNSELL, A. 1942: "Book of Colour". Munsell Color Co. Inc., Baltimore, Maryland. 2 vols.

MONTAGU, G. 1818: An essay on sponges, with descriptions of all the species that have been discovered on the coast of Great Britain. *Memoirs of the Werner Society 2*: 67–122, pls III–XVI.

NEAVE, S.A. 1940: "Nomenclator Zoologicus: a list of the names of genera and subgenera in Zoology from the tenth edition of Linneaus, 1758, to the end of 1935". Zoological Society of London. 4 vols.

RIDLEY, S.O. 1881: Spongida. Chapter XI *in* Account of the Zoological Collections made during the Survey of H.M.S. "Alert" in the Straits of Magellan and on the coast of Patagonia. *Proceedings of the Zoological Society, London*: 107–37, pls X, XI.

RIDLEY, S.O.; DENDY, A. 1886: Preliminary report on the Monaxonida collected by H.M.S. "Challenger". Part 1. *Annals and Magazine of Natural History, series 5, 18*: 325–51. Part 2. *Ibid*: 470–93.

RIDLEY, S.O.; DENDY, A. 1887: Report on the Monaxonida collected by H.M.S. "Challenger" during the years 1873–1876. *Report on the Scientific Results of the Exploring Voyage of H.M.S. Challenger 1873–76. Zoology 20(59)*: 275 p., 11 figs, 51 pls.

SCHMIDT, E.O. 1862: "Die Spongien des Adriatischen Meeres". Leipzig. vi + 88 p., 7 pls.

SCHMIDT, E.O. 1864: "Supplement der Spongien des Adriatischen Meeres". Leipzig. iv + 48 p.

SCHMIDT, E.O. 1870: "Grundzuge einer Spongien-Fauna des Atlantischen Gebietes". Leipzig. iv + 88 p., 6 pls.

SCHMIDT, E.O. 1875: Spongien. *Zoologische Ergebnisse der Nordseefahrt 2 & 3*: 115–20.

SHAW, M.E. 1927: On a collection of sponges from Maria Island, Tasmania. *Proceedings of the Zoological Society, London 28*: 419–39, 1 pl.

SIMPSON, T.L. 1968: The structure and function of sponge cells: new criteria for the taxonomy of poecilosclerid sponges (Demospongiae). *Bulletin of the Peabody Museum of Natural History 25*: 141 p.

SOEST, R.W.M. VAN 1984: Marine sponges from Curacao and other Caribbean localities. Part 3. Poecilosclerida. *Studies on the Fauna of Curacao and other Caribbean Islands 199*: 167 p.

STEPHENS, J. 1916: Preliminary notice of some Irish sponges. -The Monaxonellida (Suborder Sigmatomonaxonellida) obtained by the Fisheries Branch of the Department of Agriculture and Technical Instruction, Ireland. *Annals and Magazine of Natural History, series 8, 17*: 232-42.

STEPHENS, J. 1921: Sponges of the coasts of Ireland II. The Tetraxonida (concluded). *Department of Agriculture, Ireland. Fisheries Branch Scientific Investigations, 1920 No. 2*: 1-75, pls I-VI.

THIELE, J. 1903a: Kieselschwämme von Ternate: II. *Abhandlungen der Senckenbergischen naturforschenden Gesellschaft 25(4)*: 933-68, pl.XXVIII.

THIELE, J. 1903b: Beschreibung einiger unzureichend bekannten monaxonen Spongien. *Archiv fur Naturgeschichte 69(1)*: 375-98, pl.XXI.

THIELE, J. 1905: Die Kiesel -und Hornschwämme der Sammlung Plate. *Zoologischen Jahrbuchern Suppl. 6*: 407-96, pls 27-33.

TOPSENT, E. 1890: Notice préliminaire sur les spongiaires recueillis durant les campagnes de l'Hirondelle (1886-1887-1888). *Bulletin de la Société Zoologique de France 15*: 26-32.

TOPSENT, E. 1892a: Contribution à l'étude des Spongiaires de l'Atlantique Nord. *Résultats des Campagnes scientifiques accomplies sur son Yacht par Albert 1er, Prince Souverain de Monaco. Fascicule 2*: 165 p, 11 pls.

TOPSENT, E. 1892b: Diagnoses d'éponges nouvelles de la Méditerrané et plus particulièrement de Banyuls. *Archive de Zoologie Expérimentale et Générale, série 2, 10*: xvii-xxviii.

TOPSENT, E. 1893: Nouvelle série de diagnoses d'éponges de Roscoff et de Banyuls. *Archive de Zoologie Expérimentale et Générale, série 3, 1*: xxxiii-xliii.

TOPSENT, E. 1894: Une reforme dans la classification des Halichondrina. *Extrait des Memoires de la Société Zoologique de France 7*: 5-26.

TOPSENT, E. 1897: Spongiaires de la Baie d'Amboine. *Revue suisse de Zoologie 4*: 421-87, pls 18-21.

TOPSENT, E. 1904: Spongiaires des Acores. *Resultats des Campagnes scientifiques accomplies sur son Yacht par Albert 1er, Prince Souverain de Monaco. Fascicule 25*: 280 p.

TOPSENT, E. 1907: Poecilosclérides nouvelles recueillies par le "Français" dans l'Antarctique. *Bulletin du Muséum National d'Histoire Naturelle 13*: 69-76.

TOPSENT, E. 1913: Spongiaires de l'Expédition antarctique national ecossaise. *Transactions of Royal Society of Edinburgh, 49(3)*: 579-643.

TOPSENT, E. 1917: Spongiaires. *Deuxième Expédition Antarctique Française 1908-1910*: 88 p., 6 pls.

TOPSENT, E. 1920: Spongiaires du Musee Zoologique de Strasbourg. Monaxonides. *Bulletin de l'Institut Océanographique de Monaco 381*: 36 p.

TOPSENT, E. 1924: Révision des *Mycale* de l'Europe occidentale. *Annales de l'Institut Océanographique, Monaco 1(3)*: 77-118.

TOPSENT, E. 1925: Etude de Spongiaires du Golfe de Naples. *Archive de Zoologie, Paris 63*: 623-725, pl.VIII.

TOPSENT, E. 1927: Diagnoses d'Eponges nouvelles recueillies par le Prince Albert 1er de Monaco. *Bulletin de l'Institut Océanographique de Monaco 502*: 19 p.

TOPSENT, E. 1928: Spongiaires de l'Atlantique et de la Mediterranée provenant des croisières du Prince Albert 1er de Monaco. *Résultats des Campagnes Scientifiques de Albert I de Monaco 74*: 376 p., 11 pls.

VACELET, J.; VASSEUR, P.; LÉVI, C. 1976: Spongiaires de la pente externe des récifs coralliens de Tulear (sud-ouest de Madagascar). *Mémoires du Museum National d'Histoire Naturelle. Nouvelle série, Série A, Zoologie 99*: 116 p., 10 pls.

VOSMAER, C.G.J. 1880: The sponges of the Leyden Museum I. The family of the Desmacidinae. *Notes from the Leyden Museum 2*: 99-164.

VOSMAER, C.G.J. 1885: Porifera, Parts VII-XI. Pp. 177-368, pls XIX-XXV *in* Bronn, H.G. (Ed.): "Die Klassen und Ordnungen des Thierreichs". Vol. 2. Leipzig and Heidelberg.

VOSMAER, C.G.J. 1887: Porifera. Pp 369-496, pls XXVI-XXXIV *in* Bronn, H.G. (Ed.): "Die Klassen und Ordnungen des Thierreichs". Vol. 2. Leipzig and Heidelberg.

VOSMAER, C.G.J. 1935: The sponges of the Bay of Naples. Porifera Incalcaria. (Vosmaer-Roell, C.S.; Burton, M. (Eds)). *Capita Zoologica 's-Gravenhage 5*: 777-875, 6 pls.

WELLS, H.W.; WELLS, M.J.; GRAY, I.E. 1960: Marine sponges of North Carolina. *Journal of the Elisha Mitchell Scientific Society 76(2)*: 200-45.

WHITELEGGE, T. 1906: Scientific results of the trawling expedition of H.M.C.S. "Thetis" off the coast of New South Wales. *Memoirs of the Australian Museum 4(1)*: 487-515.

WIEDENMAYER, F. 1977: Shallow-water sponges of the Western Bahamas. *Experientia Supplementa 28*: 287 p., 43 pls.

WILSON, H.V. 1894: Observations on the gemmule and egg development of marine sponges. *Journal of Morphology 9*: 277-406.

WILSON, H.V. 1904: The Sponges. *Reports of an Exploration off the West Coasts of Mexico, Central and South America and off the Galapagos Islands in charge of Alexander Agassiz, by the U.S. Fish Commission Steamer "Albatross", during 1891, 30*: 164p.

WYVILLE THOMSON, C. 1873: "The Depths of the Sea". London. 527p.

INDEX

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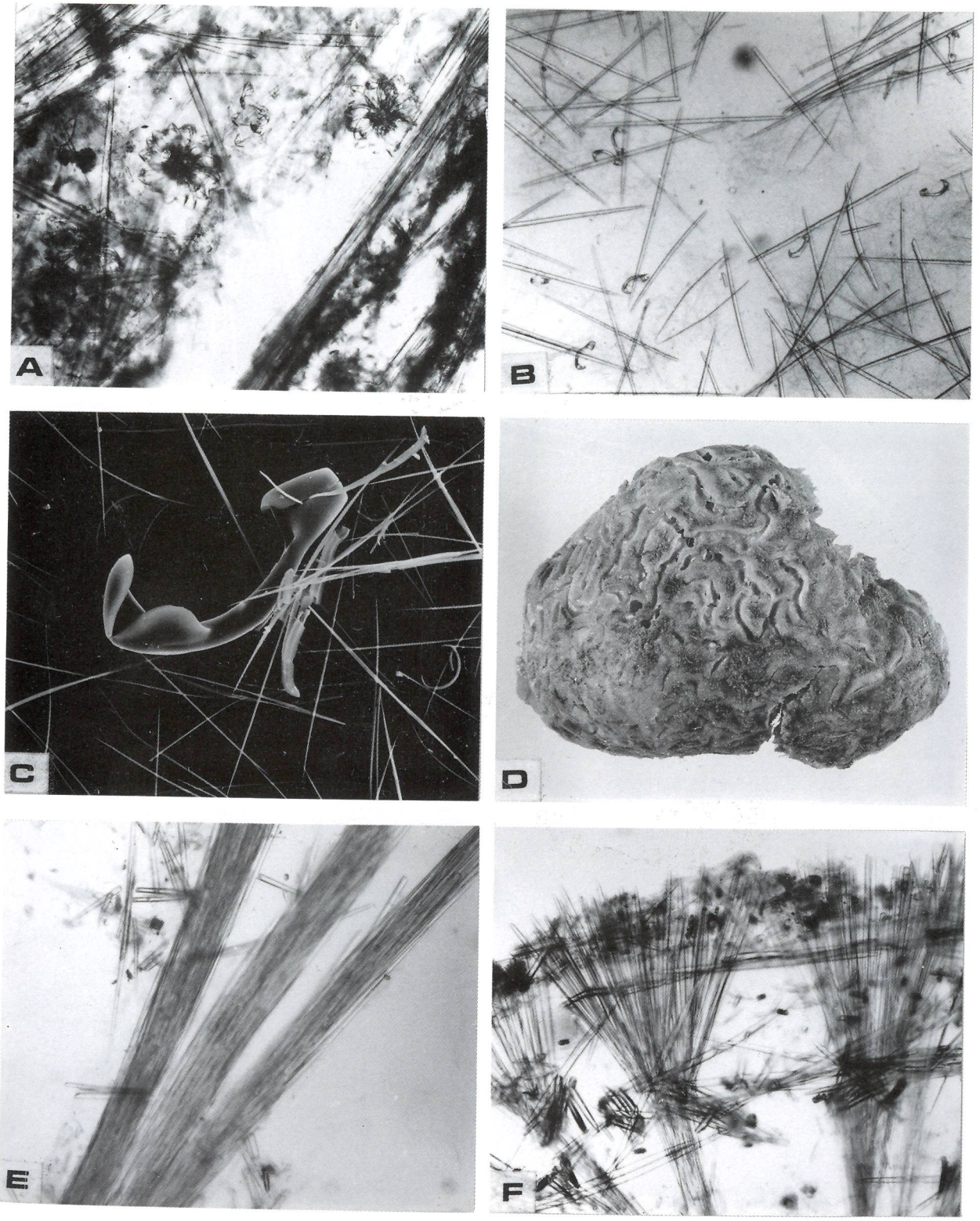
PLATES



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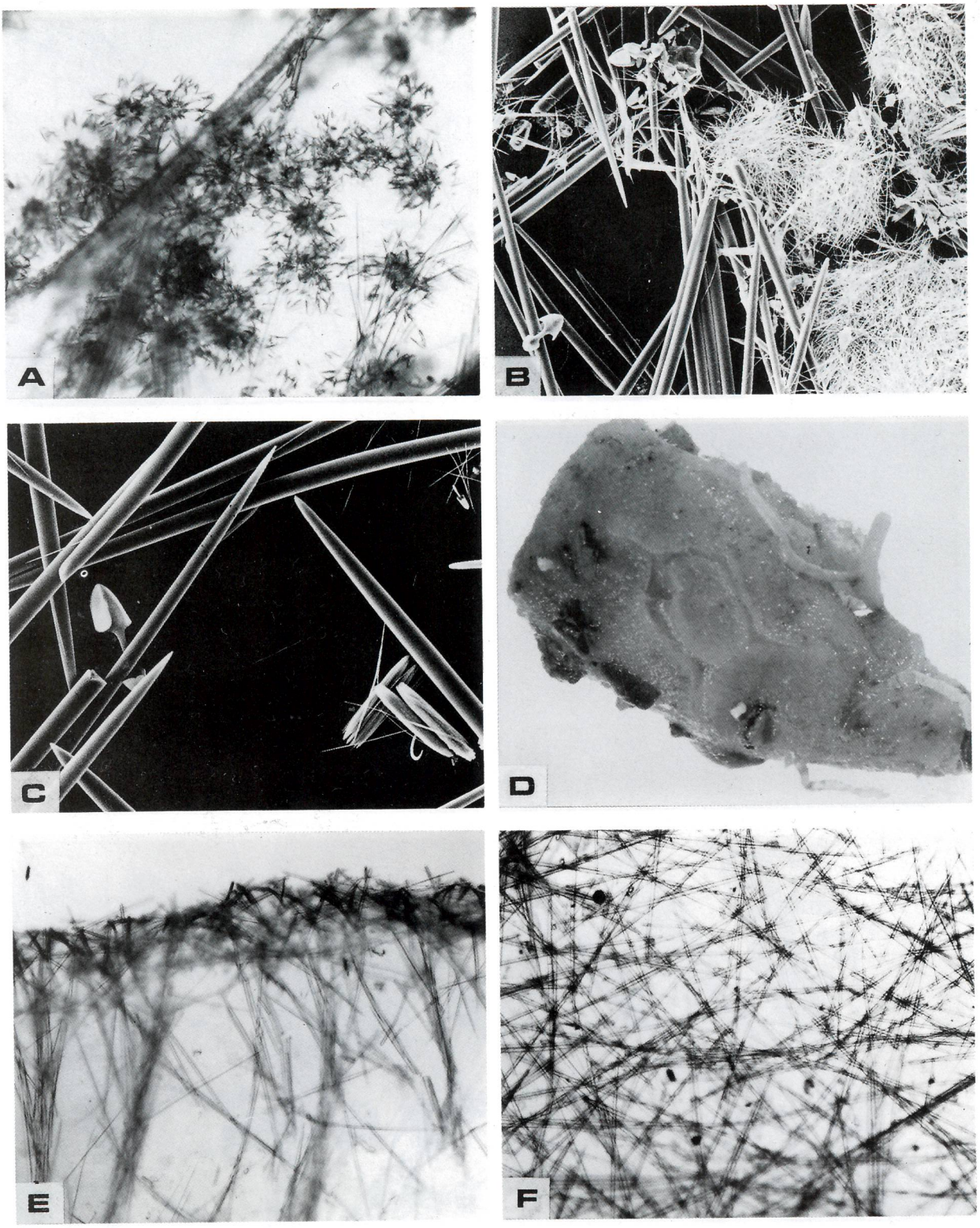

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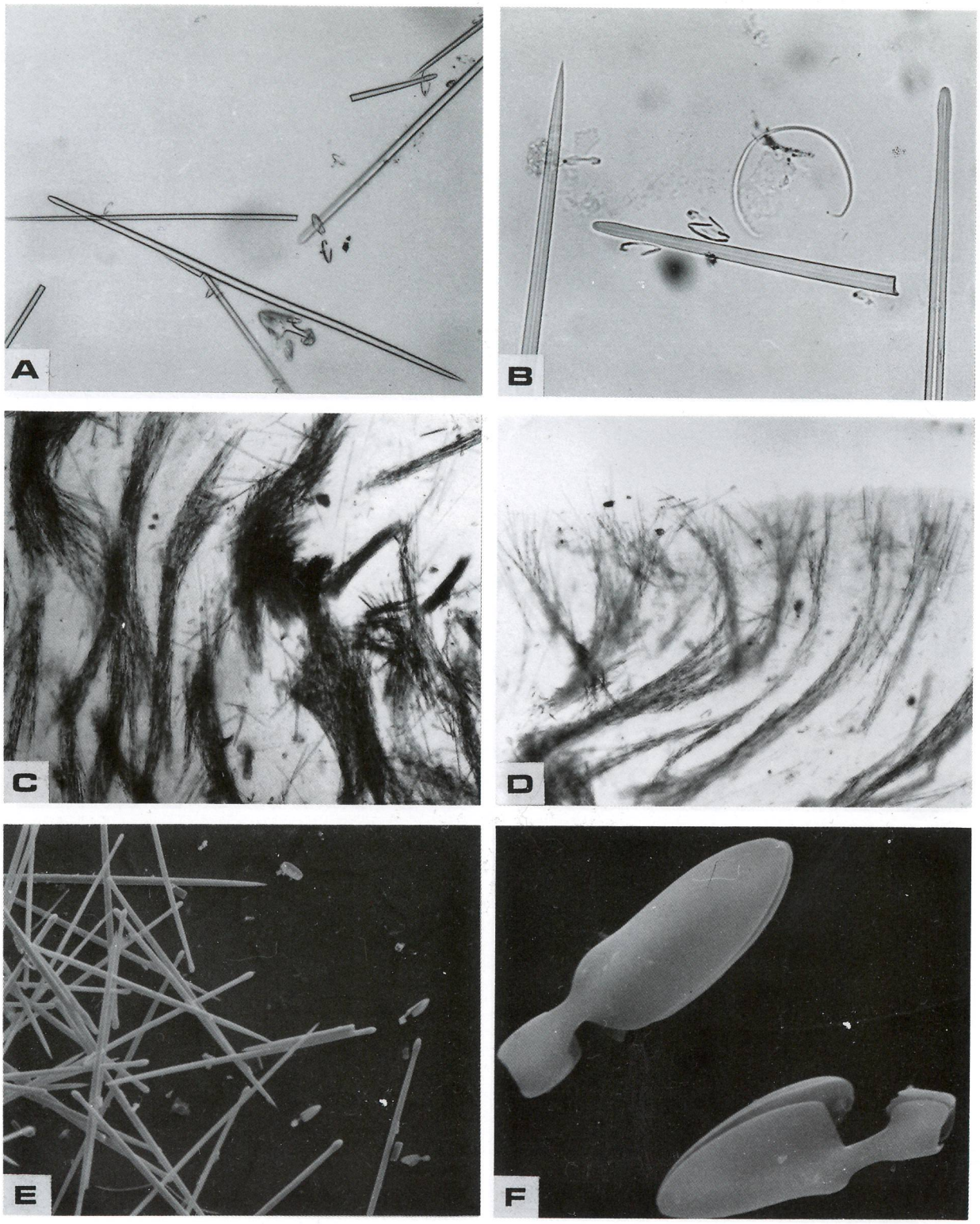

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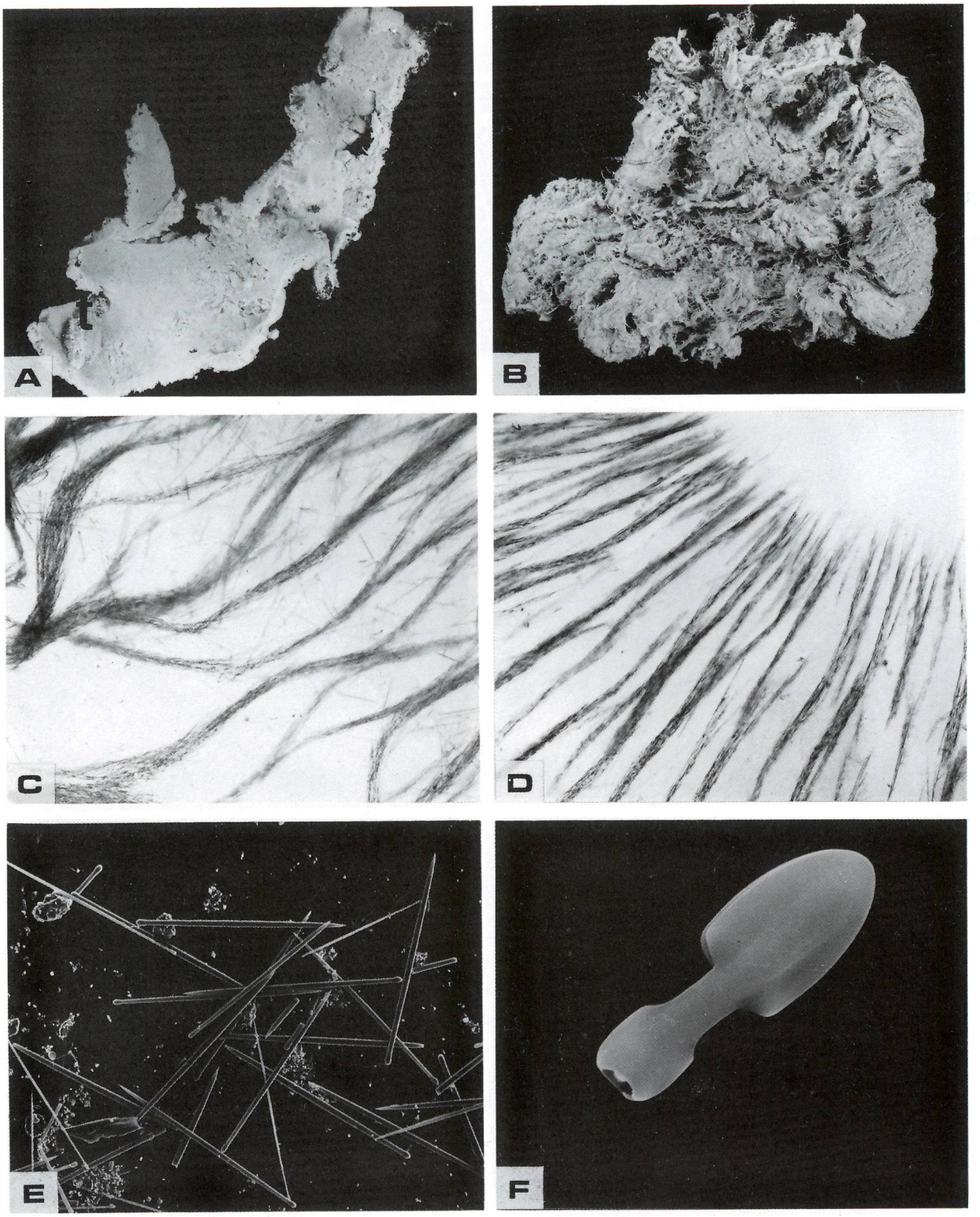

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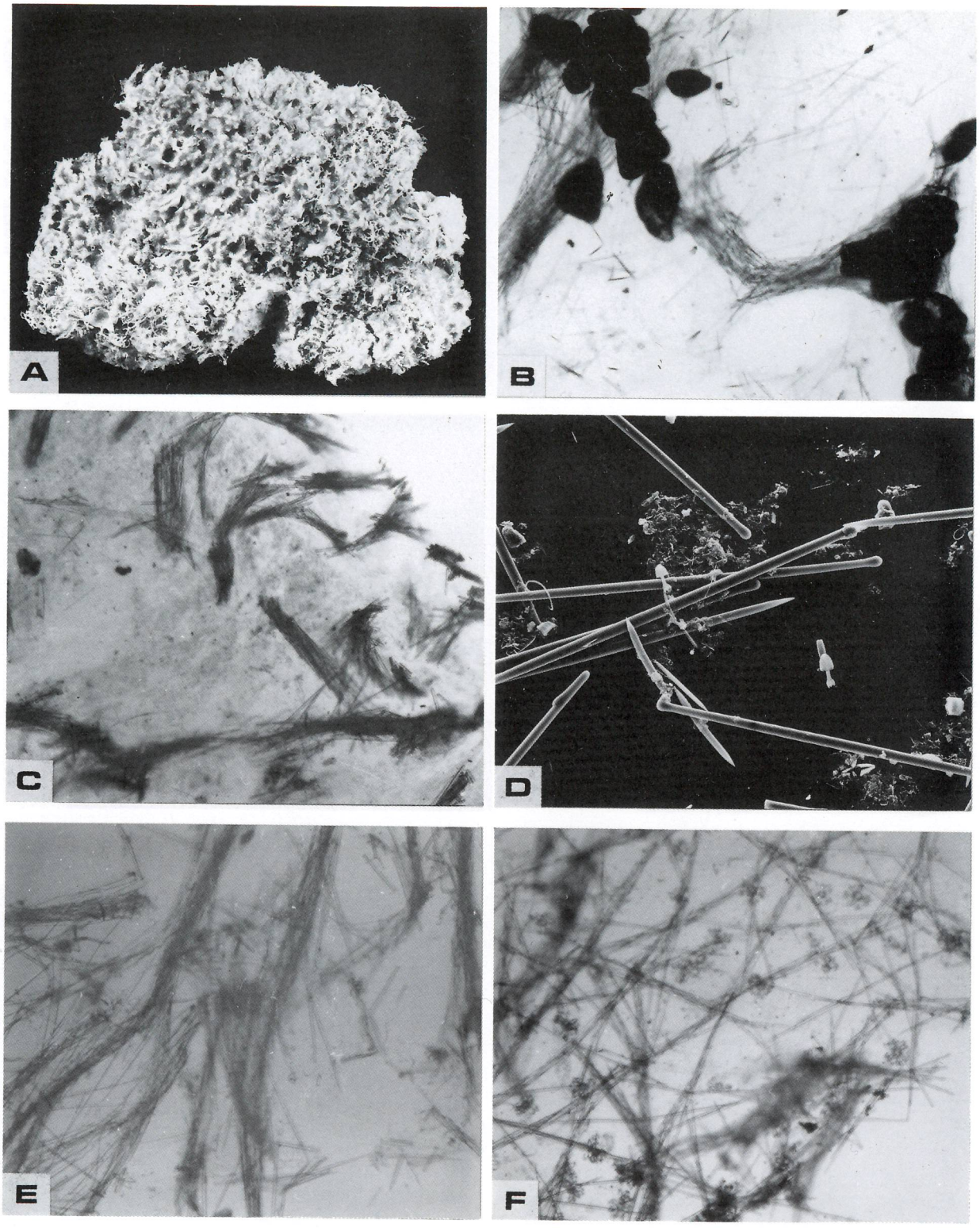

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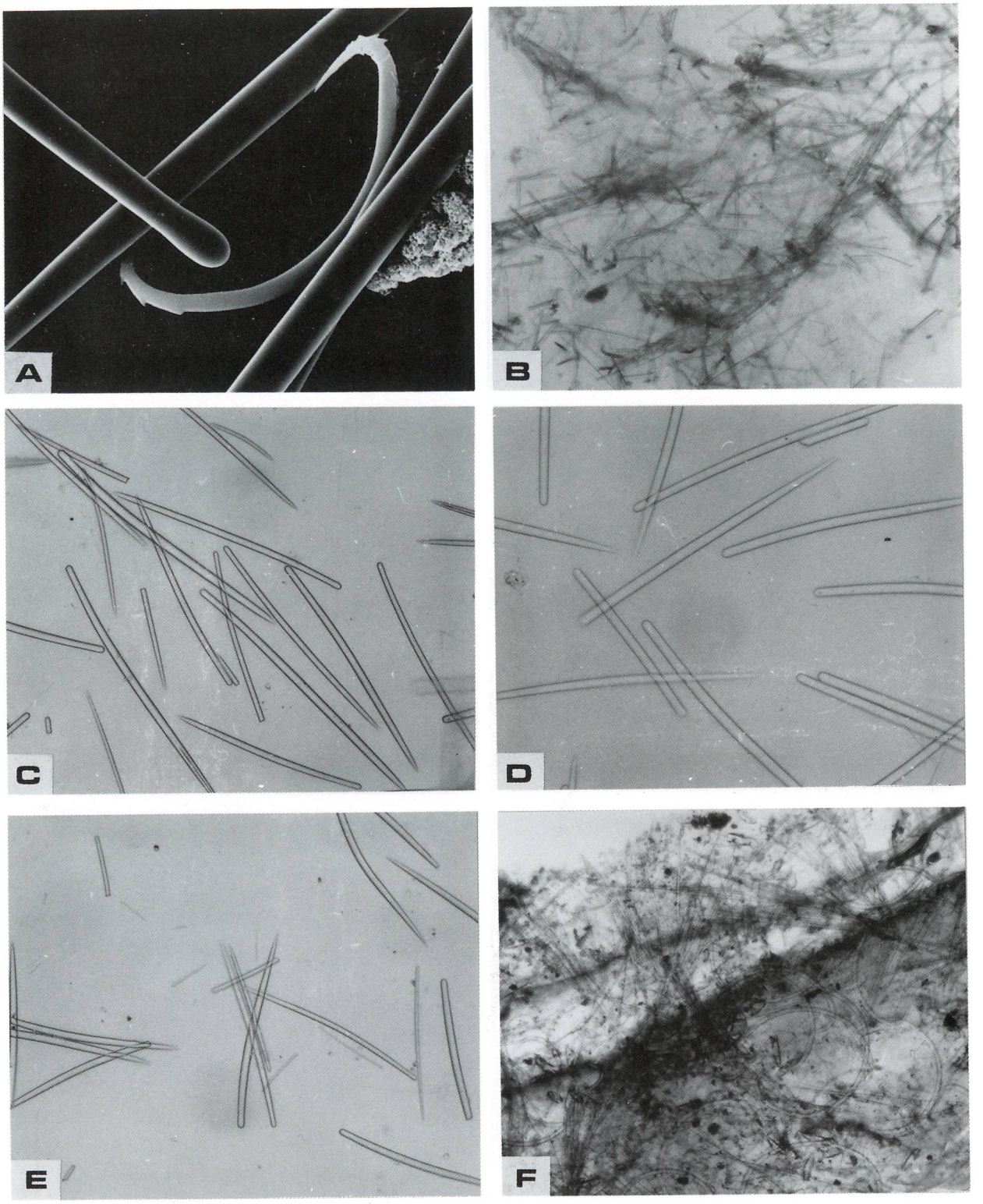

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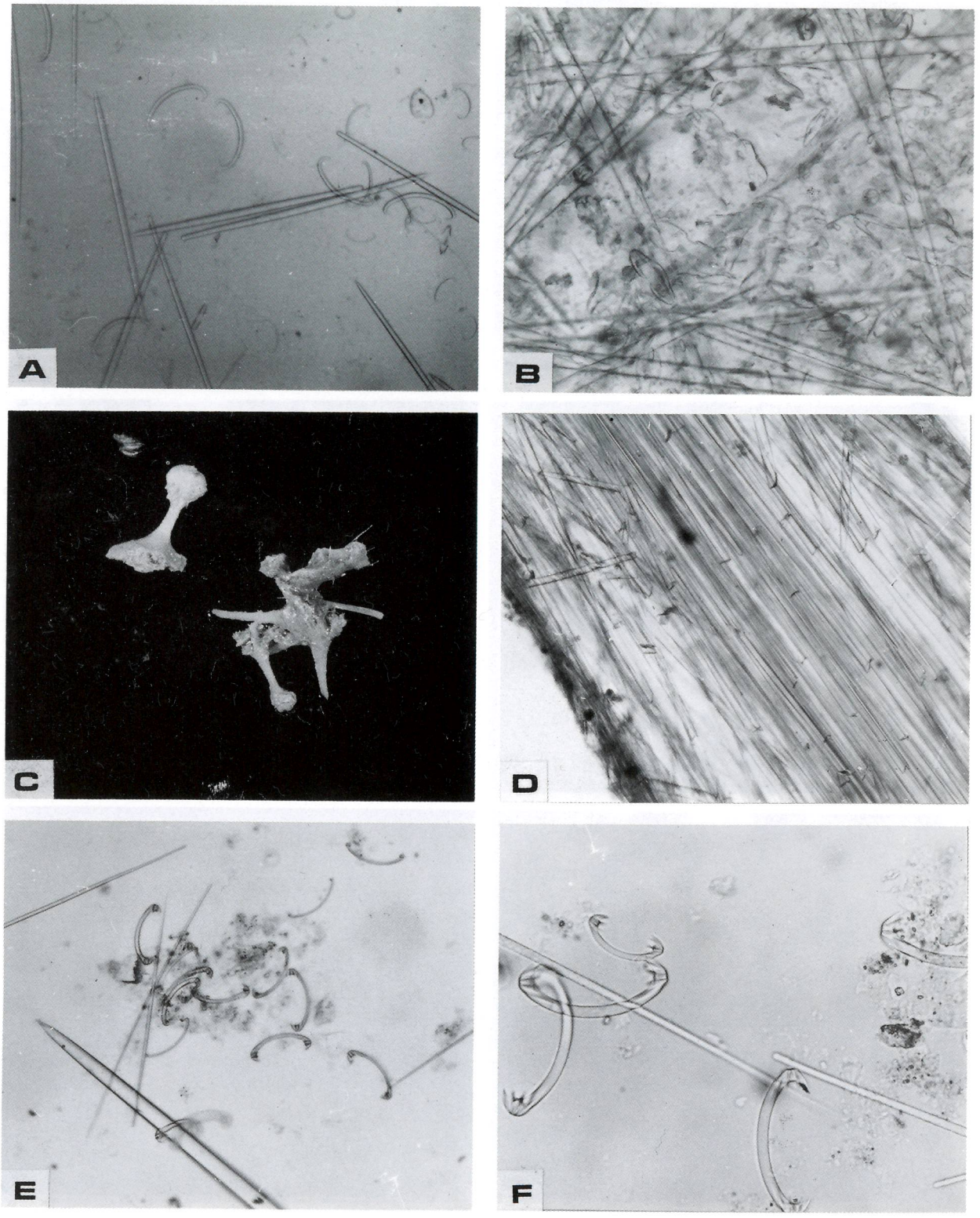

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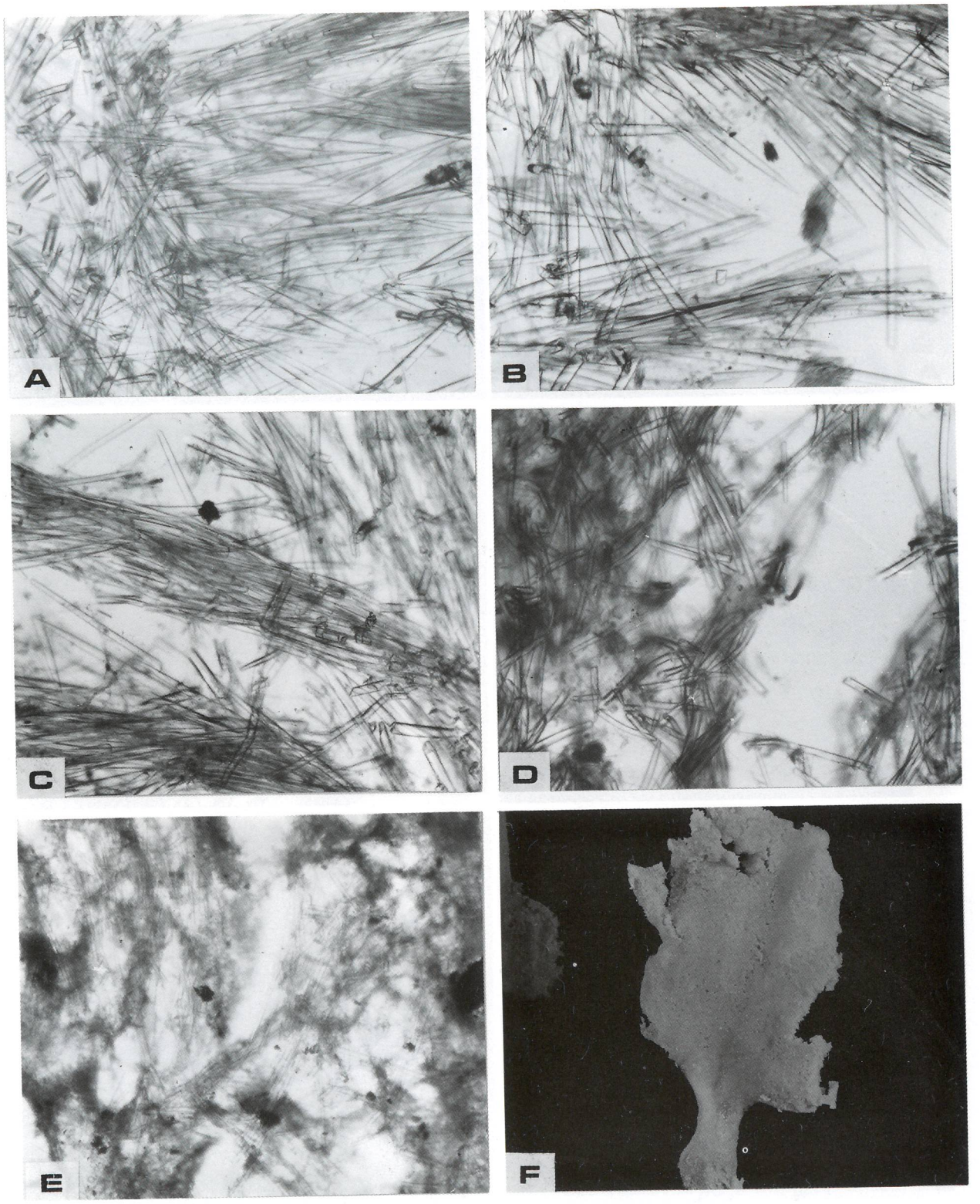

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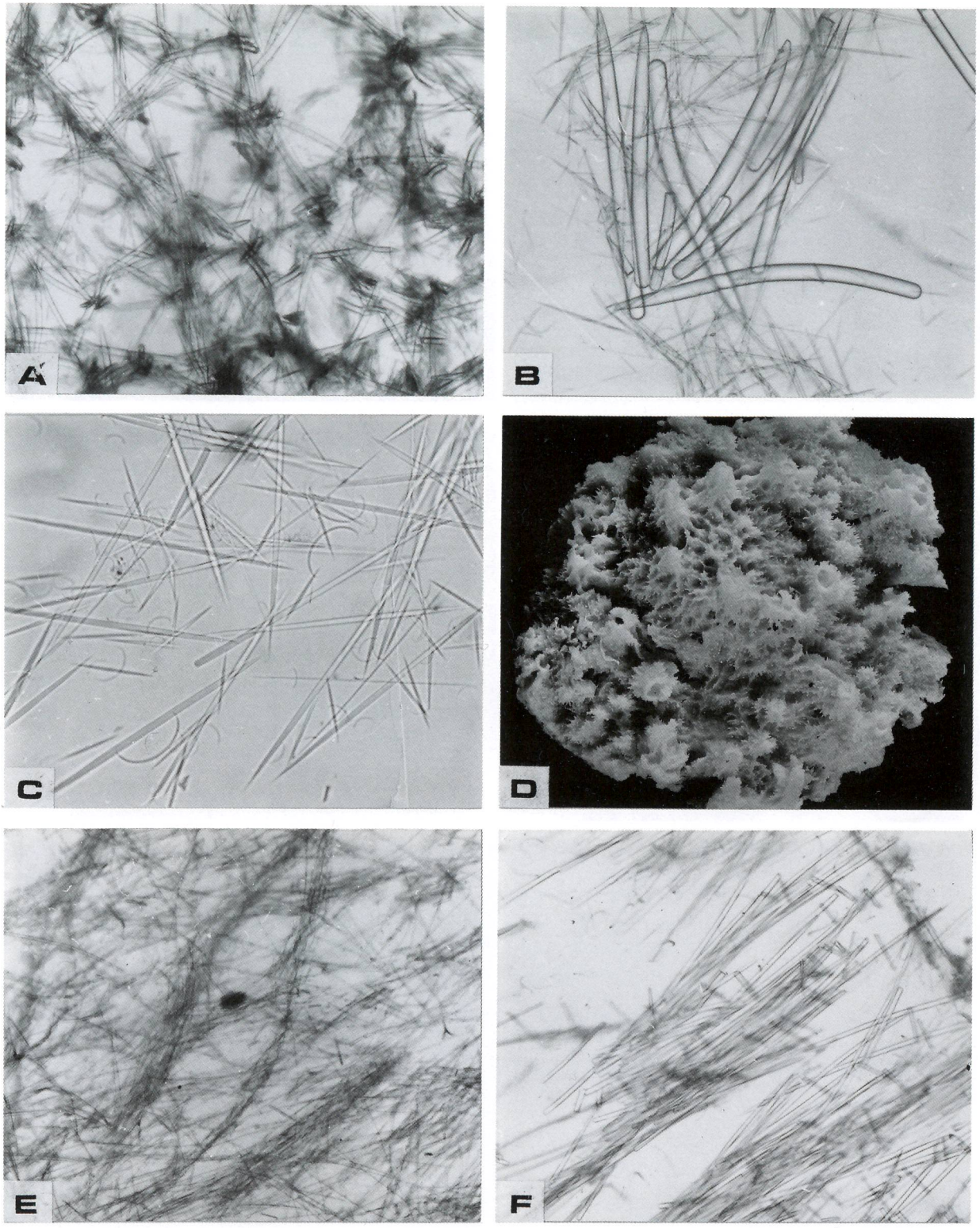

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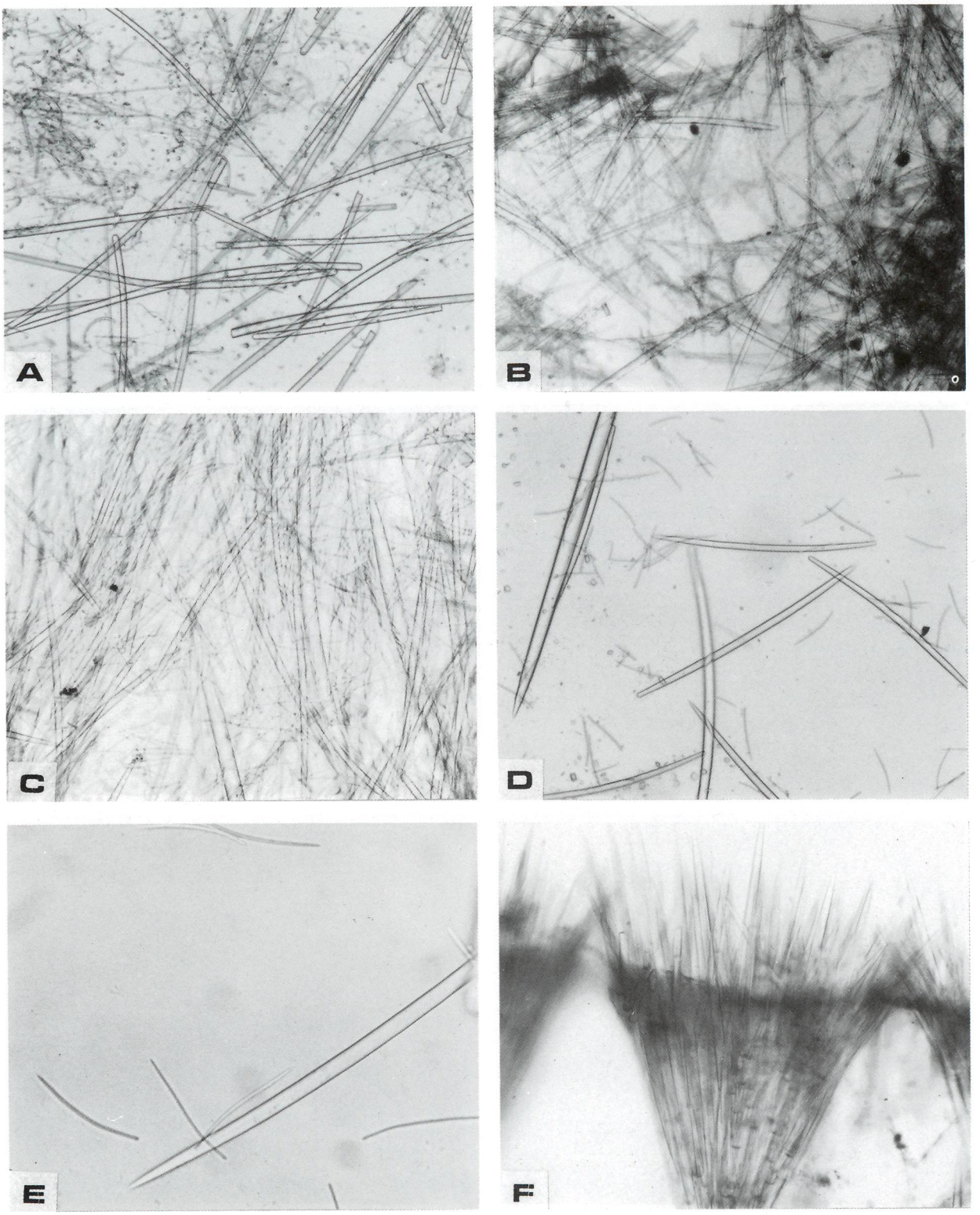

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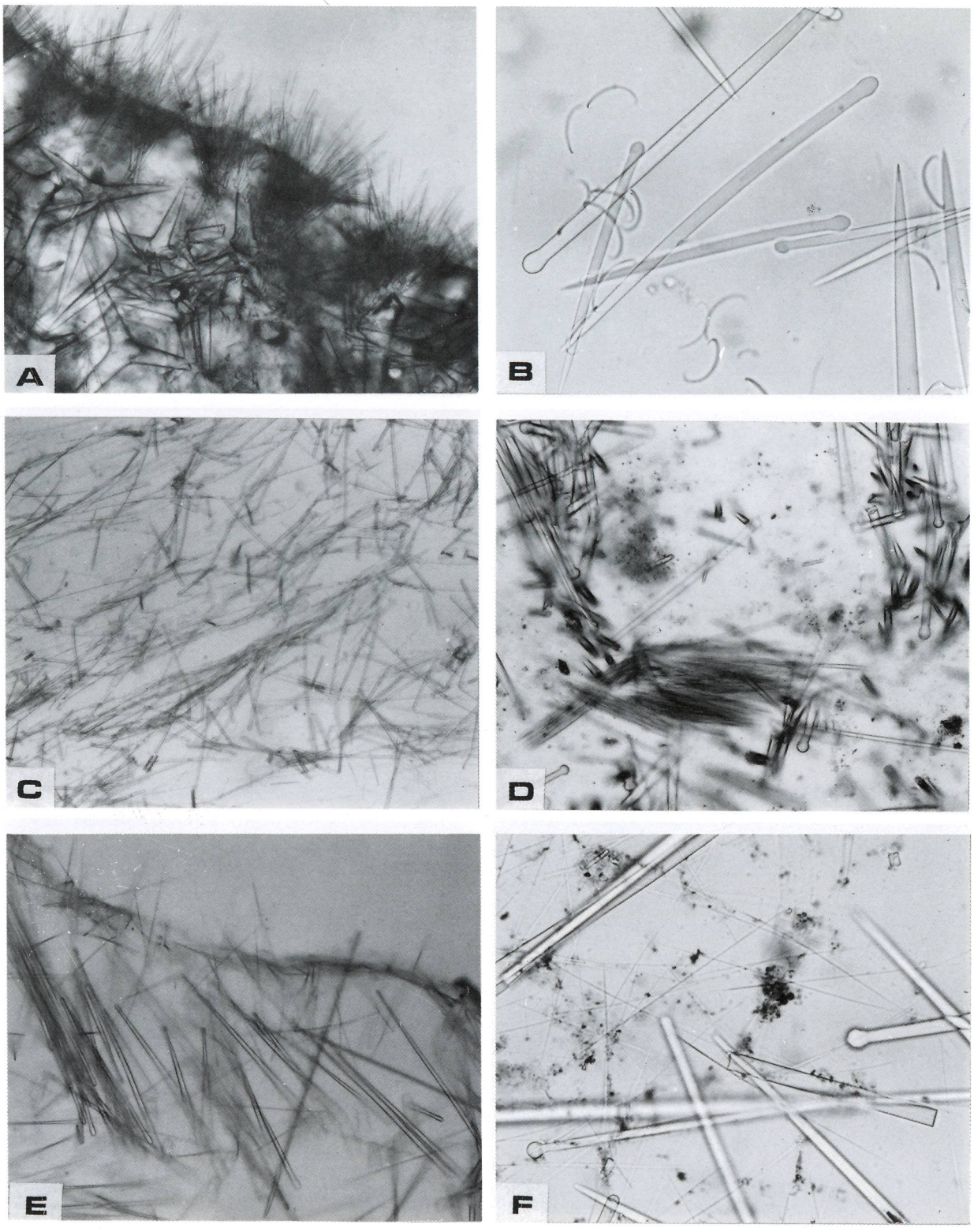

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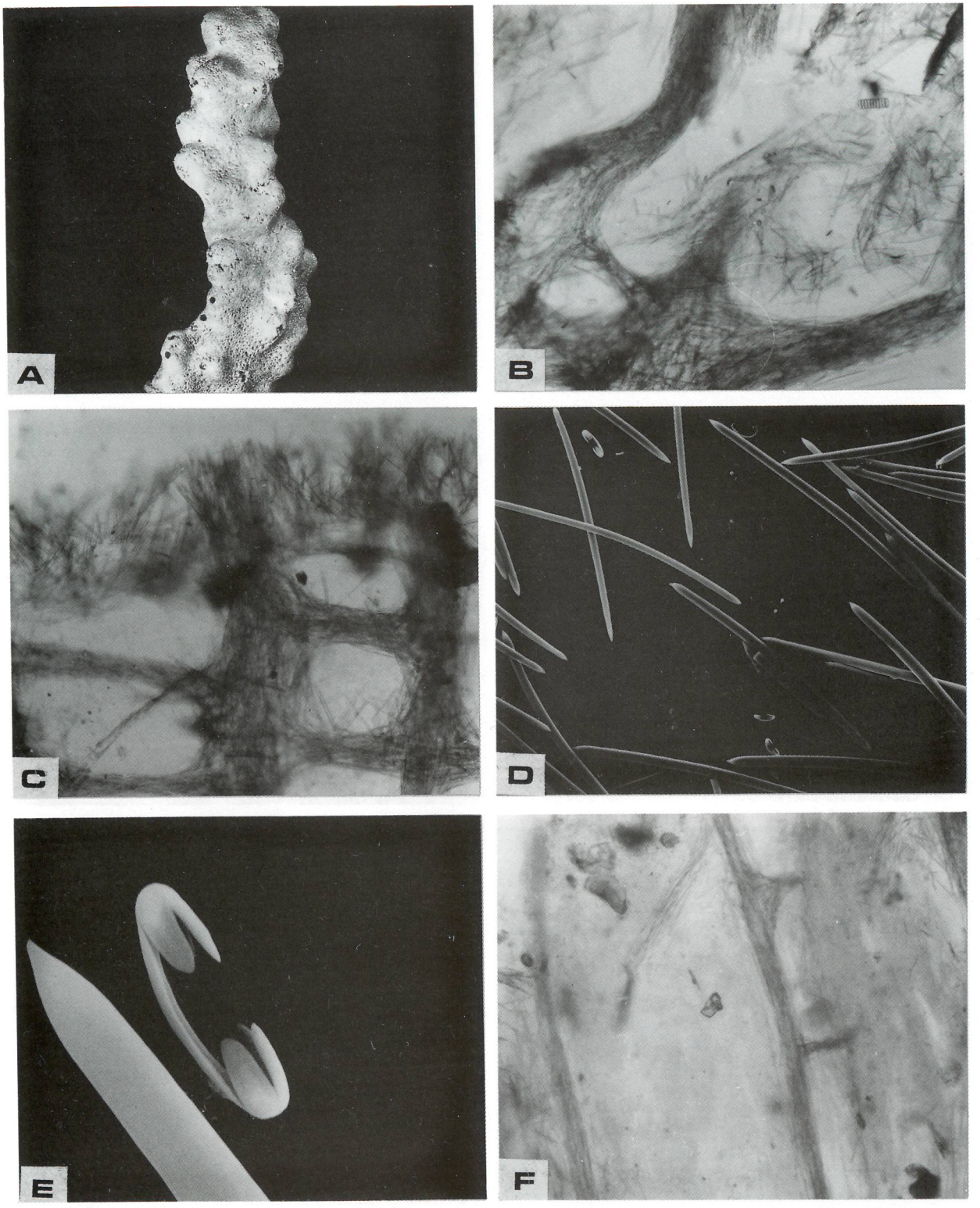

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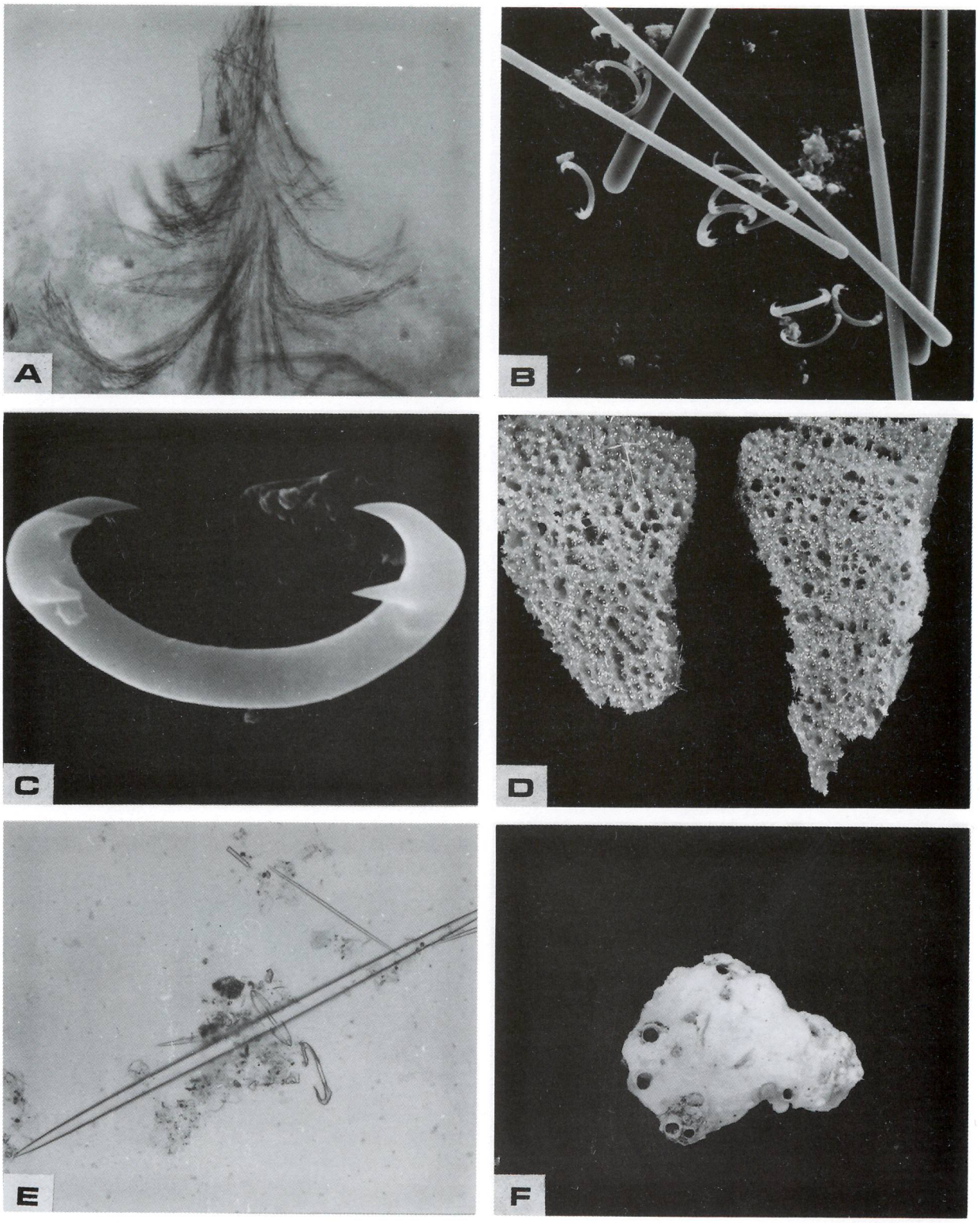

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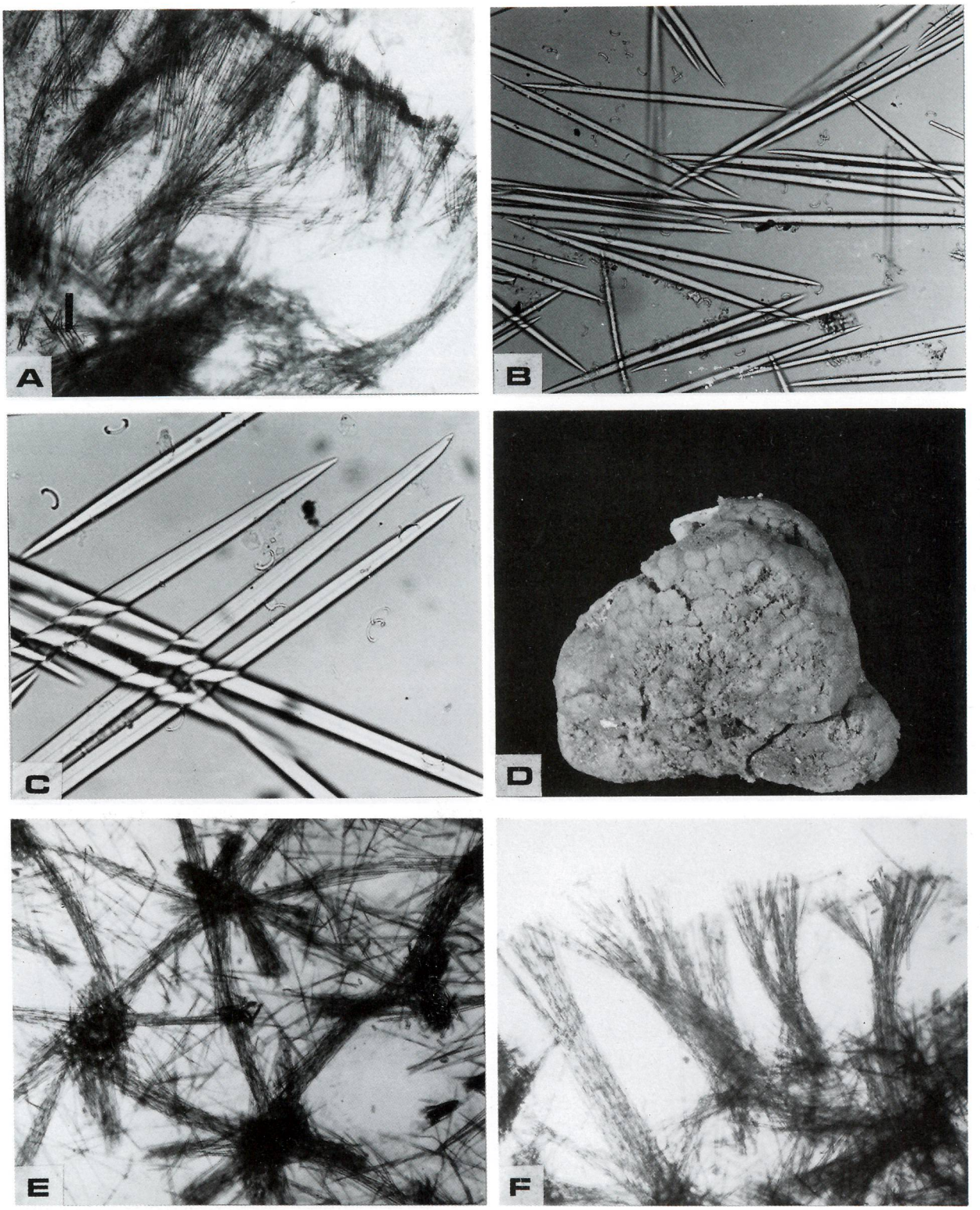

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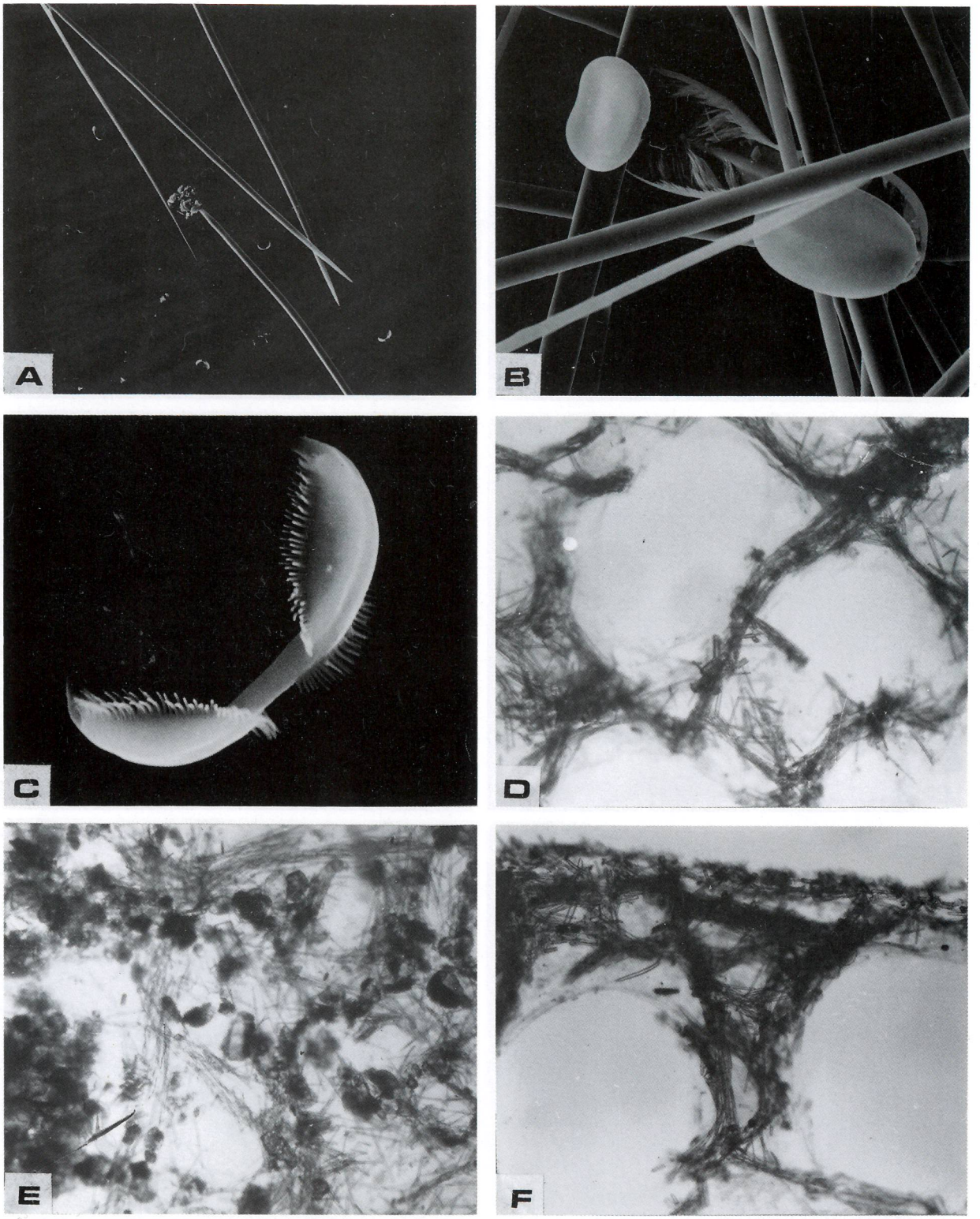

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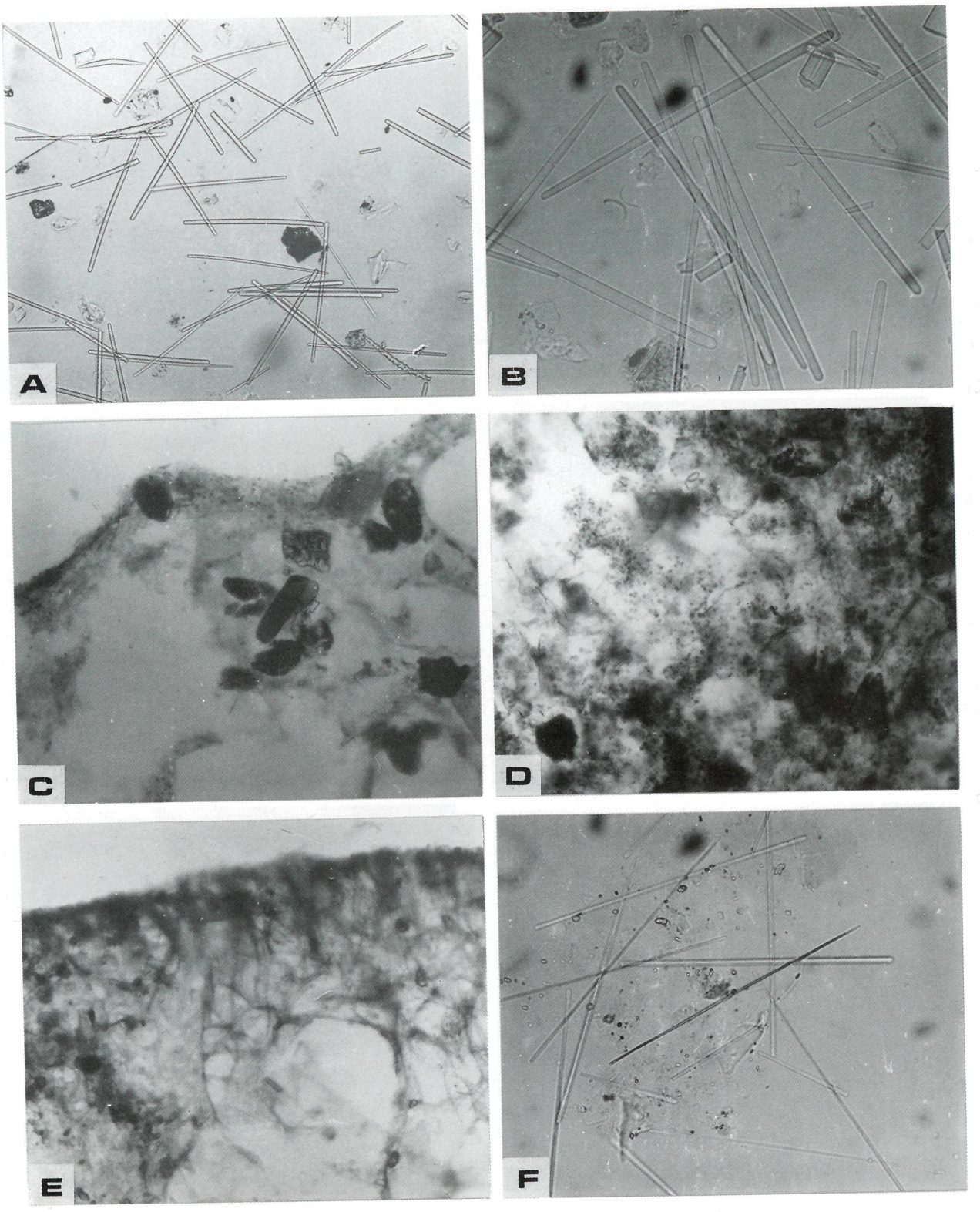

PLATE 16. A, B, *Chondropsis kirkii* (Carter): A, spicules; × 252; B, spicules, × 630. C–F, *Chondropsis topsentii* Dendy: C, ectosomal skeleton incorporating sand grains, × 101; D, choanosome showing pigment cells, × 101: E, tufts of strongyles in the ectosome, × 101; F, spicules, × 630.

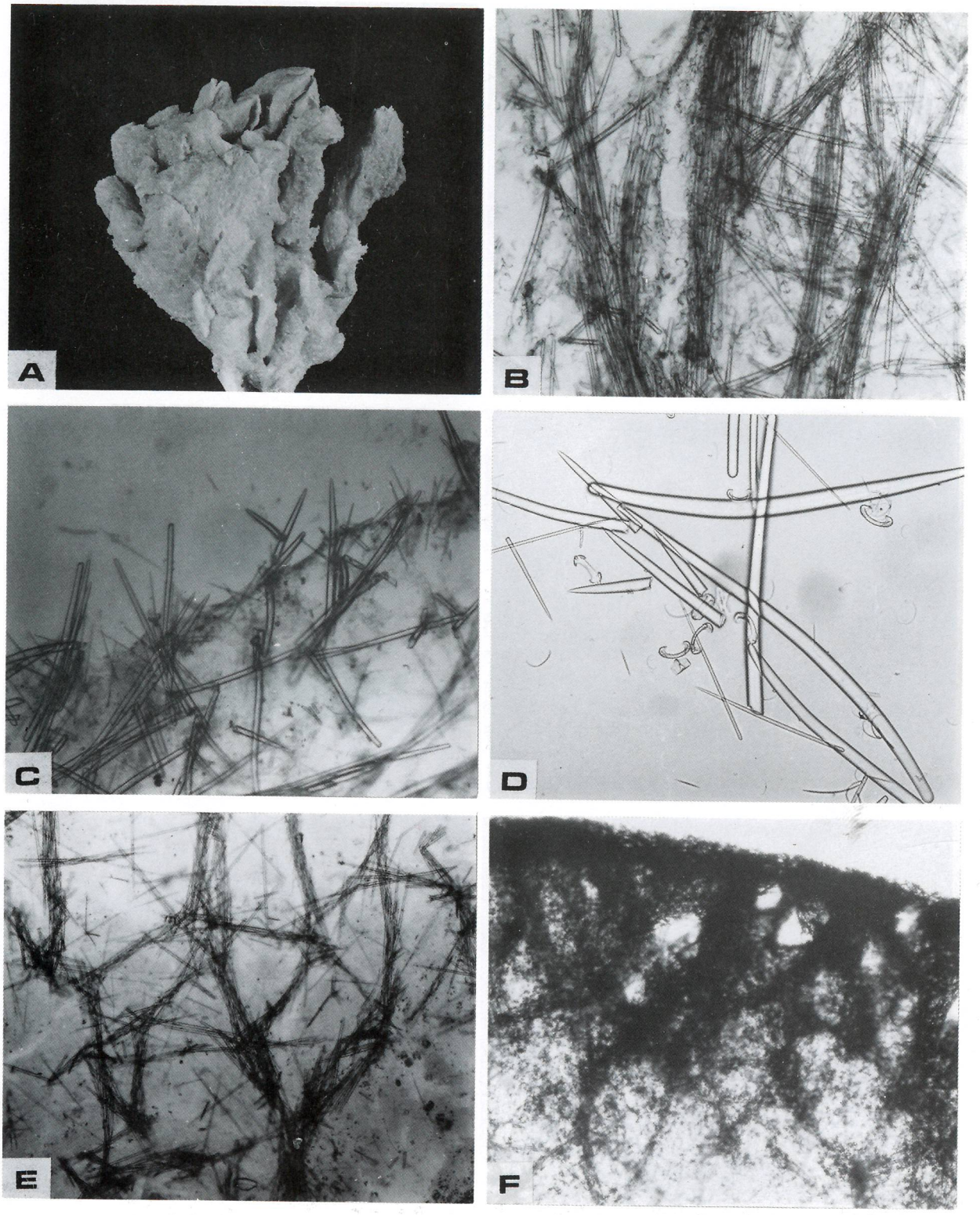

PLATE 17. A–D, *Echinostylinos reticulatus* Topsent: A, whole specimen; B, choanosomal spicule tracts, × 101; C, ectosomal skeleton, × 101; D, spicules, × 252. E, F, *Tetrapocillon novaezealandiae* Brøndsted: E, choanosomal reticulation, × 101; F, ectosomal skeleton with pigment cells, × 101.

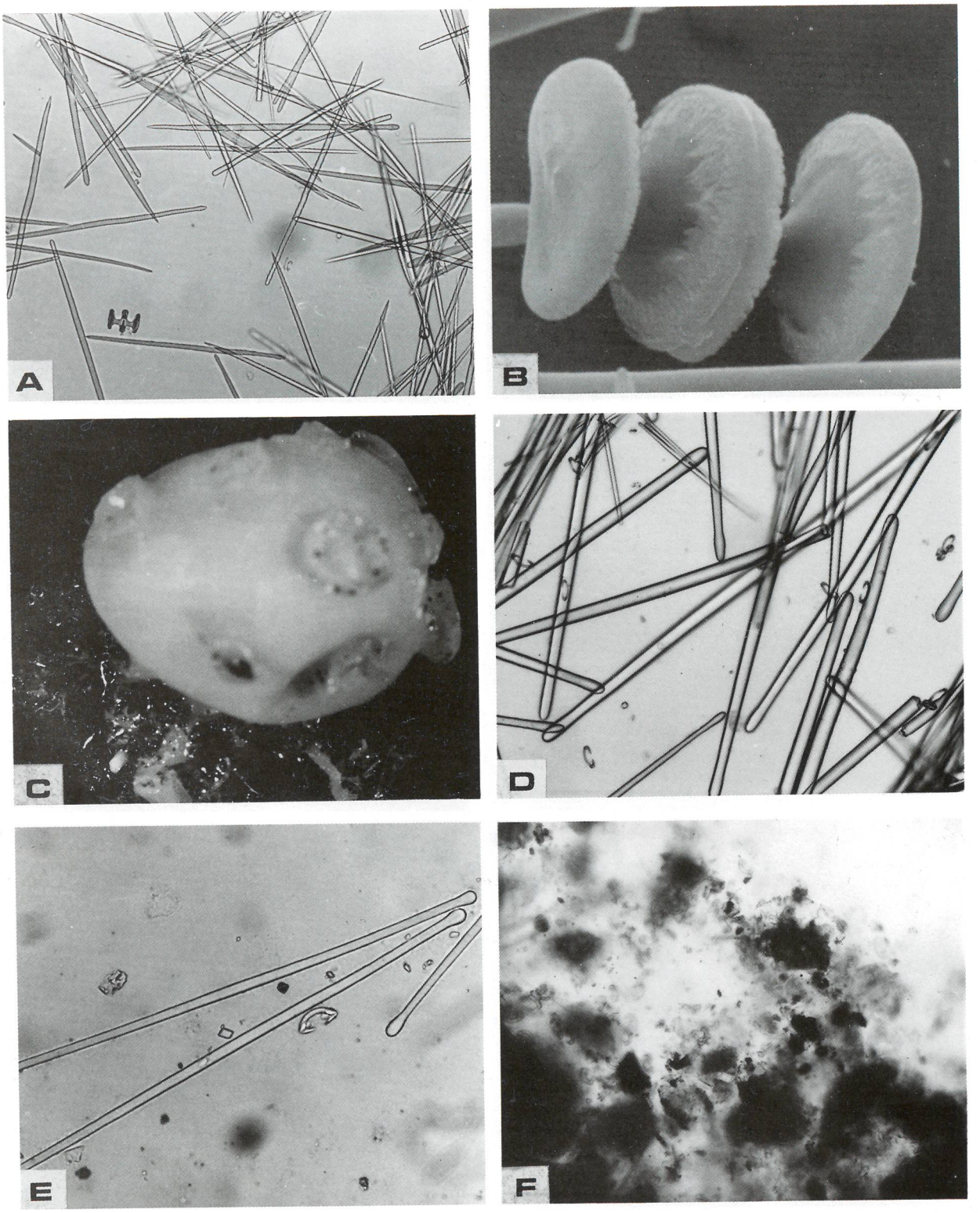

PLATE 18. A, B, *Tetrapocillon novaezealandiae* Brøndsted: A, spicules, × 252; B, tetrapocilli, × 2300. C, D, *Coelosphaera globosa* Bergquist: C, whole specimen; D, spicules, × 252. E, *Coelosphaera calcifera* (Burton): spicules, × 630. F, *Coelosphaera transiens* n.sp.: choanosomal skeleton with sand grains, × 252.

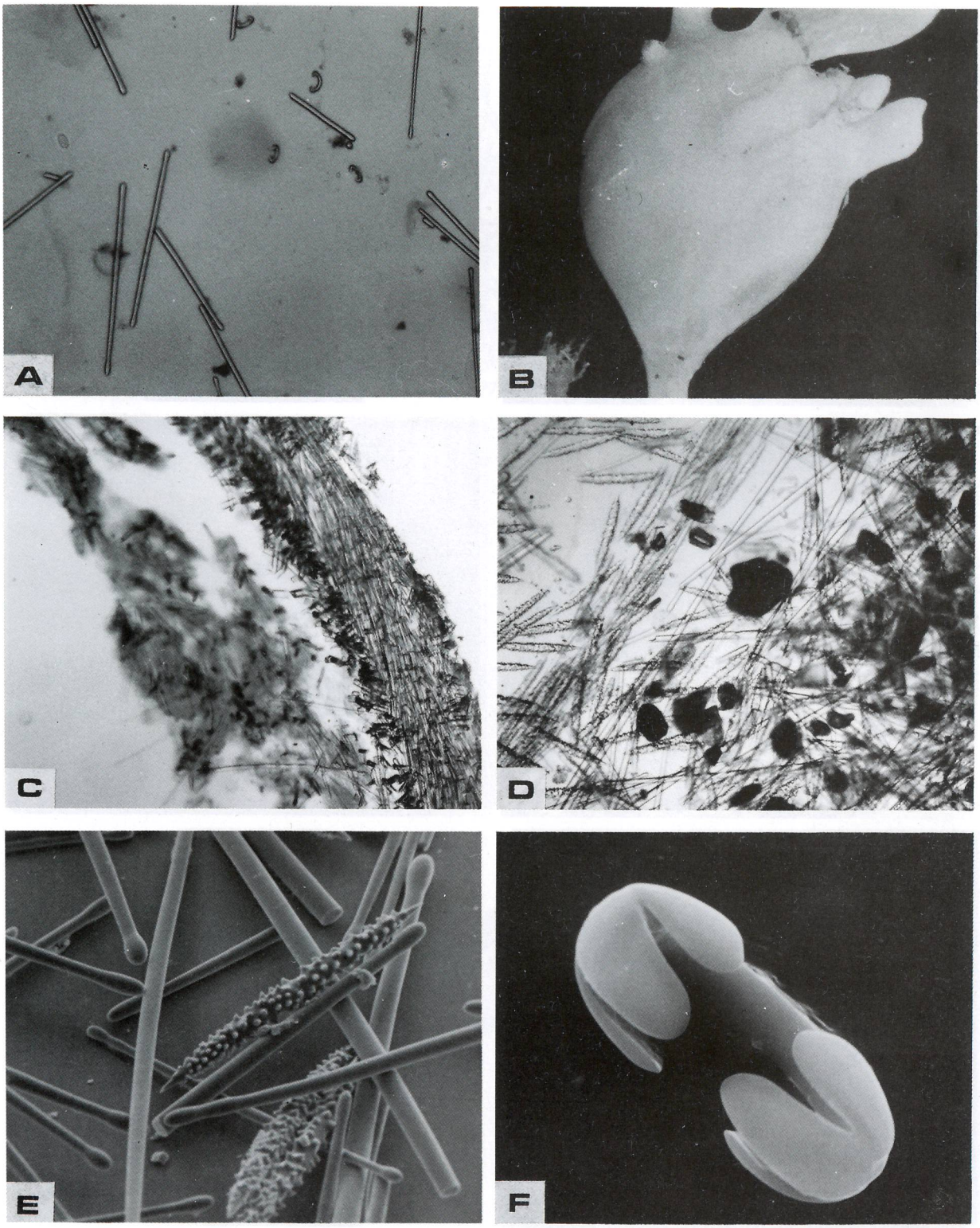

PLATE 19. A, *Coelosphaera transiens* n.sp.: spicules, × 252. B–F, *Histodermella australis* Dendy: B, whole specimen; C, ectosome and pulpy choanosome, × 101; D, surface view of ectosome, × 101; E, spicules, × 200; F, isochelae, × 3100.

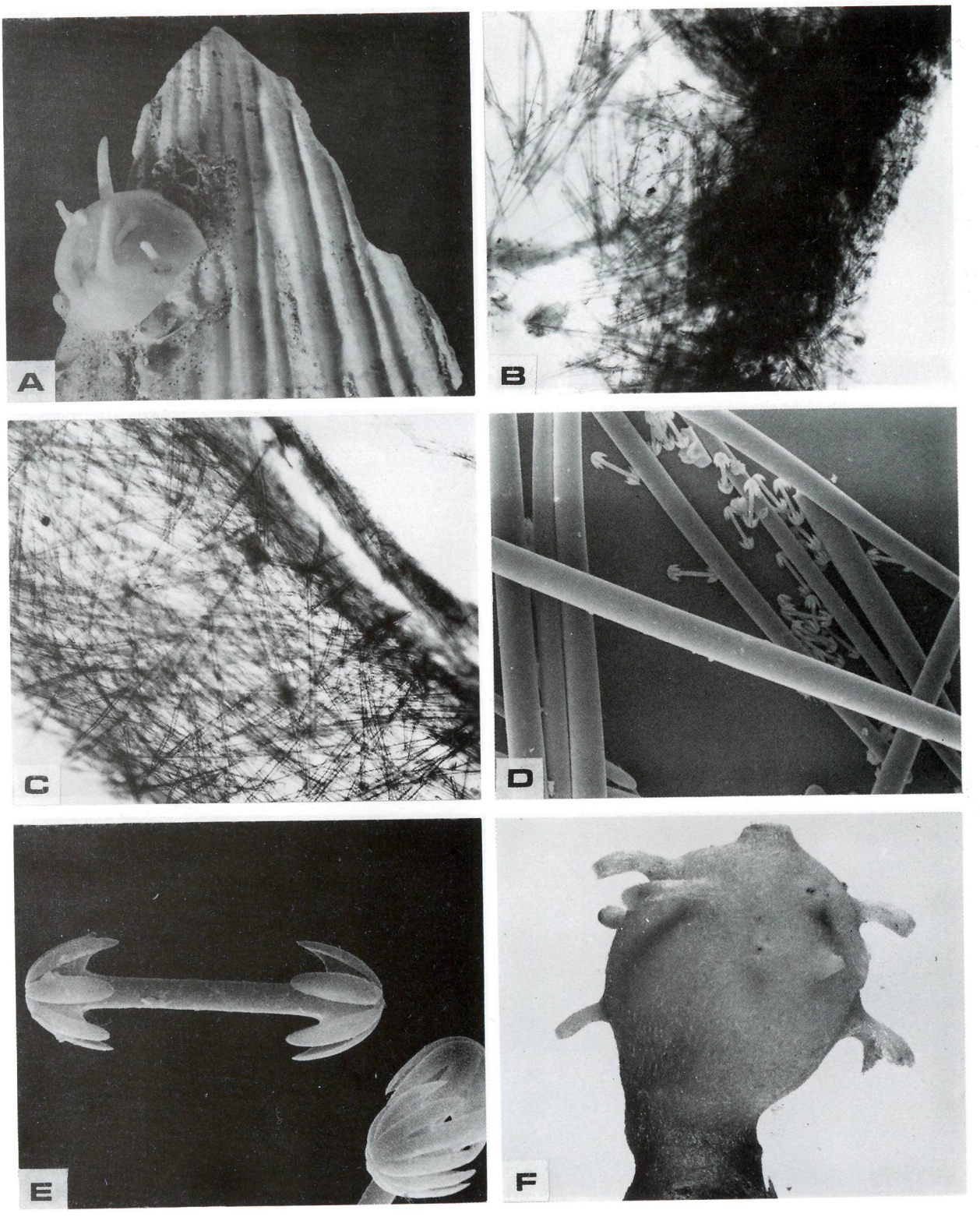

PLATE 20. A–E, *Amphiastrella kirkpatricki* Dendy: A, whole specimen; B, ectosome (dark region) and some choanosome, × 101; C, ectosome, × 101; D, spicules, × 330: E, birotulate isochelae, × 2100. F, *Inflatella spherica* Dendy: whole specimen.

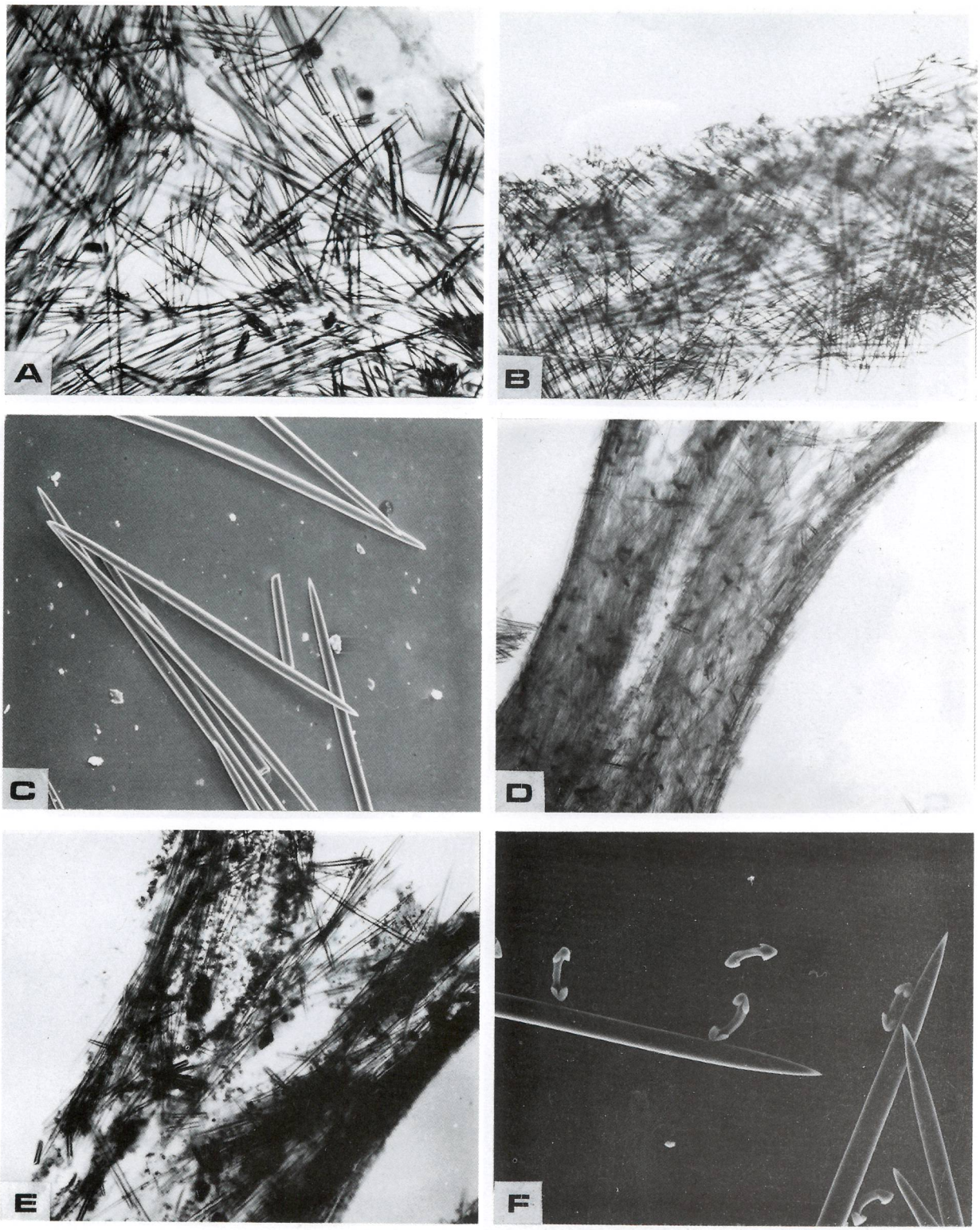

PLATE 21. A–C, *Inflatella spherica* Dendy: A, choanosomal spicules, × 252; B, ectosome, × 101; C, oxeas, × 90. D–F, *Manawa demonstrans* (Dendy): D, ectosomal skeleton, × 101; E, ectosome (dark region) and pulpy choanosome, × 101; F, spicules, × 295.

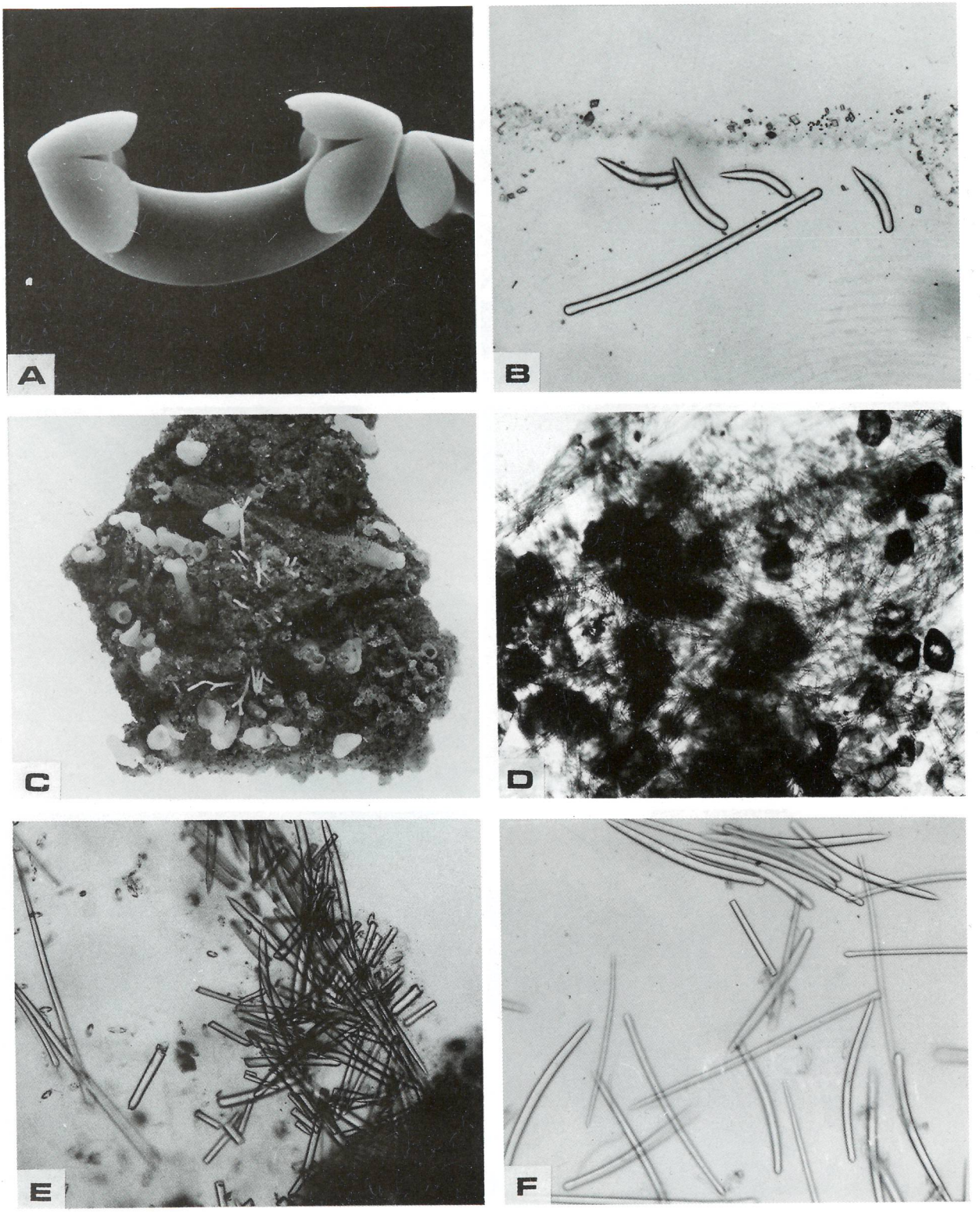

PLATE 22. A, *Manawa demonstrans* (Dendy): isochelae, × 2300. B, *Cornulum strepsichela* Dendy: spicules, × 252. C–F, *Paracornulum sinclairi* n.sp.: C, whole specimen looking down on the erect fistules; D, irregular choanosomal skeleton with sand grains, × 101; E, choanosomal spicule tract, × 252; F, spicules, × 252.

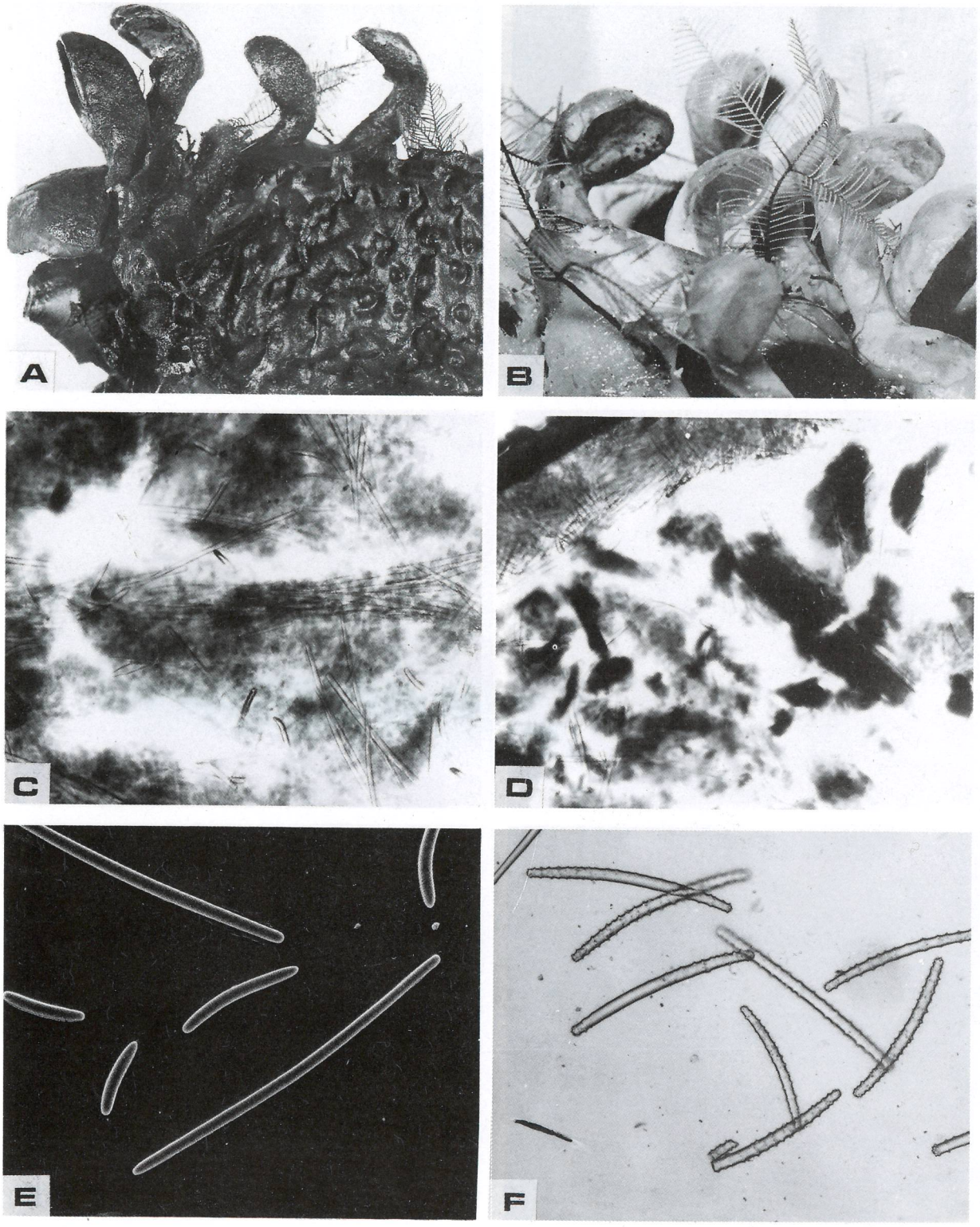

PLATE 23. A–E, *Coelocarteria spatulosa* n.sp.: whole specimen growing over *Latrunculia brevis*; B, inverted spatula-shaped fistules; C, loose tracts of spicules in dense choanosome, × 101; D, ectosomal skeleton (top left-hand corner) and dense choanosome, × 101; E, spicules, × 120. F, *Zyzza massalis* (Dendy): verticillate-spined acanthostrongyles, × 252.

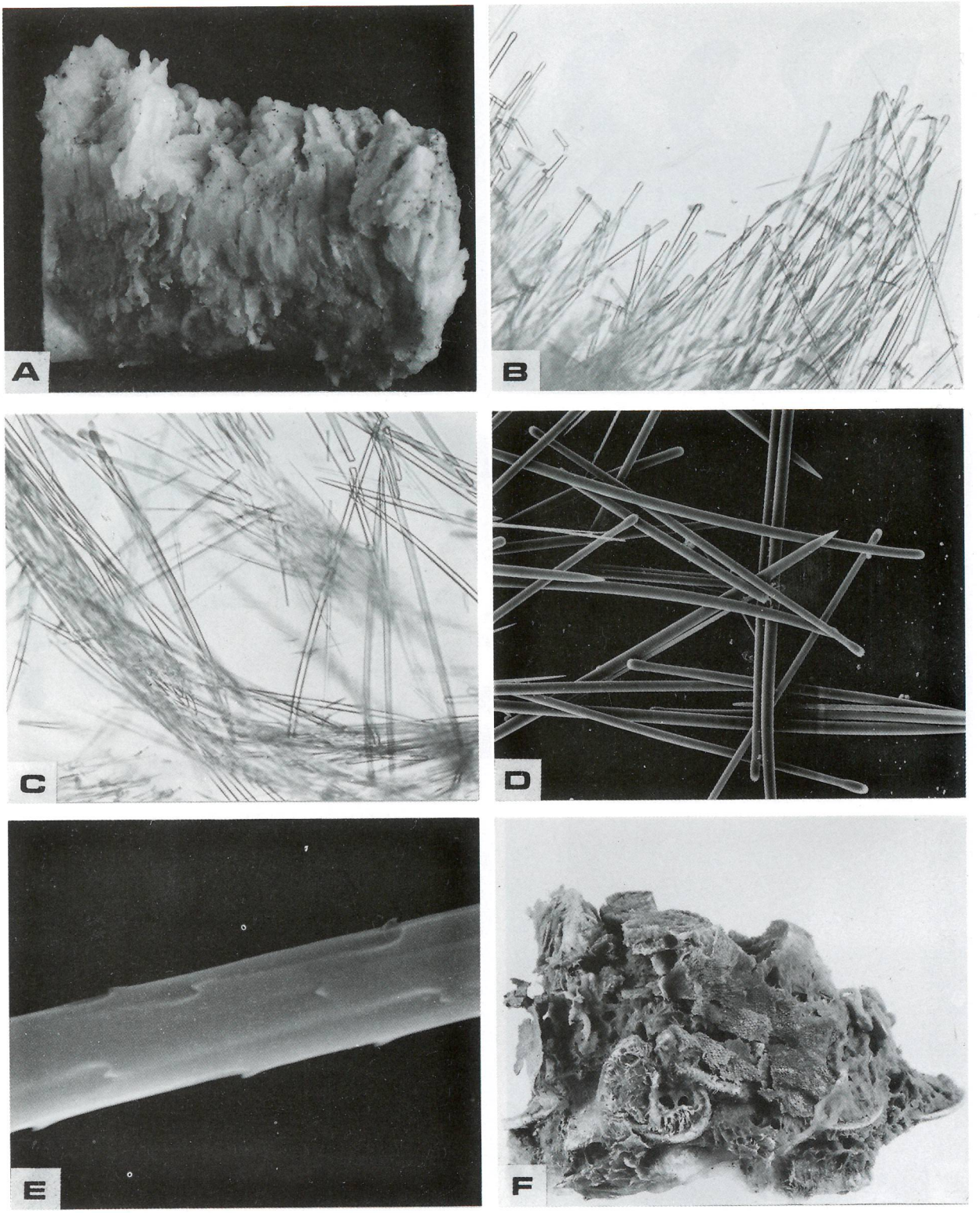

PLATE 24. A–E, *Tedania connectens* (Brøndsted): A, whole specimen showing uneven surface; B, ectosomal tylotes, × 284; C, choanosomal spicule tracts, × 284; D, spicules, × 292; E, onychaete, × 6600. F, *Tedania diversirhaphidiophora* Brøndsted: side view of whole specimen.

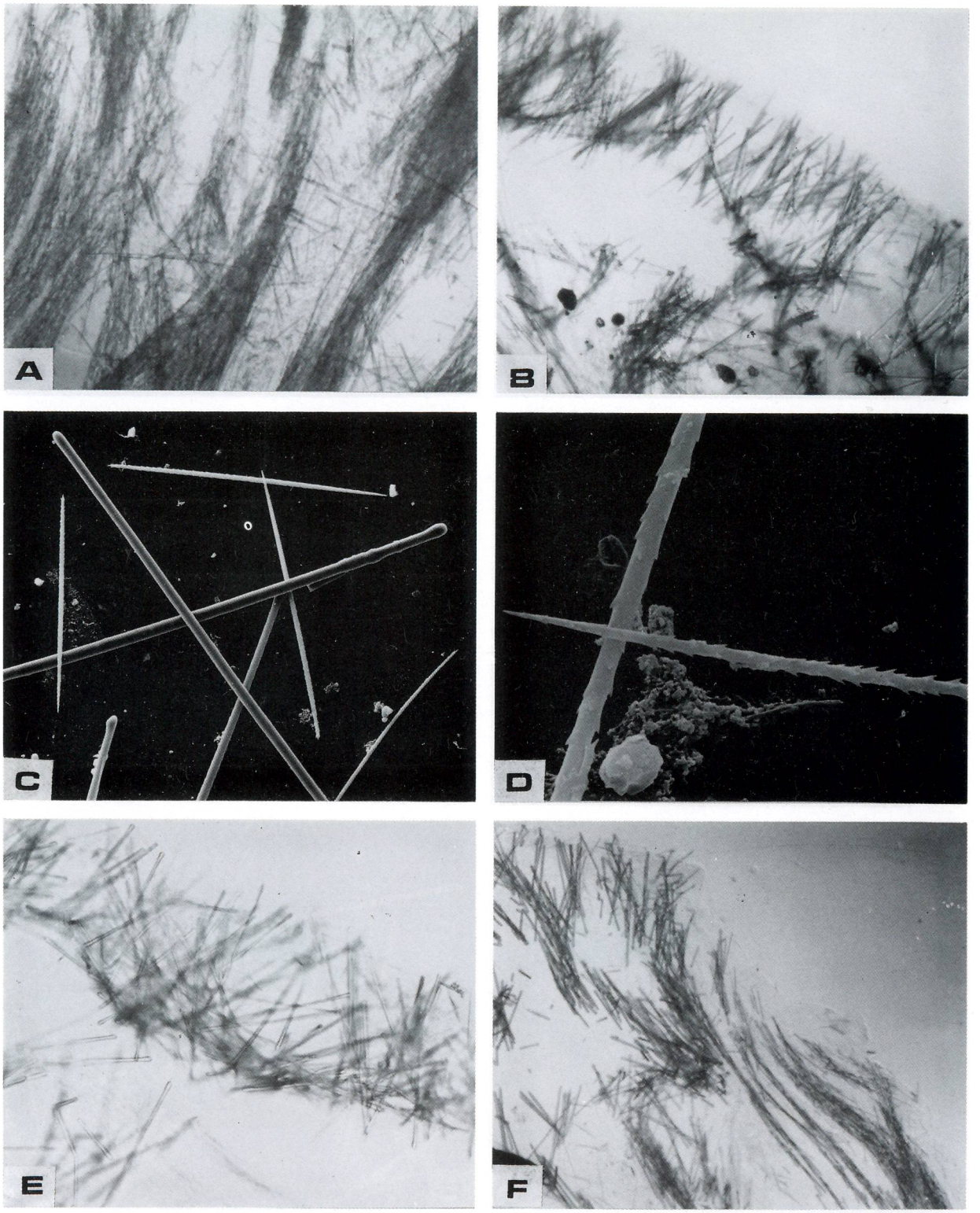

PLATE 25. A–D, *Tedania diversirhaphidiophora* Brøndsted: A, choanosomal spicule tracts, × 113; B, ectosomal fans of spicules, × 113; C, spicules, × 325; D, onychaetes, × 2800. E, F, *Tedania spinostylota* n.sp.: irregular ectosomal palisade of spicules, × 113; F, choanosomal spicule tracts, × 113.

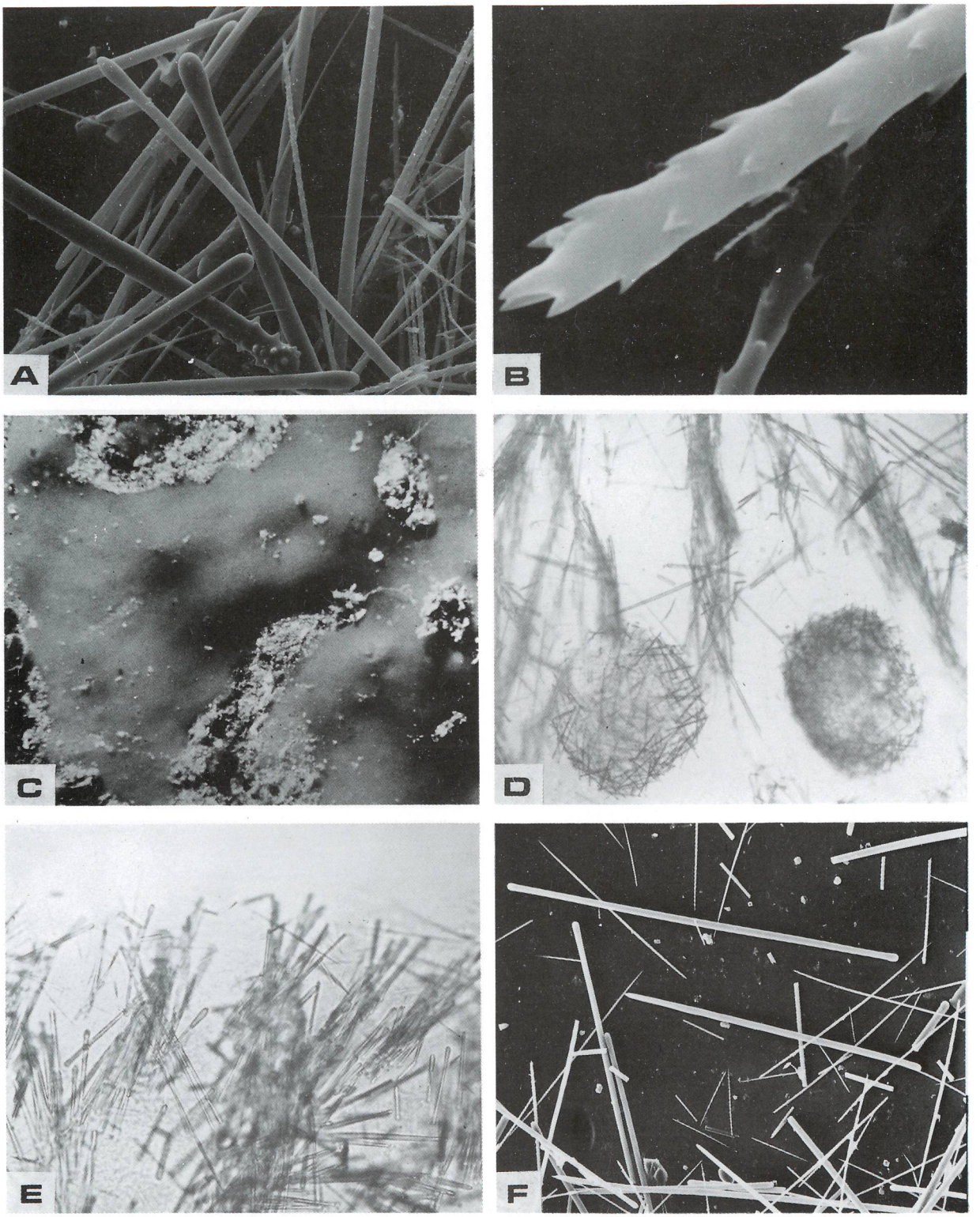

PLATE 26. A, B, *Tedania spinostylota* n.sp.: A, spicules showing spined head of a style, × 725; B, onychaete, × 7500. C–F, *Tedania battershilli* n.sp.: C, whole specimen; D, choanosomal spicule tracts with larvae, × 113; E, ectosomal fans of spicules, × 284; F, spicules, × 260.

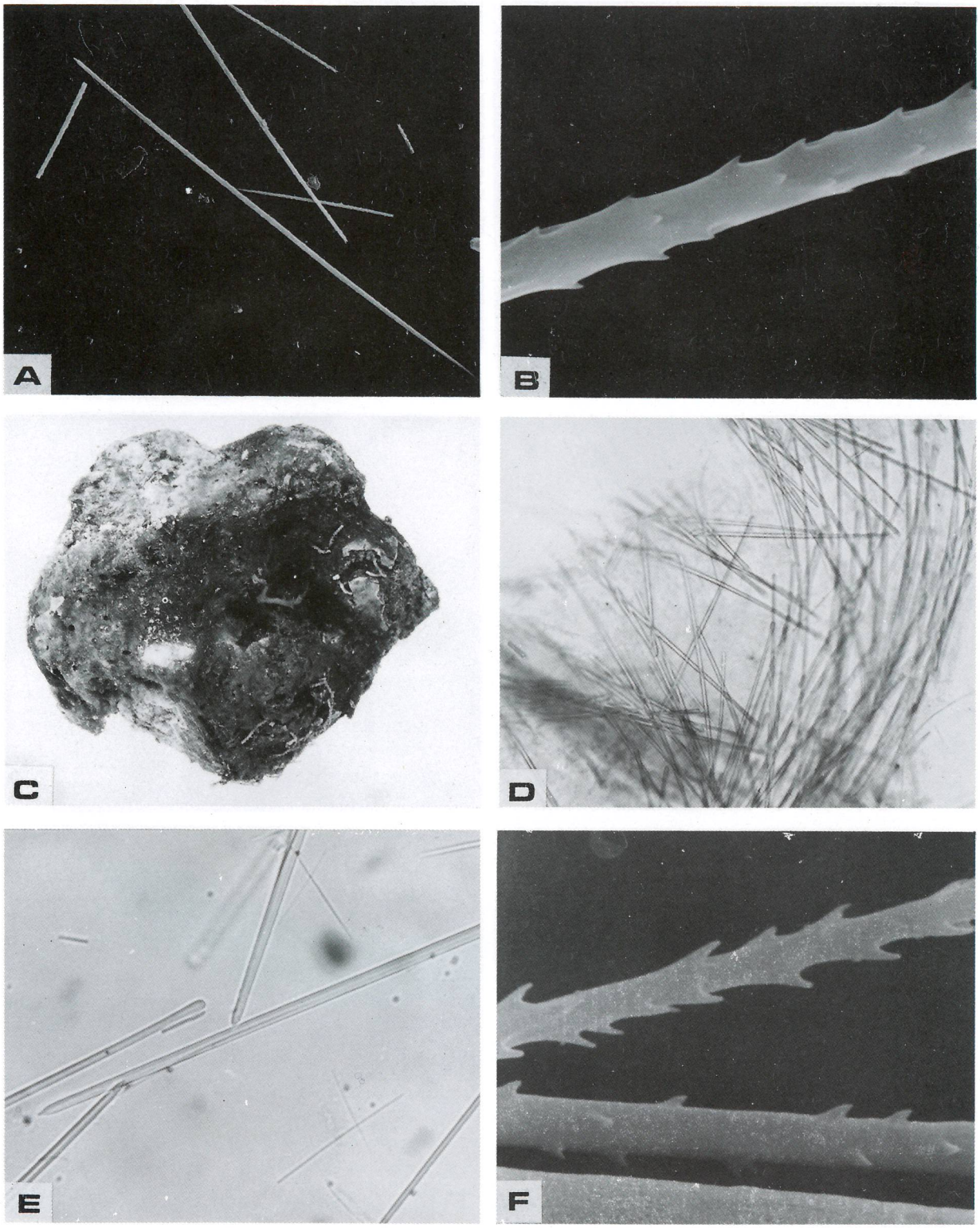

PLATE 27. A, B, *Tedania battershilli* n.sp.: A, onychaetes, × 700; B, onychaete, × 5500. C–F. *Tedania purpurescens* n.sp.: C, encrusting sponge (dark region); D, ectosomal skeleton, × 284; E, spicules, × 709; F, onychaetes, × 9000.

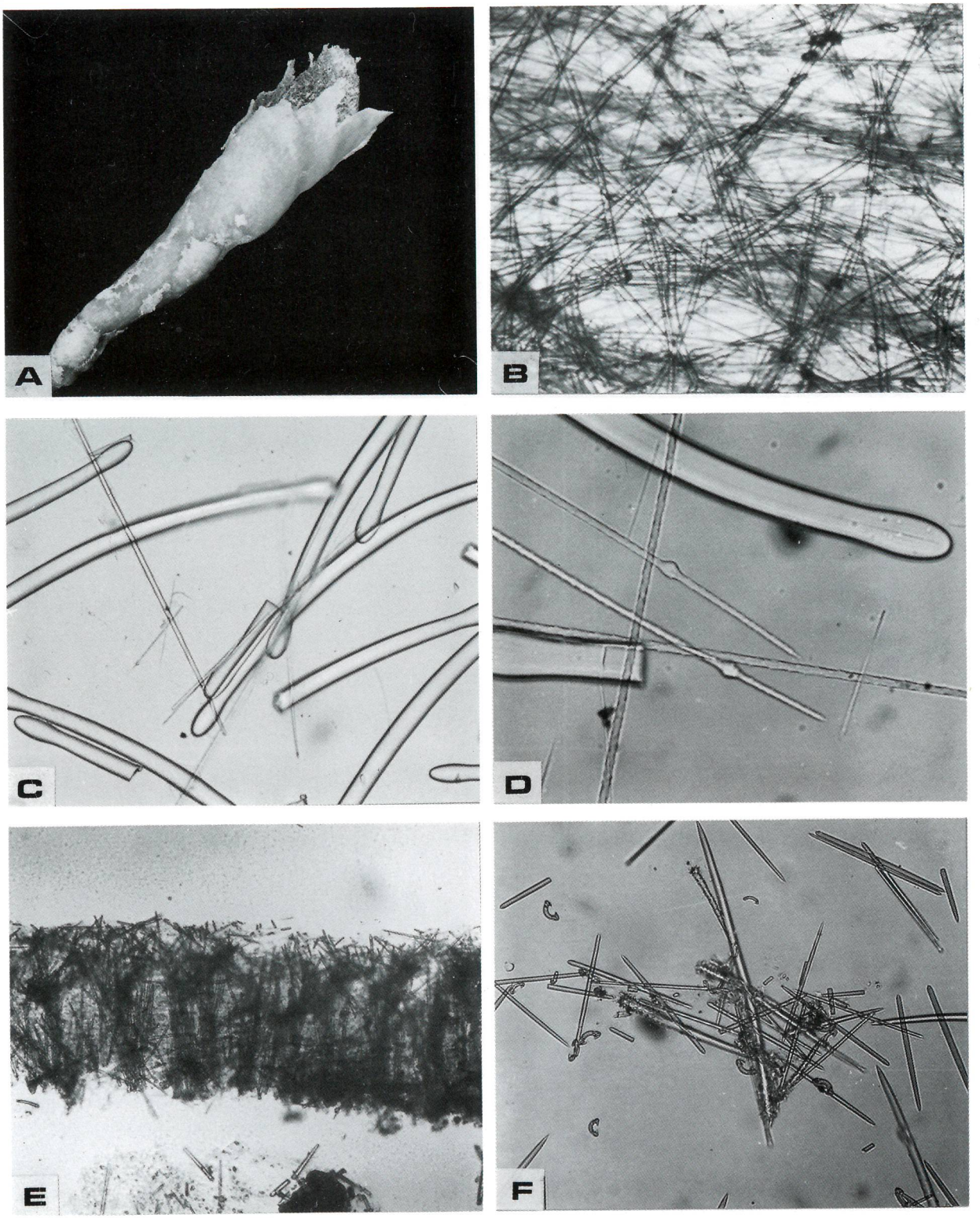

PLATE 28. A–D, *Tedaniopsis turbinata* Dendy: A, piece of whole specimen; B, surface view of ectosome, × 113; C, spicules, × 284; D, subterminal bulbs on onychaetes, × 709. E, F, *Hymedesmia microstrongyla* n.sp.: E, skeleton of plumose tracts extending from the base to the surface of the sponge, × 101; F, spicules, × 252.

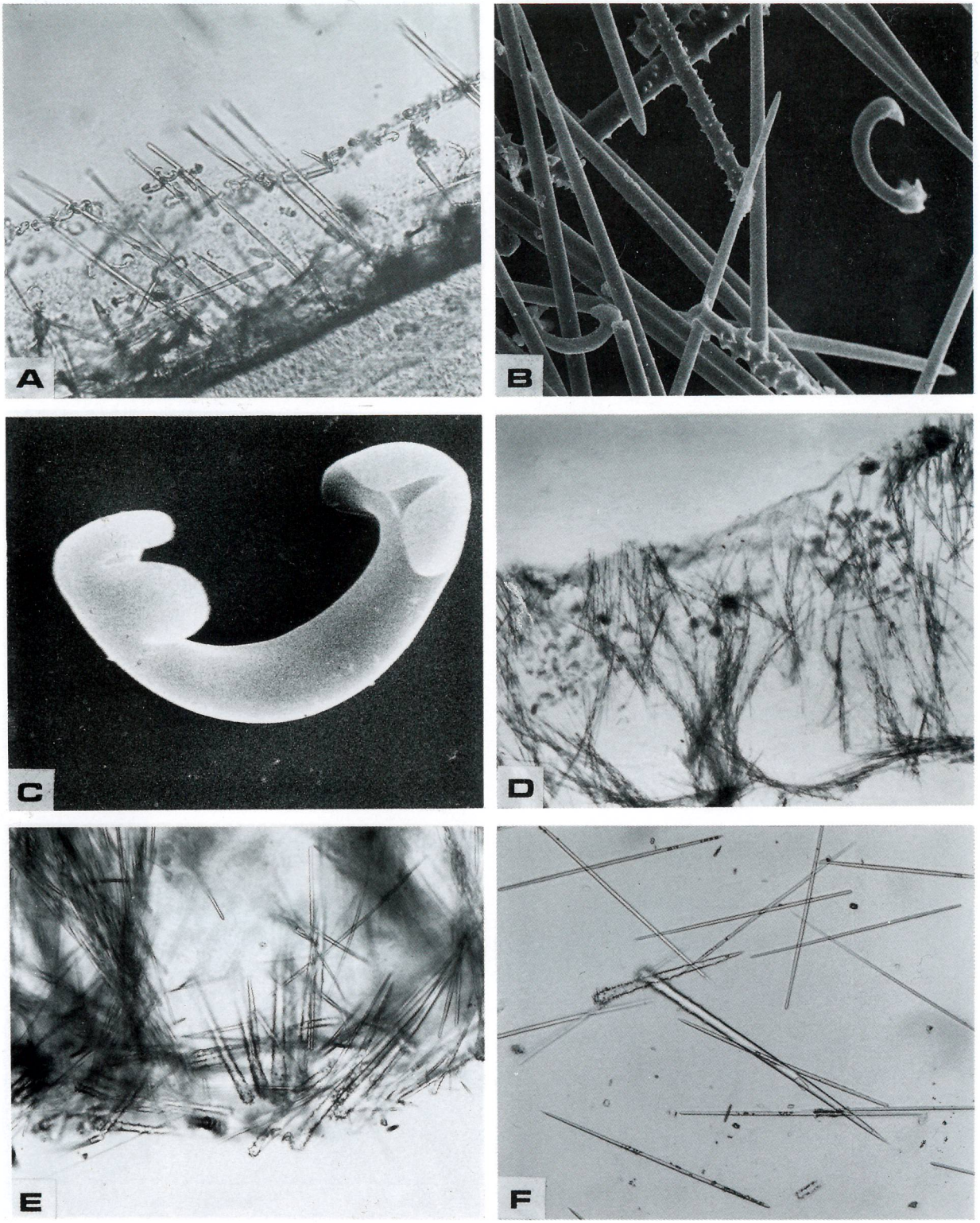

PLATE 29. A–C, *Hymedesmia anisostrongyloxea* n.sp.: A, large acanthostyles extending from the base to the surface of the sponge, × 252; B, spicules, × 700; C, isochelae, × 2600. D–F, *Stylopus lissostyla* n.sp.: D, choanosomal spicule tracts, and ectosomal spicules aggregated around pore areas, × 101; E, erect acanthostyles at the base of the sponge, × 252; F, spicules, × 252.

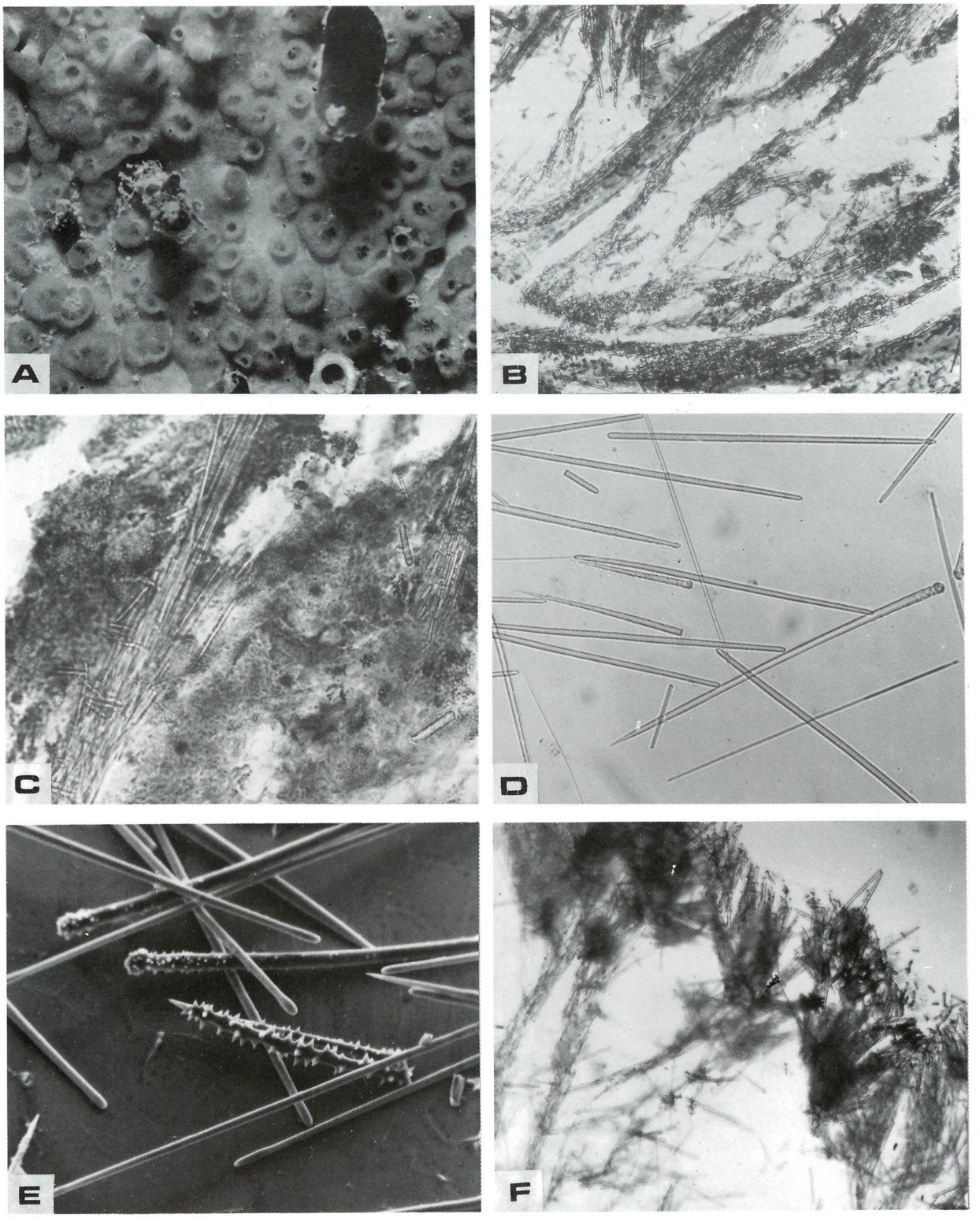

PLATE 30. A–E, *Stylopus australis* n.sp.: A, pronounced areolate pore-fields in live specimen; B, choanosomal spicule tracts, × 101; C, choanosomal spicule tracts, × 284; D, spicules, × 284; E, spicules, × 350. F, *Phorbas intermedia* Bergquist: ectosomal skeleton of erect spicules and underlying plumose choanosomal tracts, × 101.

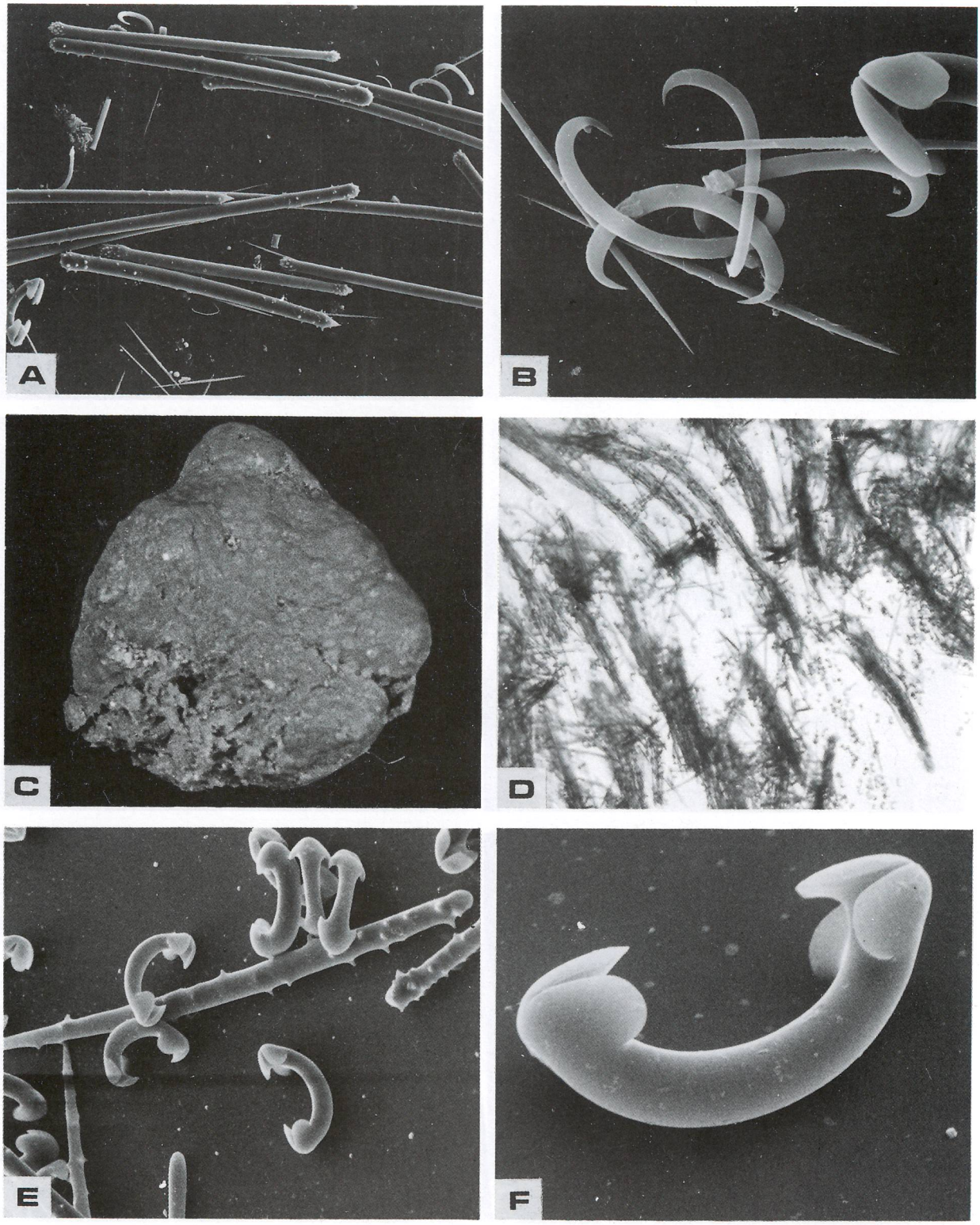

PLATE 31. A, B, *Phorbas intermedia* Bergquist: A, spicules, × 340; B, sigmas, rhaphides and isochelae, × 1600. C–F, *Phorbas areolata* n.sp.: C, whole specimen; D, plumose choanosomal tracts, × 113; E, acanthostyles and isochelae, × 950. F, isochelae, × 3200.

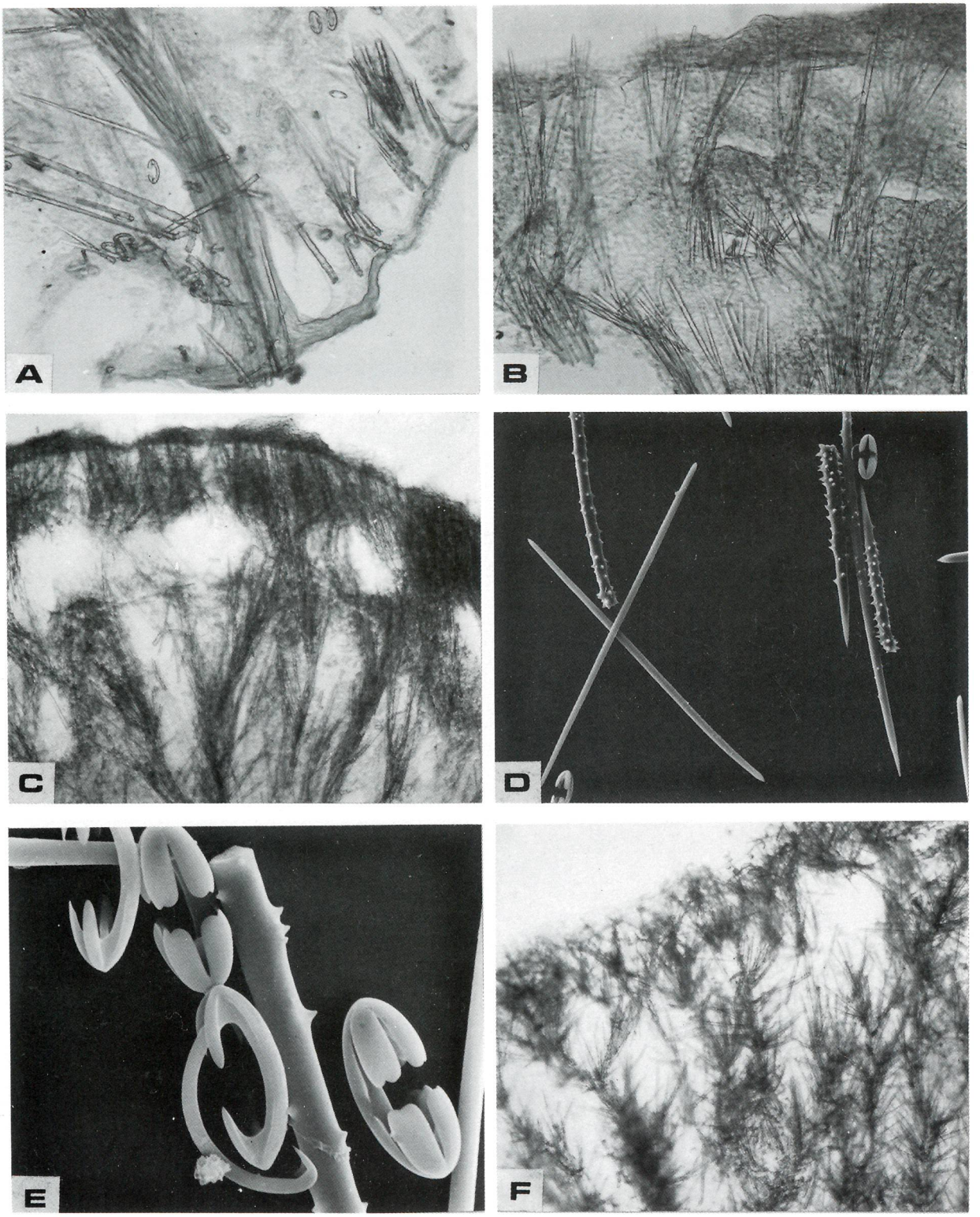

PLATE 32. A–E, *Pronax anchorata* n.sp.: A, base of choanosomal spicule tract showing fibre development, × 252; B, ectosomal skeleton of erect spicules, × 252; C, plumose choanosomal spicule tracts and subdermal spaces, × 101; D, spicules, × 330; E, isochelae and sigmas, × 1008. F, *Pronax fulva* n.sp.: ectosomal and choanosomal skeleton, × 101.

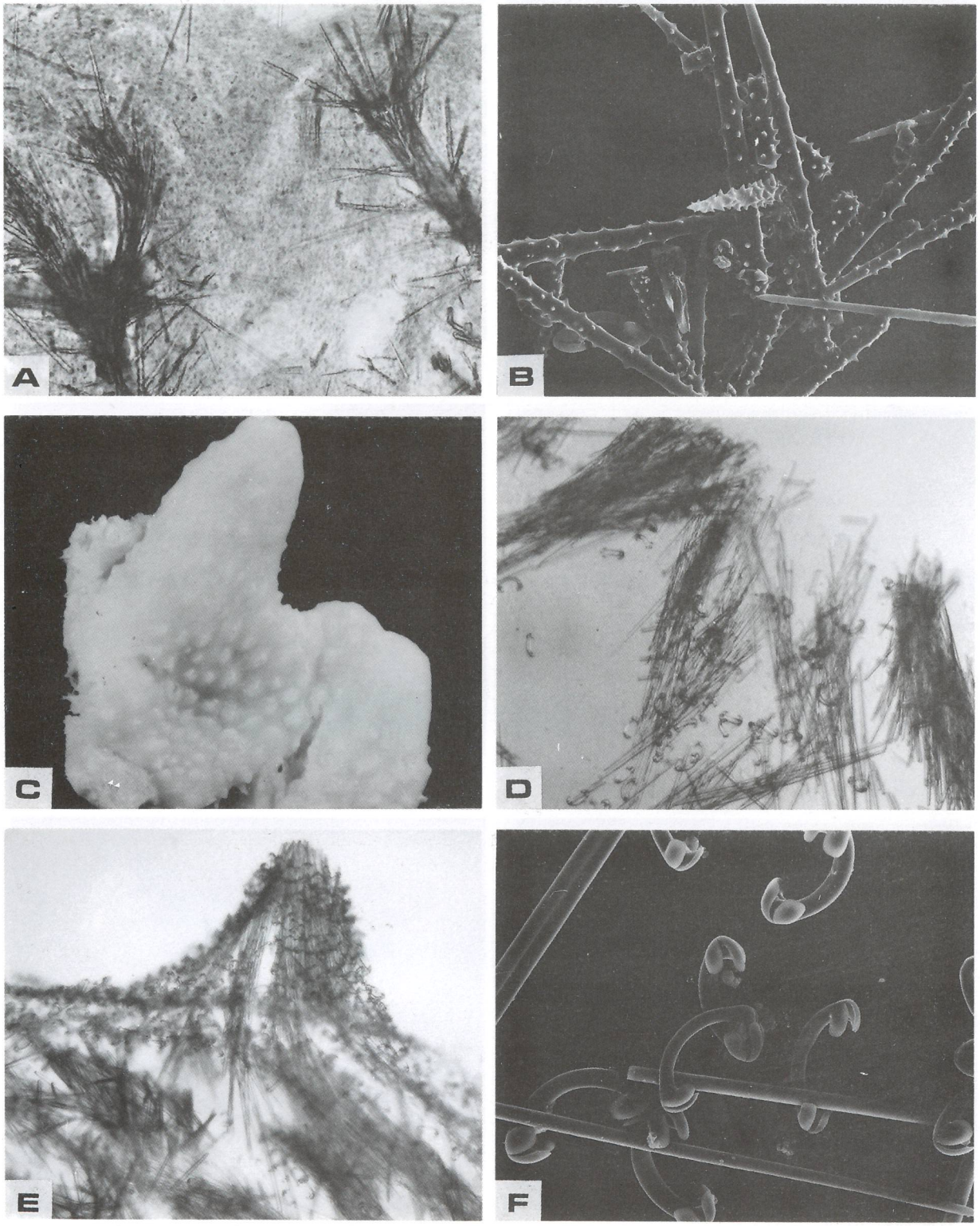

PLATE 33. A, B, *Pronax fulva* n.sp.: A, choanosomal spicule tracts showing fibre development, × 252; B, acanthostyles, × 480. C–F, *Hamigera macrostrongyla* n.sp.: C, whole specimen; D, ectosomal skeleton of erect spicules, × 113; E, skeleton of surface projection, × 113; F, isochelae, × 430.

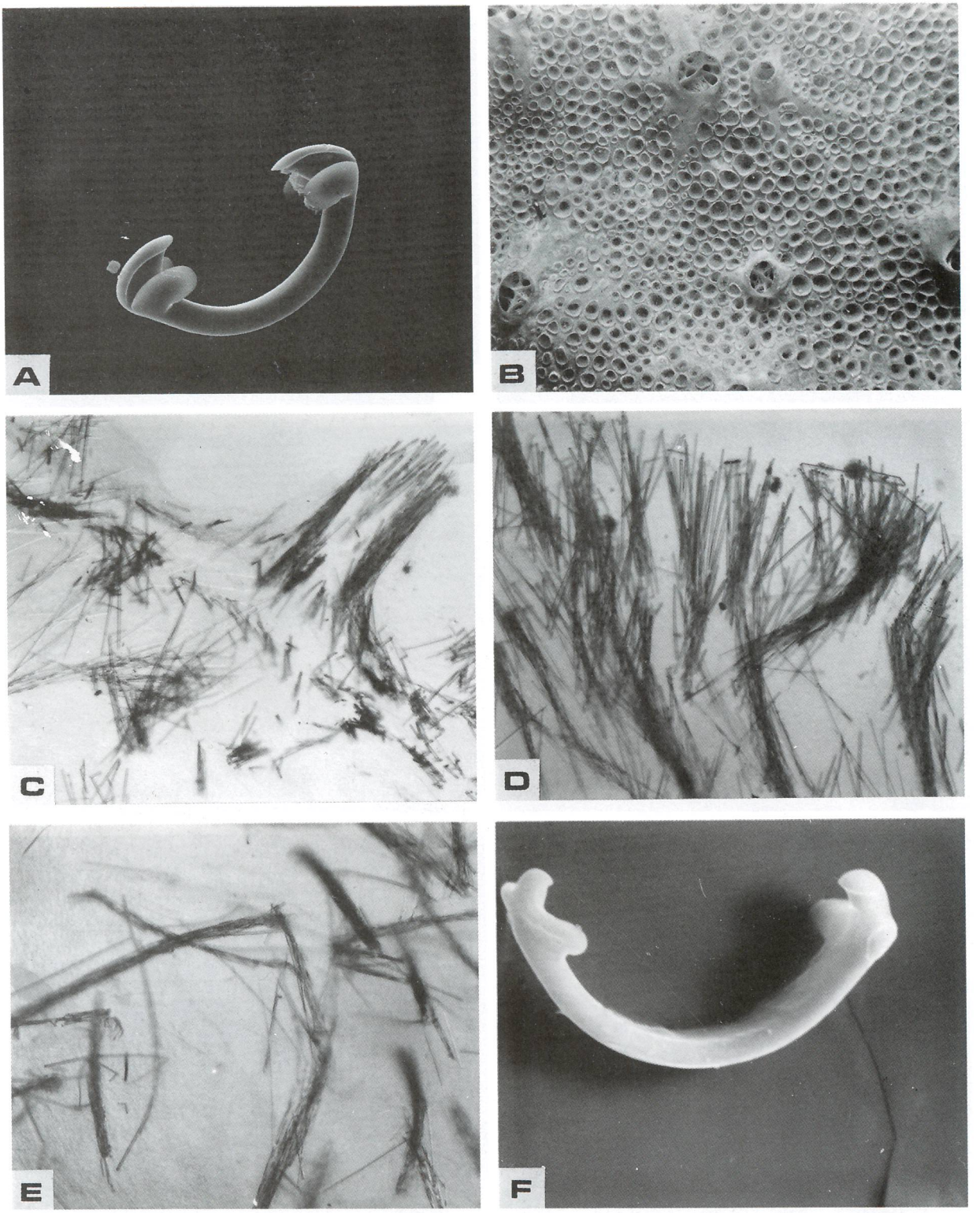

PLATE 34. A, *Hamigera macrostrongyla* n.sp.: isochelae, × 860. B–F, *Hamigera tarangaensis* n.sp.: B, whole specimen; C, skeleton of surface projection, × 113; D, ectosomal skeleton of erect spicules, × 284; E, choanosomal spicule tracts, × 113; F, isochelae, × 1600.

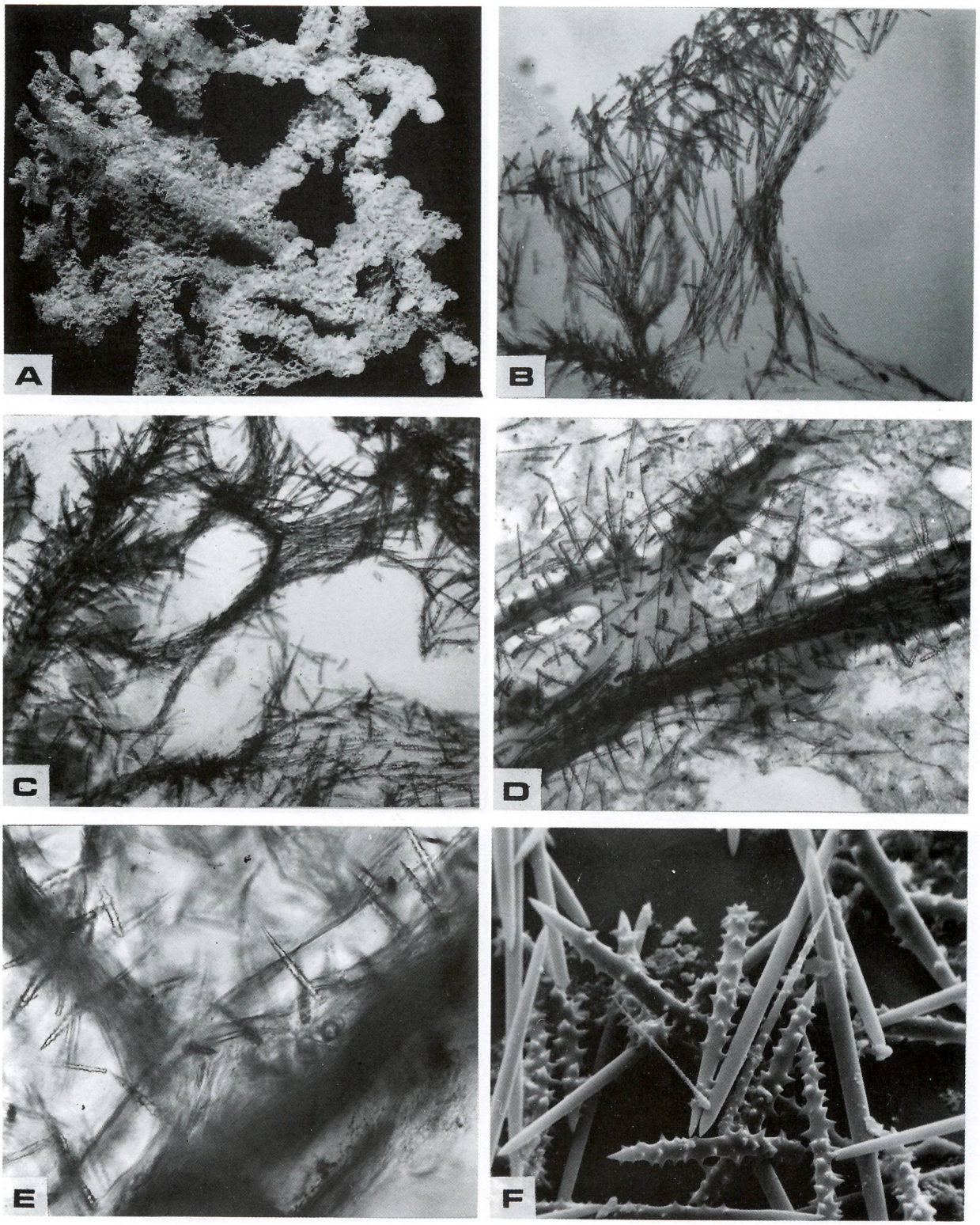

PLATE 35. A–F, *Crella incrustans* (Carter): A, whole specimen; B, ectosomal skeleton, × 113; C, subdermal spaces and tracts of oxeas beneath the ectosome, × 113; D, choanosomal fibre development and echinating spicules, × 113; E, basal layer of spongin showing erect acanthostyles, × 284; F, spicules, × 650.

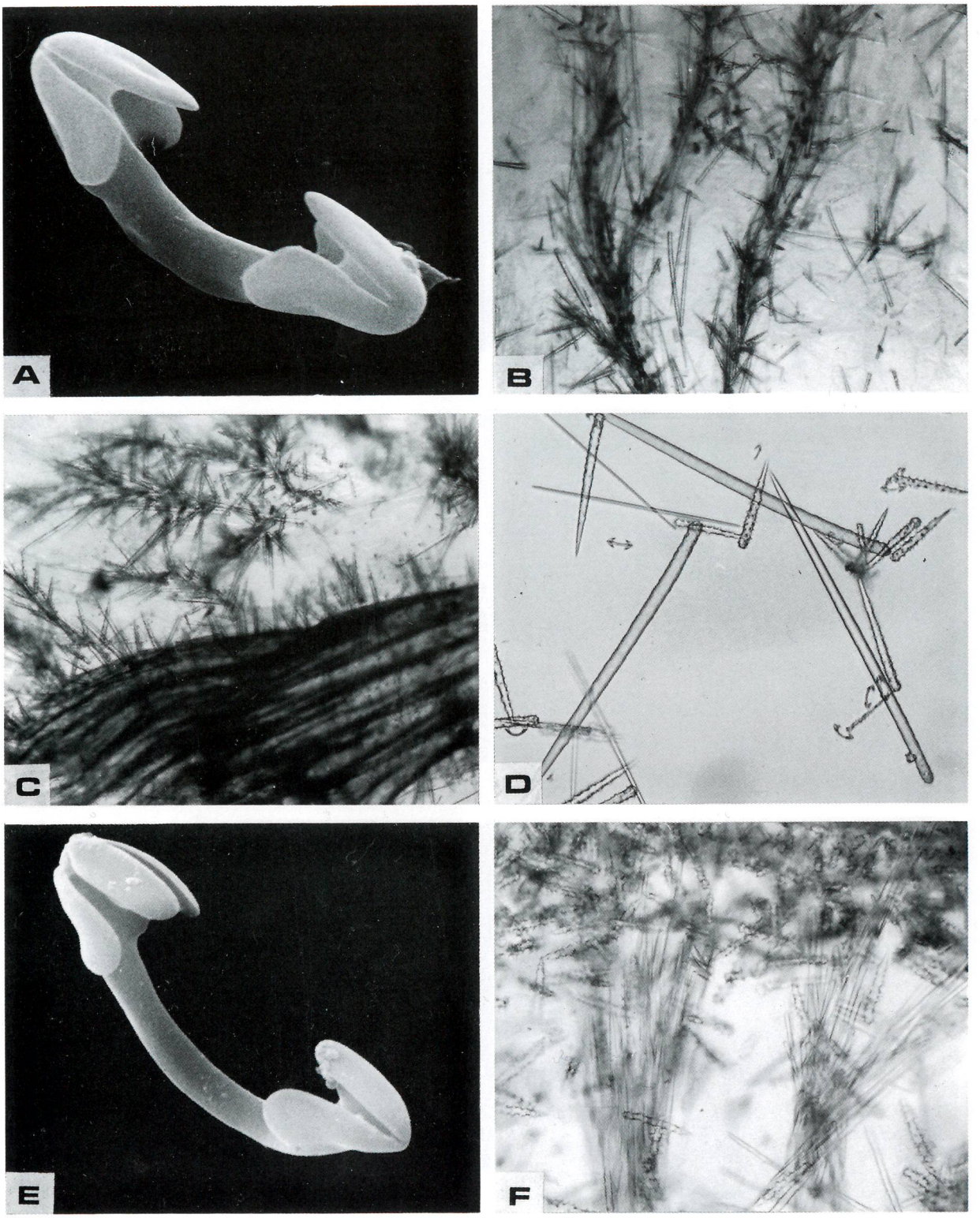

PLATE 36. A, *Crella incrustans* (Carter): isochelae, × 7500. B–E, *Crella fristedi* (Dendy): B, choanosomal spicule tracts with echinating spicules, × 113; C, bryozoan fragment incorporated into the choanosomal skeleton, × 113; D, spicules, × 284; E, isochelae, × 3200. F, *Crella affinis* (Brøndsted): diactinal spicules supporting the ectosome of acanthostyles, × 284.

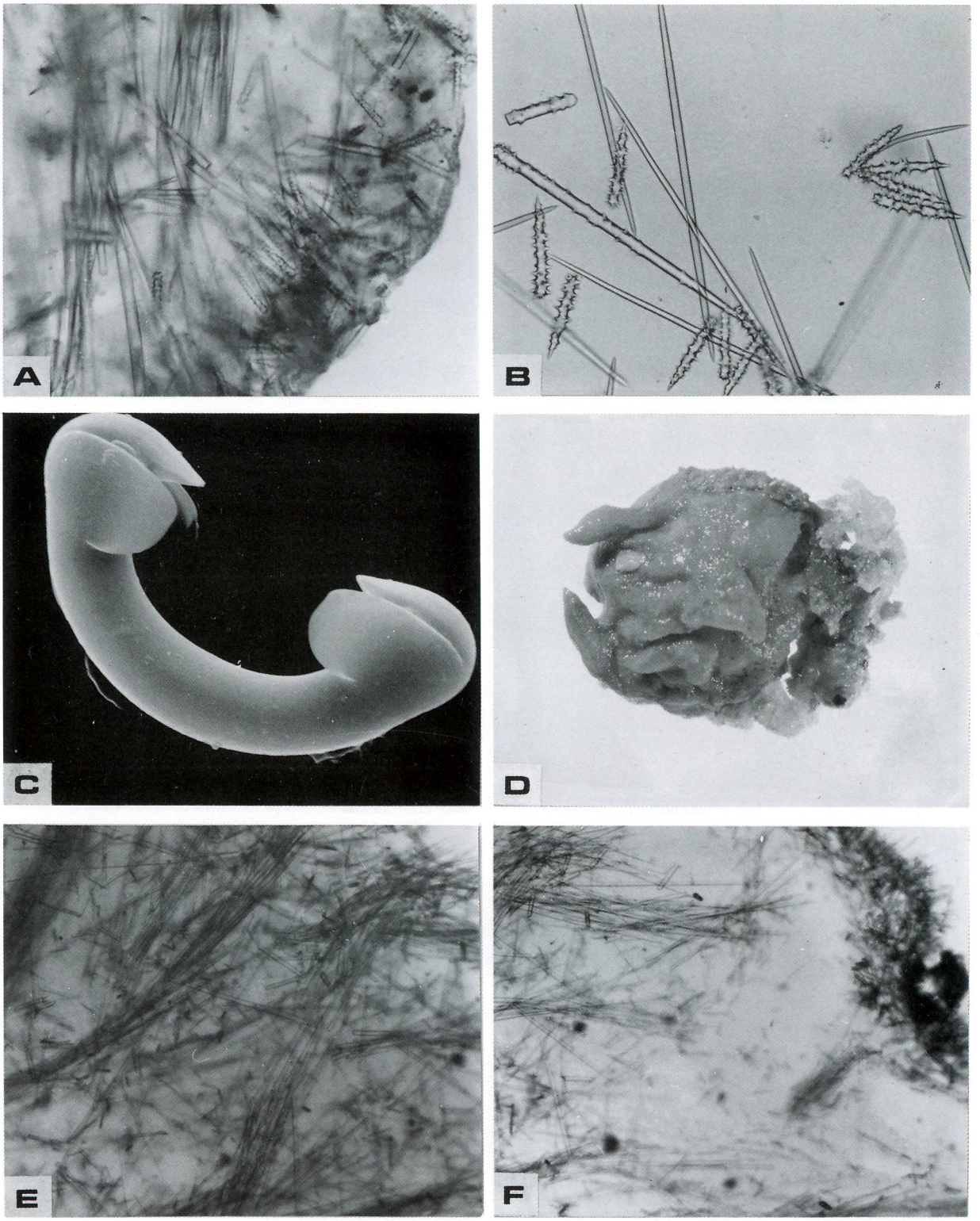

PLATE 37. A–C, *Crella affinis* (Brøndsted): A, basal region of sponge showing erect acanthostyles, × 284; B, spicules, × 284; C, isochelae, × 3300. D–F, *Naniupi novaezealandiae* n.sp.: D, whole specimen; E, choanosomal spicule tracts, × 113; F, ectosomal acanthostyles and choanosomal spicule tracts, × 113.

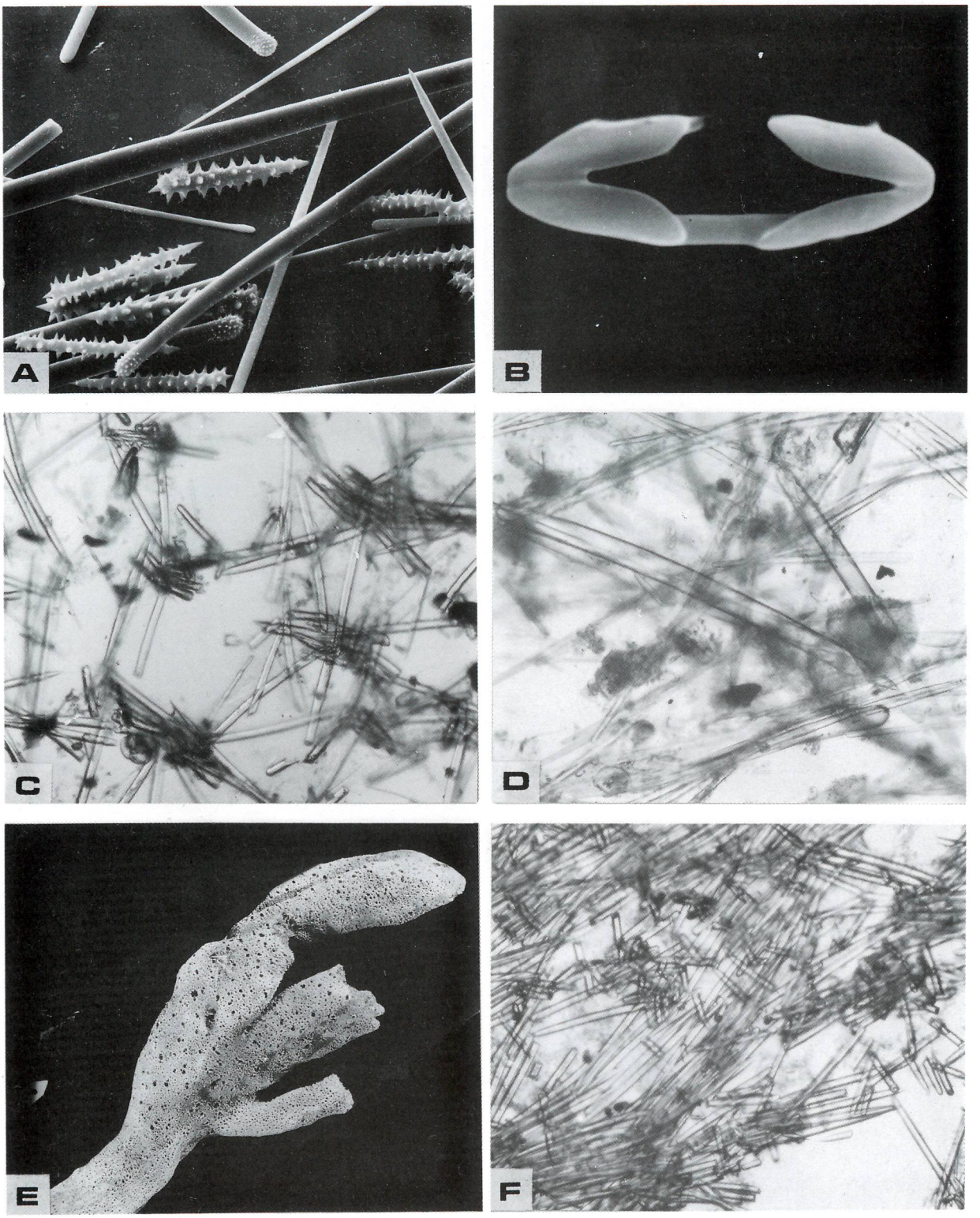

PLATE 38. A, B, *Naniupi novaezealandiae* n.sp.: A, spicules, × 400; B, isochelae, × 3800. C, D, *Myxilla novaezealandiae* Dendy: C, irregular isodictyal choanosomal skeleton, × 113; D, surface view of ectosome, × 284. E, F, *Myxilla columna* n.sp.: E, whole specimen; F, thick choanosomal spicule tract, × 113.

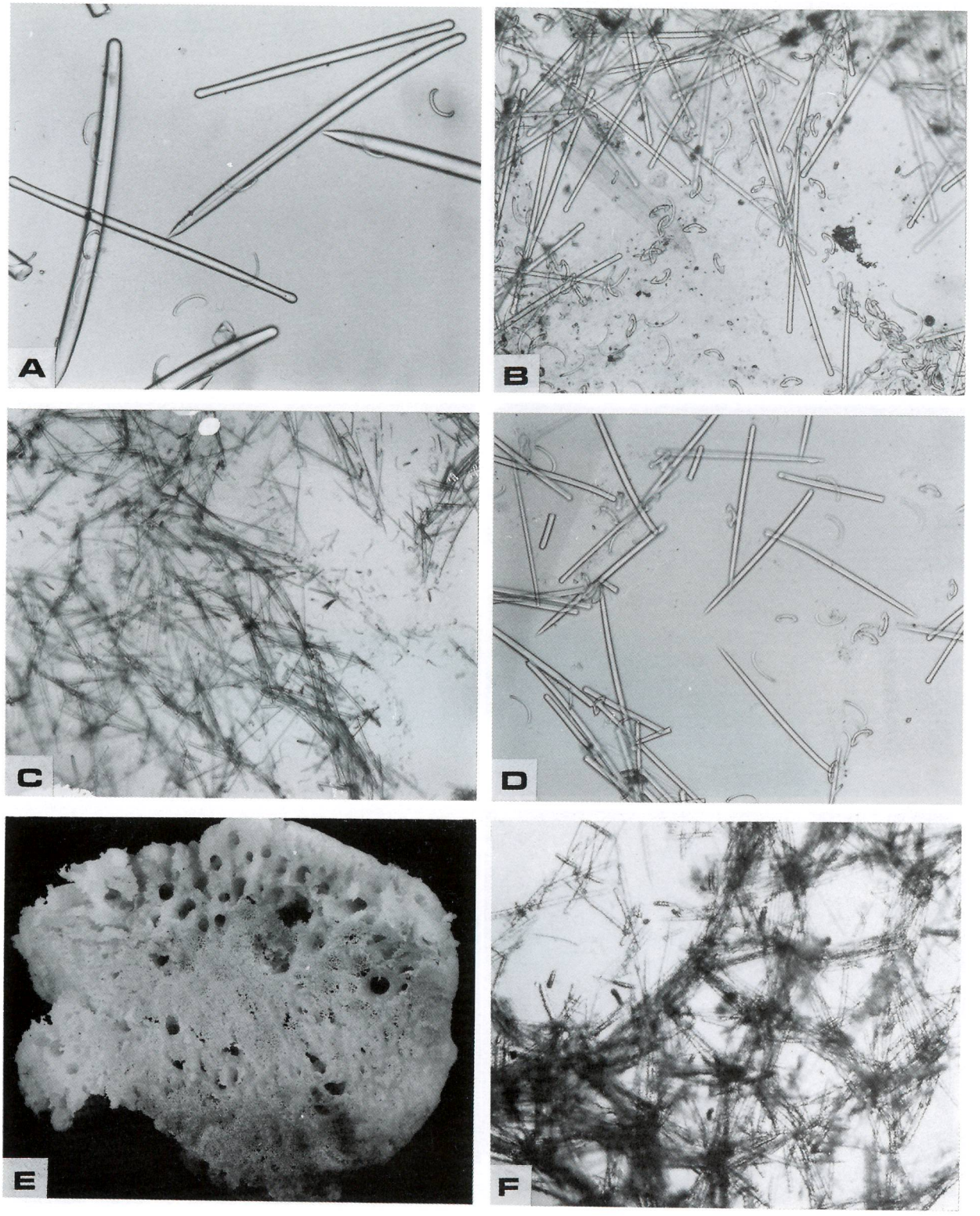

PLATE 39. A, *Myxilla columna* n.sp.: spicules, × 284. B–D, *Lissodendoryx isodictyalis* (Carter): B, surface view of ectosome, × 284; C, irregular choanosomal reticulation, × 113; D, spicules, × 284. E, F, *Ectyomyxilla kerguelensis* Hentschel: E, whole specimen; F, isodictyal choanosomal reticulation, × 101.

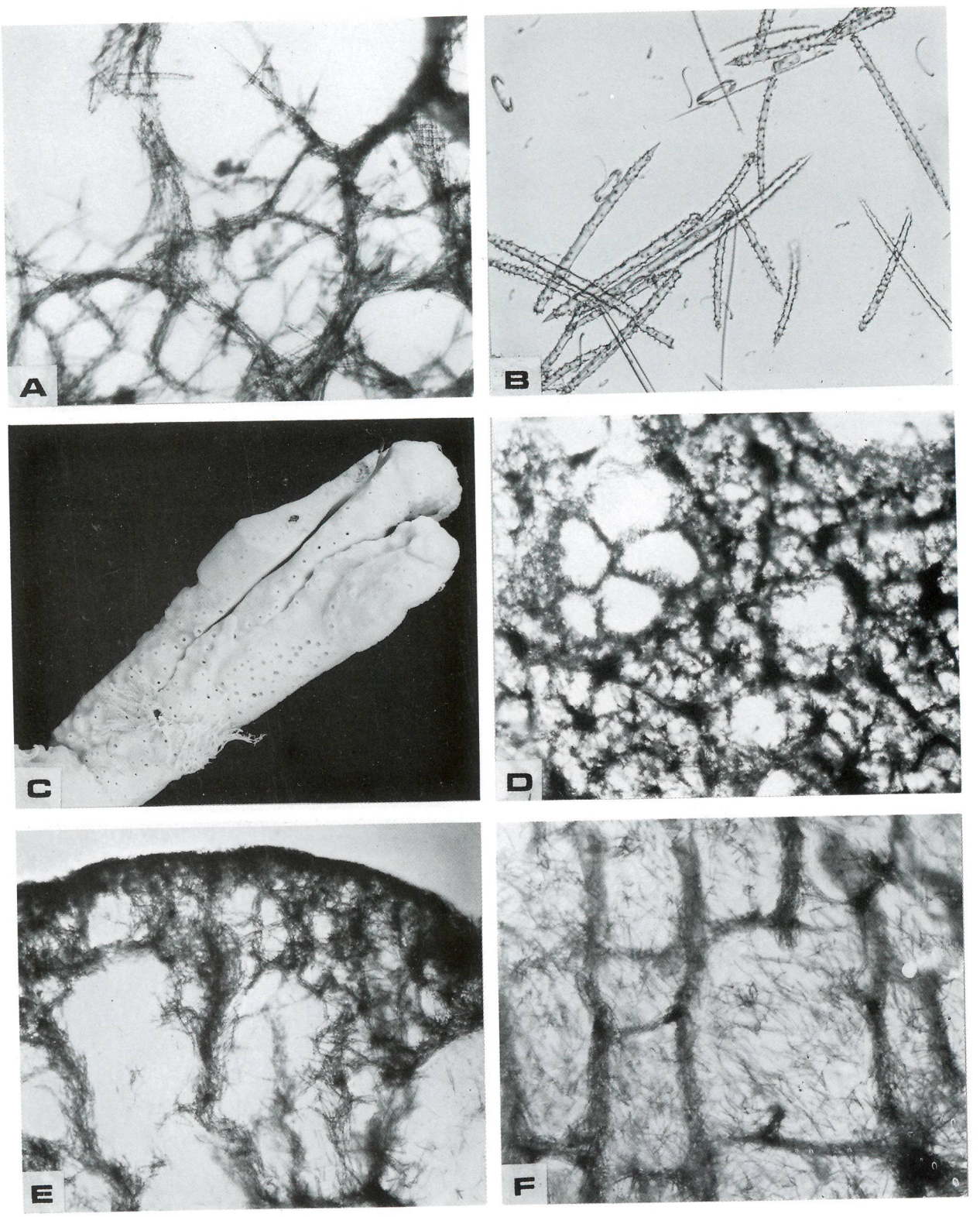

PLATE 40. A, B, *Ectyomyxilla kerguelensis* Hentschel: A, surface view of ectosome, × 101; B, acanthostyles, isochelae and sigmas, × 252. C–F, *Ectyomyxilla ramosa* n.sp.: C, whole specimen; D, surface view of ectosome, × 101; E, ectosomal and choanosomal skeletons, × 101; F, regular choanosomal reticulation, × 113.

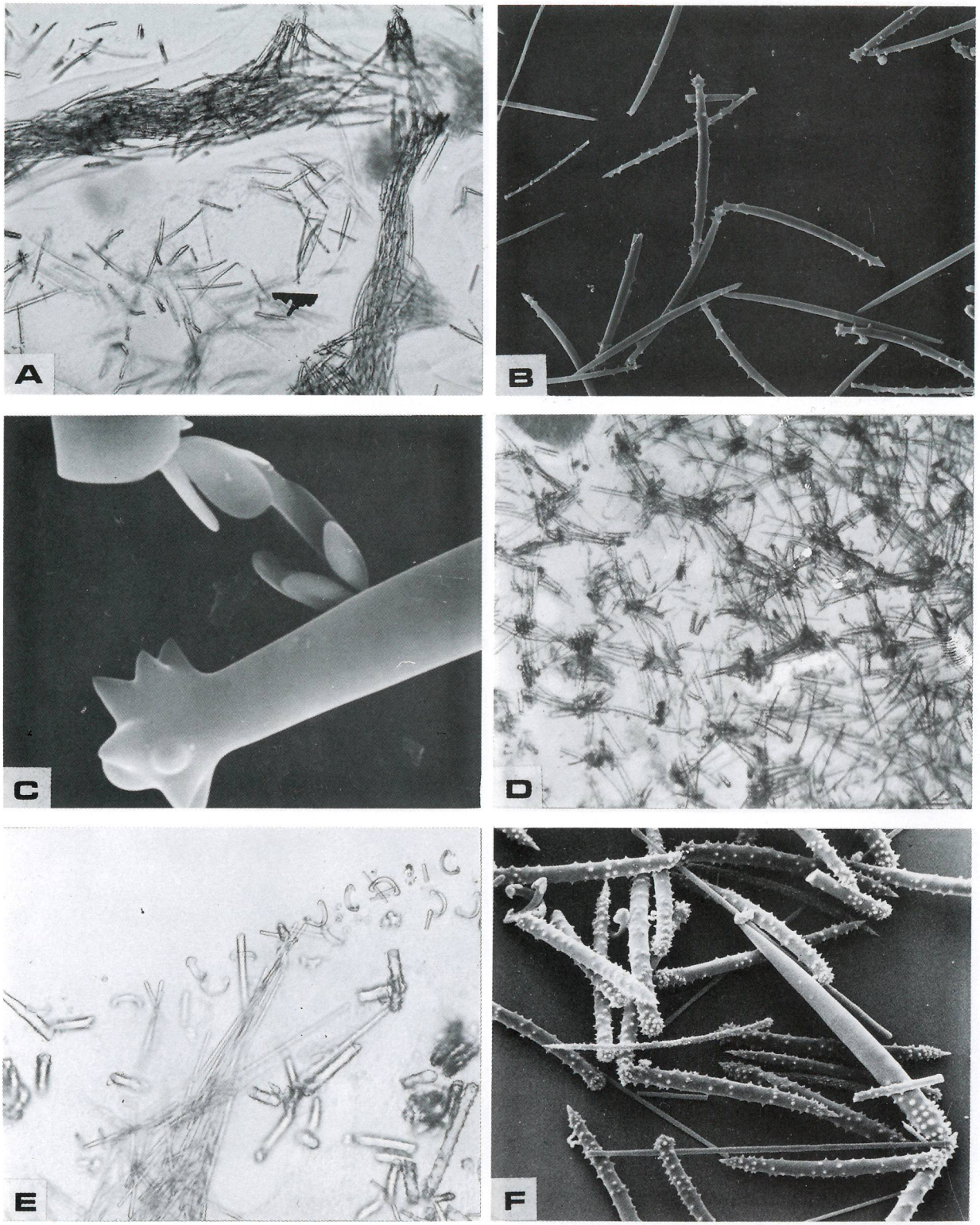

PLATE 41. A–C, *Ectyomyxilla ramosa* n.sp.: A, choanosomal skeleton showing spongin fibre development, × 252; B, acanthostyles and oxeas, × 380; C, anchorate isochelae, × 4400. D–F, *Ectyodoryx crelloides* (Brøndsted): D, isodictyal choanosomal reticulation, × 113; E, ectosomal skeleton showing layer of isochelae, × 252; F, spicules, × 320.

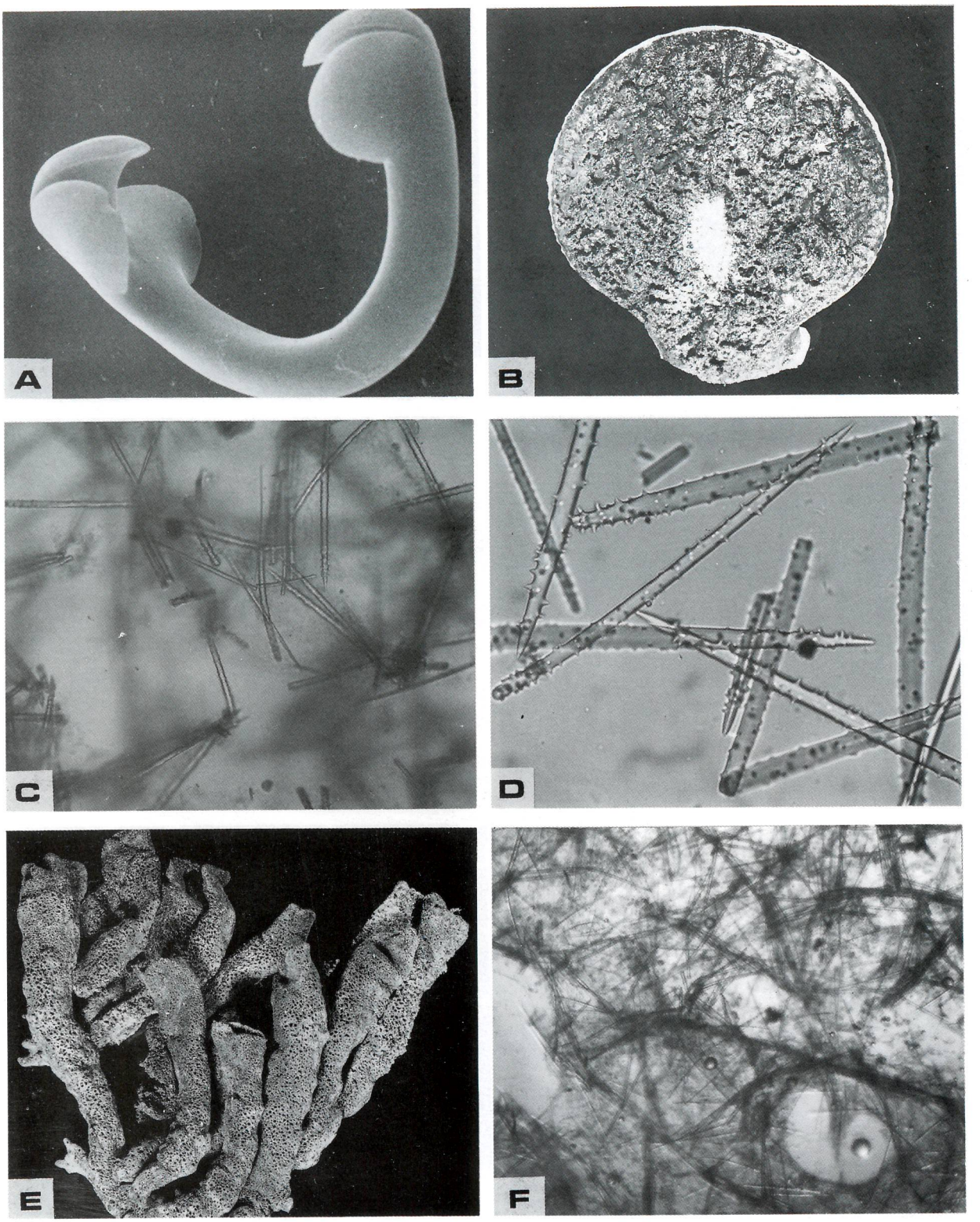

PLATE 42. A, *Ectyodoryx crelloides* (Brøndsted): isochelae, × 3500. B–D, *Iophon proximum* (Ridley): B, encrusting sponge growing over a scallop shell; C, choanosomal reticulation, × 113; D, acanthostyles, × 709. E, F, *Iophon laevistylus* Dendy: E, whole specimen from Rakitu Island; F, irregular isodictyal choanosomal reticulation, × 113.

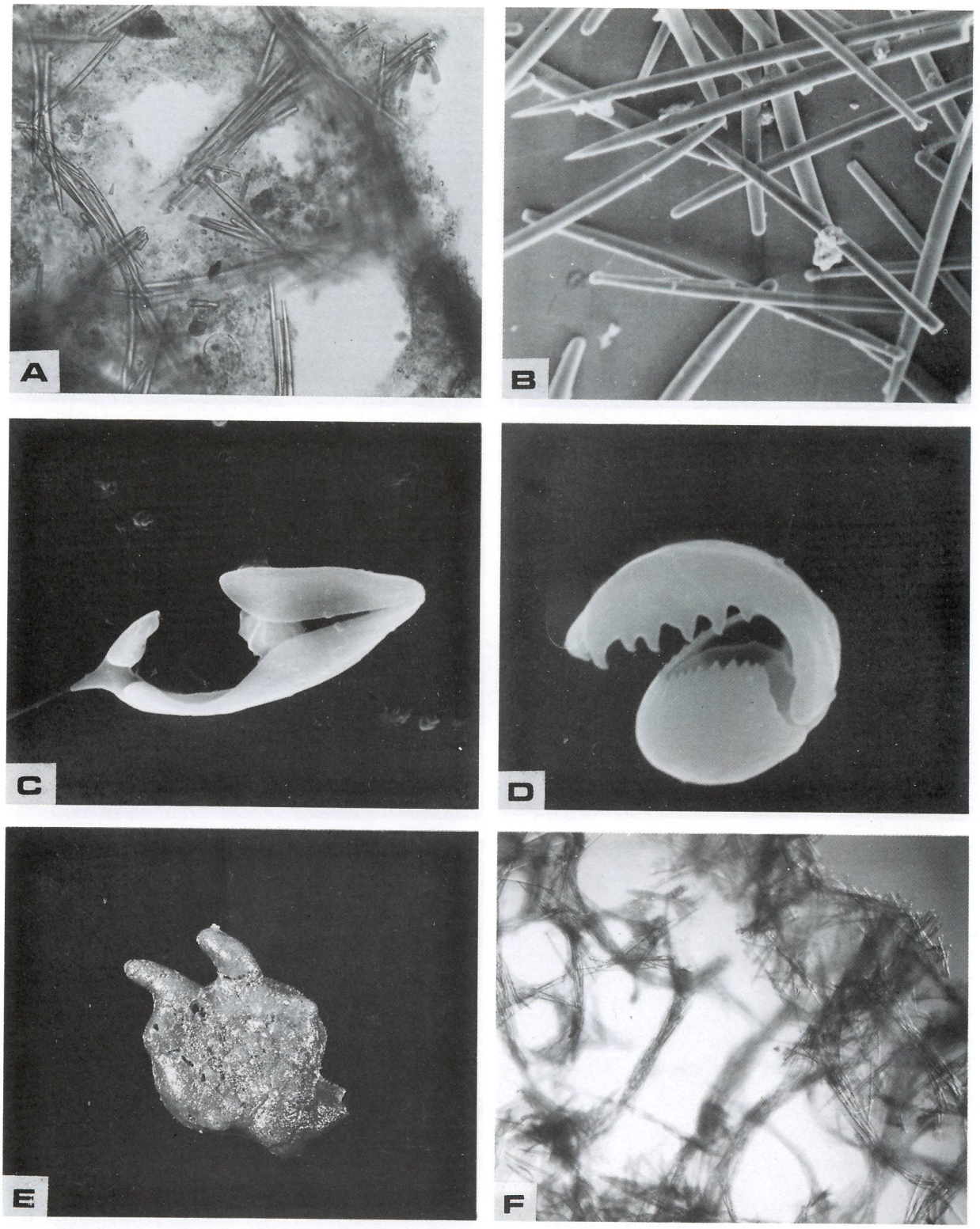

PLATE 43. A–D, *Iophon laevistylus* Dendy: A, regular choanosomal reticulation, × 252; B, spicules, × 350; C, palmate anisochelae, × 5000; D, inequiended bipocilli, × 7600. E, F, *Iophon minor* (Brøndsted): E, whole specimen; F, ectosomal skeleton showing erect spicule brushes and choanosomal reticulation; × 113.

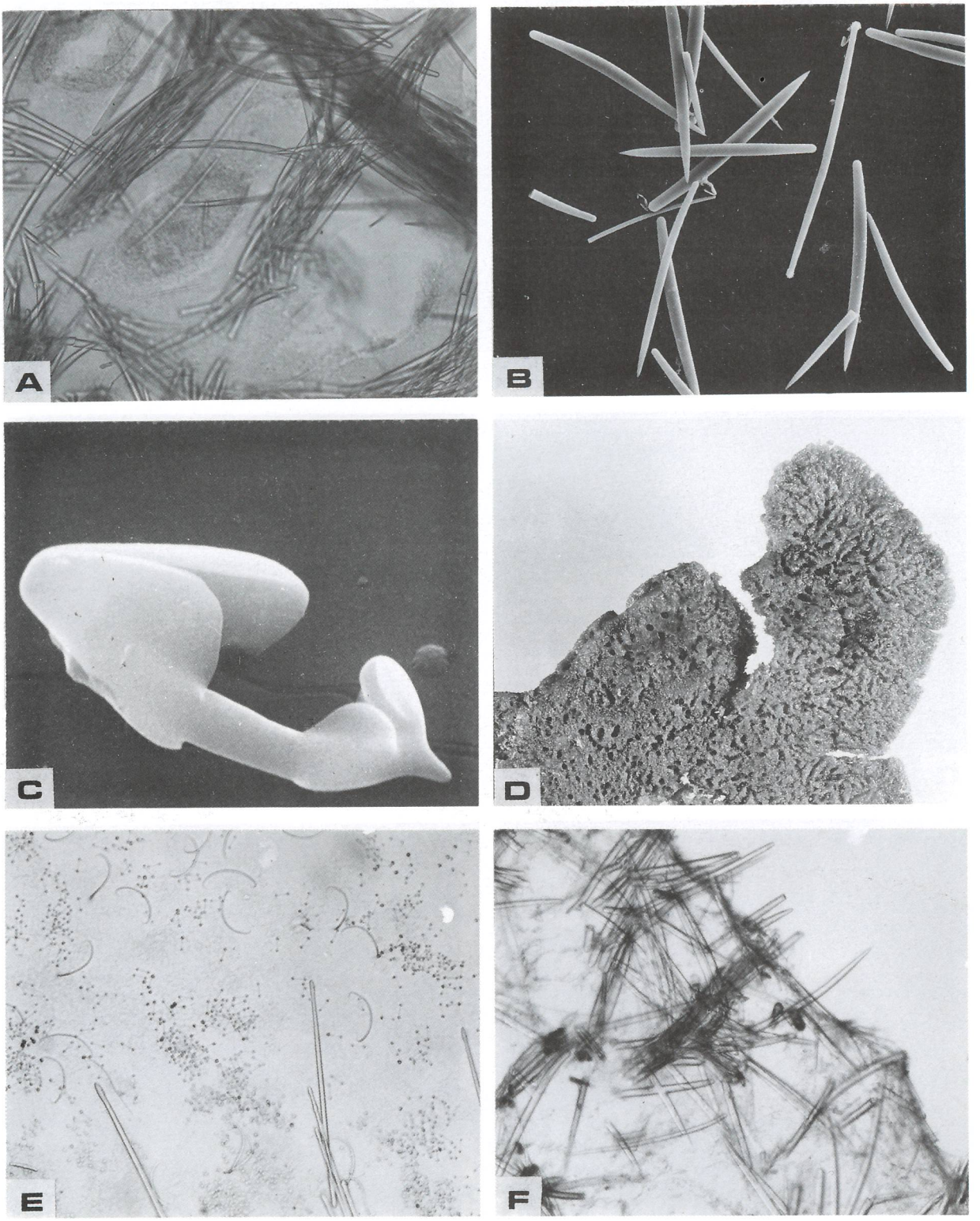

PLATE 44. A–C, *Iophon minor* (Brøndsted): A, regular choanosomal reticulation, × 284; B, spicules, × 230; C, palmate anisochelae, × 7000. D–F, *Sigmarotula lamellata* n.sp.: D, flat lamellate pieces of sponge; E, surface view of dermal skeleton, × 113; F, sparse ectosomal spicule brushes, × 113.

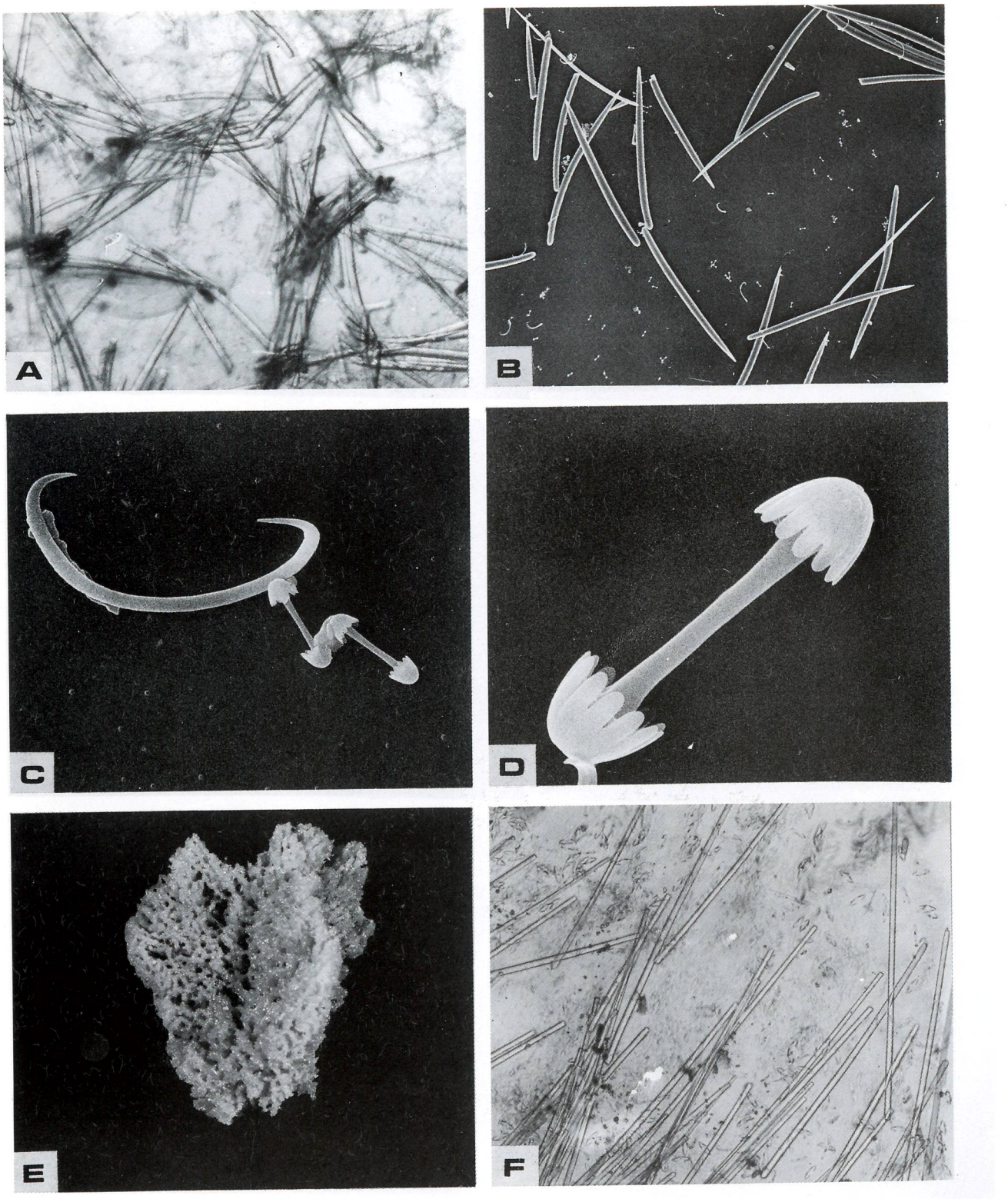

PLATE 45. A–D. *Sigmarotula lamellata* n.sp.: A, isodictyal choanosomal reticulation, × 113; B, spicules, × 69; C, sigma and birotulate isochelae, × 1200; D, birotulate isochelae, × 4300. E, F, *Allocia chelifera* (Hentschel): E, whole specimen; F, surface view of ectosomal skeleton, × 284.

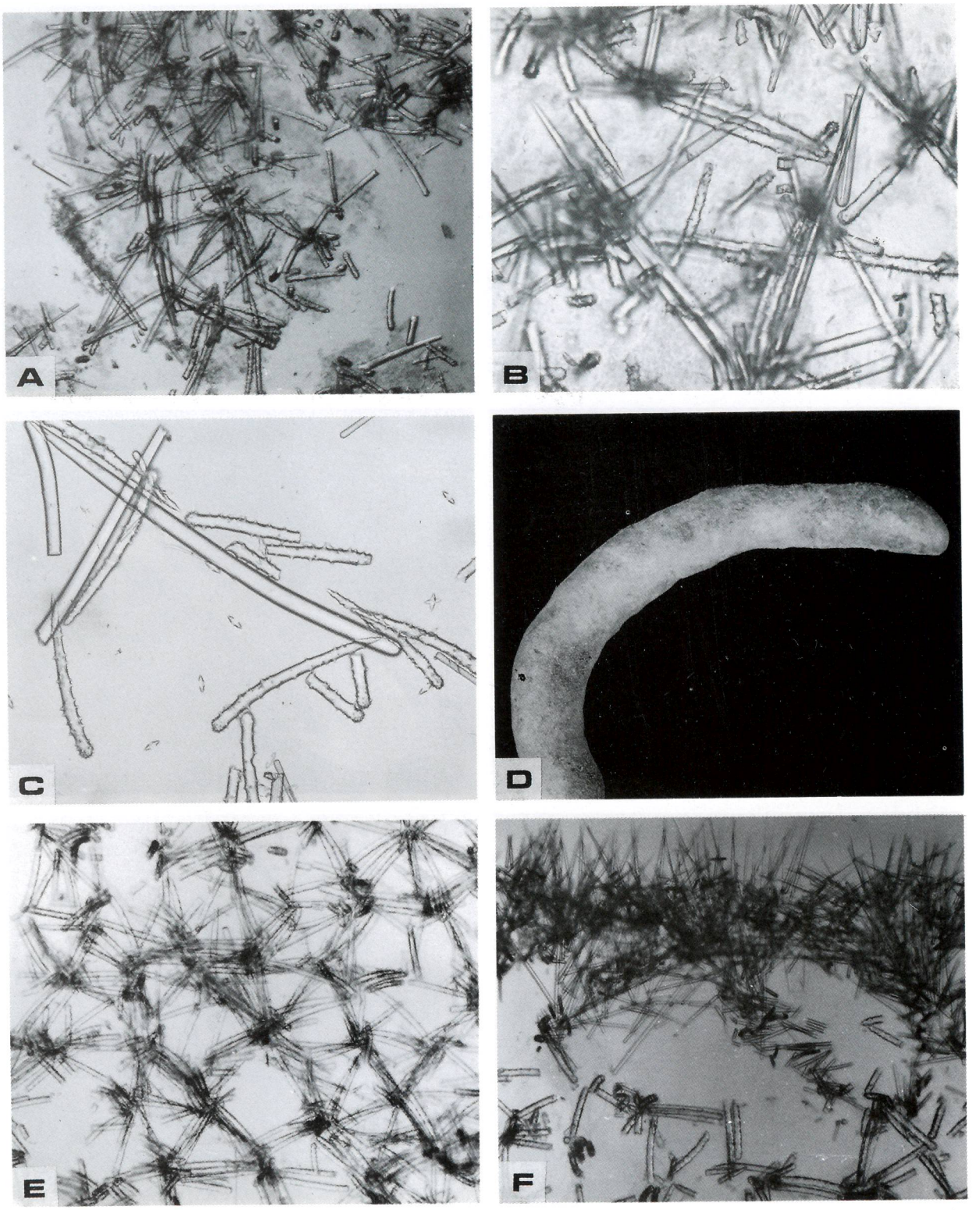

PLATE 46. A–C, *Allocia chelifera* (Hentschel): A, irregular isodictyal choanosomal skeleton, × 113; B, choanosomal skeleton, × 284; C, spicules, × 284. D–F, *Antho brondstedi* n.sp.: D, cylindrical branch narrowing at the tip; E, isodictyal choanosomal reticulation, × 101; F, ectosomal spicule brushes, × 101.

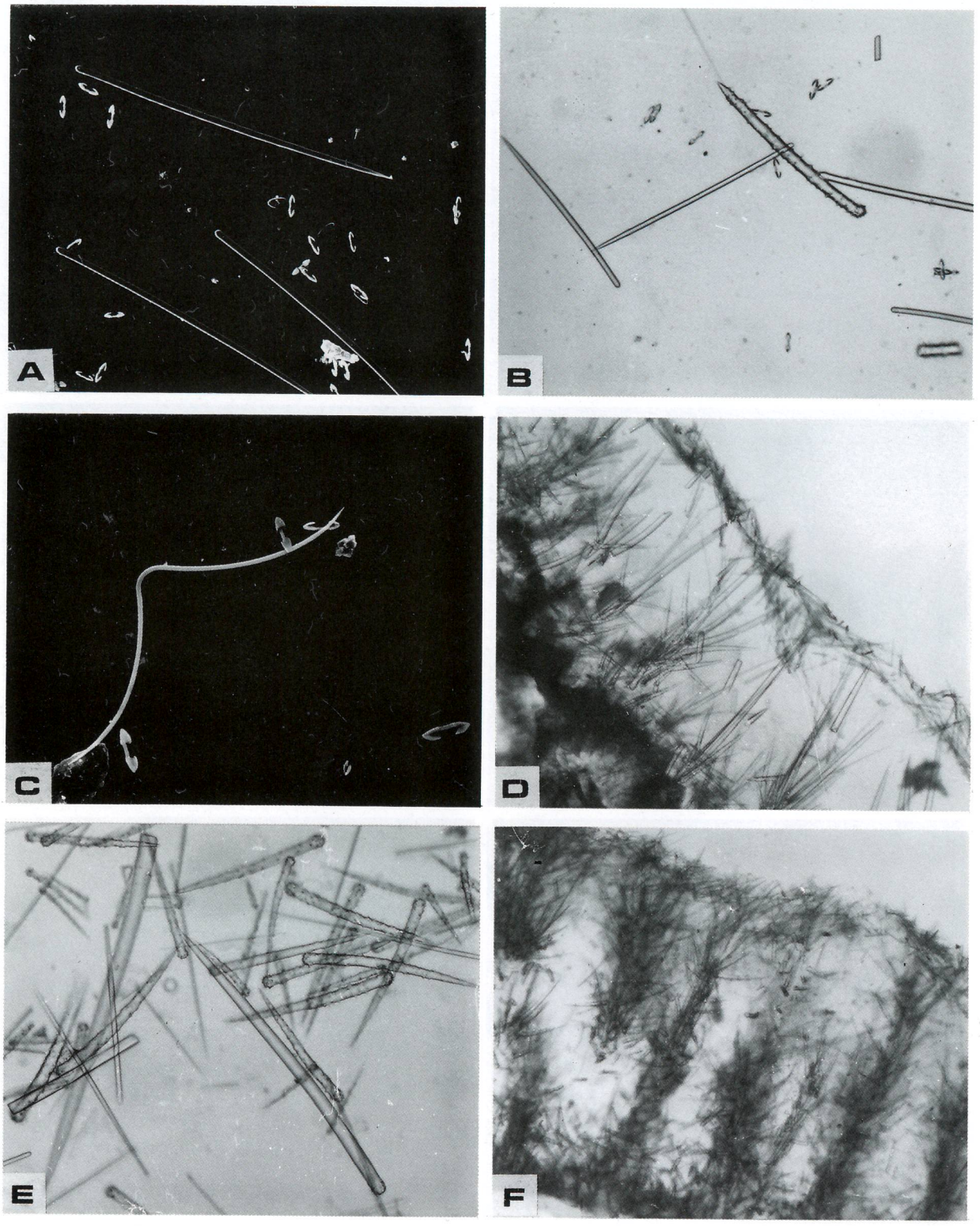

PLATE 47. A–C, *Antho brondstedi* n.sp.: A, spicules, × 160; B, acanthostyles and subtylostyles, × 101; C, toxa and palmate isochelae, × 310. D, E, *Microciona dendyi* n.sp.: D, choanosomal tracts of acanthostyles extending from the base to the surface of the sponge, × 101; E, spicules, × 252. F, *Microciona coccinea* Bergquist: choanosomal tracts of spicules extending from the base to the surface of the sponge, × 101.

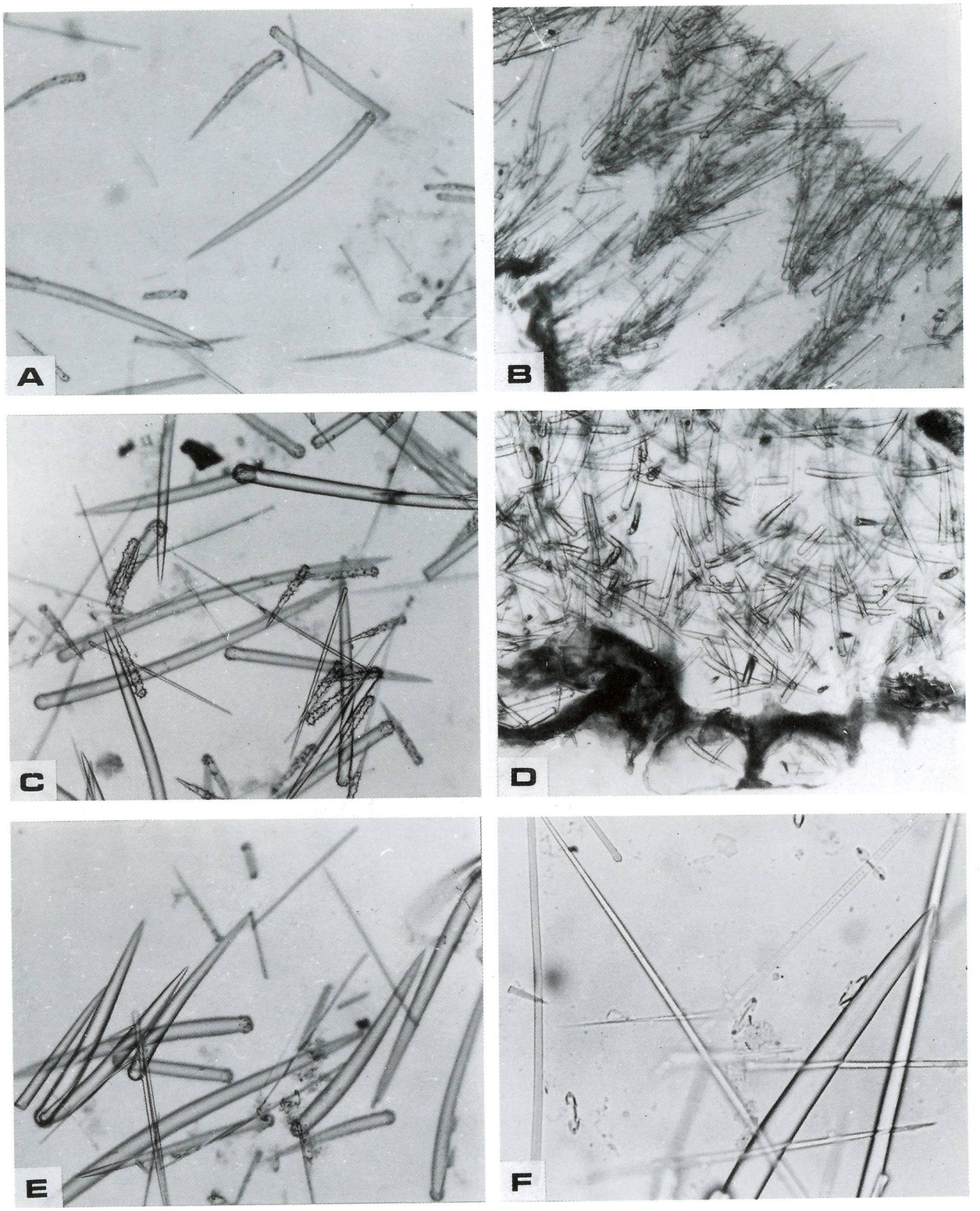

PLATE 48. A, *Microciona coccinea* Bergquist: spicules, × 252. B, C, *Microciona rubens* Bergquist: B, choanosomal tracts of spicules extending from the base to the surface of the sponge, × 101; C, spicules, × 252. D–F, *Dictyociona contorta* n.sp.: D, choanosomal skeletal network, × 101; E, spicules, × 252; F, palmate isochelae with straight and twisted shafts, × 630.

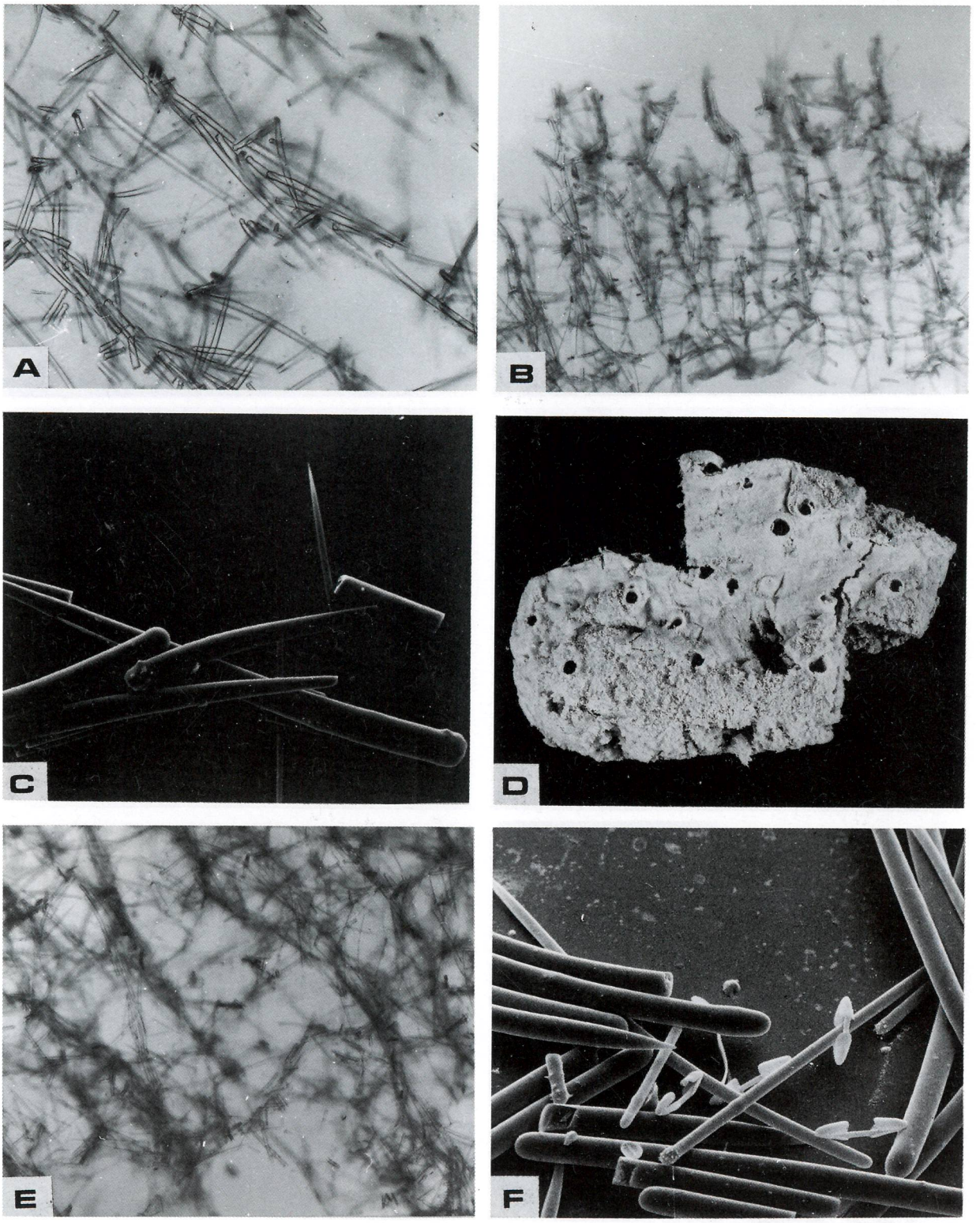

PLATE 49. A–C, *Dictyociona atoxa* n.sp.: A, choanosomal primary spicule tracts, × 252; B, choanosomal skeletal network, × 101; C, spicules, × 1000. D–F, *Clathria lissosclera* n.sp.: D, surface view of a specimen showing circular oscules; E, irregular reticulate choanosomal skeleton, × 113; F, spicules, × 650.

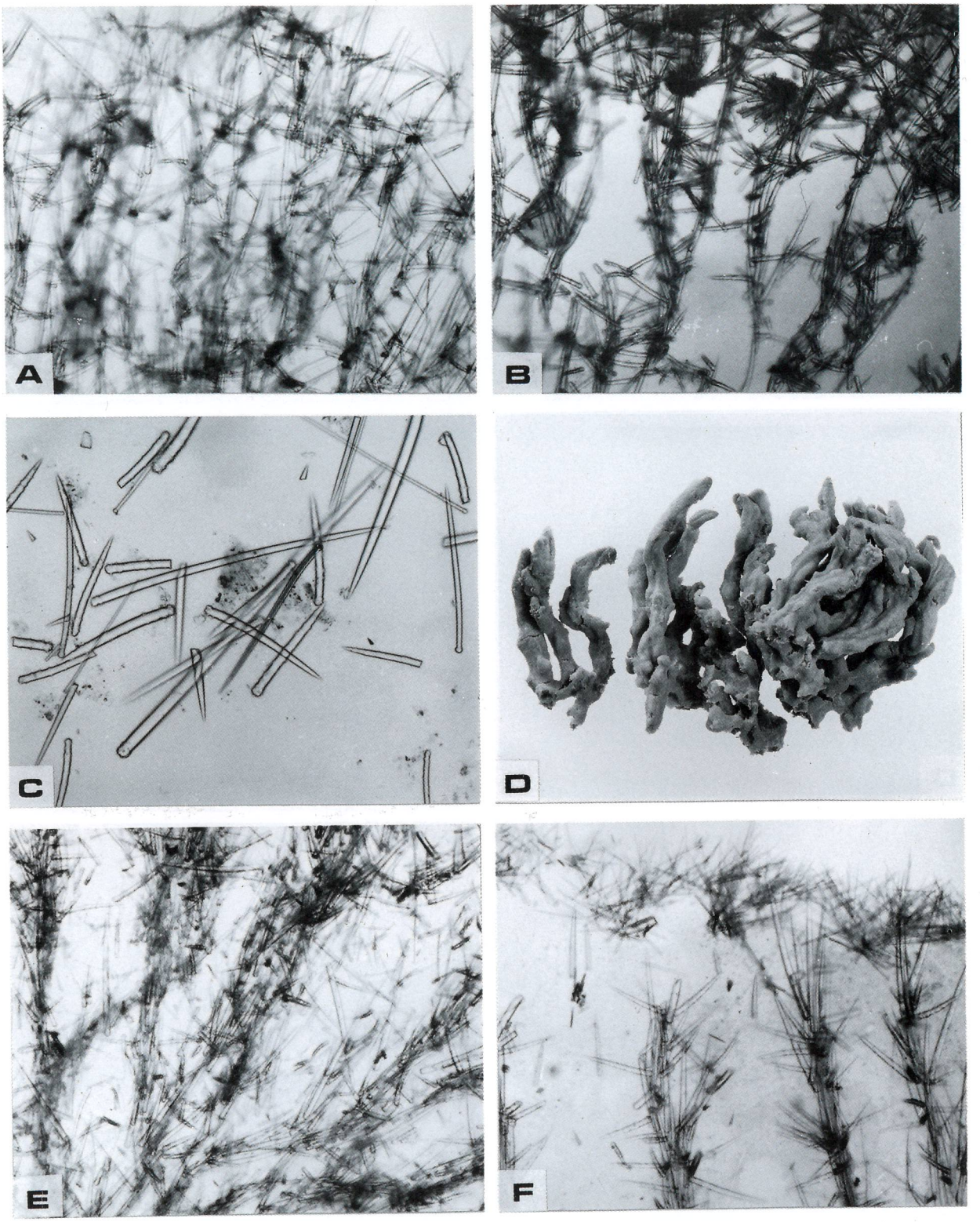

PLATE 50. A–C, *Clathria mortensenii* Brøndsted: A, large styles extending beyond the ectosomal skeleton (upper right-hand edge of photograph), × 113; B, reticulate choanosomal skeleton, × 113; C, spicules, × 284. D–F, *Clathria terraenovae* Dendy: D, longitudinally grooved branches; E, plumose columns in the choanosome, × 113; F, plumose choanosomal tracts and ectosomal skeleton, × 113.

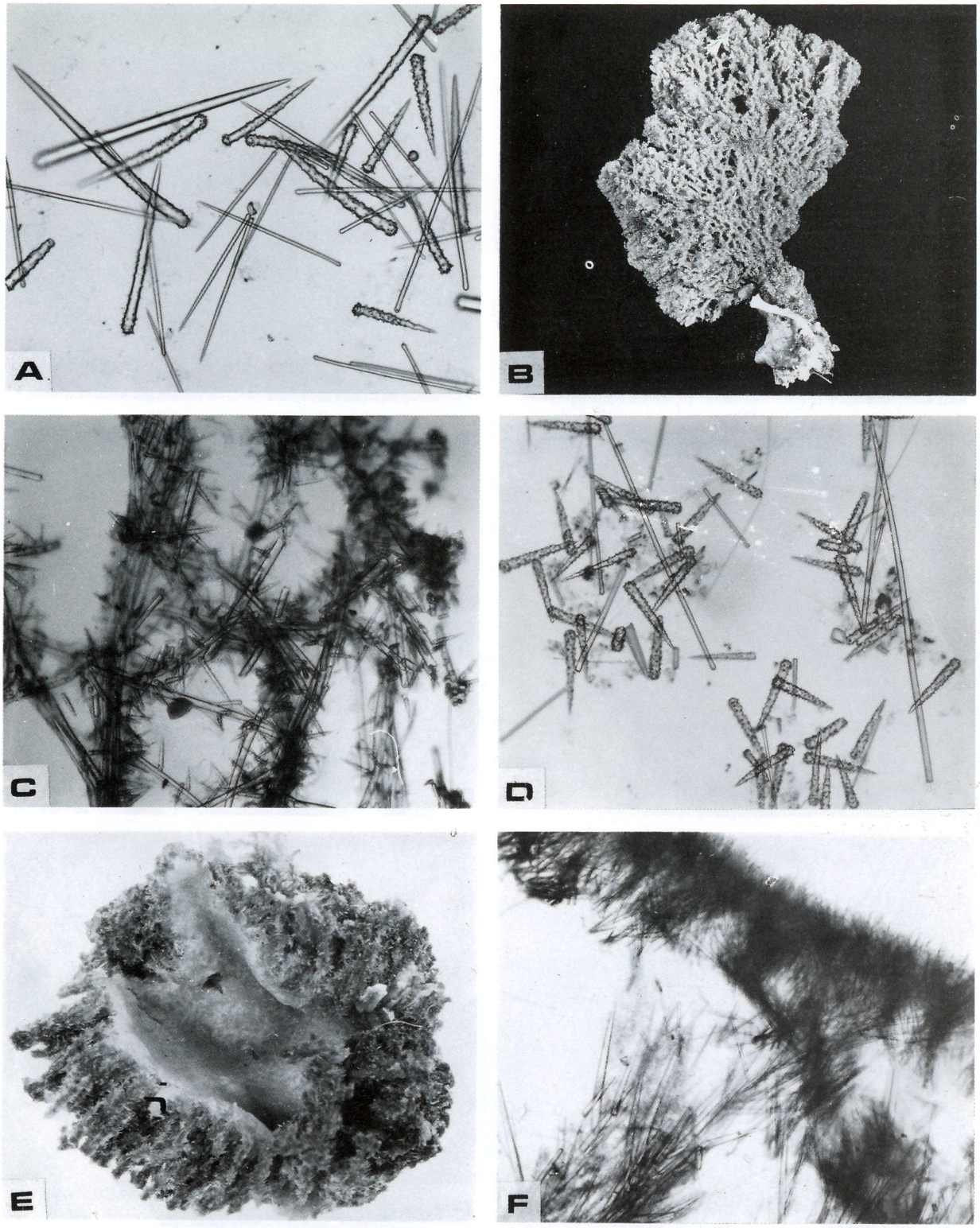

PLATE 51. A, *Clathria terraenovae* Dendy: spicules, × 284. B–D, *Pseudanchinoe scotti* (Dendy): B, whole specimen; C, irregular reticulate choanosomal skeleton, × 113; D, spicules, × 284. E, F, *Rhaphidophlus coriocrassus* n.sp.: E, encrusting specimen showing the skin-like dermal layer; F, ectosomal skeleton of erect spicule brushes, × 113.

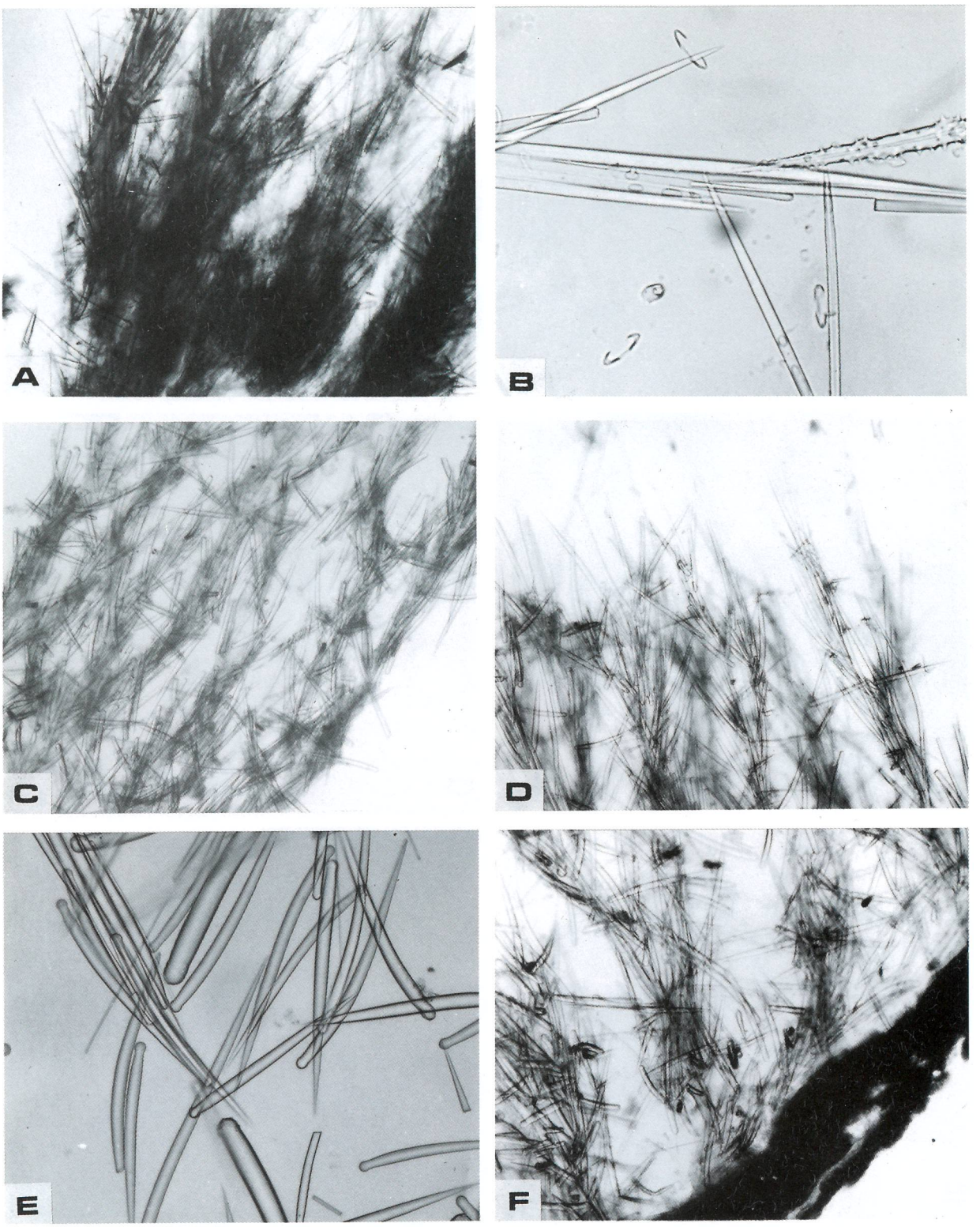

PLATE 52. A, B, *Rhaphidophlus coriocrassus* n.sp.: A, branching, plumose, choanosomal spicule tracts, × 113; B, spicules, × 709. C–E, *Ophlitaspongia oxeata* n.sp.: C, plumose choanosomal spicule tracts, × 101; D, choanosomal spicules extending beyond the ectosomal skeleton, × 101; E, spicules, × 252. F, *Ophlitaspongia reticulata* n.sp.: plumose spicule tracts at the base of the sponge, × 113.

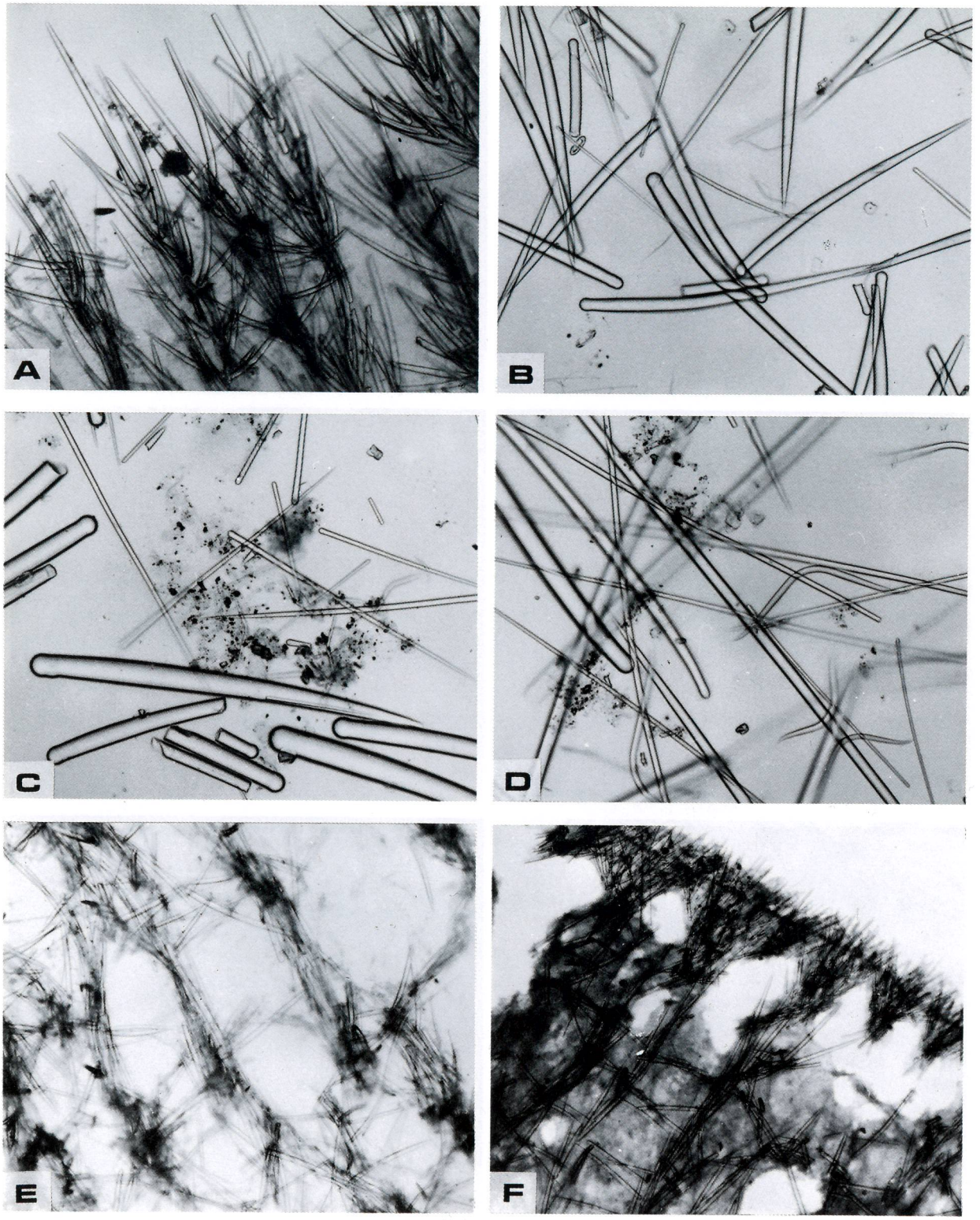

PLATE 53. A–C, *Ophlitaspongia reticulata* n.sp.: A, choanosomal spicules extending beyond the ectosomal skeleton, × 113; B, spicules, × 284; C, spicules, × 709. D, *Ophlitaspongia* sp.: spicules of specimen collected from Dunedin, × 709. E, F, *Isociella incrustans* Bergquist: E, choanosomal reticulation, × 113; F, ectosomal skeleton of erect spicule brushes and choanosomal reticulation, × 113.

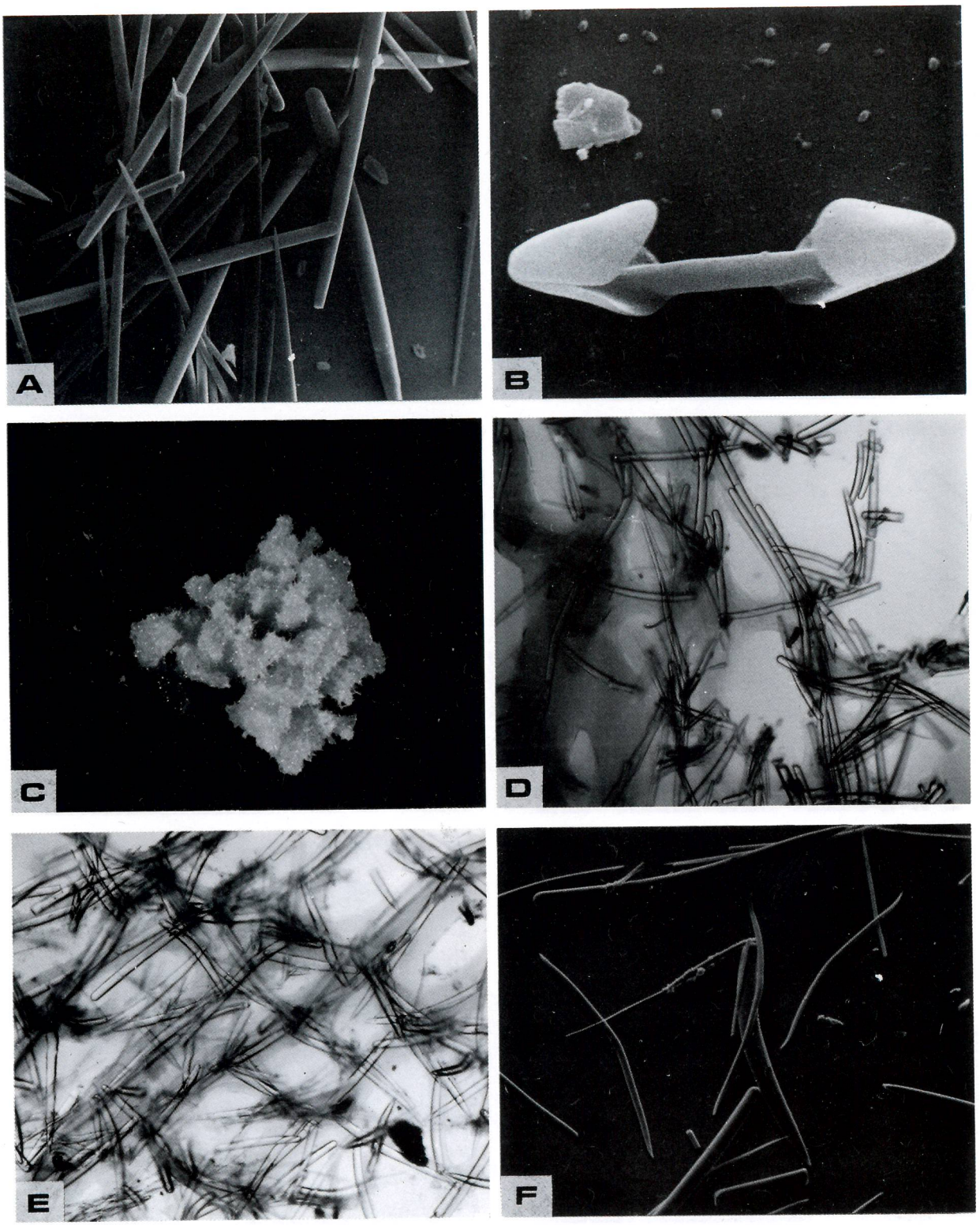

PLATE 54. A, B, *Isociella incrustans* Bergquist: A, spicules, × 350; B, palmate isochelae, × 6600. C–F, *Axociella macrotoxa* n.sp.: C, surface view of whole specimen; D, axial region of choanosome showing spongin fibre, × 113; E, choanosomal reticulation, × 113; F, long toxas, × 120.

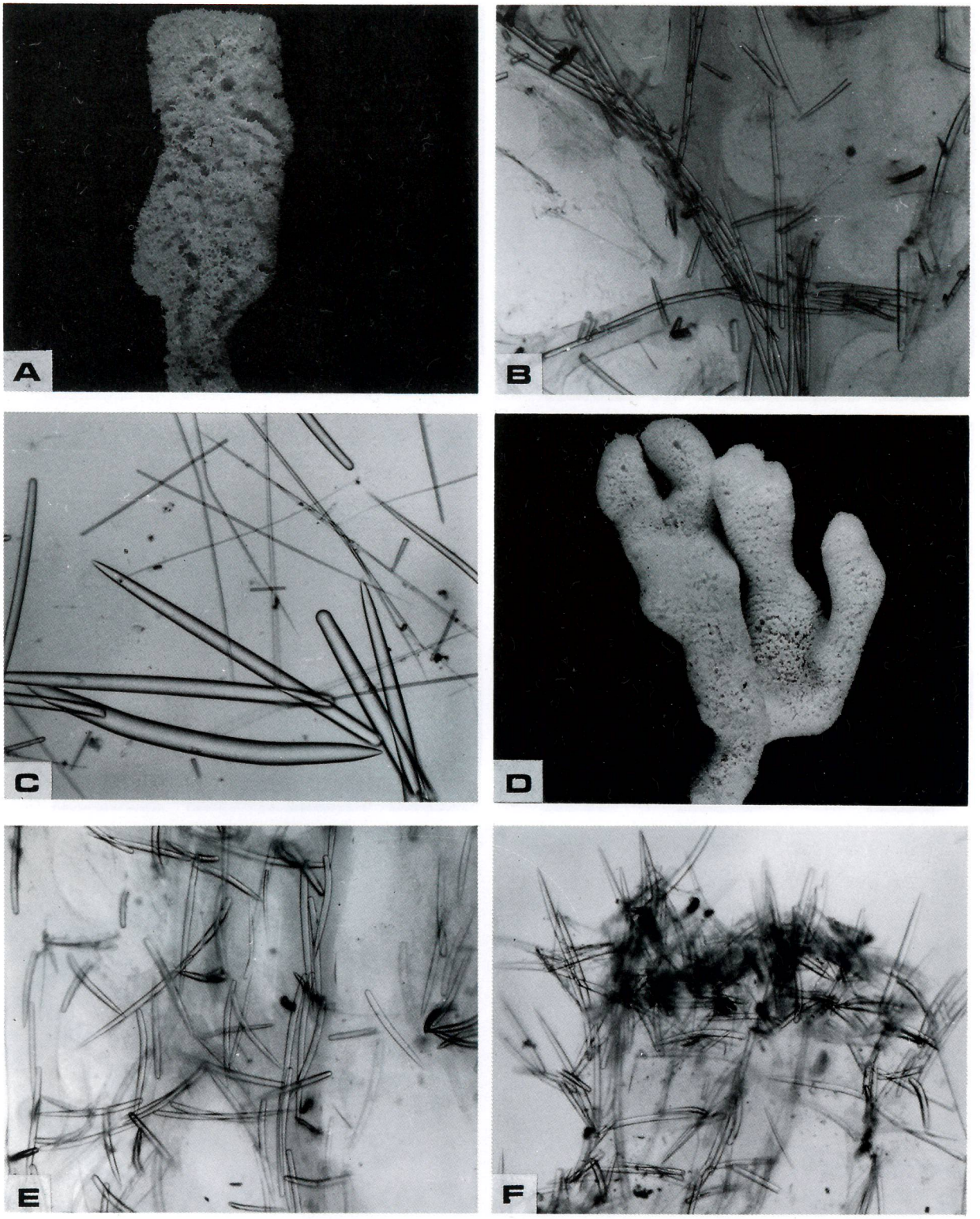

PLATE 55. A–C, *Axociella toxitenuis* n.sp.: A, whole specimen; B, axial region of choanosome showing spongin fibre, × 113; C, spicules, × 284. D–F, *Axociella multitoxaformis* n.sp.: D, whole specimen; E, axial region of choanosome showing spongin fibre, × 113; F, ectosomal skeleton, × 113.

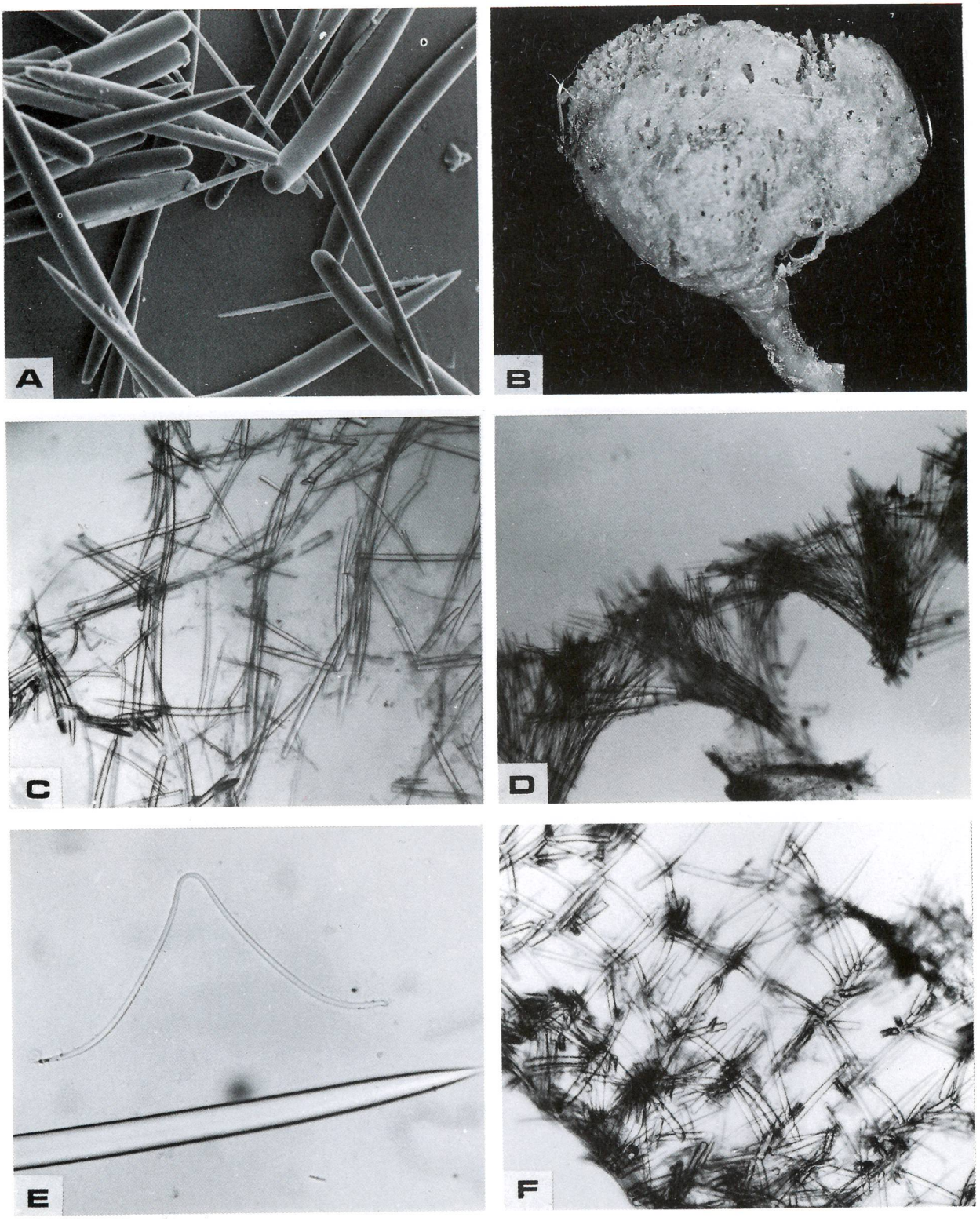

PLATE 56. A, *Axociella multitoxaformis* n.sp.: spicules, × 240. B–E, *Artemisina jovis* Dendy: B, whole specimen; C, irregular choanosomal reticulation, × 113; D, ectosomal skeleton of erect spicule brushes, × 113; E, toxa with terminal spines, × 709. F, *Plocamia novizelanicum* (Ridley): choanosomal reticulation, × 113.

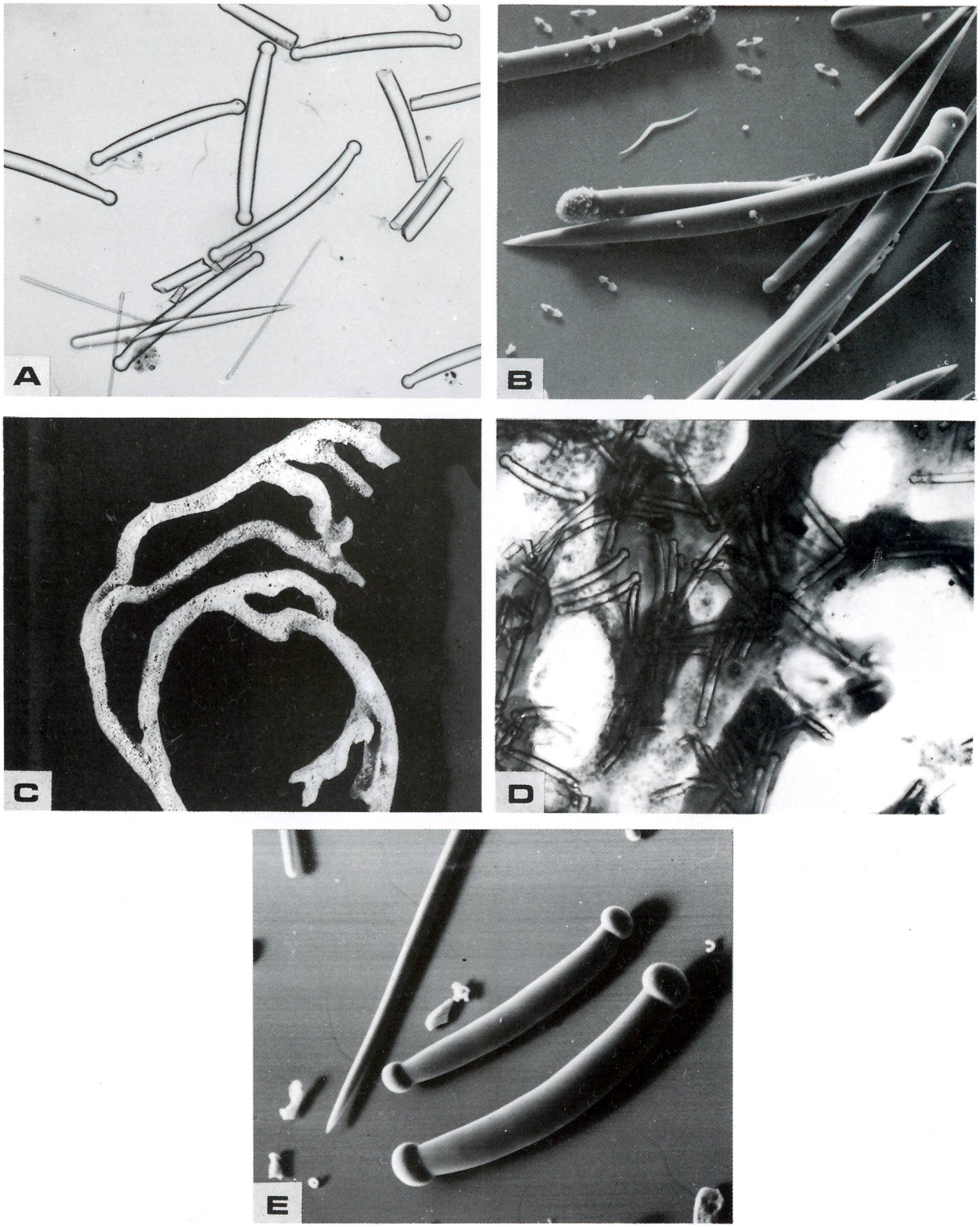

PLATE 57. A, B, *Plocamia novizelanicum* (Ridley): A, tylotes with faintly roughened heads from a subtidal specimen, × 284; B, tylotes with well-spined heads from an intertidal specimen, × 260. C–E, *Plocamia prima* (Brøndsted): C, type specimen; D, axial region of choanosome showing spongin fibre, × 113; E, tylotes, × 220.

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