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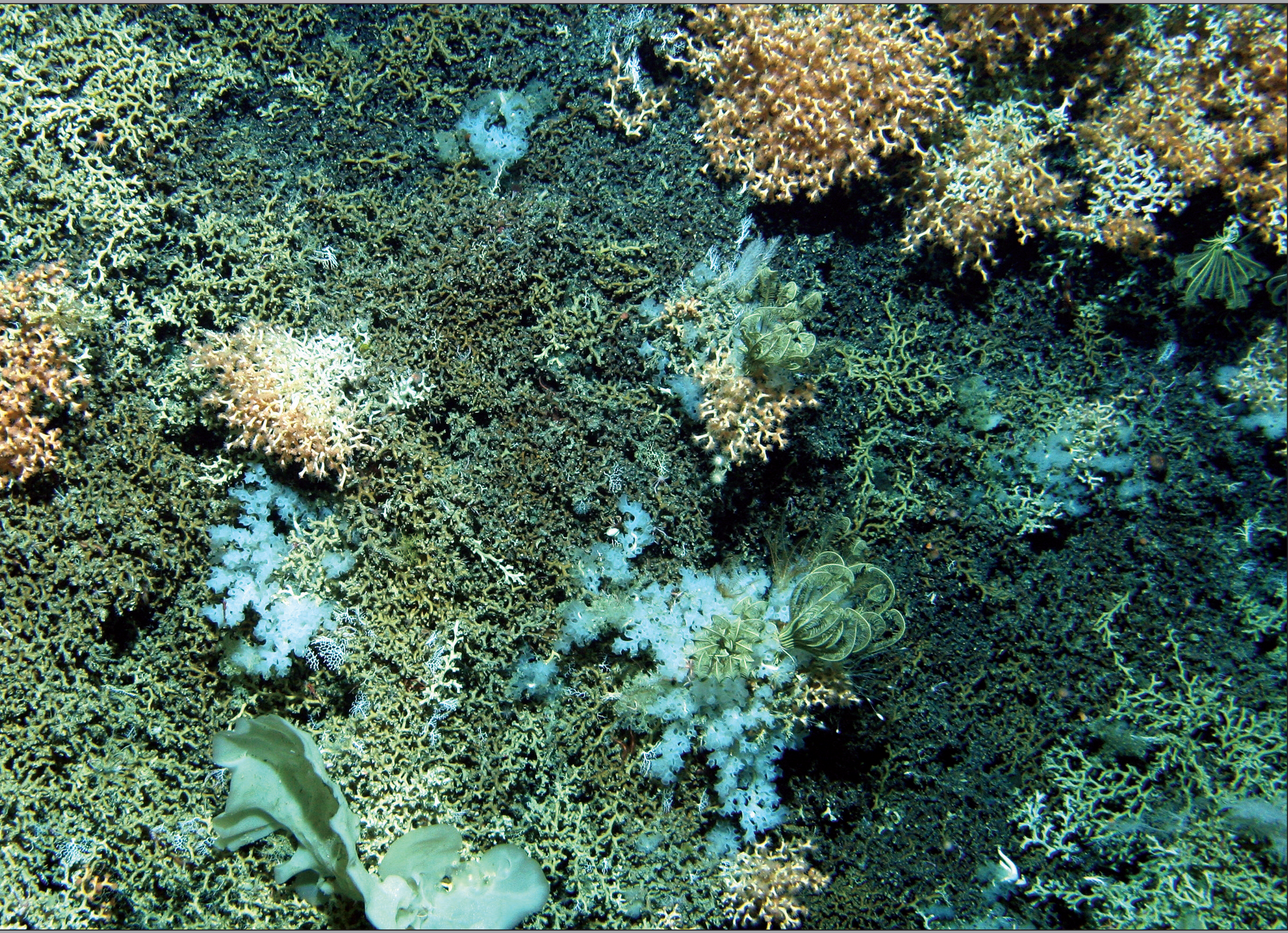
NIWA
Taihoro Nukurangi



The Marine Fauna of New Zealand:

Hexasterophoran Glass Sponges of New Zealand (Porifera: Hexactinellida: Hexasterophora): Orders Hexactinosida, Aulocalycoida and Lychniscosida

Henry M. Reiswig and Michelle Kelly

NIWA Biodiversity Memoir 124

COVER PHOTO

Two unidentified hexasterophoran glass sponge species, the first possibly *Farrea onychohexastera* n. sp. (frilly white honeycomb sponge in several bushy patches), and the second possibly *Chonelasma lamella*, but also possibly *C. chathamense* n. sp. (lower left white fan), attached to the habitat-forming coral *Solenosmilia variabilis*, dominant at 1078 m on the Graveyard seamount complex of the Chatham Rise (NIWA station TAN0905/29: 42.726° S, 179.897° W). Image captured by DTIS (Deep Towed Imaging System) onboard RV *Tangaroa*, courtesy of NIWA Seamounts Programme (SFAS103), Oceans2020 (LINZ, MFish) and Rob Stewart, NIWA, Wellington

(Photo: NIWA).

NATIONAL INSTITUTE OF
WATER AND ATMOSPHERIC RESEARCH (NIWA)

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Four hexasterophoran glass sponge-species photographed on the Chatham Rise and the Macquarie Ridge of southern New Zealand. From the Macquarie Ridge (Australian EEZ): A, *Homoieurete macquariense* n. gen. n. sp. (NIWA station TAN0803/078, 53.430° S, 159.075° E, 845–903 m), and B, *Chonelasma* sp. (NIWA station TAN0803/018, 48.318° S, 164.570° E, 1077–1262 m). From the Chatham Rise: C, *Aphrocallistes beatrix beatrix* Gray, 1858 (NIWA station TAN0905/123, 44.136° S, 174.720° W, 643–816 m), and D, *Aulocalyx australis* n. sp. (NIWA station TAN0905/023, 42.760° S, 179.990° W, 770–919 m).

Images captured by DTIS (Deep Towed Imaging System) onboard RV *Tangaroa*, courtesy of NIWA Seamounts Programme (SFAS103), Oceans2020 (LINZ, MFish) and Rob Stewart, NIWA, Wellington (Photos: NIWA).

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ABSTRACT

The Hexactinellida of New Zealand, orders Hexactinosida, Aulocalycoida, and Lychniscosida, are reviewed, inventoried from existing and new collections, and revised where necessary. Collections within the NIWA Invertebrate Collection and the Museum of New Zealand Te Papa Tongarewa, both in Wellington, and specimens from the NORFANZ mid-Tasman Sea survey housed at the Queensland Museum, yielded well over 300 catalogued specimens, some of which are from the Australian EEZ. The previous list of four known species in New Zealand, *Farrea occa* Bowerbank, 1862, *Euryplegma auriculare* Schulze, 1886, *Chonelasma hamatum* Schulze, 1886, and *C. lamella* Schulze, 1886, has now been expanded to 30, including 21 new species, within 15 genera, one of which is new (*Homoieurete* n. gen.). The neglected family Auloplacidae (Schrammen, 1912) is resurrected. All four species previously known from New Zealand waters are well represented in the newly surveyed material. Five species known from elsewhere, *Anomochone expansa* Ijima, 1927, *Aphrocallistes beatrix beatrix* Gray, 1858, *Lefroyella ceramensis Ijima*, 1927, *Periphragella elisae* Marshall, 1875, and *Psilocalyx wilsoni* Ijima, 1927, but previously unknown in the New Zealand area, are reported and described, extending their distribution ranges. The 21 new species include six in Farreidae, seven in Euretidae, four in Tretodictyidae, two in Auloplacidae, one in Aulocalycidae, and one in Aulocystidae; the new genus *Homoieurete* belongs to Euretidae. One of the new species described here, *Neoaulocystis cristata* n. sp., has been recorded only near the Kingdom of Tonga, but is included here for the sake of a complete review of the genus. Similarly, two new species of the genus *Anomochone* collected on the NORFANZ voyage are found thus far only in Australian waters (northern Norfolk Ridge and Lord Howe Rise), but are included in this work for the sake of completeness of the review of the genus in this region. Similarly, two new species have been described from the Australian EEZ surrounding Macquarie Island, on Macquarie Ridge, and have been included here, as the species are also found in the New Zealand EEZ. The moderate number of washed-out specimens whose dictyonal skeleton are incompatible with any known species in New Zealand waters indicates that several species remain unknown and are yet to be collected in condition needed for full species level determination and description.

Keywords: Porifera, Hexactinellida, Hexactinosida, Aulocalycoida, Lychniscosida, Farreidae, Euretidae, Tretodictyidae, Aphrocallistidae, Auloplacidae, Aulocalycidae, Aulocystidae, *Farrea, Conorete, Gymnorete, Homoieurete* n. gen., *Lefroyella, Chonelasma, Periphragella, Anomochone, Hexactinella, Psilocalyx, Aphrocallistes, Auloplax, Aulocalyx, Euryplegma, Neoaulocystis*, systematics, glass sponge, taxonomy, new species, Norfolk Ridge, Lord Howe Rise, Tongan EEZ, New Zealand EEZ, Australian EEZ

INTRODUCTION

The Hexasterophora is the larger of two subclasses of class Hexactinellida, the glass-sponge poriferans that are distinguished by their basic six-rayed siliceous spicules with rays emanating from the spicule centre in three axes perpendicular to each other. Hexasterophorans are themselves distinguished among hexactinellids by having among their microscleres hexasters, spicules with two or more secondary or terminal rays radiating from the ends of some or, more commonly, all of their six primary rays. These rays can be interpreted as distally branched. The other subclass, Amphidiscophora, lacks hexasters but is instead characterised by having among their microscleres amphidiscs. These consist of a single developed axis of two primary rays (a siliceous rod) with whorls of recurved teeth at their distal ends.

Four of the five orders of Hexasterophora, all covered here, construct primary internal siliceous skeletons of fused hexactine spicules. The component spicules are called dictyonalia, or 'net elements', and the skeletons are called dictyonal skeletons. The fifth order, the Lyssacinosida, a group common in New Zealand waters and to be treated separately, sometimes has a fused internal siliceous skeleton, but it is never constructed of spicules with six developed rays and is thus non-dictyonal. Among the four groups of Hexasterophora, the order Fieldingida has not been found in Recent collections and is not included in this memoir. Membership in the dictyonal order Lychniscosida is usually easily recognised in that all, or almost all, dictyonalia have 12 anaxial (without an axial canal) struts joining adjacent rays, forming distinctive lantern nodes or lychniscs. Arguments for the acceptance of occasional lacy nodes as cryptic lychniscs and inclusion of such forms in Lychniscosa have not generally been accepted.

This leaves membership in the orders Hexactinosida and Aulocalycoida among the New Zealand Hexasterophora to be defined. Previously it was thought that these groups could be distinguished by the difference in construction in their primary longitudinal skeletal strands: addition of simple hexactine dictyonalia, one at a time, on the terminal end of strands in Hexactinosida (analogy: adding bricks in columns), in contrast to unlimited growth of distal longitudinal rays of primary dictyonalia (analogy: a column of cement) in Aulocalycoida. Recent recognition that primary longitudinal strands are constructed of overlapping dictyonal rays in members of both of these orders has blurred the distinction between the two groups. Until details of skeletal construction are determined, and fully understood, we use the presence of lateral and radial joining rays that are both regularly spaced and composed of two overlapping fused rays as evidence of farreoid/euretoid framework type and membership in Hexactinosida. Where such joining rays are absent, the forms are assigned to Aulocalycoida. Within Hexactinosida, family distinctions generally depend upon a combination of skeletal channelisation type and spicule complement; one family, Dactylocalycidae, lacks primary longitudinal strands and its position with respect to other ordinal members remains elusive.

The Systema Porifera (Hooper & Van Soest 2002) has provided an invaluable summary of well-accepted genus-group definitions and a new starting point for re-examination of family groupings and definitions, which remain far less accepted. Phylogenetic relationships among families based solely upon physical characters have rarely been proposed (Mehl 1992), but relationships between groups implied by the present taxonomic arrangement (e.g. Systema Porifera) have been largely supported by results of early molecular sequence work (Dohrmann *et al*. 2008, 2009), although many relevant taxa (e.g. Lychniscosida, Aulocalycoida, Craticulariidae, Cribrospongiidae, and many genera) remain to be sampled for these studies.

Paleontological studies of hexactinellids suffer from the lack of complete specimens for analysis; body fossils generally lack loose spicules and where loose spicules are extracted from consolidated sediments, the body forms relating to those spicules generally remain unknown. Recent summaries of fossil hexactinellids (Reid 2003; Finks *et al*. 2004) are thus based mainly upon body fossils. Nonetheless, these recent summaries will act as a starting point in generating new studies to reexamine old groupings and integrate them with work on Recent hexactinellids.

Hexactinellids are of exceptional interest for a number of reasons, not the least of which is their ancient origin (Leys *et al*. 2007). Analysis of their genetic systems holds clues to the evolutionary pathways within the higher Metazoa. They are also of cytological and physiological interest because they are the only group of Porifera with syncytial tissues, allowing both communication and translocation of materials throughout the entire organism without cellular specialisation (Leys 2003; Leys *et al*. 2007). Discovery off the coast of British Columbia of living hexactinellid reefs (Conway *et al*. 1989), structures known mostly from the Jurassic and Cretaceous fossil record and long thought extinct (Krautter *et al*. 2001), has revived interest in the dynamics of reef formation by non-coral organisms. And finally, the process that hexactinellids use to construct siliceous spicules of great toughness and exceedingly fine and complex morphology at low temperature is of special interest for materials science for the development of new engineering methods in fibre-optic and silicon-chip production (Ehrlich & Worch 2007; Müller *et al*. 2009).

Hexactinellid sponges are distributed throughout all of the world's oceans, from 5 to 6770 m, but are most abundant and diverse in the bathyal zone, 200–3000 m depths (Tabachnick 1994). The assemblage, the topic of this report, is, with very few exceptions, dependent upon hard substratum for settlement. Members of this group have not been reported from the hadal zone but still have a surprisingly extensive vertical distribution down to 5600 m. At the genus level, the New Zealand hexactinellid fauna is most closely linked to that of South Australia, which in turn is next linked with those of Kerguelen and South America (Tabachnick 1994).

Regional monographs of Hexactinellida fauna are almost nonexistent. The geographic area with the best coverage is clearly that around New Caledonia (Lévi & Lévi 1982; Tabachnick & Lévi 1997, 2000, 2004; Tabachnick & Reiswig 2000), but even here the Hexactinosida remain poorly known. Hexactinellids from most other areas have been reported from single cruises or limited single-institution collections, but never have large multi-cruise collections from several institutions covering a moderately large area been summarised.

HISTORY OF THE NEW ZEALAND HEXASTEROPHORAN SPONGE FAUNA

We define the New Zealand region in this review as that bounded by 24–60° S latitude and 157° E–167° W longitude, thus including almost all of the research and fisheries survey cruises administered by NIWA, formerly New Zealand Oceanographic Institute. Within our restricted taxonomic and areal coverage, the first species reported and described were those from HMS *Challenger* collections by Franz E. Schulze (1887), consisting of three Hexactinosida: *Farrea occa* Bowerbank, 1862, *Chonelasma lamella* Schulze, 1886, *C. hamatum* Schulze, 1886, and one now assigned to the order Aulocalycoida, *Euryplegma auriculare* Schulze, 1886. All of these, and an additional three species of Lyssacinosida outside our detailed taxonomic coverage, were obtained from a single station, *Challenger* 170A, on Kermadec Ridge near Macauley Island. Hutton (1904) included seven of these in his index of the New Zealand fauna, but listed incorrect authority dates and left out the species name for *F. occa*.

Much later, Arthur Dendy (1924) added reports and descriptions of two additional new species of Lyssacinosida from HMS *Terra Nova* collections east of North Cape, but included no new forms relevant to our coverage. Following another long time interval, Claude Lévi (1964) reported and described seven additional, mostly new, species of Amphidiscophora and Lyssacinosida from the RV *Galathea* collections made in the Tasman Sea and the Kermadec Trench; his report again contained no species within our restricted taxonomic groups. Bruce and Baba (1973) reported a single species of Lyssacinosida, previously described but new to New Zealand, from the Bay of Plenty. These additions to the New Zealand hexactinellid fauna were all meticulously summarised by Dawson (1993) in his index of Porifera.

Since Dawson's summary, the extensive French expeditions to survey the fauna of the New Caledonia area have overlapped somewhat with our northern area of interest. From these expeditions, Tabachnick (2002) reported and described a new species of Lyssacinosida collected by New Caledonia's ZoNeCo project (1990–1992) on the Norfolk Ridge. Tabachnick and Lévi (2004) also reported and described ten additional new species of Lyssacinosida from the New Caledonia expeditions, collected during the ZoNeCo project and RV *Jean Charcot* from the Norfolk Ridge within our area of interest. No species of Hexactinosida, Aulocalycoida or Lychniscosida were reported from these expeditions within our area of interest. Bruce (2005) reported one additional new, still undescribed, Lyssacinosida from Norfolk Ridge, which served as host to pontonine shrimps.

In a report on fossil sponges from the Tutuiri Greensand outcropping on Chatham Island, Kelly and Buckeridge (2005) also listed collections of Recent hexactinellids from Chatham Rise, including three new species of Hexactinosida — *Eurete simplissima* Semper, 1868 (misspelling of *E. simplicissima*), *Conorete* cf. *erectum* (Schulze, 1899), and *Pararete farreopsis* (Carter, 1877). Since specimens were not described and identifications were not vetted by a hexactinellid specialist, the listed species names cannot be added to the New Zealand fauna with confidence. Kelly and Buckeridge (2005) also described fossils from the Greensand that closely resembled some Recent species already known from the New Zealand area, and four more Hexactinosida species names new to the area: *Heterorete* sp., *Anomochone* sp., *Psilocalyx wilsoni* Ijima, 1927, and *Sclerothamnopsis compressa* Wilson, 1904, as well as a member of the order Fieldingida, presently unknown in Recent New Zealand waters. These names also cannot be securely added to the known New Zealand fauna because the loose spicules required for confirmation were absent, rendering the identifications given to the fossils putative. We confirm the report of *Psilocalyx wilsoni* in this work.

Kelly *et al*. (2009) provided a preliminary analysis of the Hexactinellid fauna of New Zealand, listing *Aphrocallistes beatrix beatrix* Gray, 1858 in addition to Schulze's list of four species. Several species records in this work have not been confirmed here: the record of *Auloplax auricularis* (Schulze, 1904) is probably now better regarded as *Auloplax breviscopulata* n. sp. described herein, and *Chonelasma* cf. *choanoides* Schulze & Kirkpatrick, 1910 is probably now better regarded as *Chonelasma australe* n. sp. described herein.

In summary, only the four species originally reported by Schulze (1887), and *A. beatrix beatrix* reported by Kelly *et al*. (2009), can be considered certain members of the three hexactinellid orders covered in this work, Hexactinosida, Aulocalycoida and Lychniscosida, occurring in New Zealand waters. It has been clear for many years that several other species of these taxa are present here (Kelly *et al*. 2009), and the intent of the present monograph is to bring these species to light.

MATERIALS AND METHODS

SAMPLE COLLECTION

Most of the sponges were collected by rock dredge from New Zealand waters by the National Institute of Water & Atmospheric Research (NIWA) research vessels *Tangaroa*, between 1965 and 2008, and *Kaharoa*, between 2002 and 2004. The RV *Tangaroa* stations are cited under the sections entitled 'Material Examined' in each description, as NIWA Stn TAN0XXX/XX, and the RV *Kaharoa* stations as NIWA Stn KAH0XXX/XX. A few sponges were collected by other New Zealand fisheries, research and commercial vessels, RV *Acheron*, FV *Cordella*, FRV *James Cook*, RV *Rangitoto*, RV *Rapuhia*, FV *Willwatch*, RV *Sonne*, MV *Tangaroa*, FV *Endeavour III*, and some very old, historically important specimens reviewed were originally collected by the HMS *Challenger*, SS *Valdivia*, and HMS *Sealark*. NIWA and other collection stations are illustrated in Fig. 1. Specimens were either frozen immediately upon collection or preserved and stored for the long term in 70% ethanol, or are now dry.

Figure 1. Study area showing collection stations for hexasterophoran glass-sponge species in New Zealand EEZ, Australian EEZ (surrounding Macquarie Island on Macquarie Ridge), Tongan EEZ (surrounding the Kingdom of Tonga), and in International waters.

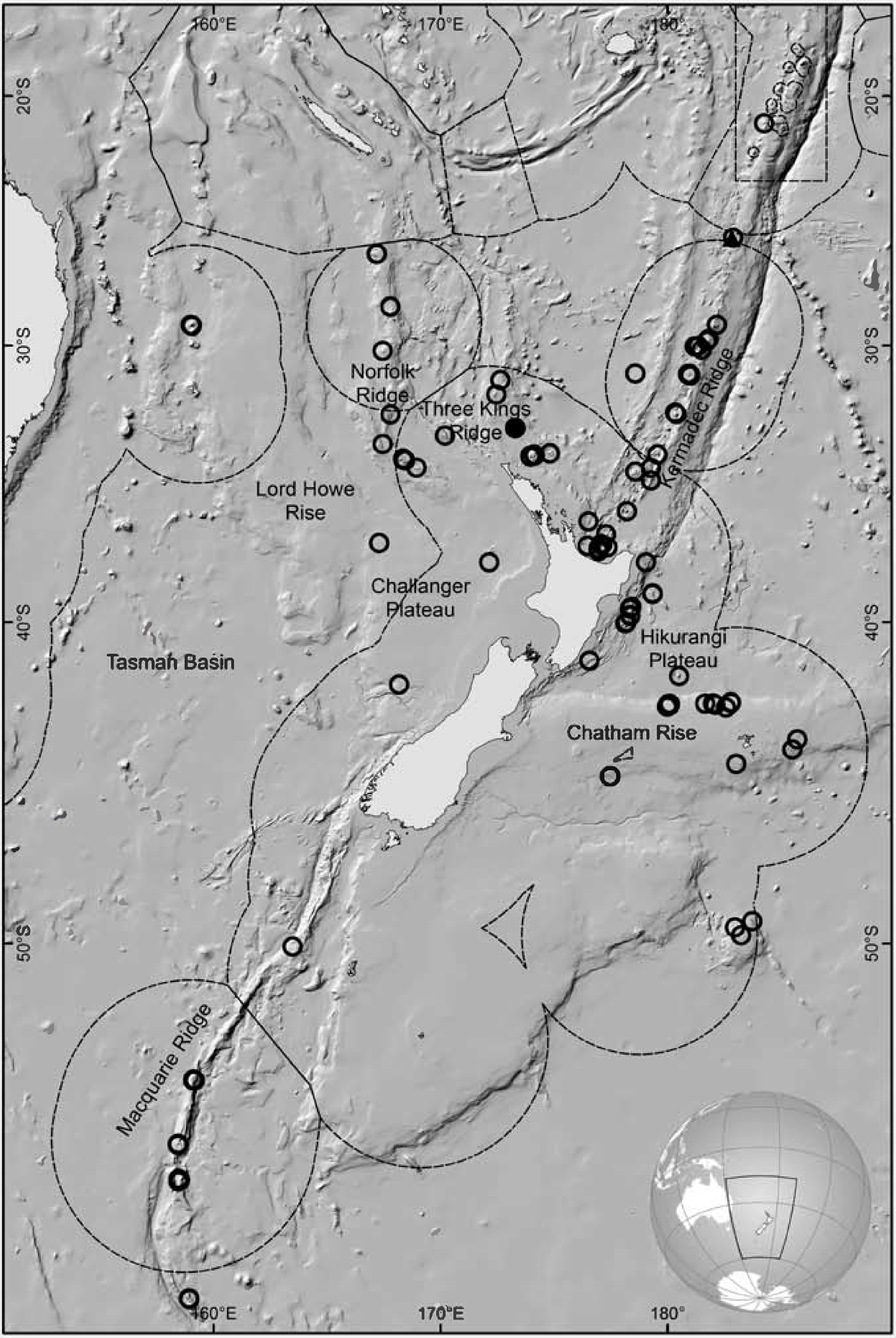
SAMPLE PREPARATION

Specimens were first triaged to determine if proper spicules were present — if dry, by simply viewing directly under a dissecting microscope, or, if wet, by making temporary digestions of small pieces of the body wall in commercial sodium hypochlorite bleach. These preliminary examinations usually provided all of the information on structure of the frameworks, presence or absence of channelisation, type of nodes present, etc. required for most long-dead, washed-out specimens. Where spicules were present, small tufts were picked by forceps or scraped by scalpel from dermal and atrial surfaces, dehydrated, cleared and mounted in Canada balsam on microscope slides to identify surface spicule types. Where specimens had thin walls and were in good condition, wall sections about 0.5 mm^2 were excised, dehydrated, cleared, and whole mounted in balsam on microscope slides.

Preparations of cleaned spicules and/or dictyonal frameworks were made by taking one or two 0.5–1.0 ml subsamples from a specimen, soaking them in water to remove ethanol, then digesting them in test tubes in hot (95 °C) nitric acid to dissolve organic contents from spicules and frameworks. After cooling and diluting in a small petri dish, large and medium-size spicules were picked from the suspension by forceps or pipette under a dissecting microscope, repeatedly rinsed in distilled water, and transferred directly to 9 mm square cover glasses to which they quickly adhered by drying. The cover glasses were then attached to scanning electron microscopy (SEM) stubs by epoxy and prepared for SEM. Clean dictyonal frameworks were picked from the spicule suspension, rinsed several times in tap water, dissected where necessary to show dermal, atrial and transverse section surfaces, dried, mounted on SEM stubs with epoxy or double-sided tape, and prepared for SEM.

The clean spicules remaining in the diluted nitric acid suspension were further processed for both light microscopy (LM) and SEM. About 50 dermal and atrial spicules (pentactins or hexactins) were transferred by pipette to a petri dish of water; two of the four tangential rays were broken off with fine forceps and the remaining 3- or 4-rayed spicules were pipetted onto microscope slides and spread out with forceps and needle. After drying, Canada balsam and cover glasses were added. These slides, with consistently orientated dermal and atrial spicules, provided easy measurement

Figure 1 (*opposite*). Study area showing collection stations for hexasterophoran glass-sponge species in New Zealand EEZ, Australian EEZ (surrounding Macquarie Island on Macquarie Ridge), Tongan EEZ (surrounding the Kingdom of Tonga), and in International waters.


160°E
170°E
180°
20°S
30°S
40°S
50°S
Norfolk Ridge
Three Kings Ridge
Kermadec Ridge
Lord Howe Rise
Challanger Plateau
Tasman Basin
Hikurangi Plateau
Chatham Rise
Macquarie Ridge
160°E
170°E
180°

of tangential and proximal rays. A small aliquot of the remaining spicule suspension was passed through a 13 mm diameter, 0.2 µm pore-size Nuclepore© polycarbonate membrane filter. After drying the filter, which contained both megascleres and microscleres, it was mounted on an SEM stub using double-sided tape. The remainder of the spicule suspension was processed for LM; it was passed through three or four 25 mm diameter, 0.22 µm pore-size nitrocellulose Millipore© filters. The three or four filter preps made from each suspension were rinsed with tap water while in the filter holder and transferred to microscope slides to dry; the last filter intentionally was given a heavy spicule load that, before drying, was mostly transferred, often as a pad of wet spicules, by forceps from the filter to several drops of water on a clean microscope slide and spread with a fine needle. After drying, each filter and spicule spread was cleared with xylene, the filters trimmed with scissors to remove the excess unused periphery, and mounted in Canada balsam under cover glass. Occasionally, but not routinely throughout this process, when spicules in suspension accumulated fine clay particles and adhered to one-another in clumps, the suspensions were further diluted with water and treated with an ultrasonic cleaner in their normal solutions (cleaning agents were not used).

The dry SEM preparations, consisting of cleaned spicules on cover glasses or filters, cleaned frameworks on epoxy or tape, were sputter-coated with gold-paladium and imaged with a Hitachi S-3500 SEM at the Biology Department, University of Victoria.

SPICULE AND FRAMEWORK DIMENSIONS

Measurements of spicules were made using a computer-digitiser joined to either compound or dissecting LM by drawing tube (camera lucida) and Sigma-Scan® software. Framework elements were either measured directly by LM as above, or indirectly by using the image-analysis software SigmaScan Pro® on the SEM images. Dimensions are expressed as micrometres (µm); where expressed as millimetres (mm), this is stated accordingly. Dimensions are given in a table associated with the 'Description' section for each species. Dimensions are cited as mean (mean) and standard deviation (s. d.), range, and the number of measurements made. Where a particular spicule form being considered within a table of dimensions is not present in a particular specimen, this is indicated by n/a.

REGISTRATION OF TYPE AND GENERAL MATERIALS

Primary and secondary type materials of new species, and additional material, are deposited in the NIWA Invertebrate Collection (NIC) at the National Institute of Water & Atmospheric Research (NIWA; formerly New Zealand Oceanographic Institute, NZOI), Greta Point, Wellington, using the prefix NIWA—, and the Museum of New Zealand Te Papa Tongarewa (formerly National Museum of New Zealand, NMNZ), using the prefix NMNZ POR.—. Twenty-six specimens, including the holotypes of *Homoieurete macquariense* n. gen. n. sp. and *Aulocalyx australis* n. sp., as well as some paratypes, were recorded from the Australian EEZ around Macquarie Island, on Macquarie Ridge, to the southwest of New Zealand. These specimens have been donated to the Queensland Museum and accessioned into their biodiversity collections (prefix QM G—). Forty specimens included here were collected on the joint New Zealand-Australian NORFANZ voyage of May 2003 (Clark *et al*. 2003; Williams *et al*. 2006); these were accessioned on the voyage by the Queensland Museum using the prefix QM G—. The following agreement was made regarding sharing of this material, some of which was collected from Australian EEZ locations (Lord Howe Rise, North Norfolk Ridge, West Norfolk Ridge), New Zealand EEZ locations (West Norfolk Ridge, South Norfolk Ridge), and in International waters on the West Norfolk Ridge (Fig. 1). Any QM G-registered specimens from within the New Zealand EEZ are to be re-registered with a NIWA registration number and housed at NIC. A voucher of the main NIWA-registered specimen will be retained where practical (without destroying the specimen) with the original QM G accession number and sent back to the QM. Any QM G-registered samples from within the Australian EEZ are to retain the QM G accession number and this is to be cited in this work with the specimen held at the QM. A voucher of the main QM G specimen will be retained where practical (without destroying the specimen), re-registered with a NIWA number and retained in New Zealand. Any QM G-registered samples from within International waters are to retain the QM G accession number and this is to be cited in this work with the specimen held at the QM. A voucher of the main QM G specimen will be retained where practical (without destroying the specimen), re-registered with a NIWA number and retained in New Zealand. Registration numbers are cited in the text. Synonomies of taxa are not exhaustive but are restricted to the major works dealing with those names.

AREA OF STUDY

The main area covered extends from 24° to below 60° S and 157° E to 167° W, covering seamount regions in the Kingdom of Tonga EEZ, New Zealand EEZ including the Kermadec Ridge and Cavalli Seamount region, Chatham Rise, Challenger Plateau, and south to the Macquarie Ridge, including the Australian EEZ surrounding Macquarie Island, and on the Norfolk Ridge and Lord Howe Rise (Fig. 1). Locations of specimens are shown on individual maps included in the detailed treatments of each species. Depths range from 154 to 2700 m. While the majority of sponges were collected by NIWA (and formerly the New Zealand Oceanographic Institute), several specimens were also collected on New Zealand fishing vessels, and on joint New Zealand-Australian collaborations. These included: the NORFANZ voyage of May 2003, which covered 14 seamount and slope sites in the general region of the Norfolk Ridge and Lord Howe Rise (Clark *et al*. 2003; Williams *et al*. 2006); and the MacRidge 2 voyage (TAN0803) of 2008, which represented a collaboration between NIWA and the Institute of Geological and Nuclear Sciences (GNS Science) in New Zealand, and Commonwealth Scientific and Industrial Research Organisation (CSIRO) Division of Marine and Atmospheric Research, the Antarctic Climate and Ecosystems Cooperative Research Centre (ACECRC), and the Research School of Earth Sciences, Australian National University (ANU) in Australia. All specimens collected from Australian EEZ, Tongan EEZ, and International waters are listed as such in the sections entitled 'Material Examined' within each species description. Unless otherwise stated as such, all specimens are from the New Zealand EEZ.

TERMINOLOGY

Specialist terminology for hexactinellid sponges follows Boury-Esnault & Rützler (1997) and Tabachnick & Reiswig (2002), and is included here for convenience. Some terms have been modified.

amararhysis (ses) – local tunnel-like channels running longitudinally, opening on atrial surface by slit-like apertures and on dermal surface as accessory oscula on ledge-like or papilla-like prominences; channels may branch radially into prominences; e.g. *Ptychodesia*

amphidisc – (birotulate) diactine spicule with umbels, often equal to each other, at opposite ends

anchorate – end of spicule with two or more claw- or grapnel-like spines, often in a whorl

aporhysis (ses) – channel in the dictyonal framework that penetrates into the body wall from below the bounding spicules of the atrial (gastral) surface, usually perpendicularly, ending blindly at various levels within the wall; in Hexactinosida only

aspidoscopule – a scopule with a discoid head

aster – stellate spicule where 1–6 primary rays undergo terminal branching to form secondary rays (differs from definition used for demosponges); primary rays may be secondarily fused and obscured in mature spicule form

atrial cavity – (atrium, gastral cavity, paragaster, vestibule) large internal cavity of funnel, cup or tube-form sponges; usually but not always exhalant

atrialia – (gastralia) spicules associated with the atrial surface

atrium – see *atrial cavity*

aulocalycoid – dictyonal framework in which fusion occurs at points of ray intersection (tip to ray or at ray crossings), not by fusion of ray pairs aligned in parallel; strands are always formed fundamentally of single hexactin rays that are longer than mesh sides; defining character of Aulocalycidae

axial canal – the continuous space occupied by the axial filament of siliceous spicules

axial cross – the intersection of axial canals in hexactine spicules; defines the spicule centre

axial filament – organic thread occupying the thin axial or central canal in siliceous spicules

basal disc – see *basidictyonal plate*

basal plate – see *basidictyonal plate*

basidictyonal plate – (basal disc, basal plate) siliceous framework formed by the first (basal) layer of hexactine spicules, irregular spicule elements and synapticula, which serves as attachment to hard substrate

basiphytous(e) – (basiphytes) method of attachment to hard substratum by basidictyonal plate

calycocom(e) – hexasterous spicule with secondary rays emanating from a solid calyx (capitulum); used in the description of stellate discohexasters of *Rossella* and related genera; also known in some Euplectellidae

calycoid(al) – type of branching when the secondary rays begin from calyx-like outer ends of primary rays

canal – tissue-lined path for water conduction inside sponges (see also *channel*)

canalisation – see the preferred term *channelisation*

channel – (canal) gap in dictyonal skeleton; term suggested to replace use of *canal* for this feature of dictyonal skeletons to avoid confusion with tissue-lined paths (canals) for water conduction

channelisation – (skeletal canalisation) in sponges with dictyonal skeleton, the development of canals owing to growth of dictyonal meshwork around pre-existing spaces

choanosomal skeleton – specifically denotes the rigid dictyonal framework (primary frame plus dermal and atrial cortices) plus the loose spicules associated with this region (see also *ectosomal skeleton*, *dictyonal framework*)

choanosomal – (parenchymal) location of objects (spicules, skeleton) between dermal and atrial surfaces

clavate – club-shaped; term for shape of distal termination of a spicule ray

clavule – monaxon spicule with discoidal, spherical, clavate or anchorate distal end; a type of sceptrule

codon- – condition of spicule ray tip: umbel with very long parallel teeth; thimblate

-come – suffix relating to secondary rays of a microsclere now used in names of distinct forms, e.g. graphiocome = graphiohexaster, floricome, pappocome, discocome = discohexaster; origin confused: Latin, comes = satellite; Greek kohn = hair

cortex – (cortical framework, cortical dermal frame, dermal cortex, atrial cortex, cortical layer) a superficial secondary layer of dictyonal framework laid down on the primary dictyonal framework (atrial or dermal). This differs in structure from the primary framework, consisting of one or two layers of dictyonalia fused without regular arrangement, forming triangular to polygonal meshes, extending to variable depth. Note that the term *cortex* in Hexactinellida is restricted in use to the peripheral parts of the dictyonal framework and refers only to the dictyonal framework, not the loose spicules associated with the atrial or dermal surfaces (see *ectosomal skeleton*)

dermalia – spicules of any size category associated with the dermal (external) surface; autodermalia (see also *hypodermalia*)

diactin – (diactine spicule; diactin; diact; oxydiact; rhabdodiactin) two-rayed spicule with rays aligned on the same (single) axis; both rays often with similar endings

diarhysis (ses) – radial channels of a dictyonal framework which pass entirely through the wall, arranged in a honeycomb-like pattern; e.g. *Aphrocallistes*

diaster – diactine microsclere with branching rays

dichotomous – (isotomous) type of sponge body branching in which, at each branch point, both branches are approximately equal (repeated series of Y-forks)

dictyonal beams – individual struts between fusion points (nodes) of a dictyonal framework

dictyonal framework – (dictyonal skeleton) the primary part of a dictyonal framework formed at the growing edge and persisting through life; may include a secondary framework added to outer and inner surfaces, composed of fused hexactins, in all Hexactinosida and Lychniscosida

dictyonal skeleton – (see *dictyonal framework*)

dictyonal strands – longitudinally aligned dictyonal beams produced by the fusion of a series of dictyonalia or extension of single dictyonal rays as continuous siliceous threads

dictyonalia – hexactine spicules which, when fused together, form a dictyonal skeleton

dictyonine – see dictyonal skeleton (vs lyssacine skeleton)

dictyorhysis (ses) – passage through normal mesh spaces of a dictyonal framework; not a special skeletal channel

disc(o) – (umbel) disc-like; adjective describing disc-like or toothed-disc terminus of a spicule ray or tine (see also *discoidal*)

discohemihexaster – see hemihexaster; preferred as hemidiscohexaster

discohexactin – (discohexact) six-rayed spicule with discoidal ends

discohexaster – hexaster with secondary rays ending as small discs

discoidal – disc-like termination of primary or secondary ray, usually with serrated or toothed margin

distal – for spicules placed distant from the spicule centre (axial cross), or attachment to sponge, term used to differentiate a specific spicule ray from other rays within the same spicule; the distal ray is that ray which is directed away from the choanosome centre; in atrialia it projects to the atrium

ectosomal skeleton – (ectosomal spicules) specifically denotes the loose spicules associated with the surface (dermal and atrial) as distinct from the choanosomal skeleton (see *choanosomal skeleton*)

epirhysis (ses) – closed, radially-directed channels or continuous gaps in the dictyonal skeleton of Hexactinosida, their openings (ostica) situated on the dermal surface (beneath the dermalia)

euretoid – skeleton of three-dimensional primary meshwork, two or more dictyonalia in thickness at growth margin; adjacent dictyonalia joined by silica deposition around rays lying parallel, side-by-side

false nodes – dictyonal nodes without a central cross, hence not formed from a dictyonal hexactin

farreoid – (primary framework) skeleton of a single net-like layer of paratangential meshwork at margin; typically grows in the marginal direction around oscula; may have secondary components as additional meshwork layers

graphiocome – (graphiocom, graphicome, graphi(o)hexaster) hexaster with numerous long, thin secondary rays arrayed in parallel tufts, each tuft emanating from a disc-like capitulum of a primary ray

hemi- – (hemy-) prefix for hexasterous spicules with irregular number of secondary rays, often with one or more primary rays carrying a single secondary ray

hemidiscohexaster – see *hemi-* and *discohexaster*

hemihexaster – (roller star) see *hemi-* and *hexaster*

hemioxyhexaster – see *hemi-* and *oxyhexaster*

hexactin(e) – (hexact, hex-) six-rayed triaxon spicule with rays of equal length and form perpendicular to one another; noun as hexactin (a hexactin) and adjective as hexactine (an hexactine spicule)

hexaster – hexactine spicule with six distally branching primary rays

hypodermalia – (dermalia) large pentactine spicules whose tangential rays are paratangentially situated immediately beneath the dermal surface, each with proximal ray directed inside body; support overlaying layer of dermal spicules; centre and tangential rays may be pushed up over the dermal surface but still called hypodermalia to reflect position of origin

inter(-)canals – (intercavaedia) interconnecting spaces between anastomosing tubules, lined by dermal spicules

labyrinthine – meandering without order (see also *plexiform*)

lateral (parietal) osculum – (oscula; gap) single or numerous holes located on the lateral wall of the dermal surface, usually penetrating the entire wall thickness

lonchiole – monaxon spicules having a single tine or distal ray (in contrast to sarules and scopules which have more than one tine), or diactin with rays of significantly different length

lopho- – prefix for spicules with a tuft of thin secondary rays (Greek: lophos = tuft or comb)

lophodiscohexaster – see *lopho-* and *discohexaster*

lophohexaster – (pappocome) see *lopho-* and *hexaster*

lychnisc – (lychnisk; lantern node) hexactine spicule with an octahedron of 12 fused siliceous struts formed around the centre or node (Lychniscosida only)

lychniscosan – (lychniscose) those sponges whose dictyonal frameworks (rigid skeleton) are built of regularly fused lychniscs (Lychniscosida only)

lyssacine – skeletal arrangement in which the choanosomal skeleton is formed by the interlocking and weaving, not fusion, of irregularly arranged spicules; direct point cementation and synapticulation may occur between spicules at later maturation stage (antonym: dictyonine)

microhexactin(e) – small hexactin with rays <150 µm long; see *hexactin*

onyc(h)hexaster – hexaster with onychoidal secondary ray termini (claws); often misnamed as discohexasters

onych(o)- – prefix referring to onychoidal or claw-bearing ray termination

onychexaster – astrose microsclere with onychoidal secondary ray termini (claws); sometimes imprecisely referred to as discasters

onychaster – see *onychexaster*

onychohexaster – see *onychexaster*

onychoid(al) – refers to the distal terminus of a spicule ray which bears one or several claws, spines, or teeth, often arranged in a grapnel-like manner, emanating from the original ray without swelling; commonly misidentified with discoidal terminations

oxy- – prefix for spicules with acutely pointed tips

oxydiaster – diaster with acute ray tips

oxyhexactin – hexactin with acute ray tips

oxyhexaster – hexaster with acute ray tips

oxyoid(al) – term referring to the distal terminus of a spicule ray which tapers slowly to a slender and sharp (acute) point

oxypentaster – pentaster with acute tips

oxystauraster – stauraster with acute tips

parenchymal(ia) – location in middle layer of body wall, between dermal and atrial layers; spicules located in this region; see *choanosomal*

parietal oscula – lateral oscula

pentactin(e) – (pentact; pent-) five-rayed triaxon spicule with perpendicular rays

pentaster – see *pentactine* (pent-) and *aster*

pinular – ray of a spicule having a spined pine tree-like form (i.e., pinular diactin; pinular pentactin)

pinule – name for a spicule that possesses a pinular ray

pinulus (uli) – name for a pinular ray

plexiform – (labyrinthine) descriptor of body forms of branching and anastomosing tubes or cylinders; branching is usually dichotomous

primary frame – the primary part of the growing dictyonal framework, excludes the secondary cortical framework or cortex (see *cortex*)

primary ray – those rays of a hexaster which are centrally connected together at the node of the spicule and distally give rise to branching secondary rays; usually six in number; bear internal axial filament or canal

prostalia – (prostal) spicules which protrude from the body surface, includes basalia; marginalia; pleuralia = lateralia; oscularia = marginalia

raphides – (rhaphides) small thin spicules or parts of spicules; they are commonly secondary rays broken from the graphiocomes

rhizophytous – (rhizophytes) sponges with basal root processes, composed of body structures rather than simple projecting spicule tufts

rhopalaster – an astral spicule, probably always hexastral, with rhopaloid tips

rhopalhexaster – hexaster with rhopaloid terminations (known in *Aulocalyx irregularis*)

rhopaloid(al) – type of spicule tip in which the ray widens distally to a clubbed form with dense coverage of long reclined spines on shaft and sometimes on clubbed end

sarule – type of sceptrule (monaxon spicule) with tuft of spines emanating from the top of the head, opposite the developed ray

sceptrule – special surface monaxon spicules in many Hexactinosida, including scopules, clavules, sarules, lonchioles, and aspidoscopules

schizorhysis (ses) – a type of channel system in dictyonal skeletons: these channels traverse the entire body wall by locally branching and intercommunicating system of cylindrical passages; e.g. Tretodictyidae

scopule – fork-like sceptre with few, commonly four, rays or tines extending from head

secondary framework – the parts (layers) of the dictyonal skeleton added in ontogenesis to the primary dictyonal layer(s) behind the growing margins

secondary points of basal attachment – attachment points other than the primary (larval) attachment point

secondary ray – one of the terminal branches of a primary rosette ray

sieve-plate – perforated skeletal lattice that covers the main or terminal osculum in Hexasterophora (e.g. *Euplectella*, *Aphrocallistes*); or atrialia and hypoatrialia separated from the choanosome by developed subatrial cavities and canals in Amphidiscophora

sigmoid(al) – shape of a spicule ray, s-form

sph(a)ero- – prefix indicating type of ray termination; see second meaning of *spherical*

spherical – used for hexaster where secondary tips are evenly distributed to give the entire spicule an overall spherical shape; or, type of ray termination, a knob-like end (see *tyloid*-)

spirodiscohexaster – discohexaster with each tuft of secondary rays spirally twisted

spur – (peg) a free (unfused) ray of a dictyonalium at framework margin

staur(o)- – spicule shape as four rays in a cross (two developed axes in one plane)

stauractin(e) – (stauract) cross-like spicule which consists of four rays perpendicular to one another

stauraster – see *staur*- and *aster*

stellate – used to describe the form of discohexaster or hexaster where secondary tips are grouped in clusters, instead of spreading evenly around the entire periphery as in spherical forms

synapticulum (ula) – (synapticular junctions) bridges between spicules or rays composed of siliceous cement; may be short and simple or extended, filament-like, branching and anastomosing structures forming silica networks; synapticula never have axial filaments

tangential – (paratangential) planes parallel to body surfaces, dermal or atrial; spicule rays situated in those planes

tetractin(e) – (tetract; quadriradiate) four-rayed spicule, either stauractin (two axes with both rays) or paratetractin (three axes, with 2, 1, 1 rays each)

tine – branches emanating from a scopule head; prongs

triactin(e) – spicules with three rays in two axes (diaxon; rays lie in one plane)

tyl(o)- – prefix for spicules with tyloid (spherical) tips

tyl(o)hexaster – see *tyloid* and *hexaster*

tyloid(al) – (tylo-) outer ends of spicule rays which are spherical

uncinate – (barbule) a distinctive spicule type ornamented with barbs overlying brackets, all orientated towards one end; axial canal sometimes present; axial cross not present hence monaxial or diaxial nature cannot be determined and derivation from hexactine spicule cannot be substantiated.

ABBREVIATIONS OF INSTITUTIONS

NHMUK	Natural History Museum (formerly British Museum of Natural History, BMNH, BM(NH), NHM), London
MNHN	Muséum National d'Histoire Naturelle, Paris
NIWA	National Institute of Water and Atmospheric Research (formerly New Zealand Oceanographic Institute, NZOI), Greta Point, Wellington
NMNZ	Museum of New Zealand Te Papa Tongarewa (formerly National Museum of New Zealand)
QM	Queensland Museum
RMNH	Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (formerly Rijksmuseum van Natuurlijke Historie)

CHECKLIST OF SPECIES

Class **HEXACTINELLIDA** Schmidt

Order **HEXACTINOSIDA** Schrammen

Family **FARREIDAE** Gray

Farrea occa occa Bowerbank, 1862
Farrea similaris n. sp.
Farrea medusiforma n. sp.
Farrea raoulensis n. sp.
Farrea anoxyhexastera n. sp.
Farrea ananchorata n. sp.
Farrea onychohexastera n. sp.
Farrea sp.
Farreidae incertae sedis

Family **EURETIDAE** Zittel

Subfamily **EURETINAE** Zittel

Conorete gordoni n. sp.
Homoieurete macquariense n. gen. n. sp. †
Gymnorete pacificum n. sp.
Gymnorete stabulatum n. sp.
Lefroyella ceramensis Ijima, 1927
Farreidae/Euretinae incertae sedis
Euretinae incertae sedis

Subfamily **CHONELASMATINAE** Schrammen

Chonelasma lamella Schulze, 1886
Chonelasma glaciale n. sp.
Chonelasma hamatum Schulze, 1886
Chonelasma australe n. sp.
Chonelasma biscopulatum n. sp.
Chonelasma chathamense n. sp.
Chonelasma sp.
Periphragella elisae Marshall, 1875
Chonelasmatinae incertae sedis
Farreidae/Euretidae incertae sedis
Euretidae incertae sedis

Family **TRETODICTYIDAE** Schulze

Anomochone expansa Ijima, 1927†
Anomochone furcata n. sp. †
Hexactinella acanthacea n. sp.
Hexactinella simplex n. sp.
Hexactinella aurea n. sp.
Psilocalyx wilsoni Ijima, 1927
Tretodictyidae incertae sedis

Family **APHROCALLISTIDAE** Gray

Aphrocallistes beatrix beatrix Gray, 1858

Family **AULOPLACIDAE** Schrammen

Auloplax breviscopulata n. sp.
Auloplax sonnae n. sp.
Auloplacidae incertae sedis (with spicules)
Auloplacidae incertae sedis (without spicules)
Hexactinosida incertae sedis

Order **AULOCALYCOIDA** Tabachnick & Reiswig

Family **AULOCALYCIDAE** Ijima

Subfamily **AULOCALYCINAE** Ijima

Aulocalyx australis n. sp.
Euryplegma auriculare Schulze, 1886

Order **LYCHNISCOSIDA** Schrammen

Family **AULOCYSTIDAE** Sollas

Neoaulocystis cristata n. sp. *

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* This species is found only near the Kingdom of Tonga, but is included here for the sake of a complete review of the genus in this region.

† These species are only found in Australian EEZ waters but are included in this work for the sake of a complete review of the genus in this region.

SYSTEMATICS

The concepts and classifications of the three orders of Hexasterophora covered here are basically the same as those published in the appropriate chapters of Systema Porifera (Hooper & Van Soest, 2002). Reasons for omission of the two orders Fieldingida (Tabachnick & Janussen, 2004) and Lyssacinosida from this memoir have been given above. In Systema Porifera, Recent members of the order Hexactinosida were contained in seven families with 36 valid genera. Since then only one new genus, *Asceptrulum* Duplessis & Reiswig, 2004, has been added to Farreidae. Below we propose moving the genus *Auloplax* Schulze, 1904, from the Dactylocalycidae to the resurrected family Auloplacidae, bringing the constitution of the order to eight families with 37 genera. Of these, five families and 12 genera are represented in New Zealand waters.

The order Aulocalycoida contained two families with seven genera in Systema Porifera (2002). Since then Janussen and Reiswig (2003) added a subfamily, Cyathellinae, to Aulocalycidae and moved one previously unplaced Hexactinosida genus, *Cyathella*, to this subfamily. Prior to the present work, the order had two families with eight genera; of these, one family and two genera have been found in New Zealand waters.

In Systema Porifera, the order Lychniscosida contained Recent members in two families with three genera; no changes have occurred since 2002. New Zealand waters contain only one living species representing one family and one genus.

Identification of Hexactinellida may at first appear daunting but, as with most human endeavours, success lies in patience and being prepared by having literature available. With the illustrations and the list of 'Key Diagnostic Characters' provided at the end of the formal description of each species, workers with access to modest laboratory equipment should be able to identify most specimens collected in the New Zealand area. Readers, however, should anticipate encountering problems in specimens that do not fit any of the taxa described here. Although we have reviewed a large number of specimens from New Zealand waters in preparation of the present summary, there are likely still several species of these orders yet to be discovered and described in the region.

HEXACTINOSIDA Schrammen

Hexactinosa Schrammen, 1903: 4; 1912: 190; Ijima 1927: 113; Reid 1958: xliv.
Hexactinosida Reiswig 2002: 1281.

Basiphytous Hexasterophora in which a rigid dictyonal framework is formed by fusion of simple hexactins; dictyonalia fuse either along rays lying side by side, or at junction points of ray tips to nodes of other dictyonalia, or ray tips to tips of other dictyonal rays; dictyonal ray length is limited to length of mesh sides.

FARREIDAE Gray

Ferreadae Gray, 1872: 457.
Euretidae Zittel, 1877: 35 (in part).
Farreidae: Schulze 1885: 447; Schulze 1887: 266; Ijima 1927: 129; Reid 1958: 1; Reiswig 2002b: 1332; Duplessis & Reiswig 2004: 200.

Hexactinosida, with sceptrules in the form of clavules, or their derivatives, sarules, lonchioles or aspidoscopules, or entirely lacking. With a farreoid dictyonal framework (modified from Duplessis & Reiswig, 2004 to accommodate the new proposal by Dohrmann *et al*., submitted to *Zool. J. Linnean Soc*.).

Remarks:

Sarostegia Topsent, 1904 is in the process of being removed to Euretidae, by Dohrmann *et al*., *Zool. J. Linnean Society* (submitted), based on a recent molecular and morphological analysis. With this transfer, Farreidae no longer have species with a euretoid skeleton. We have emended the diagnosis of Farreidae in anticipation of this change.

Farrea Bowerbank

Farrea Bowerbank, 1862: 1118; Schulze 1887: 266; Schrammen 1912: 209; Ijima 1927: 130; Reiswig 2002b: 1336; Duplessis & Reiswig 2004: 200.
Aulodictyon Kent, 1870: 249.
Chonodictyon Reid, 1958: 4.
Phyllobrochis Reid, 1958: 9.

Sceptrules as c1avules; dermalia and atrialia as pentactins; microscleres as oxyhexasters with long primary rays with or without discohexasters; tylohexasters, pentasters, staurasters and diasters may occasionally occur; attached to hard substratum by spreading basal plate; body form varies from typical dichotomously branching and anastomosing tubes with open lateral branches to broad funnel to laterally undulated flat blade, and intermediates; primary dictyonal wall, seen in distal growing edges as a regular, rectangular-meshed monolayer with dictyonal strands oriented longitudinally;

primary wall not channelised; secondary dictyonalia added externally as one or more duplications of the organised primary layer or as irregularly joined dictyonalia forming triangular meshes; secondary layers may contain shallow epirhyses and/or aporhyses (modified from Reiswig 2002b).

REMARKS:

The only previous report of a member of the genus *Farrea* from New Zealand waters is that of *Farrea occa* by Schulze (1887), collected by HMS *Challenger* off Raoul Island in the Kermadec Islands group in 1874. Previous workers have interpreted slight differences in spicule complement between specimens of *Farrea* species as being due to intraspecific variation in widely distributed highly variable species. It has been recently shown that many supposed cosmopolitan shallow-water demosponge species are really composed of a suite of distinct species (Boury-Esnault & Solé-Cava 2004). We thus assume that small distinct consistent differences in spicule complements of *Farrea* specimens are genetically based and taxonomically significant. In addressing a very large collection of *Farrea* specimens in this study, we have chosen to erect new species where these differences are obvious and consistent.

TYPE SPECIES: *Farrea occa* Bowerbank, 1862

Farrea occa occa Bowerbank, 1862 (Figs 2, 3)

Farrea occa Bowerbank, 1862: 1118; Schulze 1887: 277; Reiswig 2002b: 1337.

Farrea occa occa Ijima 1927: 131.

MATERIAL EXAMINED:

Bay of Plenty, *ESE of Mayor Island*: NMNZ POR.000499, 37.366° S, 176.475° E, 388–448 m, 2 Jan 1979. *Rumble V Seamount*: NIWA 43422, 43423, NIWA Stn TAN0107/225, 36.147° S, 178.204° E, 772–951 m, 23 May 2001.

Kermadec Ridge, *Volcano H*: NIWA 43427, 43429, NIWA Stn TAN0205/39, 32.605° S, 179.602° W, 1175–1252 m, 17 Apr 2002; NIWA 31494, NIWA Stn J0660, 35.033° S, 179.265° E, 803 m, 5 Sep 1974.

North Chatham Rise, *Graveyard seamount complex*, *Diabolical Seamount*: NIWA 51861, NIWA Stn TAN0104/47, 42.793° S, 179.981° W, 900–950 m, 16 Apr 2001. *Gothic Seamount*: NIWA 25218, NIWA Stn TAN0604/103, 42.728° S, 179.898° W, 1050 m, 04 Apr 2006; NIWA 25232, 62087, NIWA Stn TAN0604/106, 42.727° S, 179.899° W, 1030 m, 05 Jun 2006. *Ghoul Seamount*: NIWA 51928, NIWA Stn TAN0104/115, 42.802° S, 179.988° W, 931–1013 m, 17 Apr 2001.

East Chatham Rise, *Andes Seamounts*, *Diamond Head*: NIWA 54110, NIWA Stn TAN0905/114, 44.151° S, 174.768° W, 830 m, 27 Jun 2009.

Rock Garden, *southern end of Ritchie Ridge*, *Hikurangi Margin*: NIWA 62102, NIWA Stn TAN0616/9, 40.041° S, 178.143° E, 748 m, 4 Nov 2006.

Southern Hikurangi Margin: NIWA 63551, NIWA Stn TAN1004/52, 41.461° S, 175.896° E, 923–960 m, 20 Apr 2010.

Macquarie Ridge, *Seamount 9* (*Australian EEZ*): QM G331857, NIWA Stn TAN0803/98, 56.246° S, 158.506° E, 676–750 m, 16 Apr 2008.

DISTRIBUTION: Cosmopolitan; known from several northern and southern locations in New Zealand waters (Fig. 2A), forming an arc from ESE of Mayor Island up to HMS *Challenger* Stn 170A, off Raoul Island, Kermadec Islands, south to the Hikurangi Margin and Chatham Rise, and a single remote southern occurrence on Macquarie Ridge.

HABITAT: Attached to hard substratum in muddy sediments, depth range within the New Zealand region 388–1252 m, worldwide 86–3018 m.

DESCRIPTION:

Morphology is a small stock of branching and anastomosing tubes attached to hard substratum (Fig. 2B–D), typically on hard coral framework, gravel, pebbles or shells; specimens are often collected only as broken fragments.

Dimensions of largest specimen 4.8 cm long; tubes 4–12 mm diameter with wall 0.5–1 mm in thickness and lumen 3–10 mm diameter.

Texture stony but slightly flexible and fragile.

Surface smooth, without channelisation.

Colour light beige wet or dry.

Choanosomal skeleton is a dictyonal framework usually one mesh thick (Fig. 2E) but a secondary cortical layer may be added to outer dermal side; meshes are square or rectangular in primary frame layer but triangular in dermal cortex where present. Beams are moderate size (Table 1), mostly smooth but some individual beams and patches of beams are sparsely ornamented with fine spines. Spurs are rough and sharply digitate in form, curved towards the direction of growth. Loose choanosomal spicules include uncinates and microscleres.

Ectosomal skeleton is a reticulation of pentactine megascleres with overlapping tangential rays in the surface planes; clavules radiate head-outwards along the pentactin proximal rays; pointed tips of uncinates project vertically from the surfaces; microscleres are located in or just below the surface tissues.

Megascleres (Table 1) are pentactins, pileate and anchorate clavules and uncinates. Dermal and atrial pentactins (Fig. 3A) do not differ within specimens. In NIWA 31494 about one half of the tangential rays have large spines (approximately as long as ray thickness) on

Table 1. Spicule and framework dimensions (μm) of *Farrea occa occa* Bowerbank, 1862.

Parameter	**NIWA 31494**				**NMNZ POR.000499**			
	mean	**s. d.**	**range**	**no.**	**mean**	**s. d.**	**range**	**no.**
Surface pentactin:								
tangential ray length	218	40	135–383	50	207	35	135–294	50
tangential ray width	7.9	1.5	4.5–11.8	50	8.1	1.6	5.2–11.8	50
proximal ray length	208	40	101–299	50	166	40	74–254	50
proximal ray width	8.1	1.4	5.1–11.0	50	7.8	1.5	5.1–10.8	50
Pileate clavule length	284	19	241–336	50	221	15	189–250	50
head width	19.5	1.8	14.2–23.2	50	15.6	1.4	12.4–18.2	50
Anchorate clavule length	264	59	188–450	50	225	17	185–262	50
head width	35.6	7.8	23.2–59.7	50	25.5	2.5	19.5–31.3	50
Uncinate length	1493	256	881–1980	37	2179	262	1477–2519	50
width	8.0	1.4	5.3–10.6	50	9.6	1.4	6.7–12.4	50
Oxyhexaster diameter	106	10	82–127	50	107	11	82–128	50
primary ray length	22.9	3.1	16.5–31.2	50	24.2	5.2	14.1–39.1	50
secondary ray length	35.2	3.8	26.8–43.9	50	31.2	4.5	23.4–44.3	50
Discohexaster diameter	65	13	43–97	50	-	-	-	-
primary ray length	16.6	3.9	9.4–26.2	50	-	-	-	-
secondary ray length	17.3	4.2	10.3–27.3	50	-	-	-	-
Oxyhexactin ray length	72	15	50–89	7	-	-	-	-
Framework beam length	332	79	165–540	50	249	65	127–405	50
beam width	43.8	4.1	31.6–51.4	50	49.5	9.2	29.1–67.8	50
dermal spur length	221	34	155–306	50	180	33	126–259	50
atrial spur length	228	43	160–323	50	239	55	148–451	50

the outer surface while the other half has small spines all around the rays. In NMNZ POR.000499 only about 1% of the pentactins are of the large-spined form. Pinulate clavules (Figs 2F, 3B) have 14–20 sharp marginal teeth, a hemispherical head, and a narrow neck with small inflation; the lower neck is moderately spined. The 1 μm thick shaft is sparsely spined throughout. The fine spines on the upper head can only be seen in SEM. Anchorate clavules (Figs 2G, 3C) have a hemispherical to conical head bearing 3–10 long marginal claws which are straight or curve downwards; a very slight neck inflation may or may not be present; the head, neck and most of the shaft is smooth but small sparse spines occur on the lower half to fifth of the shaft. A few intermediates between pileate and anchorate form occur as well as very rare clavate forms with a smooth club-shaped head. The uncinate (Fig. 3D) is of moderate size with relatively small barbs closely appressed to the shaft.

Microscleres (Table 1) are oxyhexasters and their variants, and discohexasters which may be lacking. Oxyhexasters (Figs 2H, 3E) have 2–4 terminal rays per primary; the terminal rays are also slightly longer than the primaries; all rays appear smooth in LM but very finely spined in SEM. Hemihexaster and hexactin (Fig. 3G) variants are both rare, about 1% and 0.1% of oxy-tipped microscleres respectively. Discohexasters and their discohemihexaster variants (Figs 2I, 3F) were found only in NIWA 31494. Each primary bears 1–3 terminals which are about the same length or sometimes shorter than the primary; the terminals end in small discs with 4–6 short sharp marginal spines; terminals are rough in LM but spines are resolvable on both rays in SEM. A few onychohexasters were encountered; they are probably immature stages of discohexasters.

Remarks: The history and description of the cosmopolitan species *Farrea occa* was summarised in great detail by Schulze (1887) before the advent of subspecies recognition. Spiculation and form of the species is based upon Carter's 1885 specimen from Sagami Sea, Japan, with confirmatory descriptions of other specimens obtained from throughout the world. The first subspecies were formed by Wilson (1904) and Lendenfeld (1915) each erecting a new subspecies, *F. occa claviformis* and *F. o. scutella*, respectively, on the basis of differences in their clavules from those in the typical form. Ijima (1927) recognised a suite of seven additional forms, differing in combinations of body form and spiculation from the typical *F. o. occa*. Tabachnick (1988) described

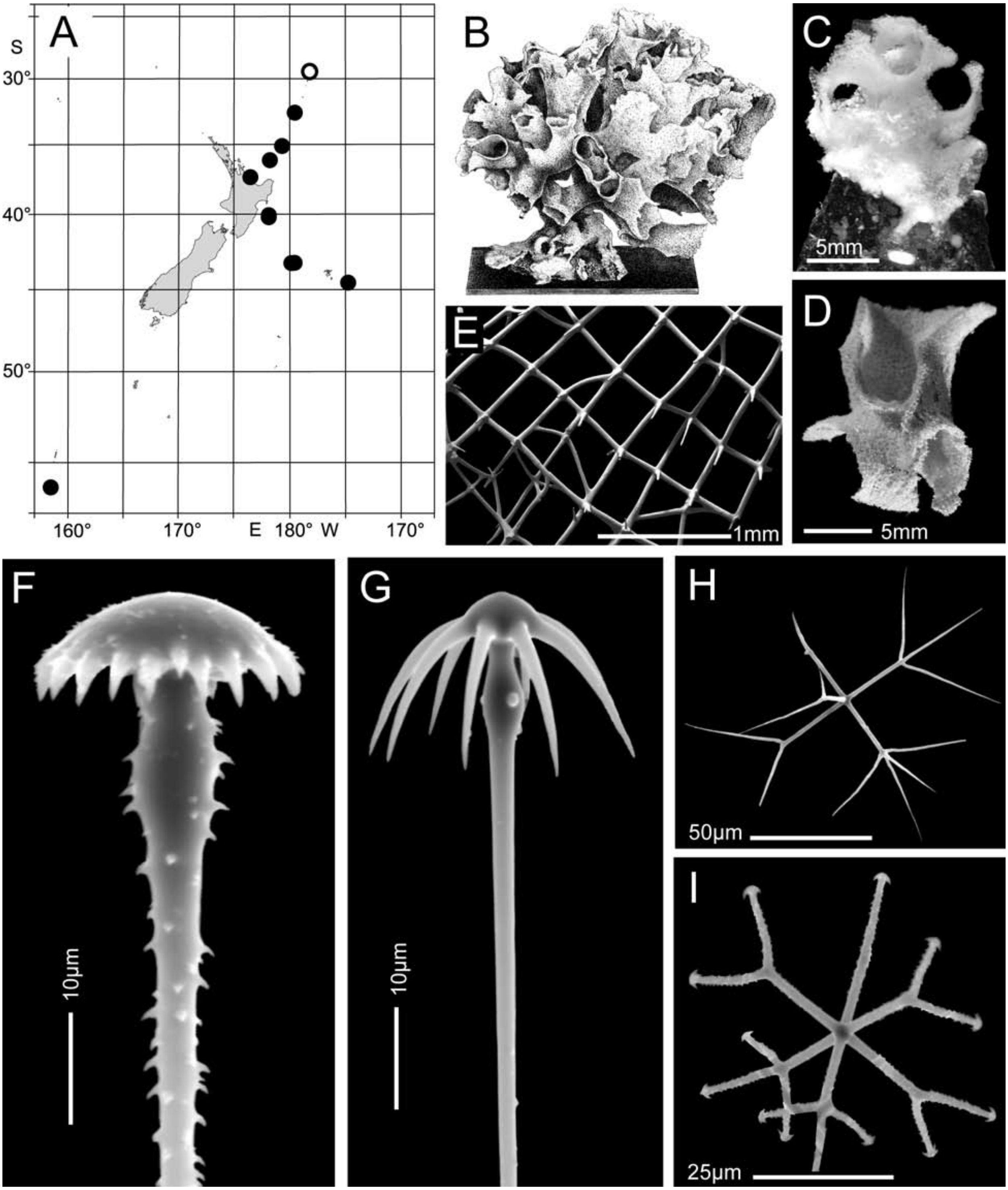


Figure 2. *Farrea occa occa* Bowerbank, 1862. A, distribution in New Zealand waters (open circle, HMS *Challenger* specimen; closed circles, new collections). B, Carter's original 1885 reference specimen from Japan (no scale available). C, NIWA 31494 attached to a pebble. D, fragment of NMNZ POR.000499. E, cleaned dictyonal framework (NIWA 31494). F, upper part of pileate clavule (NMNZ POR.000499). G, upper part of anchorate clavule (NMNZ POR.000499). H, oxyhexaster (NMNZ POR.000499). I, discohexaster (NIWA 31494).

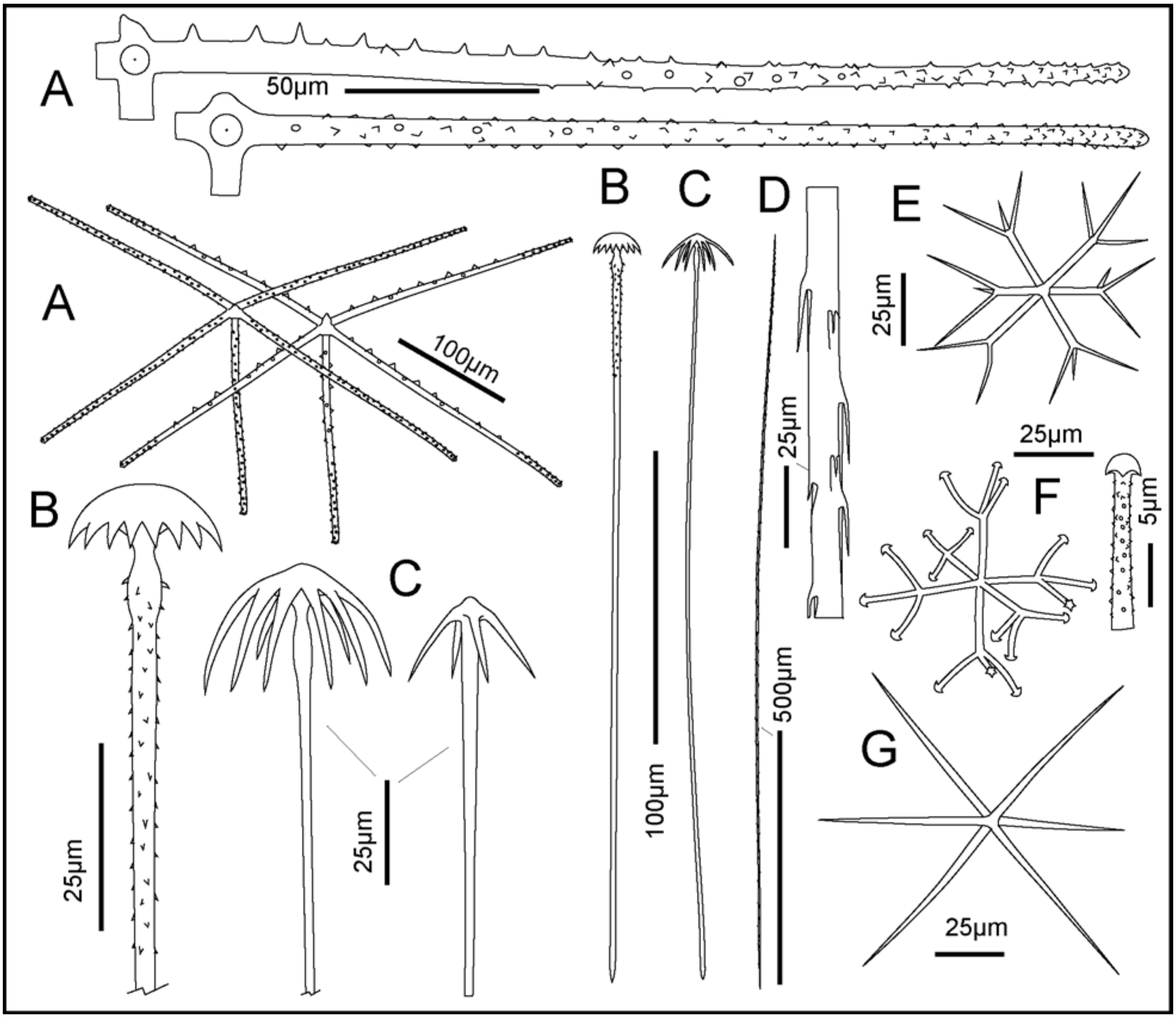


Figure 3. Spicules of *Farrea occa occa* Bowerbank, 1862, from NIWA 31494. A, two surface pentactins with coarse and medium spination, with enlargements of their tangential rays (above). B, pileate clavules, whole and enlargement of the upper part. C, anchorate clavules, whole and enlargement of the upper parts of two forms. D, uncinate, whole and enlargement of middle part. E, oxyhexaster. F, discohexaster with enlargement of terminal ray tip. G, oxyhexactin.

the tenth and latest subspecies, *F. o. polyclavula*, in which the clavules are highly variable in shape and oxyhexasters are apparently absent. The New Zealand specimens reviewed here agree most closely in body form and spiculation with the typical form, *F. o. occa*, as delimited by Ijima (1927), but differ in the size and shape of their oxyhexasters: diameter here is 82–128 µm vs 50–77 µm in the typical form, and here the primary rays are shorter than the terminals vs the reverse in the typical form. These differences are not considered to be taxonomically significant in view of the considerable variation that has been documented for the typical subspecies across its extensive geographic range. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a branching and anastomosing network of 4–12 mm diameter tubes
- Dictyonal framework is a single layer in thickness at the growing margin
- Clavules include both pileate and anchorate forms with simple shafts which may be finely spined but without large thorns
- Microscleres are oxyhexasters; discohexasters may be present or absent

Farrea similaris n. sp. (Figs 4, 5)

Material examined:

Type material: **Holotype** NMNZ POR.000460, E of Chatham Islands, 44.178° S, 174.500° W, FV *San Rangitoto* Trip 576, Tow 57, c. 1000 m, 25 Jan 1993. **Paratypes** NIWA 69115, NIWA Stn Z10898, slope east of Chatham Rise, 44.191° S, 174.493° W, 975 m, 19 Jul 2000; NIWA 53867, NIWA Stn TAN0905/106, Ritchie Seamount, Andes Seamounts, E Chatham Rise, 44.175° S, 174.553° W, 704 m, 26 Jun 2009; NIWA 53927, NIWA Stn TAN0905/107, Ritchie Seamount, Andes Seamounts, E Chatham Rise, 44.177° S, 174.559° W, 760 m, 26 Jun 2009; NIWA 53752, NIWA Stn TAN0905/102, Dickies Seamount, Andes Seamounts, E Chatham Rise, 44.127° S, 174.571° W, 845 m, 26 Jun 2009; NIWA 62146, NIWA Stn TAN0905/98, Dickies Seamount, Andes Seamounts, E Chatham Rise, 44.147° S, 174.698° W, 720 m, 26 Jun 2009; NIWA 69116, NIWA Stn Z10250, Dickies Seamount, Andes Seamounts, E Chatham Rise, 44.115° S, 174.571° W, 660–1109 m, 12 Jul 2000.

Non-type material: *South Fiji Basin*: NIWA 69112, NIWA Stn TAN0411/25, 26.375° S, 177.267° W, 855 m, 6 Oct 2004.

Southern Lord Howe Rise: NIWA 66036, NIWA Stn TRIP2894/88, 35.651° S, 165.933° E, 844–1000 m, 14 Jul 2009; NIWA 66082, NIWA Stn TRIP2894/90, 35.901° S, 166.101° E, 966–1021 m, 14 Jul 2009; NIWA 69234, NIWA Stn Z9720, 35.933° S, 166.151° E, 1050 m, 6 Mar 1999;

West Norfolk Ridge: NIWA 70640, NIWA Stn Z11101, 34.501° S, 168.733° E, 874–1030 m, 21 Jul 2002.

East of West Norfolk Ridge: NIWA 69111, NIWA Stn TRIP1711/13, 33.967° S, 167.983° E, 840–1079 m, 16 Oct 2002; NIWA 69117, NIWA Stn TRIP2474/42 , 34.531° S, 168.797° E, 820–1071 m, 3 Aug 2007.

Three Kings Ridge: NIWA 62105, NZOI Stn U582, 31.862° S, 172.433° E, 790 m, 5 Feb 1988.

Southern Kermadec Ridge: NIWA 62115, NZOI Stn X693, 35.883° S, 177.925° E, 1664–1920 m, 14 Feb 1996.

Northern Bay of Plenty: NIWA 69118, NIWA Stn Z8483, 35.951° S, 176.501° E, 700 m, 29 Apr 1996.

Hikurangi Margin: NIWA 69120, NIWA Stn Z9727, 40.001° S, 178.117° E, 647 m, 13 Dec 1998.

Northeast of Challenger Plateau: NIWA 62169, NIWA Stn KAH0006/50, 37.505° S, 172.228° E, 960–1060 m, 24 Apr 2000.

Chatham Rise: NIWA 62050, NIWA Stn TAN9406/260, 43.857° S, 174.285° W, 754–1000 m, 6 Jul 1994; NIWA 50580, NIWA Stn TRIP2626/17, 44.683° S, 175.201° W, 941–1155 m, 15 May 2008; NIWA 50591, NIWA Stn TRIP2551/82, 44.167° S, 174.573° W, 836–1100 m, 18 Dec 2007; NIWA 50596, NIWA Stn TRIP2626/24, 44.633° S, 175.201° W, 957–1244 m, 15 May 2008; NIWA 50600, NIWA Stn TRIP2094/30, 44.212° S, 174.467° W, 760–1210 m, 29 Apr 2005; NIWA 62843, NIWA Stn TRIP2650/63, 44.155° S, 174.515° W, 746–1202 m, 4 Aug 2008; NIWA 62904, NIWA Stn TRIP2807/82, 44.132° S, 174.553° W, 680 m, 19 Feb 2009; NIWA 62907, NIWA Stn TRIP2862/63, 43.052° S, 174.387° W, 1064–1076 m, 30 May 2009; NIWA 62912, NIWA Stn TRIP2807/79, 44.132° S, 174.553° W, 720–1062 m, 19 Feb 2009; NIWA 62914, NIWA Stn TRIP2699/33, 44.133° S, 174.552° W, 724 m, 4 Oct 2008; NIWA 66028, 66043, 66044, NIWA Stn TRIP2955/40, 44.211° S, 174.467° W, 745–1197 m, 9 Oct 2009; NIWA 66029, NIWA Stn TRIP2969/11, 44.183° S, 174.533° W, 905–1180 m, 2 Nov 2009: NIWA 67809, NIWA Stn TRIP2521/36, 44.635° S, 175.215° W, 955–1275 m, 11 Nov 2007; NIWA 69114, NIWA Stn TRIP1603/21, 44.187° S, 174.533° W, 1000–1246 m, 12 Feb 2002; NIWA 69119, NIWA Stn TRIP1731/48, 44.247° S, 174.611° W, 1098–1311 m, 8 Feb 2003; NIWA 69121, NIWA Stn TRIP1731/16, 44.212° S, 174.601° W, 760–1085 m, 19 Jan 2003; NIWA 70620, NIWA Stn TRIP1603/56, 44.205° S, 174.512° W, 818–1113 m, 2 Mar 2002; NIWA 70647, NIWA Stn TRIP2520/129, 44.188° S, 174.533° W, 775–1064 m, 25 Nov 2007.

Off Banks Peninsula: NIWA 62050, 69113, NZOI Stn X491, 43.857° S, 174.285° E, 754–1000 m, 6 Jul 1974; NIWA 69113, NZOI Stn X491, 43.858° S, 178.117° E, 754–1000 m, 9 Jul 1994.

Bollons Seamount, south-east of Bounty Plateau: NIWA 34858, NIWA Stn TAN0307/82, 49.819° S, 176.744° W, 1210–1218 m, 2 May 2003.

Type locality: East of Chatham Islands, New Zealand.

Distribution: Throughout South Fiji Basin, south through Lord Howe Rise and Norfolk Rises, south to circum New Zealand, particularly common on the Chatham Rise, southernmost location Bollons Seamount, southeast of Bounty Plateau (Fig. 4A).

Habitat: Presumably attached to hard substratum, depth range c. 1000 m, and probably at 1210–1218 m.

Description:

Morphology of the entire massive, club-shaped specimen resembles teredo-bored 'worm-wood' (Fig. 4B) with what look like rods passing through the centre of the specimen; composed of a tight fusion of small-gauge branching and anastomosing tubes, alive at collection in the upper, more loosely fused parts. The lower columnar part is cylindrical and more dense, almost solid silica, due to tubule wall thickening and infilling into both tubule lumina and interspaces by addition of fused spicules onto wall surfaces. Basally an attachment disc is present but no substratum is present. The specimen from Bollons Seamount is similar in tight branching of small tubules, but is entirely washed out.

Dimensions of the holotype are 35 x 22 x 12 cm, component tubules are 6–7.5–10 mm diameter with 1.5 mm wall thickness and 3–4.5–6 mm lumina; interspaces between tubules are only slightly larger.

Texture is stony hard and brittle.

Surface of whole specimen is covered by walls and openings of tubule lumina and interspaces between tubules; both outer and inner wall surfaces of individual tubule components (Fig. 4C) are smooth, without channelisation.

Colour from light grey in upper living parts to dark brown in the dead compacted lower column.

Choanosomal skeleton (Table 2) of the upper parts is composed mainly of a thick, dense, dictyonal framework, 3–8 layers of dictyonalia. Dermal meshes are mainly rectangular and triangular without directional orientation (Fig. 4D); atrial meshes are rectangular with clear longitudinal orientation of beam strands (Fig. 4E); several layers of cortical dictyonalia occur on both dermal and atrial surfaces but the primary farreoid framework of a single layer of thick longitudinal strands with fairly regular transverse connecting beams is evident when these have been removed (Fig. 4F). Large numbers of microxyhexactins are fused to dictyonal beams throughout the entire framework. Beams are mostly smooth, but sparse spines occur occasionally and some beams, especially those with strong curvature and probably thus derived from spurs, are densely covered with blunt nodules. Nodes are not swollen; spurs are rough, conical, and sharply pointed, without swollen bases. Loose choanosomal spicules include uncinates and microscleres.

Ectosomal skeleton is mainly a lattice formed by the overlapping tangential rays of pentactins. Pileate and anchorate clavules project heads-out along the pentactin proximal rays. Anterior tips of uncinates project from the choanosome through the ectosomal surface while microscleres occur in and just below the dermal membrane.

Megascleres (Table 2) are surface pentactins, indistinguishable on the dermal and atrial surfaces of tube walls, pileate and anchorate clavules and uncinates. The surface pentactin (Fig. 4G, 5A) is ornamented by very large conical spines approximately ray-thickness in length on the outer surfaces of tangential rays and on all surfaces of the proximal ray; the distal third of all rays is entirely covered by fine spines; tangential rays are rounded or blunt-tipped while the proximal ray ends in a parabolic or sharp tip. The pileate clavule (Fig. 4H, 5B) has a smooth hemispherical head bearing only

Table 2. Spicule and framework dimensions (µm) of *Farrea similaris* n. sp.

Parameter	**Holotype NMNZ POR.000460**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	129	20	91–192	50
tangential ray width	8.3	2.1	5.3–12.9	50
proximal ray length	176	64	83–319	50
proximal ray width	8.2	1.8	5.4–15.6	50
Pileate clavule length	291	57	207–456	50
head width	24.8	2.7	16.8–30.1	50
Anchorate clavule length	194	18	161–248	50
head width	17.3	1.9	12.0–22.3	50
Uncinate length	703	176	267–1072	50
width	4.0	1.1	1.6–6.4	50
Oxyhexaster diameter	99	16	63–135	50
primary ray length	25.7	4.5	13.9–36.2	50
secondary ray length	26.7	4.2	15.5–33.2	50
Discohexaster diameter	80.7	10.4	57.6–103.4	50
primary ray length	22.8	3.8	14.2–31.9	50
secondary ray length	18.9	2.8	14.1–24.9	50
Framework beam length	342	135	148–665	50
beam width	47.9	11.2	28.3–88.7	50
dermal spur length	138	47	78–286	50
atrial spur length	130	34	72–209	50

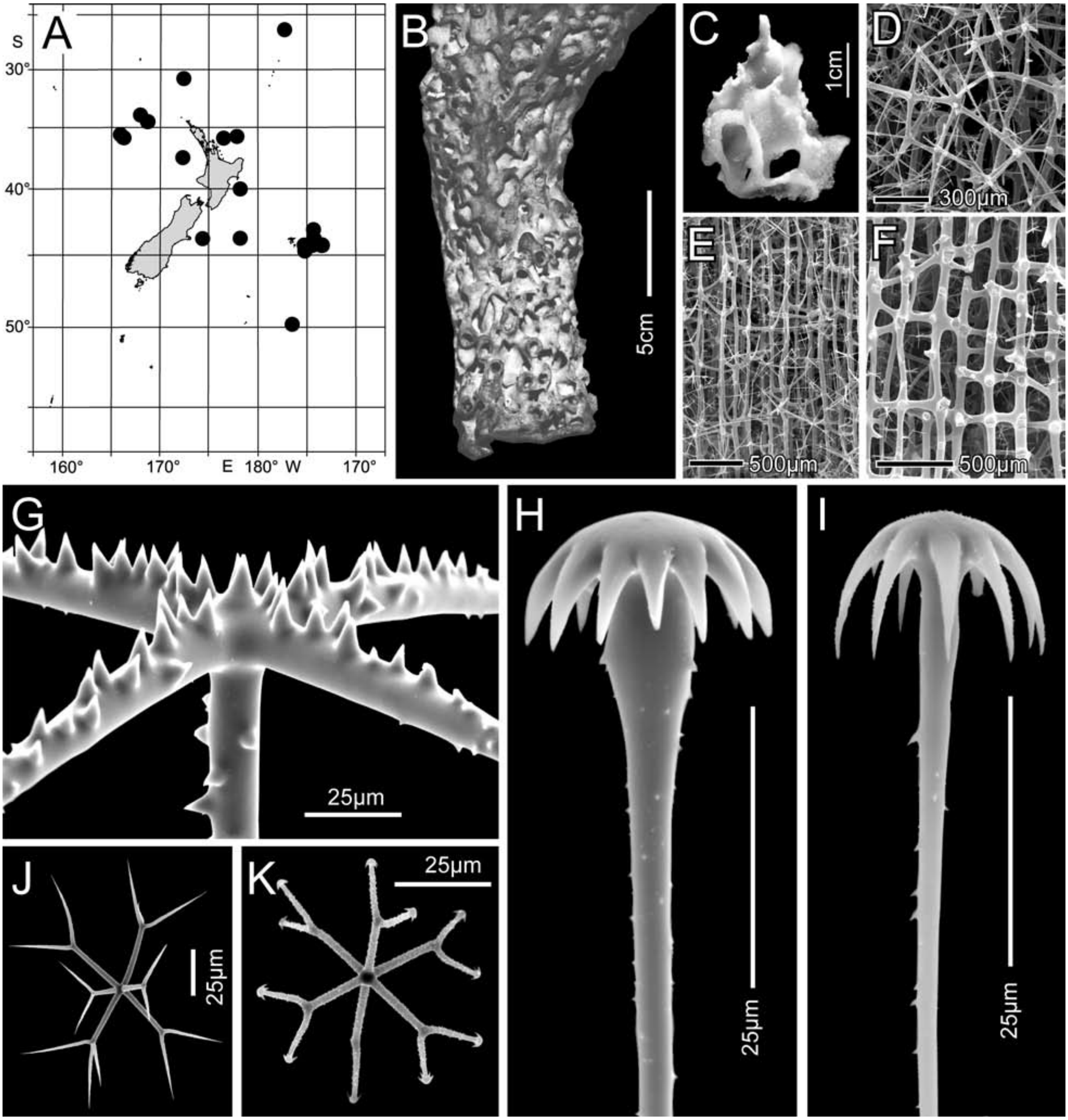


Figure 4. *Farrea similaris* n. sp., holotype NMNZ POR.000460. A, distribution in New Zealand waters. B, holotype. C, small portion of upper tubule system of holotype. D, cleaned dermal framework. E, cleaned atrial framework. F, primary framework after removal of atrial cortex layers. G, central part of macrospined pentactin. H, upper part of pileate clavule. I, upper part of anchorate clavule. J, oxyhexaster. K, discohexaster.

10–16 sharp relatively long marginal teeth; the neck is slightly inflated, without a break in contour, and is lightly spined as is the shaft which ends in a moderately sharp parabolic tip. The anchorate clavule (Fig. 4I, 5C) has a small hemispherical head which is lightly spined (seen only in SEM), and bears 7–11 long claws which project back in smooth continuation of the head or with slight flaring but never bent outwards towards their tips; the neck is not inflated or nearly imperceptibly so; the neck and shaft are entirely finely spined ending in moderately sharp parabolic tip. The two types of clavule appear very similar in LM and indeed some intermediate forms cannot be assigned to either form. The uncinate is relatively small for this genus, but has well-developed brackets and barbs, the latter of which incline or curve out from the spicule surface.

Microscleres (Table 2) are mainly oxyhexasters (80%), discohexasters (20%), and very rare oxydiasters,

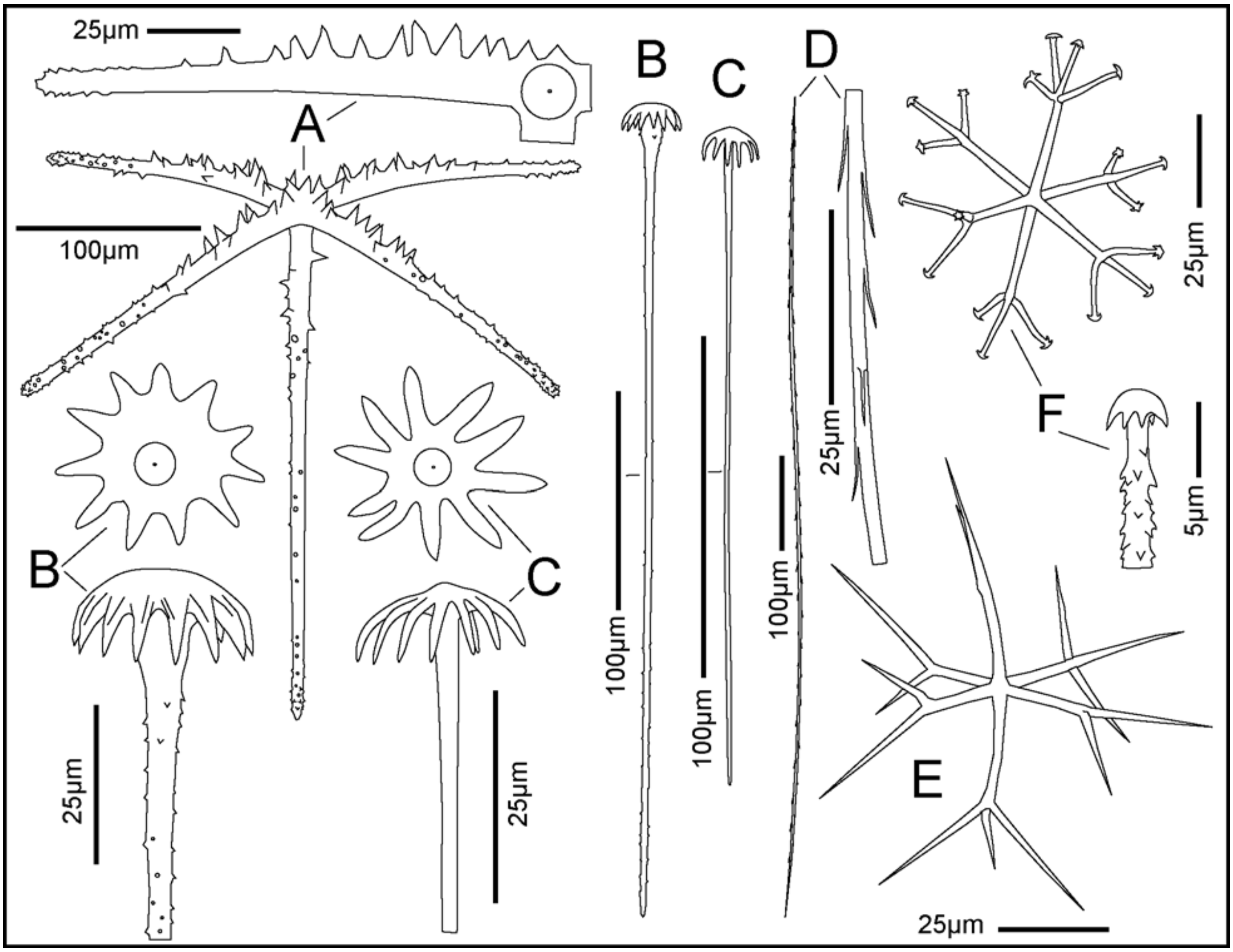


Figure 5. Spicules of *Farrea similaris* n. sp., holotype NMNZ POR.000460. A, surface pentactin, whole and side view of tangential ray. B, pileate clavule, whole and enlargement of upper part. C, anchorate clavules, whole and enlargement of upper part. D, uncinate, whole and enlargement of middle part. E, oxyhexaster. F, discohexaster with enlargement of terminal ray tip.

hemidiscohexasters and discohexactins. The oxyhexaster has primary and secondary rays of equal length; each primary bears 2–3–4 straight secondary rays; all parts appear smooth in LM but are found finely roughened in SEM. The discohexaster has long primary rays, each bearing 1–3–4 straight short secondary rays which end in small discs with 5–8 marginal spines; they are entirely rough in both LM and SEM; thin immature forms have ray ends which could be classified as onycho-tips.

Etymology: The species name *similaris* reflects the similarity of form of the pileate and anchorate clavules.

Remarks: This new species is highly recognisable with the massive club-like shape and considerable size; some specimens are up to 50 cm long. *Farrea similaris* n. sp. is thus easily distinguished from *F. occa occa* in size alone. It differs from its closest relative, *F. o. occa*, most obviously in the difficulty of separating pileate and anchorate clavules with LM. This is due not only to dissimilarity in number and length of marginal teeth and claws, but also to the differences in overall shape and fine ornamentation of the clavule heads in *F. occa* and the new species (compare Fig. 2F, G with Fig. 4H, I). The new species also differs from *F. o. occa* in having much smaller uncinates and in having oxyhexasters of different shape, with primary to secondary ray length ratio of nearly 1 (0.96), while local *F. o. occa* specimens have mean uncinate lengths twice as long and oxyhexasters with much longer secondary rays, primary to secondary ray length ratios between 0.65 and 0.78. While this new species differs in at least these three features of spiculation from local *F. o. occa* specimens, it differs in more characters from other *Farrea* species and *F. occa* subspecies. These distinctions are here considered sufficient to recognise the southern form as a new species, designated *F. similaris*. A comparison of the free spicule complements of all New Zealand *Farrea* species is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a branching and anastomosing network of 6–10 mm diameter tubes; may become massive and club-shaped, with rod-like structures supporting the length of the sponge
- Clavules occur as pileate and anchorate forms with simple shafts which may be finely spined but without large thorns
- The two clavule forms appear very similar in light microscopy
- Microscleres are oxyhexasters and discohexasters

Farrea medusiforma n. sp. (Figs 6, 7)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NMNZ POR.000488, NE of White Island, Bay of Plenty, 37.410° S, 177.358° E, 1377–1402 m, 19 Jan 1979. **Paratypes** NMNZ POR.000485, NE of White Island, Bay of Plenty, 37.410° S, 177.358° E, 1377–1402 m, 19 Jan 1979; NIWA 43445, NIWA Stn TAN0205/82, southern Kermadec Ridge, 32.549° S, 179.655° W, 1958–2312 m, 23 Apr 2002.

NON-TYPE MATERIAL: *Kermadec Ridge*: NIWA 34859, 34860, NIWA Stn TAN0205/82, 32.549° S, 179.655° W, 1958–2312 m, 23 Apr 2002.

Macquarie Ridge, *Seamount 7* (*Australian EEZ*): QM G331856, NIWA Stn TAN0803/84, 53.705° S, 159.115° E, 998–1100 m, 13 Apr 2008.

TYPE LOCALITY: Bay of Plenty.

DISTRIBUTION: Southern Kermadec Ridge, Bay of Plenty, and Macquarie Ridge (Fig. 6A).

HABITAT: Presumed attached to hard substratum, depth range 998–2312 m.

DESCRIPTION:

Morphology as an ovoid system of branching and anastomosing, thin-walled tubes (Fig. 6B), forming a tight network in its basal portions and a more open, lettuce-like, frilled system in the outer areas. The basal attachment is not present in any of the six specimens.

Dimensions of the largest fragment is 14.3 x 6.5 cm; tube diameters are 10–16 mm or larger in outer lettuce-like frilled areas; wall thickness is 0.8–2.8 mm.

Texture stony hard and brittle in lower small-tube areas and more flexible and wiry in outer parts.

Surface smooth without channelisation or obvious prostalia, though emergent uncinates can be seen with a dissecting microscope.

Colour light beige.

Table 3. Spicule and framework dimensions (µm) of *Farrea medusiforma* n. sp.

Parameter	**Holotype NMNZ POR.000488**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	280	48	172–370	50
tangential ray width	11.7	2.4	6.9–16.3	50
proximal ray length	366	83	213–556	50
proximal ray width	11.2	1.8	6.9–15.5	50
Pileate clavule length	424	44	320–518	50
head width	35.6	4.7	25.0–48.2	50
Anchorate clavule length	348	44	216–449	50
head width	56.4	8.0	42.8–76.2	50
longest shaft spine length	21.4	6.3	6.3–34.4	50
Uncinate length	1121	47	753–1721	24
width	6.6	1.3	4.7–11.1	24
Oxyhexaster diameter	97	11	57–114	50
primary ray length	20.0	1.6	16.0–23.5	50
secondary ray length	32.1	3.5	26.0–41.9	50
Framework beam length	379	66	228–526	50
beam width	44.2	5.9	30.4–57.2	50
dermal spur length	534	88	342–760	50
atrial spur length	430	67	271–587	50

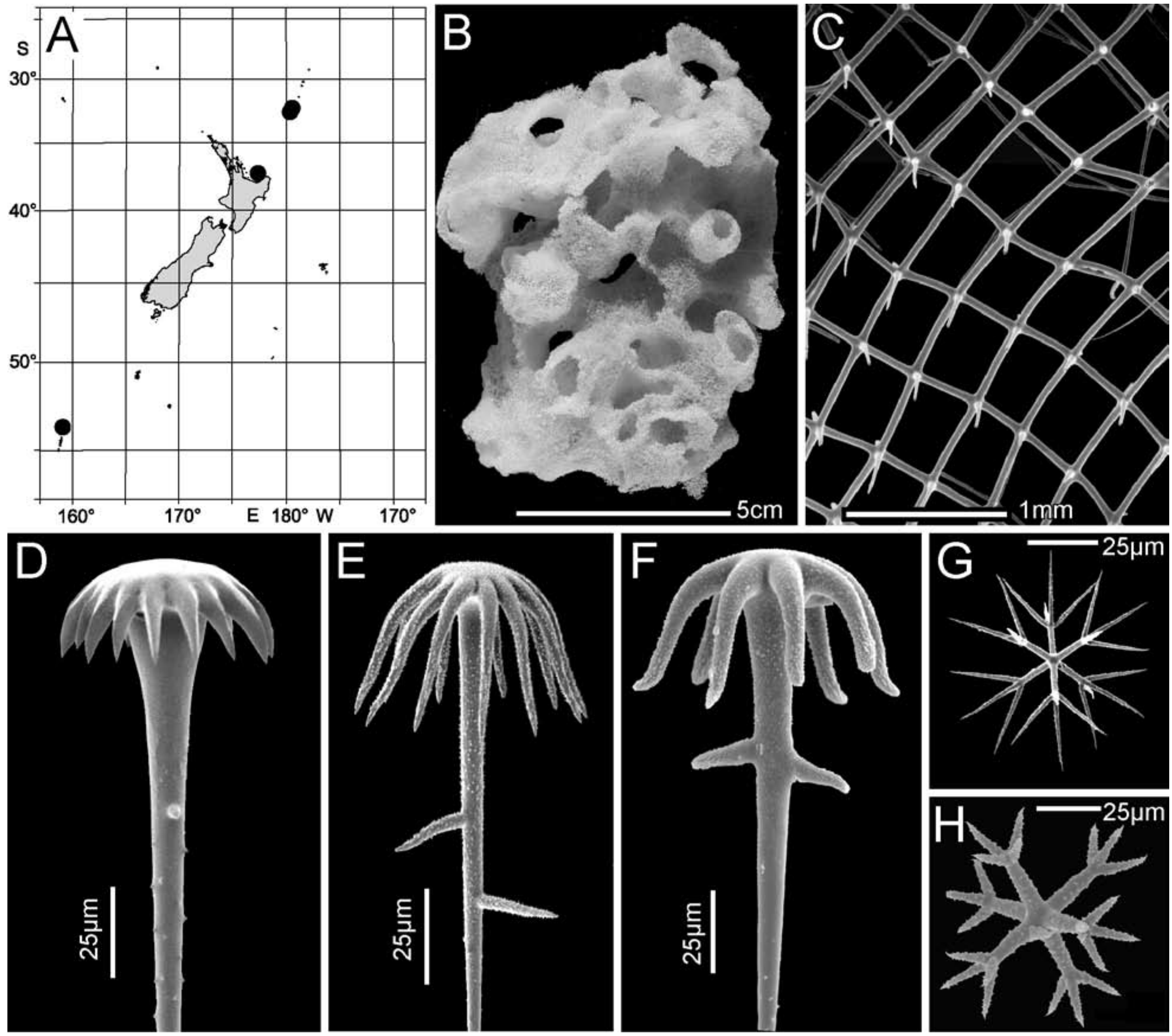


Figure 6. *Farrea medusiforma* n. sp. A, distribution in New Zealand waters. B, non-type specimen NIWA 324860. C, clean framework (holotype NMNZ POR.000488). D, upper end of pileate clavule (holotype NMNZ POR.000488). E, upper end of normal anchorate clavule (holotype NMNZ POR.000488). F, upper end of thick anchorate clavule (NIWA 34860). G, normal oxyhexaster (holotype NMNZ POR.000488). H, thick oxyhexaster (NIWA 34860).

Choanosomal skeleton (Table 3) is mostly a one-layer dictyonal framework of rectangular meshes in outer areas (Fig. 6C), with a secondary layer of cortical dictyonalia added on the outer, dermal side forming triangular meshes. In the denser basal areas, addition of cortical dictyonalia on both dermal and atrial surfaces, up to 10 indistinct layers, results in considerable wall thickening to nearly 3 mm. Longitudinal strands are very strong, with transverse strands also in fairly regular arrangement in the primary layer. Nodes are normal, not swollen, and beams are smooth. Spurs are long, digitate, sharply pointed and rough. Microxyhexactins do not adhere to the skeletal framework. Loose choanosomal spicules include vertical and oblique oriented uncinates and oxyhexaster microscleres.

Ectosomal skeleton consists of a smooth lattice formed by overlapping tangential rays of loose dermal pentactins, with clavule heads radiating head-out around the pentactin central junctions. Uncinates project vertically and obliquely through the dermal surface and oxyhexaster microscleres lie in and just below the dermal membrane.

Megascleres (Table 3) are surface pentactins, pileate and anchorate clavules and uncinates. Pentactins of dermal and atrial surfaces are similar (Fig. 7A), with large spines on the outer surfaces of the tangential rays; their ray tips are parabolic or rounded, often slightly inflated, and always densely microspined. Pileate

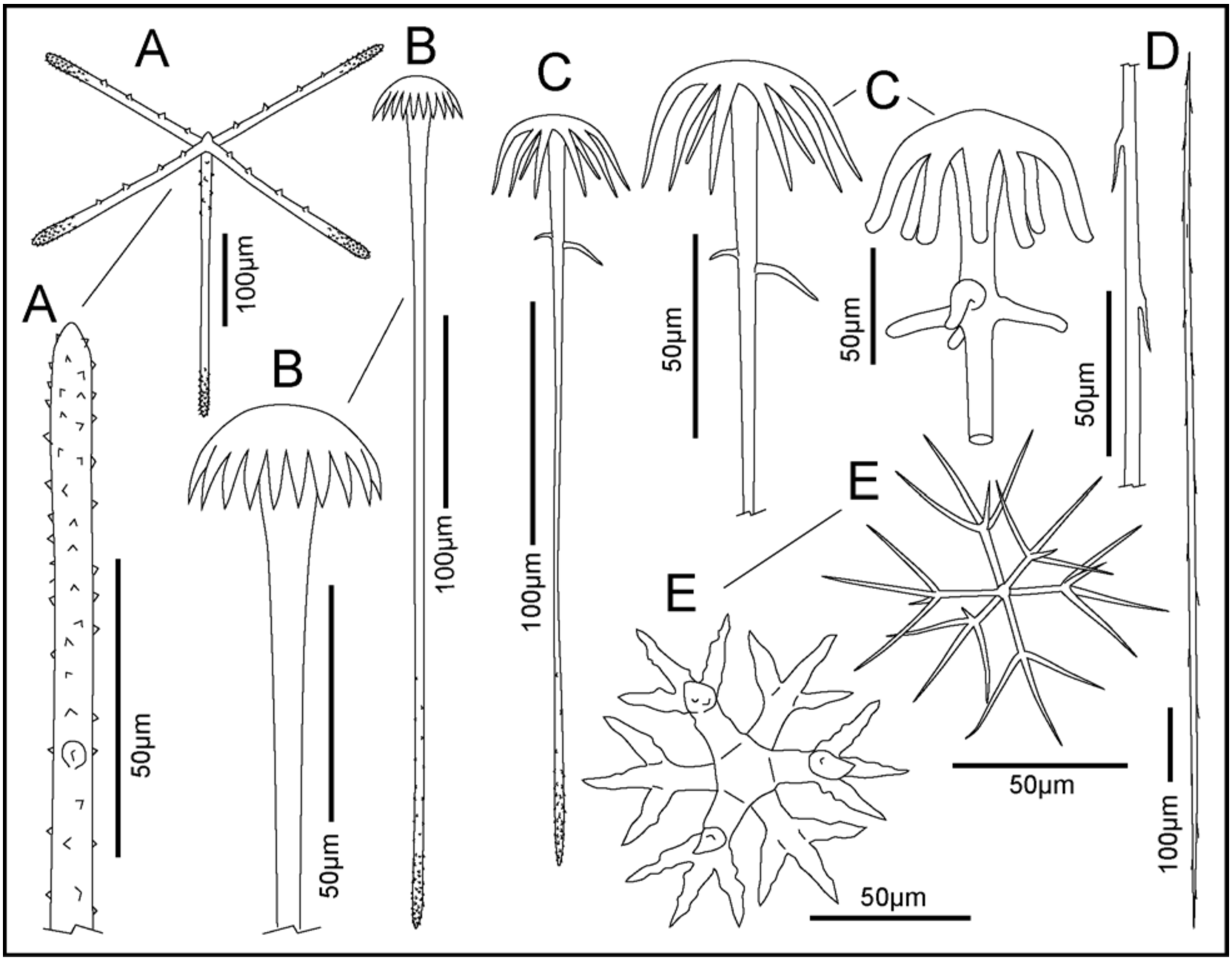


Figure 7. Spicules of *Farrea medusiforma* n. sp. A, surface pentactin, whole and tangential ray end (holotype NMNZ POR.000488). B, pileate clavule, whole and upper end (holotype). C, anchorate clavule, whole and upper end of normal and thick form (far right from NIWA 34860). D, uncinate, whole and enlargement of middle segment (holotype). E, normal oxyhexaster (holotype NMNZ POR.000488) and thick oxyhexaster (NIWA 34860).

clavules (Fig. 6D, 7B) occur on both dermal and atrial surfaces; they have a smooth hemispherical cap with 16–20 sharp marginal spines, a smoothly tapering neck and sparsely spined shaft 3–4 µm in diameter; the lower shaft is more densely microspined and ends without inflation in parabolic tip. Anchorate clavules (Fig. 6E, 7C) occur also on both dermal and atrial surfaces and are entirely microspined (only seen with SEM); the small cap bears 6–12 long marginal claws which may be thin and pointed or thickened and blunt-tipped (Fig. 6F, 7C far right); they often curve outwards distally. The clavule neck is smoothly tapered onto a shaft, which usually bears 2–3 large perpendicular spines or thorns at about one-fifth of shaft length; the shaft tapers gradually to a thickness of 1.4 µm and ends in a parabolic tip that is heavily microspined. About 5% of the anchorate clavules lack shaft spines. Uncinates (Fig. 7D) are moderately variable in size (most were broken in preparations), and carry short barbs, fairly widely spaced, which project only weakly from the shaft; the uncinates are not bushy.

Microscleres (Table 3) consist only of oxyhexasters which vary greatly in robustness among specimens. In most they are regular in shape (Fig. 6G, 7E right), entirely finely rough, with 3–4–5 straight, finely pointed terminals per primary ray, occasionally sharply hooked at the tip; the primary rays are moderately short, average ratio of primary to secondary ray lengths is 0.62. Some oxyhexasters of both NIWA specimens show extreme thickening (Fig. 6H, 7E left). Hemihexaster and hexactin forms were not detected.

ETYMOLOGY: The species name *medusiforma* is derived from the medusoid form of the cap of the anchorate clavule. Note that the medusoid shape of the clavule is not unique to this species.

REMARKS: Among the many species of *Farrea*, only six have conspicuous shaft spines on the anchorate clavules, *F. aculeata* Schulze, 1899, *F. kurilensis* Okada, 1932, *F. lendenfeldi* Ijima, 1927, *F. mexicana* Wilson, 1904, *F. nodulosa* Ijima, 1927, and *F. weltneri* Topsent, 1901b. Among these, the morphologically and geographically closest to the New Zealand form is *F. lendenfeldi* from Indonesia. Both *F. lendenfeldi* and the new species share the same type of anchorate clavule, but the dermal clavule of *F. lendenfeldi* consists primarily of smooth clavate clavules with a peculiar bulbous head, a form that does not occur in the new New Zealand specimens. Additionally, oxyhexasters are much smaller in *F. lendenfeldi*, ranging from 38–53 µm in diameter (Ijima 1927), entirely below the size range in the New Zealand form. These differences are considered here sufficient basis for distinguishing the two forms as distinct species.

Among the New Zealand specimens reviewed here, NIWA 34860 differs in having both coarse-spined and fine-spined pentacins in about equal numbers and extreme thickening in a significant number of both anchorate clavules and oxyhexasters. At present knowledge of variation within the New Zealand populations, these differences from the other five specimens are not considered to be taxonomically significant. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a branching and anastomosing network of 10–16 mm diameter tubes
- Dictyonal framework is a single layer in thickness at the growing margin but considerably thickened in basal regions
- The non-anchorate clavule is a pileate form with smooth tapered necks and shafts without spines
- Anchorate clavules occur in thin and thick forms; most bear 2–3 large perpendicular shaft spines or thorns
- Microscleres are only oxyhexasters

Farrea raoulensis n. sp. (Figs 8, 9)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NMNZ POR.000520, NNE of Herald Islets, Raoul Island, Kermadec Ridge, 29.200° S, 177.822° W, RV *Acheron*, 1188–1225 m, 05 Apr 1973. **Paratypes** QM G316637 (voucher NIWA 62094), NIWA Stn TAN0308/052, Lord Howe Rise (Australian EEZ), 29.239° S, 159.035° E, 1210–1395 m, 21 May 2003; QM G316640, NIWA Stn TAN0308/040, North Norfolk Ridge (Australian EEZ), 26.421° S, 167.188° E, 714–756 m, 17 May 2003.

TYPE LOCALITY: Raoul Island, Kermadec Ridge.

DISTRIBUTION: Near Raoul Island, Kermadec Ridge to the NE of New Zealand; Lord Howe Rise and Northern Norfolk Ridge (Australian EEZ) (Fig. 8A).

HABITAT: Presumably attached to hard substratum; depth range 714–1395 m.

DESCRIPTION:

Morphology of the body form is unknown. The holotype consists of about 12 dry, broken flakes of low curvature, probably derived from a branching stock of lettuce-like form or tubes at least 1.5 cm in diameter. The paratypes each consist of short segments of a tubular branching stock (Fig. 8B).

Dimensions of the largest flake of the holotype is 2 cm; the largest paratype is 3 cm long; walls are 1–1.5 mm thick.

Texture stony and brittle, but somewhat flexible.

Surfaces are smooth, without channelisation.

Colour white (dry), light beige in ethanol.

Choanosomal skeleton is a two-dimensional dictyonal framework of rectangular meshes (Fig. 8C), occasionally disturbed by dictyonalia that are inserted oblique to the regular and conspicuous longitudinal strands; transverse strands fairly regular and continuous. Nodes are simple, not swollen. Beams are smooth. Spurs are thin, rough, slightly curved in direction of growth and end in sharp or rounded tips. Microxyhexactins soldered to the framework are present in both paratypes, but absent in the thinner holotype. Loose choanosomal spicules include uncinates and four types of microscleres, oxyhexasters, onychohexasters, discohexasters, and oxyhexactins.

Ectosomal skeleton consists mainly of a lattice formed by overlapping tangential rays of surface pentactins; pileate and anchorate clavules project slightly heads-outward from around the pentact centres; uncinates oriented vertically and obliquely project slightly as prostalia; microscleres are located in and just below the dermal membrane.

Megascleres (Table 4) are pentactins, pileate and anchorate clavules and uncinates, all of which occur on both dermal and atrial surfaces; no differences in size or shape of any type were noted between the two surfaces. Pentactins are either entirely evenly covered with small spines on all surfaces (Fig. 9A), or spines are more dense on the outer faces of the cylindrical tangential rays; large spines are not present. All rays are slightly inflated just behind the rounded tips. The pileate clavule of the holotype (Figs 8D, 9B upper) has a smooth hemispherical cap bearing 19–23 sharp marginal teeth; the inflated neck is ornamented with strong spines recurved toward the shaft; the shaft is finely rough ending in a fairly blunt or bullet-shaped tip. The pileate clavule of the two paratypes differs in lacking neck inflation in most, and having only small neck spines (Figs 8E, 9B lower). The anchorate clavule (Figs 8F, 9C) is the same in all specimens; it is entirely finely rough (seen only in SEM); it has a small central cap bearing 8–12 long marginal claws that curve slightly outwards just behind the sharp tips; just below the head the shaft of most bears 1–5 stout spines or thorns which project vertically from the shaft and curve abruptly or gently backwards; about 5% of these clavules lack shaft spines. Uncinates (Fig. 9D) are highly variable in size and may occur in several size classes which could only be determined with difficulty; larger forms have brackets and barbs in high density with the moderately small barbs closely adherent to the spicule surface; in small uncinates the barbs are too small to resolve with LM.

Microscleres (Table 4) in the holotype are about 98% oxyhexasters, 2% onychohexasters, 1% discohexasters, and very rare oxyhexactins; in the paratypes, the onychohexasters and discohexasters are more abundant, about 15% each. Oxyhexasters (Figs 8G, 9E) are entirely smooth in LM but lightly rough in SEM; each primary ray bears 2–4 straight or slightly hooked terminals; primaries and terminals are nearly equal in length. Onychohexasters (Figs 8I, 9F) are likewise entirely rough only in SEM and each primary bears 2–4 terminals, the tip of each bearing 1–4 short perpendicular claws or occasionally buttons (resembling small discs) in presumed immature stages. Discohexasters (Figs 8H) are stouter and entirely visibly rough even in LM; each primary ray bears 2–4 terminals that end in marginally spined discs. Some hexasters are intermediate between onycho- and disco-tipped forms; the terminations cannot be ascertained clearly with LM; additionally both onycho- and discohexaster variants occur very rarely as diasters. The rare oxyhexactins (Figs 8J) and occasional oxypentactins are robust and clearly rough in LM with conspicuous proclined thorns; they are apparently not variants of the oxyhexasters but a distinct microsclere type since the fine spines on both oxyhexasters and onychohexasters are oriented vertical or reclined as normal for these microscleres.

ETYMOLOGY: The specific name *raoulensis* is derived from the holotype locality, near Raoul Island in the Kermadec Island Group.

REMARKS: The specimens described here agree in basic form of body and most megasclere spiculation with *F.*

Table 4. Spicule and framework dimensions (µm) of *Farrea raoulensis* n. sp.

Parameter	Holotype NMNZ POR.000520			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	277	45	202–446	50
tangential ray width	10.3	1.5	7.6–13.6	50
proximal ray length	371	120	199–1027	50
proximal ray width	11.2	2.1	5.5–16.4	50
Pileate clavule length	498	102	288–676	50
head width	42.5	7.5	23.8–53.6	50
Anchorate clavule length	623	113	328–863	50
head width	87.8	17.4	56.3–124.1	25
longest shaft spine length	34.5	9.5	15.7–60.6	50
Uncinate length	1106	1041	197–4156	50
width	6.0	3.4	1.6–14.3	50
Oxyhexaster diameter	94	11	71–118	50
primary ray length	25.2	3.2	18.2–31.8	50
secondary ray length	25.1	3.6	15.3–32.9	50
Onychohexaster diameter	76.8	9.9	54.4–92.7	25
primary ray length	23.8	3.8	16.0–31.9	25
secondary ray length	16.4	2.7	11.9–23.1	25
Oxyhexactin ray length	85.8	12.7	62.5–120.3	50
Framework beam length	444	100	229–706	50
beam width	49.4	5.1	32.2–61.9	50
dermal spur length	269	64	131–420	47
atrial spur length	231	51	113–349	42

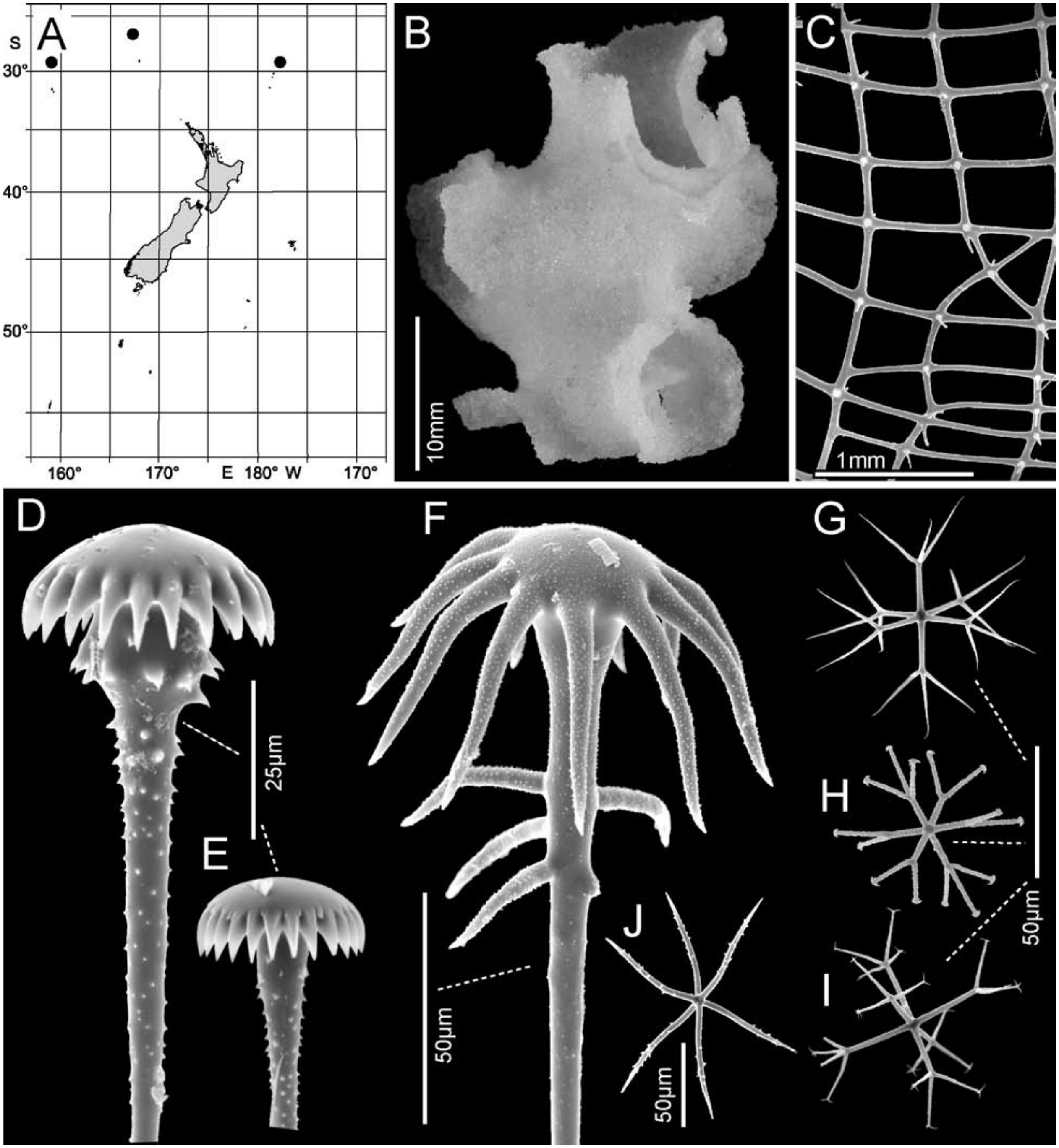


Figure 8. *Farrea raoulensis* n. sp., holotype NMNZ POR.000520. A, distribution in New Zealand and eastern Australian waters. B, paratype QM G316640. C, clean framework of holotype. D, upper end of pileate clavule with large neck spines. E, upper end of pileate clavule with small neck spines (paratype QM G316640). F, upper end of medusoid anchorate clavule. G, oxyhexaster. H, discohexaster (paratype QM G316640). I, onychohexaster. J, oxyhexactin with proclined spines.

medusiforma but differ in several points. All specimens here, in addition to oxyhexasters, have onycho- and discohexasters in varying abundance, while both of these microsclere types are absent in *F. medusiforma*. The oxyhexasters here have primary and terminal ray lengths about equal, where the primary rays are much shorter than the terminals in *F. medusiforma*. Oxyhexactins with large proclined spines are also absent in the latter. None of the surface pentactins in the new form have coarse spines, which are present in at least some of those of *F. medusiforma*. Finally, the range of uncinate length is much greater than in *F. medusiforma*. The distinctive pileate clavule form, with inflated and coarsely spined neck is known only in the holotype

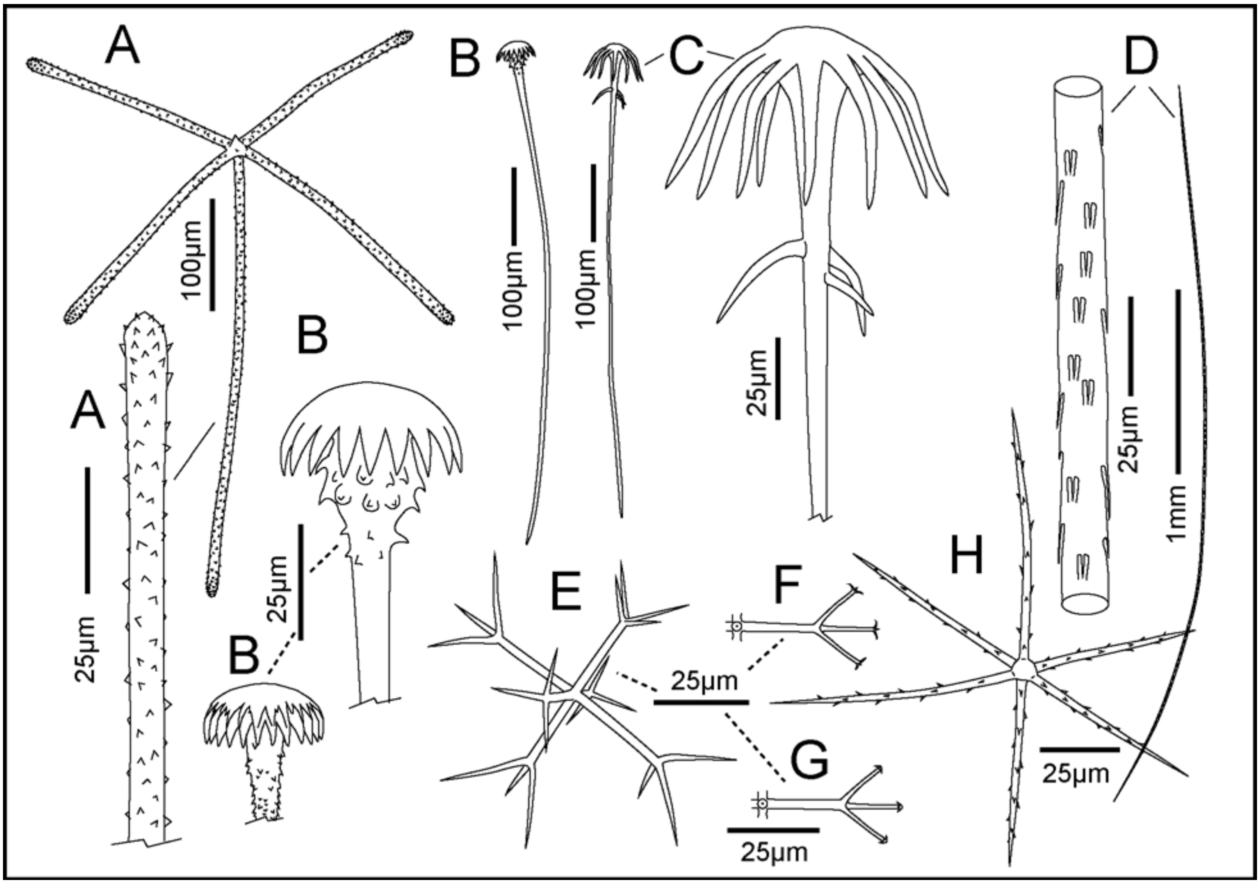


Figure 9. Spicules of *Farrea raoulensis* n. sp., holotype NMNZ POR.000520. A, surface pentactin, whole and tangential ray end. B, pileate clavules, whole and enlarged upper end of form with large and small neck spines, B lower from paratype QM G316640. C, anchorate clavule, whole and enlargement of upper end. D, uncinate, whole and enlargement of middle segment. E, oxyhexaster. F, onychohexaster, part. G, oxyhexactin.

of this new species. In view of the small number of specimens of *F. medusiforma* known, and the limited awareness of character variability in this new species, it seems prudent to recognise these three specimens, which share some of the same basic spiculation with *F. medusiforma*, but which have so many secondary differences in spiculation, as a distinct species, *Farrea raoulensis*. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Shares medusiform anchorate clavules with *F. medusiforma*
- Onychohexasters and discohexasters are present in addition to the oxyhexasters
- Range of uncinate length is very wide, 200 to over 4000 µm
- Pentactins with a few coarse spines do not occur
- Distinct oxyhexactins with proclined spines are present

Farrea anoxyhexastera n. sp. (Figs 10, 11)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 34861, NIWA Stn T0258, Kermadec Islands, 31.068° S, 178.580° E, 785 m, MV *Tangaroa*, 08 Mar 1982. **Paratypes** NIWA 43450, NIWA Stn TAN0408/22, Northeast Chatham Rise, 42.747° S, 177.897° E, 985–968 m, 12 Jul 2004; NIWA 43452, NIWA Stn TAN0408/23, 42.839° S, 177.422° E, 826–824 m, 13 Jul 2004; NIWA 51927, NIWA Stn TAN0104/80, North Chatham Rise, Graveyard seamount complex, Morgue Seamount, 42.718° S, 179.963° W, 1150–1000 m, 17 Apr 2001; NIWA 51933, NIWA Stn TAN0104/153, North Chatham Rise, Graveyard seamount complex, Gothic Seamount, 42.732° S, 179.898° W, 1076 m, 18 Apr 2001.

NON-TYPE MATERIAL: *Off Fiordland, southwest South Island*: NIWA 62104, NZOI Stn E800, 45.342° S, 166.692° E, 700 m, 20 Oct 1967.

North Chatham Rise, *Graveyard seamount complex*, *Voodoo Seamount*: NIWA 53184, NIWA Stn TAN0905/42, 42.746° S, 179.924° W, 1051 m, 18 Jun 2009.

Type locality: Kermadec Islands.

Distribution: Known from type location, Kermadec Islands, Fiordland, and North Chatham Rise (Fig. 10A).

Habitat: Attached to small pebbles; depth range 785–1150 m.

Description:

Morphology of the holotype is a small tubular stock, probably broken from a more extensive specimen, bearing a flared terminal osculum in the process of branching, and four lateral oscula with slightly raised but broken edges; attached to two small pebbles 8 mm in diameter (Fig. 10B). There is incipient branching of one end of the stock, but no indication of anastomosing. The paratypes are similarly tubular fragments, but branching and anastomosing are extensive.

Dimensions of the holotype main stock are 3.3 cm long and 6–7 mm in outer diameter; the terminal osculum is 4.6 mm in diameter and the lateral oscula range from 2.6–4.5 mm in diameter; wall thickness is 1 mm. Paratype fragments range up to 51 x 36 x 18 mm.

Texture is stony hard and brittle.

Surface is smooth.

Colour is white.

Choanosomal skeleton consists mainly of a dictyonal framework of 2–3 layers. The inner primary layer has rectangular meshes formed by conspicuous longitudinal and lateral strands (Fig. 10C). One or two layers of cortical dictyonalia are added to the outer dermal side, joined to the primary layer and to each other either in mirror image of the regular rectangular primary layer or irregularly to form triangular meshes without regular arrangement. Channelisation is absent. Nodes are regular, not swollen. Beams are generally smooth, with a few sparsely scattered sharp conical spines. Spurs are mostly broken but the few intact ones are rough, long, finger-like, and end in sharp tips. Small smooth hexactins attached to dictyonal beams are profuse in the lower part of the specimen. Loose spicules here include uncinates oriented vertically to the wall surfaces and the three forms of microscleres, onychohexasters, discohexasters, and rare hemidiscohexasters.

Ectosomal skeleton consists entirely of loose spicules. The main component is a surface lattice of overlapping tangential rays of pentactins. Clavules are oriented vertically, heads-out along the proximal ray of the surface pentactins. Anterior tips of uncinates project a short distance from the ectosomal surface. Onychohexaster

Table 5. Spicule and framework dimensions (µm) of *Farrea anoxyhexastera* n. sp.

Parameter	**Holotype NIWA 34861**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	229	35	148–338	50
tangential ray width	8.6	1.3	5.9–11.1	50
proximal ray length	190	38	83–264	50
proximal ray width	9.1	1.4	5.9–12.8	50
Pileate clavule length	339	48	240–437	50
head width	22.9	3.8	16.3–31.3	50
Uncinate length	952	173	544–1620	50
width	6.0	1.2	4.5–8.8	50
Onychohexaster diameter	76.8	7.7	60.6–92.2	50
primary ray length	21.9	2.2	17.4–27.2	50
secondary ray length	19.4	2.7	13.1–25.5	50
Discohexaster diameter	51.6	6.1	40.9–69.0	50
primary ray length	16.8	2.0	12.9–22.4	50
secondary ray length	10.4	3.2	4.9–27.2	50
Framework beam length	299	97	135–461	50
beam width	48.2	4.2	39.4–56.3	50
dermal spur length	172	35	102–248	50
atrial spur length	265	42	156–375	50

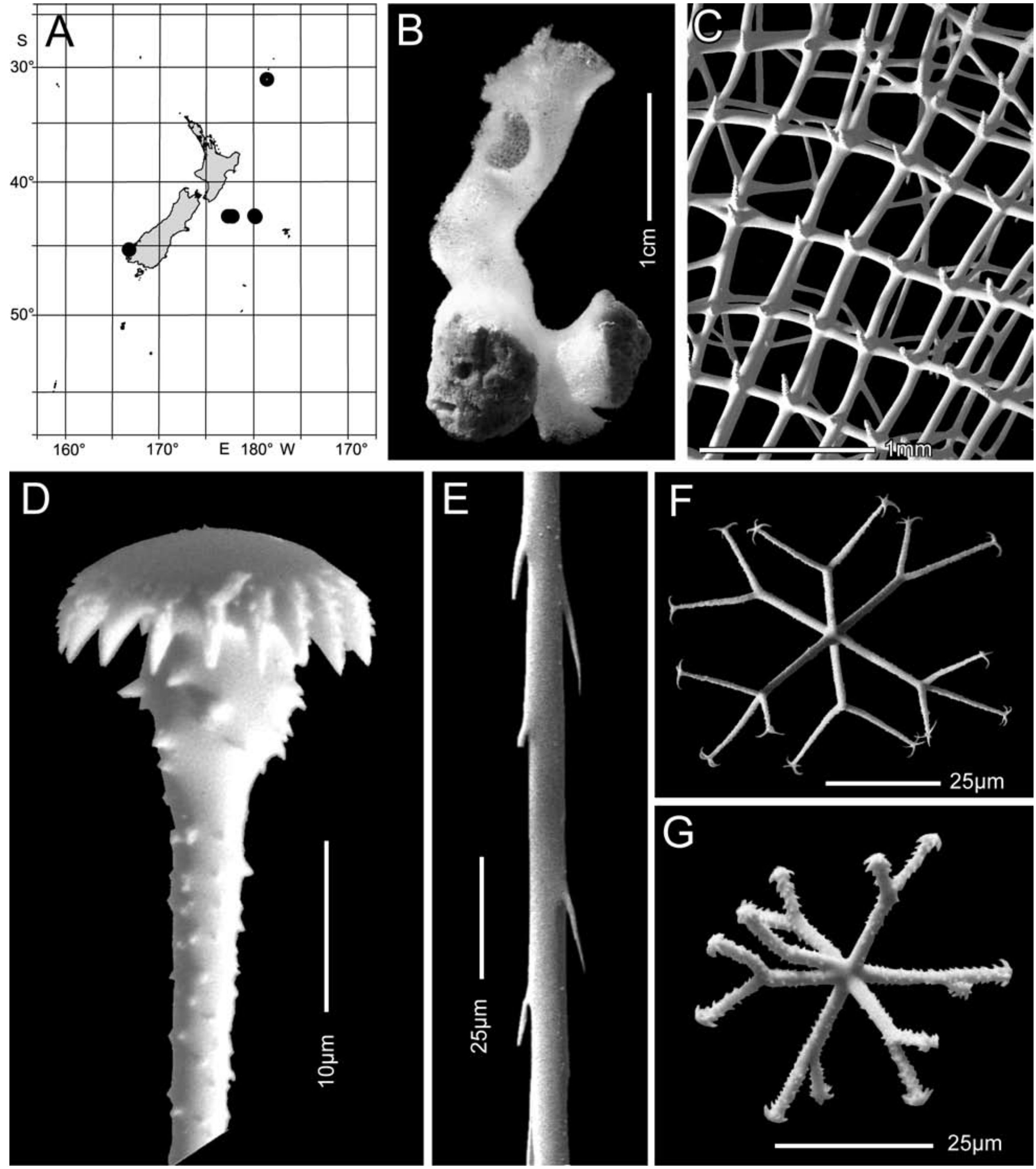


Figure 10. *Farrea anoxyhexastera* n. sp., holotype NIWA 34861. A, distribution in New Zealand waters. B, holotype. C, cleaned dictyonal framework. D, upper end of pileate clavule. E, middle part of an uncinate. F, onychohexaster. G, discohexaster.

and discohexaster microscleres lie in or just below the dermal surface.

Megascleres (Table 5) are pentactins, clavules, and uncinates. The pentactins (Fig. 11A) of dermal and atrial surfaces are indistinguishable; their tangential rays have a few medium-sized spines on the outer surface but on the distal third of these rays they are entirely covered on all sides by small sharp spines. The proximal ray is similarly ornamented but evenly on all surfaces; all rays are slightly inflated at the ends and terminate in rounded or blunt tips. The only clavules present are pileate (Figs 10D, 11B); they occur equally

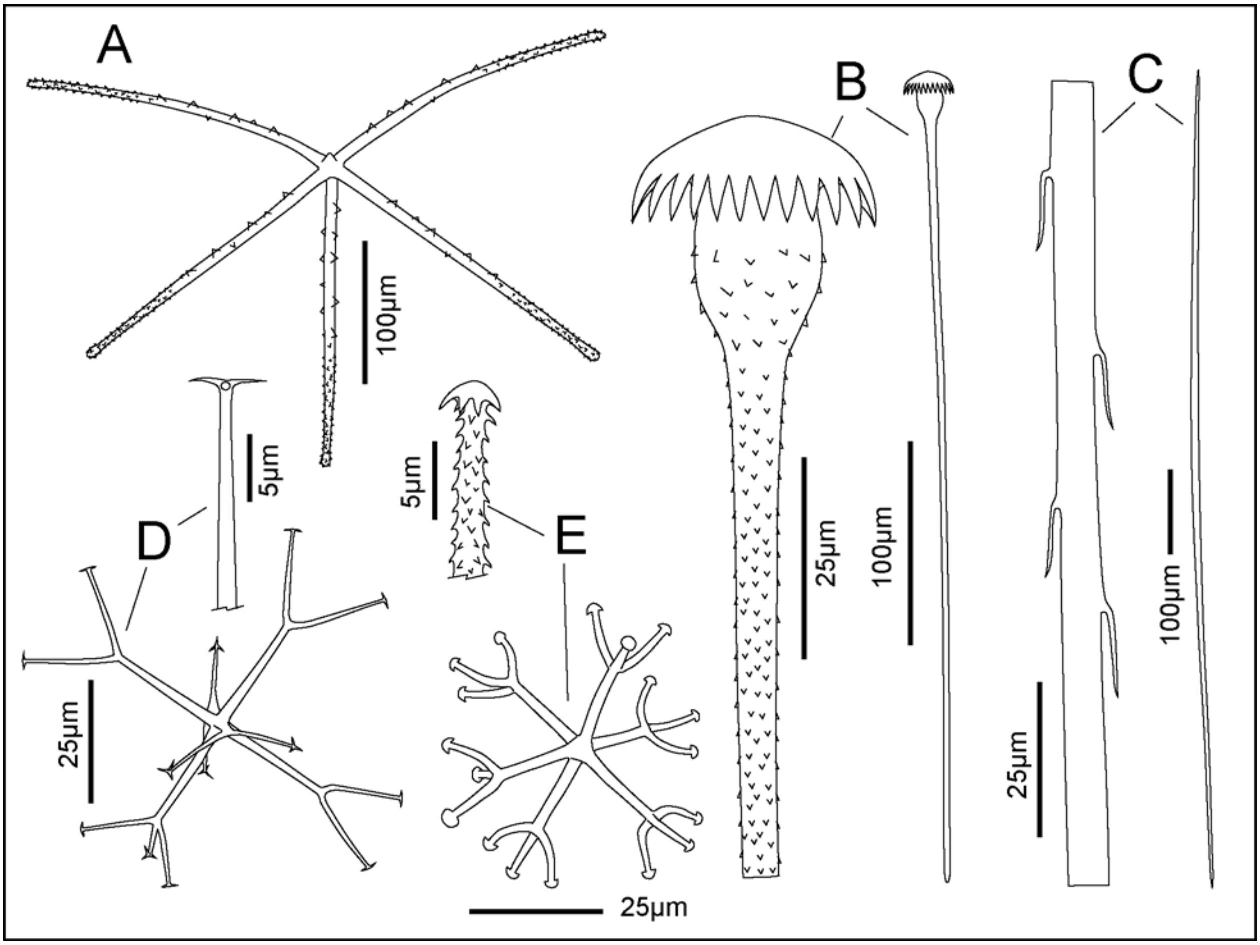


Figure 11. Spicules of *Farrea anoxyhexastera* n. sp., holotype NIWA 34861. A, surface pentactin. B, pileate clavule, whole and upper end. C, uncinate, whole and enlargement of middle segment. D, onychohexaster, whole and enlargement of terminal ray end. E, discohexaster, whole and enlargement of terminal ray end.

on dermal and atrial surfaces; the head is usually a slightly flattened disc bearing 15–20 sharp marginal teeth which are serrate on the outer surfaces (seen only with SEM); the neck is inflated, usually without a sharp break in profile, and is ornamented with moderately sized spines or reclined claws; the shaft is entirely finely spined and ends in a simple parabolic tip. No anchorate clavule occurs. The uncinates (Figs 10E, 11C) are of regular form and of moderate size range; both brackets and barbs are well-developed but sparse in number, the barbs mostly lie nearly parallel to the spicule surface but occasionally are inclined at a low angle; the smallest uncinates appear to have no barbs in LM.

Microscleres (Table 5) are onychohexasters (85%), discohexasters (15%), and hemidiscohexasters (rare). The onychohexasters (Figs 10F, 11D) have nearly equal length primary and terminal rays, each primary carrying 2–4 terminals ending in 2–5 claws that project perpendicularly and curve back toward the spicule; they appear smooth in LM but are seen to be entirely finely spined in SEM. The discohexasters (Figs 10G, 11E) and hemidiscohexasters are robust and have relatively shorter terminal rays, mean primary to secondary length ratio is 1.62; each primary carries 1–4 terminals which end in small discs with 4–7 marginal spines; their entirely coarse spination is evident with LM. A few irregular forms of both onycho- and disco-tipped microscleres occur.

ETYMOLOGY: The name *anoxyhexastera* reflects the unusual, but not unique, lack of oxyhexasters in this species of *Farrea*.

REMARKS: The five specimens from the Kermadec Islands and Chatham Rise have two significant features that mark them as distinct from the other *Farrea* forms occurring in the New Zealand area: the lack of oxyhexaster microscleres, and the lack of anchorate clavules. Both *F. onychohexastera* and *F.* sp. described below lack oxyhexaster spicules but have abundant anchorate clavules. Only four other previously known species or subspecies of *Farrea* lack, or have very few, oxyhexasters: *F. occa polyclavula* Tabachnick, 1988, *F. sollasi* Schulze, 1886, *F. weltneri*, and *F. woodwardi* Kent, 1870. All of these, however, have anchorate clavules. The specimens described here thus cannot be assigned to any known taxon and deserve recognition as a new species. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a tubular stock 6 mm in diameter with incipient branching and several lateral oscula
- Clavules are entirely pileate; no anchorate clavule occurs
- Microscleres are onychohexasters, discohexasters, and rare hemidiscohexasters; oxyhexasters are absent

Farrea ananchorata n. sp. (Figs 12, 13)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 43403, NIWA Stn KAH0204/33, E of North Cape, 34.143° S, 173.952° E, 853–870 m, 17 Apr 2002. **Paratypes** NIWA 62072, NIWA Stn KAH0204/33, West Cavalli Seamount, 34.143° S, 173.952° E, 853–870 m, 17 Apr 2002; NIWA 43405, NIWA Stn KAH0204/38, West Cavalli Seamount, 33.159° S, 173.963° E, 780–800 m, 18 Apr 2002; NIWA 62067, NIWA Stn KAH0204/32, West Cavalli Seamount, 34.162° S, 173.962° E, 780–810 m, 17 Apr 2002.

NON-TYPE MATERIAL: *East Chatham Rise*, *Andes Seamounts*, *Diamond Head*: NIWA 54076, NIWA Stn TAN0905/113, 44.151° S, 174.757° W, 519 m, 27 Jun 2009.

NON-TYPE MATERIAL DESIGNATED *F.* aff. *ananchorata*: *Chatham Rise*: NIWA 28558, NIWA Stn TAN0705/211, 42.655° S, 177.213° E, 1377–1402 m, 20 Apr 2007; NIWA 28559, NIWA Stn TAN0705/213, 42.682° S, 177.212° E, 1284–1298 m, 21 Apr 2007; NIWA 31609, NIWA Stn TAN0705/189, 42.705° S, 178.341° E, 997–1042 m, 19 Apr 2007. *Kermadec Ridge*: NIWA 43431, NIWA Stn TAN0205/51, 31.143° S, 179.006° W, 768–1144 m, 20 Apr 2002.

TYPE LOCALITY: North Cape.

DISTRIBUTION: The species is known from three closely spaced stations east of North Cape and three stations on Chatham Rise, New Zealand (Fig. 12A); a closely related form, designated *F.* aff. *ananchorata* and discussed in the remarks section, occurs at some distance on the Kermadec Ridge.

HABITAT: Attached to hard substratum; depth range 780–1402 m, depth range of related form 768–1144 m.

DESCRIPTION:

Morphology of the holotype is a nearly flat, two-dimensional network of branching and anastomosing tube with basal attachment disc intact (Fig. 12B); tube surfaces are smooth, without apertures of skeletal channels. Paratypes are all smaller fragments, four consisting of a small section of branching and anastomosing tubes while the remaining two are simple flakes without even complete tube structure.

Dimensions of the holotype main stock are 90 mm tall, 105 mm wide and 25 mm thick; constituent tubes are 5.7–9.4–13.4 mm in external diameter with wall thickness of 1.4–1.6 mm. Paratype fragments range from 7.2 x 13 mm for the smallest to 54 x 71 mm for the largest.

Texture is stony hard and brittle.

Surface is smooth.

Colour is white to beige.

Choanosomal skeleton is a typical, rigid, dictyonal, fused farreoid framework composed of a primary layer with regular rectangular mesh and one to three regular or irregular cortical dictyonal layers appended to both dermal and atrial surfaces (Fig. 12C). Channelisation is not present. The primary layer consists of longitudinal strands joined by regularly placed transverse connecting beams. The dermal cortex is formed by one or two continuous layers of dictyonalia added externally, the first being a mirror image of the regular primary layer. The atrial cortex is discontinuous, being developed only as small patches of dictyonalia added to the inside surface of the tube skeleton. Nodes are regular and not swollen. Beams are generally smooth but a few individual beams bear sparse small spines. Small oxyhexactins are fused to beams in the deeper skeletal layers in small numbers (Fig. 12H), never forming nests of secondary fusions. Atrial spurs are long, cylindrical, and rough, ending in rounded tips; they generally curve in the direction of tube growth but occasionally project in any direction where irregularities of the atrial framework have occurred. Free spicules of the choanosome are uncinates and the microscleres, oxyhexasters, discohexasters, and their variants.

Ectosomal skeleton consists entirely of loose spicules. It is mainly composed of a lattice of overlapping tangential rays of pentactins covering both dermal and atrial surfaces. Pileate clavules lie along the radially directed proximal ray of pentactins and project head outward. Anterior tips of uncinates project a short distance from the ectosomal surface. Microscleres are abundant in or just below the bounding surface membranes.

Megascleres (Table 6) are pentactins, pileate clavules, and uncinates. The pentactins (Figs 12D, 13A) of dermal and atrial surfaces are regularly cruciate and indistinguishable; all rays are cylindrical and densely microspined; the tangential rays are usually slightly inflated distally ending in clubs while the proximal rays are usually abruptly tapered and end in sharp tips but occasionally also end in clavate tips (Fig. 12D). The pileate clavules (Figs 12E, 13B) are present on both surfaces; they have a moderately swollen neck bearing spines and a moderately abrupt profile break; the shaft is entirely finely spined and moderately but clearly inflated basally, and ends in a parabolic tip. About one-half of the spicules viewed in SEM have spined ridges on the outer edges of the marginal head spines; these are detectable only under the highest magnification in LM. Anchorate clavules are absent. Uncinates are exceptionally large with well-developed brackets and barbs; the barbs are only slightly inclined from the spicule surface (Figs 12I, 13C).

Microscleres (Table 6) are mainly oxyhexasters (70%) and discohexasters (27%) with rare variants of both types, and a small number of free oxyhexactins (3%). Oxyhexasters occur in two size classes of about equal abundance. The larger oxyhexasters 1 (Figs 12G, 13D) have moderately long primary rays (primary to secondary length ratio 0.85), each bearing 2–4 usually straight, but occasionally curved or undulatory secondary rays; they appear entirely smooth in LM but prove to be sparsely covered with very small reclined spines in SEM. Occasional variants of these are hemihexasters and individual spicules with some ray tips bearing small lateral spines rendering such spicules as mixed oxy/onychohexasters. The smaller oxyhexasters 2 (Fig. 13D) have short primary rays (primary to secondary length ratio 0.37) but are otherwise similar to the larger form. Discohexasters (Figs 12F, 13E) typically have relatively long primary rays (primary to secondary length ratio 1.82), each bearing 2–5 secondary rays which end in discs with 3–8 long, recurved, marginal claws; the spicules are entirely covered with recurved spines visible in LM. Disc and marginal spines vary considerably so individual tips may appear onychoid or tyloid in LM. Rare variants of discohexasters are hemihexastrous and hexactinous forms. Oxyhexactins of size and shape similar to those attached to the framework are encountered commonly among spicule preparations; most of these have one broken ray tip suggesting these have been torn from their attachment. A moderate number have all six tips complete, although one may be swollen, so they must be included in the inventory of free microscleres.

Table 6. Spicule and framework dimensions (μm) of *Farrea ananchorata* n. sp.

Parameter	**Holotype NIWA 43403** **mean**	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	252	35	140–323	50
tangential ray width	10.8	2.0	6.4–14.4	50
proximal ray length	270	55	157–393	50
proximal ray width	11.0	1.7	6.6–14.5	50
Pileate clavule length	273	17	233–320	50
head width	19.5	1.5	15.3–21.9	50
Uncinate length	2208	307	1353–2852	50
width	16.1	2.3	10.6–21.7	50
Oxyhexaster 1 diameter	140	27	102–216	50
primary ray length	33.2	10.9	18.6–68.0	50
secondary ray length	38.9	5.8	27.5–54.7	50
Oxyhexaster 2 diameter	74.5	2.7	64.7–85.6	50
primary ray length	10.4	1.0	8.5–12.4	50
secondary ray length	28.0	2.9	21.8–33.9	50
Discohexaster diameter	91	18	62–154	50
primary ray length	29.9	6.7	18.9–51.7	50
secondary ray length	16.4	4.4	9.3–29.0	50
Framework beam length	390	142	184–782	50
beam width	54	14	26–88	50
atrial spur length	401	94	211–623	50

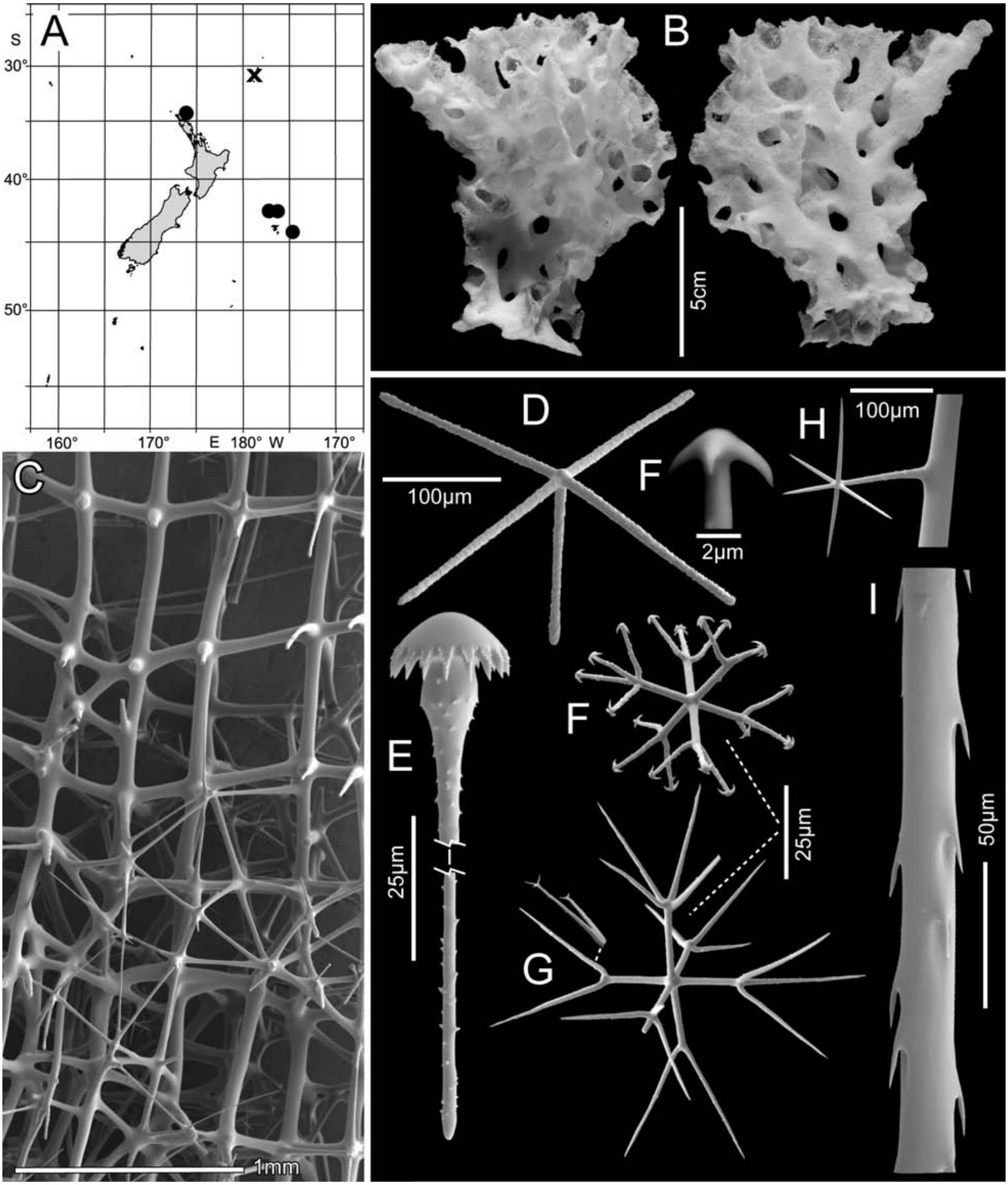


Figure 12. *Farrea ananchorata* n. sp., holotype NIWA 43403. A, distribution in New Zealand waters indicated by filled circles; X indicates other specimen not certainly assigned to this species. B, holotype, NIWA 43403 from east of North Cape, New Zealand. C, atrial side of cleaned framework showing primary dictyonal layer with curved spurs and patch of atrial cortex. D, pentactin megasclere. E, pileate clavule, upper and lower ends. F, discohexaster with enlargement of one ray tip. G, large oxyhexaster with alternate onycho-tips from another spicule. H, oxyhexactin appended to framework beam. I, segment of uncinate.

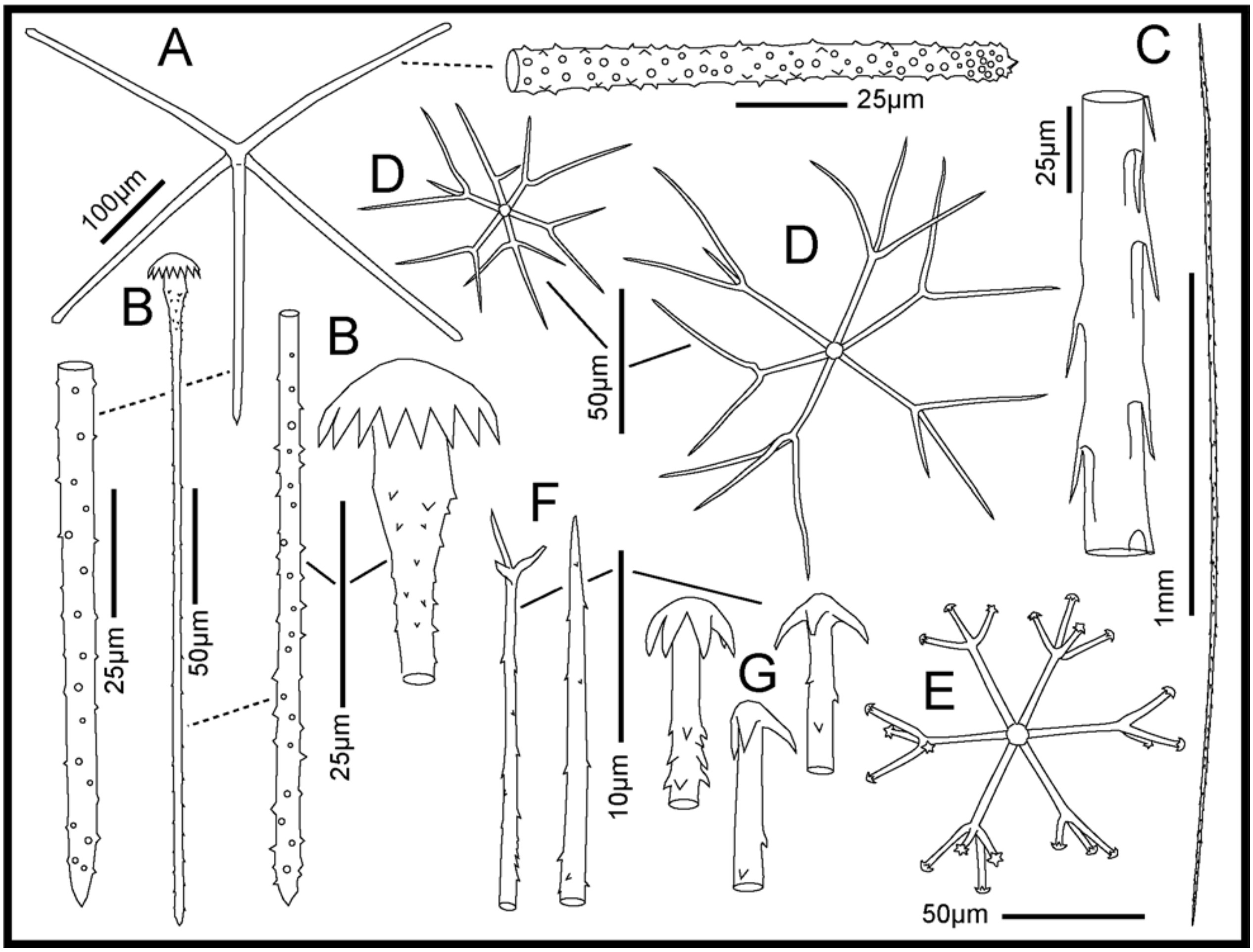


Figure 13. Spicules of *Farrea ananchorata* n. sp., holotype NIWA 43403. A, surface pentactin, whole and enlargement of tangential and proximal rays. B, pileate clavule, whole, upper and lower ends. C, uncinate, whole, and enlargement of middle segment. D, oxyhexaster 1 (right) and oxyhexaster 2 (left). E, discohexaster. F, secondary ray tips of oxyhexaster (form 1, Fig. 13D above), normal oxyoid tip, and rare onychoid tip. G, variation in secondary ray tips of discohexaster.

ETYMOLOGY: The name *ananchorata* refers to the absence of anchorate clavules in this species of *Farrea*, which is otherwise similar to *F. occa*.

REMARKS: The holotype is severely contaminated with spicules of a *Regadrella* species, but this does not obscure determination of the proper spiculation of the specimen; spicule preparations made from three locations of the holotype were identical. The paratypes are contaminated with spicules of unidentified amphidiscophorans. Four forms of *Farrea* have previously been described as lacking anchorate clavules, but the new form is easily distinguished from each of these. The North Atlantic *F. laminaris* Topsent, 1904a, has an undulatory blade body form and macrospines on its pentactins while the new form has a reticulate tube form and microspines on its pentactins. Both *F. microclavula* Tabachnick, 1988, and *F. occa* of Reiswig, 1992, have oxyhexasters with short primary rays while the main oxyhexaster of the new form has long primary rays. The form described from Gibraltar, Atlantic, by Boury-Esnault *et al*. (1994) as *F. occa* is nearly identical in pattern of spiculation to the new form, but the uncinates of the Atlantic form are very much smaller, mean length 582 µm vs 2208 µm in the New Zealand form. Finally, the new form described here differs from *F. anoxyhexastera* described earlier in having oxyhexasters while these are absent in the latter species. Two taxonomic treatments could be applied to the new form — either a new subspecies of *F. occa* or a new species of *Farrea* could be created for it. The second option appears more compatible with the long-term aim of stabilising the diagnosis of *F. occa* as a species always having both pileate and anchorate clavules, hence a new species has been erected for this well characterised group of specimens. This new species is similar in overall spiculation to the Mediterranean form described and assigned to *F. occa* by Boury-Esnault *et* *al*. (1994). Significant differences in size of the clavule heads, uncinates, and discohexasters, and the large geographic distance between the two forms ensure they are samples from separate species populations; the Mediterranean form should be reassigned as a new species sometime.

The related specimen from the Kermadec Ridge, NIWA 43431, consists of three fragments, the largest of which is tubular, 24 mm long with tube diameter 7.3 mm, and a single lateral osculum. It is similar to the new species in lacking anchorate clavules but differs from that form in many characters: it has no discohexasters, its pentactins are macrospined and smaller in dimensions, the clavule is much longer (mean length 349 µm), has very slight neck swelling without profile break and no swelling at the shaft end, its oxyhexasters occur in a single size class intermediate to those of the North Cape and Chatham Rise specimens (mean diameter 112 µm) but shaped like the larger class (primary to secondary ray length 0.85), and its uncinates are too rare to characterise. These differences, particularly the lack of discohexasters, prevent inclusion of this fragment as a variant of the new species. It cannot be assigned to any of the other *Farrea* species lacking anchorate clavules mentioned above. It is here considered too small to serve as the basis for formation of a new taxon, and it is temporarily designated *F.* aff. *ananchorata*. It is expected, however, that further collections from the Kermadec Ridge will provide better specimens needed for a reliable description of another new taxon. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a stock of branching and anastomosing tubules 6–13 mm in diameter
- Clavules are entirely pileate; anchorate clavules are absent
- Microscleres are mainly oxyhexasters of two size classes and discohexasters with long primary rays

***Farrea onychohexastera* n. sp.** (Figs 14, 15)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 51941, NIWA Stn TAN0104/133, Morgue Seamount, Graveyard seamount complex, North Chatham Rise, 42.718° S, 179.919° W, 1008–1075 m, 20 Apr 2001. **Paratype** NIWA 62103, NZOI Stn U566, West Norfolk Ridge, 35.083° S, 169.162° E, 979 m, 2 Feb 1988.

TYPE LOCALITY: North Chatham Rise.

DISTRIBUTION: The species is known only from West Norfolk Ridge and the Graveyard seamount complex of the Chatham Rise (Fig. 14A).

HABITAT: Attached to hard substratum, including the habitat-forming coral *Solenosmilia variabilis*; depth range 1008–1075 m.

DESCRIPTION:

The holotype consists of three fragments probably all from a single specimen; each consists of a network of branching and anastomosing tubes with smooth surfaces and without skeletal channels (Fig. 14B; see cover image for probable form in life).

Dimensions of the main stock are 58.2 mm tall, 53.7 mm in greatest width and 30 mm in greatest thickness; constituent tubes are 5.1–6.6–8.8 mm in external diameter with wall thickness of 0.4–1.0 mm. The other fragments are 24.3 x 38.9 x 19 mm and 27.7 x 53.4 x 10 mm.

Texture is stony hard and brittle.

Surface is smooth at the tube dimensions.

Colour is white to beige.

Choanosomal skeleton is a typical, rigid, dictyonal, fused farreoid framework composed of a primary layer with regular rectangular mesh and one to three regular or irregular cortical dictyonal layers appended to only the dermal side (Fig. 14C). Walls are not channelised. The primary layer consists of longitudinal strands joined by regularly placed transverse connecting beams. The dermal cortex is formed by one or two layers of dictyonalia added externally, the first of which in some places is a mirror image of the regular primary layer. No atrial cortex is developed. Nodes are regular and not swollen. Beams are entirely smooth and without fusion of small oxyhexactins to them. Atrial spurs are long, cylindrical, and rough, ending in slightly inflated, rounded tips (Fig. 14D); they generally curve in the direction of tube growth but occasionally project in any direction where irregularities of the atrial framework have occurred. Free spicules of the choanosome are uncinates and microscleres.

Ectosomal skeleton consists entirely of loose spicules. It is mainly composed of a lattice of overlapping tangential rays of pentactins covering both dermal and atrial surfaces. Clavules lie along the radially directed proximal ray of pentactins and project head outward. Anterior tips of uncinates project a short distance from the ectosomal surface. Microscleres are abundant in or just below the bounding surface membranes.

Megascleres (Table 7) are pentactins, three types of clavules, and uncinates. The pentactins (Fig. 15A) of dermal and atrial surfaces are regularly cruciate and indistinguishable; all rays are cylindrical and either densely microspined or sparsely macrospined on outer surfaces of tangential rays; all developed rays usually appear slightly inflated distally, ending in rounded blunt tips or occasionally abruptly pointed tips. Clavules occur in three forms distinguished by number and length of marginal head spines. Pileate clavules (Figs 14E, 15B) are present on both surfaces; they have numerous (18–22) short marginal spines and usually a moderately swollen neck with abrupt profile break and spines ornamenting the neck and upper shaft. Pileate clavules often have a smooth unswollen neck (Fig. 15B lower). Anchorate clavules are of the common farreoid form, with 4–12 long hook-like marginal spines, most usually smoothly arched to form a hemispherical profile (Figs 14G, 15D) but sometimes strongly bent inward giving the entire head a conical profile. The neck is smoothly tapered and smooth in LM and SEM but the marginal spines are rough when viewed in SEM. A third category of clavule, here called the subanchorate type (Fig. 14F), has short marginal spines like pileate clavules but fewer in number, 6–14. Their narrow tapered and smooth neck suggests these are basically anchorate clavules without growth of their marginal spines. They are abundant and constitute a distinct class of clavule here. Uncinates here range from very small forms with spines only detectable in SEM to moderate-sized forms with well-developed brackets and barbs easily seen in LM (Fig. 15E).

Microscleres (Table 7) are mainly onychohexasters (97%) and discohexasters (3%) with rare variants of both types. Onychohexasters (Figs 14I, 15F) have longer primary rays, mean primary to secondary length ratio 1.15, each bearing 2–4 usually straight, but occasionally curved or undulant secondary rays ending in 2–5 short, claws (Figs 14K, 15F); they appear smooth in LM but prove to be sparsely covered with very small reclined spines in SEM. Occasional variants of these are hemihexasters, some spicules with one or two oxy-tipped secondary rays, diasters and asters with only one ray developed (Fig 15H). Discohexasters (Figs 14H, 15G) are moderately rare, smaller but stout microscleres. Each primary ray bears 2–3, rarely 4, shorter terminals; mean primary to secondary length ratio is 1.20, ending in small hemispherical discs with 4–8 short marginal spines (Figs 14J, 15G). Discohexasters are entirely covered with recurved spines that are easily visible in LM. Oxyhexasters are not present in this species.

Table 7. Spicule and framework dimensions (µm) of *Farrea onychohexastera* n. sp.

Parameter	**Holotype NIWA 51941**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	249	46	160–363	50
tangential ray width	12.4	2.3	4.9–16.6	50
proximal ray length	246	57	149–370	50
proximal ray width	12.2	2.4	7.1–18.2	50
Pileate clavule length	387	62	300–588	50
head width	31.7	4.1	22.7–40.7	50
Subanchorate clavule length	380	74	221–573	50
head width	30.0	3.8	20.7–42.0	50
Anchorate clavule length	511	109	300–760	50
head width	52.1	10.8	31.2–83.7	50
Uncinate length	1385	383	1032–1980	5
width	10.0	1.7	6.8–13.0	16
Onychohexaster diameter	85	11	55–107	50
primary ray length	24.5	3.6	18.2–33.9	50
secondary ray length	21.3	3.4	9.3–31.8	50
Discohexaster diameter	67.9	8.7	53.4–85.9	50
primary ray length	19.2	3.5	12.9–27.7	50
secondary ray length	16.0	2.5	10.0–23.7	50
Framework beam length	511	159	253–850	50
beam width	92	14	67–117	50
dermal spur length	258	60	159–463	50
atrial spur length	364	50	235–461	48

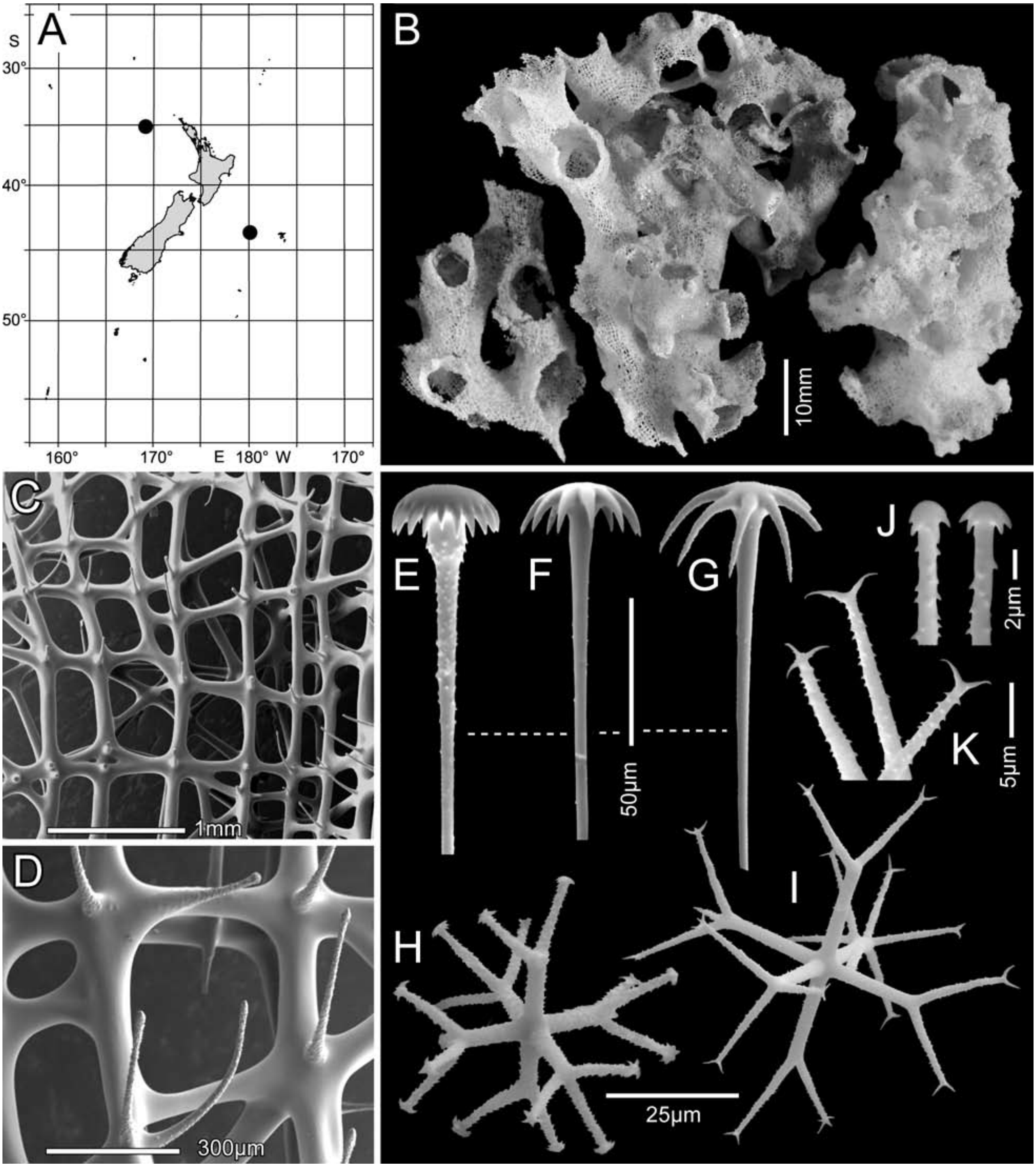


Figure 14. *Farrea onychohexastera* n. sp., holotype NIWA 51941. A, distribution in New Zealand waters. B, holotype, NIWA 51941. C, atrial side of cleaned framework, growth direction upward, showing primary dictyonal layer with curved spurs and dermal cortex behind. D, close up of atrial framework and spurs. E, upper end of pileate clavule. F, upper end of subanchorate clavule. G, upper end of anchorate clavule. H, discohexaster. I, onychohexaster. J, terminal ends of discohexaster. K, terminal ends of onychohexaster.

Etymology: The name *onychohexastera* refers to the predominant type of microsclere in this new species.

Remarks: Onychohexasters are not commonly the predominant microsclere type in *Farrea* species – indeed such occurrence is known only for *F. anoxyhexastera*

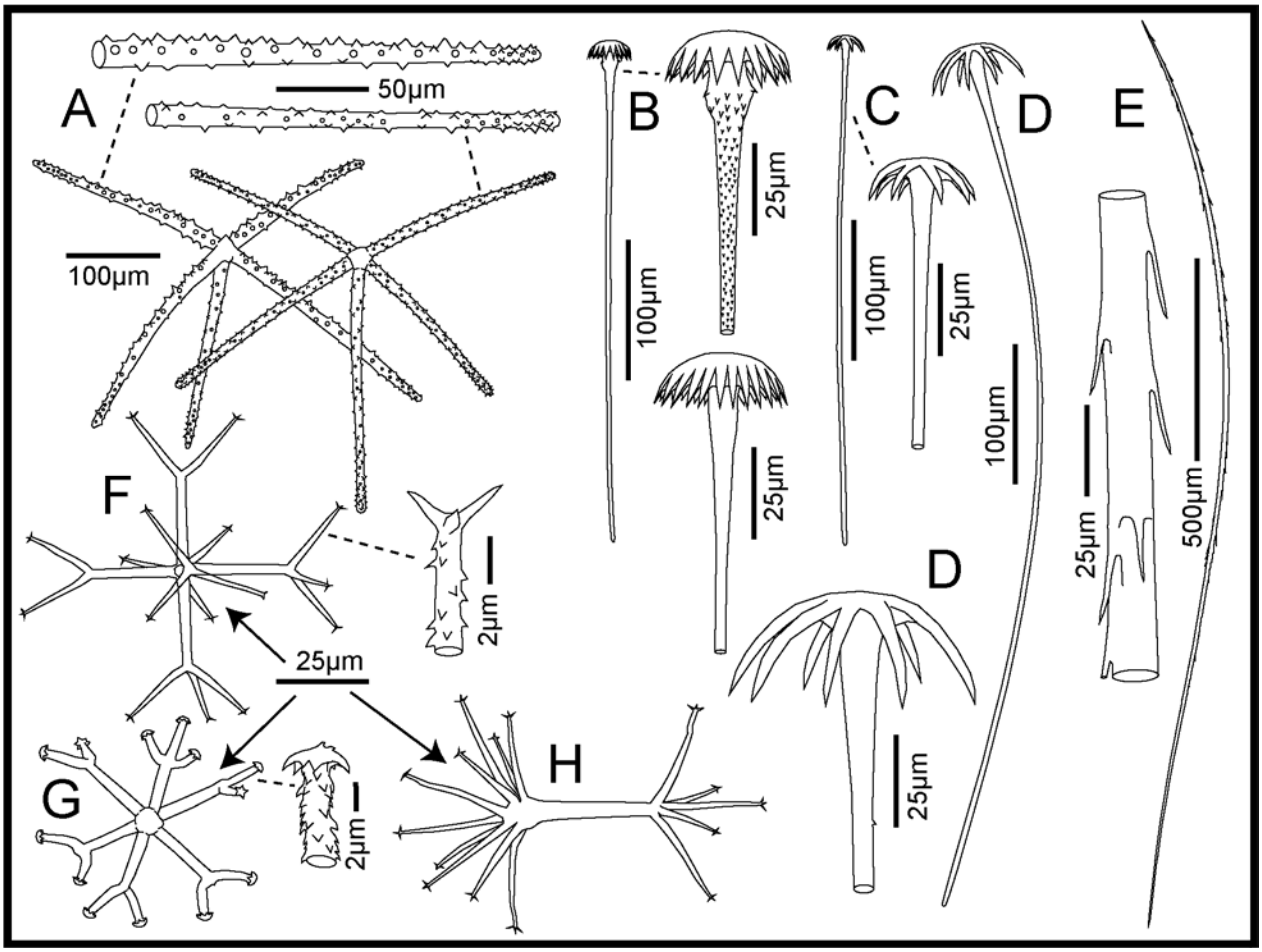


Figure 15. Spicules of *Farrea onychohexastera* n. sp., holotype NIWA 51941. A, surface pentactins with macro (left) and microtubercles (right) with enlarged tangential rays above. B, pileate clavule, whole and enlargement of upper ends of forms with and without swollen neck. C, subanchorate clavule, whole and enlargement of upper end. D, anchorate clavule, whole and enlargement of upper end. E, uncinate, whole and enlargement of middle segment. F, onychohexaster with enlargement of ray tip. G, discohexaster, whole and enlargement of ray tip. H, rare onychoaster with one developed primary ray.

n. sp. described above, and both *F. herdendorfi* Duplessis & Reiswig 2004 and *F. seiri* Duplessis & Reiswig 2004. These species differ from the new form addressed here in that *F. anoxyhexastera* has no anchorate clavules while *F. herdendorfi* and *F. seiri* both have thimblate clavules that have codon-like heads. The new form might be considered similar to *F. sollasi yakushimensis* Okada, 1932, depending upon how the description is interpreted. Okada stated that his new subspecies lacked the large onychasters of *F. sollasi*, which could be taken to mean it retained the small onychasters but indeed there were no onychasters (or onychohexasters) described in *F. sollasi* by Schulze (1886). Okada's actual statement was more ambiguous than this, claiming *F. sollasi yakushimensis* had no large onychasters or oxyhexasters of *F. sollasi*, so the reader was unable to be certain of what microscleres were actually present in his new subspecies. We have reviewed Okada's *F. sollasi yakushimensis* holotype (USNM 22036) and a USNM uncatalogued (in 1988 and still uncatalogued in 2011) paratype from *Albatross* station 4929 and found discohexasters to be the only microscleres in both specimens. The new specimen described above clearly differs from all described *Farrea* species and subspecies and warrants recognition as a new species. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a stock of branching and anastomosing tubules 6–9 mm in diameter
- Clavules occur in three forms: pileate, subanchorate, and anchorate
- Microscleres are predominately onychohexasters; oxyhexasters are absent

Farrea sp. (Fig. 16A–D)

MATERIAL EXAMINED:

North Chatham Rise, Graveyard seamount complex, Diabolical Seamount: NIWA 51950, NIWA Stn TAN0104/47, 42.793° S, 179.981° W, 900–950 m, 16 Apr 2001.

DISTRIBUTION: The form is known only from Chatham Rise (Fig. 16A).

HABITAT: Presumably attached to hard substratum which was not recovered; depth range 900–950 m.

DESCRIPTION:

The specimen is a small conical tube broken on one side, with attached basal plate (Fig. 16B).

Dimensions are 8.4 mm tall by 5.1 mm in width at the osculum.

Texture is wiry and fragile.

Surface is smooth.

Colour is white.

Choanosomal skeleton is a delicate, single layered farreoid primary framework of regular rectangular mesh with attached basal plate (Fig. 16C). No cortical layers are appended. Walls are not channelised. Nodes are regular and not swollen. Beams are entirely smooth and without addition of fused small oxyhexactins. Atrial spurs are long, cylindrical, and rough, projecting perpendicularly from the nodes, without consistent curvature with respect to growth direction. Free spicules of the choanosome are uncinates and microscleres.

Ectosomal skeleton consists entirely of loose spicules. It is mainly composed of a lattice of overlapping tangential rays of pentactins covering both dermal and atrial surfaces. Clavules lie along the radially directed proximal ray of pentactins and project head outward. Anterior tips of uncinates project a short distance from the ectosomal surface.

Microscleres are scarce in or just below the bounding surface membranes.

REMARKS: This small specimen contains spicules typical of *Farrea occa*: pileate and anchorate clavules (Fig. 16D), sparse uncinates and both macro- and microtuberculate pentactins. Microscleres could not be reliably characterised due to their scarcity. One oxyhexaster was found on an SEM preparation while none were found in the more extensive LM preparations. A few discohexasters and forms with uncompleted tips were found in LM preparations, but not in the SEM preparation. With this uncertainty of microsclere complement, it seems prudent to refrain from assigning this specimen to the previously known or newly described *Farrea* species. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

KEY CHARACTERS:

- Body form is a primary conical tube 5 mm in distal diameter

Table 8. Characters that differentiate species of *Farrea* in New Zealand waters.

Taxon	**Pentactin spines**	**Clavule**			**Hexaster***		
		pileate	**subanch**	**anchorate**	**oxy**	**onycho**	**disco**
F. occa occa Bowerbank, 1862	medium & small	x		x	S	(m)	(m)
F. similaris n. sp.	large	x	x		M		m
F. medusiforma n. sp.	large	x		medusoid cap	S		
F. raoulensis n. sp.	small	x		medusoid cap	M	l	
F. anoxyhexastera n. sp.	medium	x		(x)		M	l
F. ananchorata n. sp.	small	x			L, s		
F. onychohexastera n. sp.	medium & small	x	x	x		L	l

* Hexasters are designated as short (S, s), medium (M, m), long (L, l) primary rays; capital letters indicate the predominant microsclere form.

Parentheses indicate spicule forms may be present or absent in individual specimens.

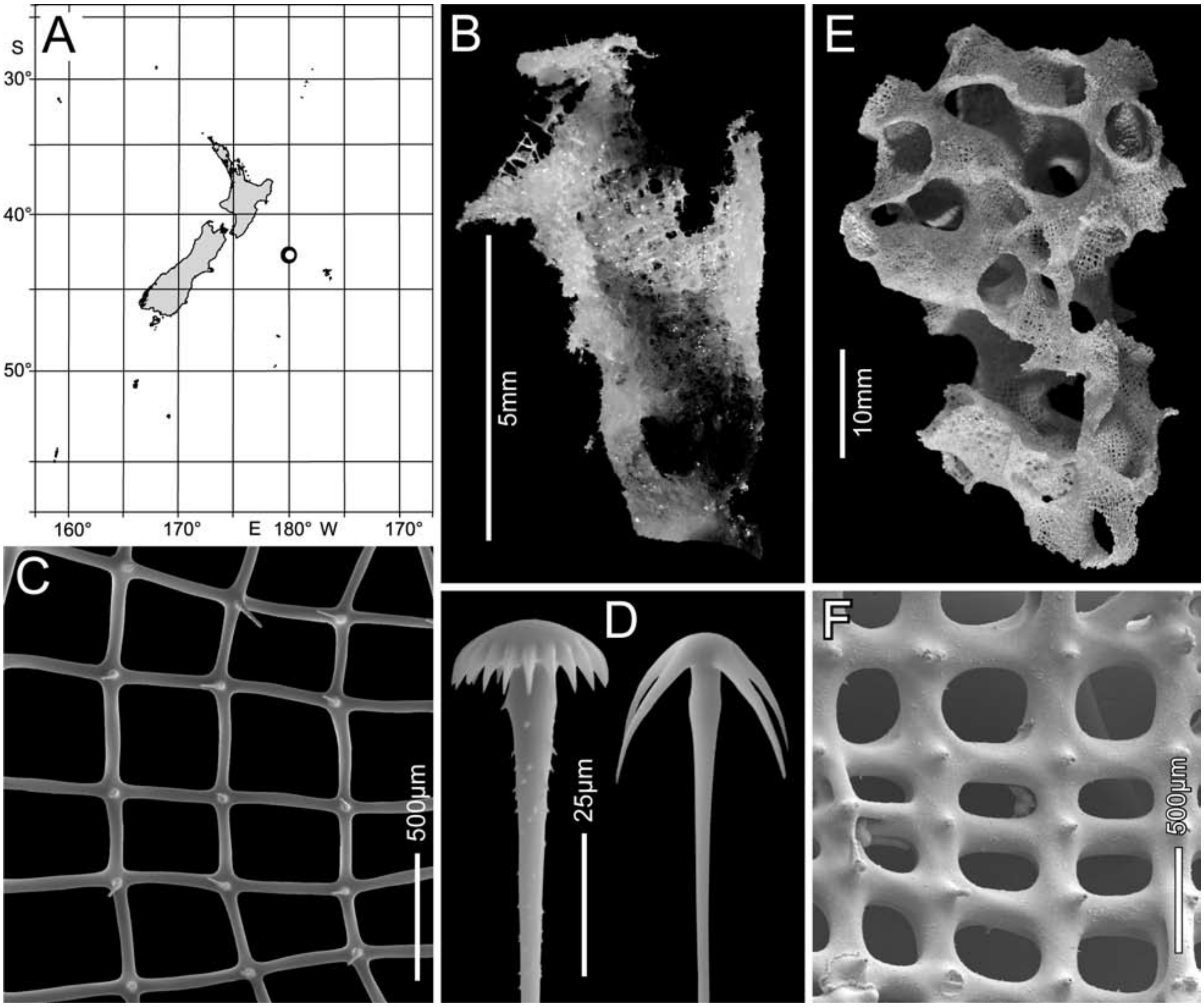


Figure 16. *Farrea* sp. (A–D) and Farreidae incertae sedis (E–F). A, distribution in New Zealand waters; *Farrea* sp. indicated by open circle overlaps locations of Farreidae incertae sedis. B, *Farrea* sp. whole young specimen, NIWA 51950. C, atrial side of *Farrea* sp. cleaned one-layered framework, growth direction towards left. D, upper ends of pileate and anchorate clavules of *Farrea* sp.. E, Farreidae incertae sedis, NIWA 51944, main fragment. F, eroded thickened one-layered framework of same.

- Clavules occur in the two traditional forms: pileate and anchorate
- Microscleres are too scarce and unformed to be reliably characterised

Farreidae incertae sedis (Fig. 16E–F)

Material examined:

North Chatham Rise, *Graveyard seamount complex*, *Pyre Seamount*: NIWA 51929, NIWA Stn TAN0104/150, 42.715° S, 179.981° W, 1181–1004 m, 18 Apr 2001; NIWA 51944, NIWA Stn TAN0104/397, 42.716° S, 179.912° W, 1050–1000 m, 21 Apr 2001; NIWA 51947, NIWA Stn TAN0104/398, 42.713° S, 179.907° W, 1080–1008 m, 21 Apr 2001. *Ghoul Seamount*: NIWA 51951, NIWA Stn TAN0104/116, 42.798° S, 179.981° W, 1000–922 m, 17 Apr 2001. *Gothic Seamount*: NIWA 52064, NIWA Stn TAN0104/387, 42.726° S, 179.898° W, 1100–1000 m, 20 Apr 2001.

Distribution: The form is known only from Chatham Rise (Fig. 16A).

Habitat: Attached to hard substratum; depth range 757–1181 m.

Description:

The six specimens all consisted of fragments of branching and anastomosing tubular stocks (Fig. 16E).

Dimensions of fragments are 10–52 mm in greatest dimensions; constituent tubes are 5.1–7.2 mm in external diameter.

Texture is stony and brittle.

Surface is smooth.

Colour is light to dark brown.

Choanosomal skeletons of these long-dead, eroded specimens are typical rectangular-mesh farreoid frameworks that are partly only one layer thick (Fig. 16F). One or two secondary cortical layers may be appended to the external dermal sides in more medial older regions. Walls are unchannelised and nodes are regular and not swollen. Beams are thick and entirely smooth and without fused small oxyhexactins but these may have been lost due to erosion. There are no free spicules remaining with these frameworks.

Remarks: These fragments can be confidently assigned to the family Farreidae because of their retention of a single layered framework in marginal areas. Although these are very likely to be members of *Farrea*, they cannot be unquestionably assigned to that genus since some Farreidae share the farreoid framework without possession of the *Farrea* spiculation. Many similar long-dead, washed-out frameworks that lack at least a portion of one-layered structure must be treated below as Farreidae/Euretidae incertae sedis. Their lack of one-layered farreoid structure makes it impossible to exclude them from Euretidae. A comparison of the free spicule complements of all New Zealand species of *Farrea* is given in Table 8.

Key characters:

- Body form is a network of branching and anastomosing 5–7 mm diameter tubes
- Part of the framework consists of a single-layered farreoid framework
- Free spicules have been entirely lost

EURETIDAE Zittel

Monakidae Marshall, 1876: 121.
Euretidae Zittel, 1877: 35; Schulze 1886: 70; Schulze 1887: 289; Ijima 1927: 163; Reiswig & Wheeler 2002: 1301.
Coscinoporidae Zittel, 1877: 36 (in part); Schulze 1886: 76 (in part).
Meandrospongidae Zittel, 1877: 38 (in part).
Myliusidae Schulze, 1885: 451.
Chonelasmatidae Schrammen, 1912: 190.
Wapkiosidae de Laubenfels, 1955: E84.

Hexactinosida with basic three-dimensional dictyonal framework several dictyonal layers in thickness even at the growing edge; primary dictyonal frame consists at least in part of four-sided (square or rectangular) meshes; rays of dictyonalia extend only one-mesh in length to the next adjacent dictyonal centrum; longitudinal dictyonal strands composed of aligned series of beams; dictyonal beams typically composed of two (sometimes one) dictyonal rays; channelisation may be absent or consist of epirhyses with or without aporhyses, or amararhyses; where epirhyses and aporhyses co-occur they are not arranged in regular, alternating, overlapping series. Body form either of branching and/or anastomosing tubes, or cup-funnel formed of a ring of tubes, or of a single tube, or of a single-wall funnel with or without lateral oscula extended on marginal tubes, or blade form; dermalia and atrialia are commonly pentactins, pinnular hexactins, or rarely diactins with rays of approximately equal length, or both forms may be lacking; scopules and uncinates are usually present but are lacking in two genera; microscleres are oxyhexasters and/or discohexasters (modified from Reiswig & Wheeler 2002).

EURETINAE Zittel

[Euretinae] Zittel, 1877: 121; Reid 1958: 16; Reiswig & Wheeler 2002: 1303.

Tubular Euretidae grow by dichotomous subdivision of basal tube to distal tubes of approximately equal diameter; resulting body form is either a simple branching stock without anastomoses, or a network of irregularly branching and anastomosing tubes, or a tube or funnel formed of a circular array of branching tubes with short lateral anastomoses; channelisation is typically absent but epirhyses with or without aporhyses occur; wall gaps unrelated to diarhyses occur in two genera; dermalia and atrialia are pentactins, hexactins, rarely diactins or may be absent; scopules and uncinates are common but absent in two genera; microscleres always present as oxyhexasters and/or discohexasters; dictyonal lamellae occur in only one genus (modified from Reiswig & Wheeler 2002).

Remarks: Members of subfamily Euretinae from the New Zealand area have been listed either as fossils without spicules (Kelly & Buckeridge 2005) or Recent species without confirming descriptions (Kelly *et al*. 2009).

Type species: *Eurete simplicissima* Semper, 1868.

Conorete Ijima

Conorete Ijima, 1927: 165; de Laubenfels 1936: 187; Reid 1958: 18; Reiswig & Wheeler 2002: 1305.
Eurete (in part) Semper, 1868: 30.
Eurete (*Conorete*) Reid 1958: 224.

Tubular unchannelised Euretidae with pinular hexactins as dermalia, heavily spined pentactins and/or pinular hexactins as atrialia (from Reiswig & Wheeler 2002).

Type species: *Eurete erectum* Schulze, 1899.

Remarks: The genus *Conorete* currently contains only two species: *C. erectum* (Schulze, 1899) with four subspecies, and *C. mucronatum* (Wilson, 1904). These are all known only from the eastern Pacific region (Galapagos and Panama).

Conorete gordoni n. sp. (Figs 17, 18)

Material examined:

Type material: **Holotype** NIWA 43426, NIWA Stn TAN0205/02, Volcano A, Kermadec Ridge, 34.578° S, 179.270° W, 1113–1124 m, 12 Apr 2002.

Type locality: Kermadec Ridge.

Distribution: Known only from type locality, Volcano A, Kermadec Ridge (Fig. 17A).

Habitat: Presumably attached to hard substratum; depth range 1113–1124 m.

Description:

Morphology is a short segment from a thin-walled, tubular stock (Fig. 17B), open at the lower and upper break points, with two lateral oscula on opposite sides alternating in position at bends of the tube. Although the segment is short, its diameter increases from one end, interpreted as the lower end, to the other, interpreted as the upper end.

Dimensions of the fragment are 34.3 mm in length, 9.1–12.7 mm in diameter at lower and upper ends, respectively. Lateral oscula are 6.2 and 6.9 mm in diameter, and wall thickness is 0.95 mm.

Texture is stony hard and brittle. Both inner and outer *surfaces* are smooth; the farreoid framework is visible to the naked eye. The wall is not channelised.

Colour light orange.

Main choanosomal skeleton is a farreoid dictyonal framework without channelisation. The primary framework consists of one or two layers of longitudinal strands joined by lateral beams to form rectangular meshes (Fig 17C, D). A secondary framework or cortex, appended on the outer (dermal) side, consists of one or two layers of dictyonalia fused without regular arrangement, forming triangular to polygonal meshes (Fig. 17E, F). Beams are smooth in most areas, moderately finely spined in others. Nodes are not swollen and there are no small oxyhexactins attached to the beams. Atrial spurs are rough, curved toward the wider (upper) end of the fragment and usually tapered to a sharp point but occasional distally inflated (Fig. 17C, D). Dermal spurs are mostly broken off and thus cannot be characterised (Fig. 17F). Loose choanosomal spicules include uncinates and microscleres.

Ectosomal skeleton of the dermal side consists of loose spicules, mainly pinular hexactins, plus small numbers of two types of scopules, uncinates, and two types of microscleres. The atrial skeleton also consists of loose spicules, mainly macrospined pentactins or hexactins with reduced distal ray plus small numbers of the same spicules found on the dermal side.

Megascleres (Table 9) are pinular hexactins, macrospined pentactins or reduced hexactins, two forms of scopules and uncinates. The pinular hexactins (Figs 17G, 18A) are dermalia but a few may occur on the atrial surface. They are slender, with clavate pinulus composed of a thin stylote rhachis bearing long spines mainly on the distal half. The tangential rays are cylindrical and densely spined only near their sharply pointed distal ends. The proximal ray is longer, tapered, and ornamented like the tangential rays. Macrospined pentactins (Figs 17H, 18B) or hexactins with reduced distal ray are atrialia. Their tangential rays are cylindrical with large pointed spines mostly on the outer surface but occasionally on lateral and lower surfaces. The proximal ray is usually longer, tapered and ornamented with small spines. A short sixth distal ray occasionally occurs but its position is usually occupied by a single or bifid macrospine. Scopules are rare, the most common being a subtyloscopule (Figs 17J, 18C). These have four nearly parallel straight tines densely covered with fine reclined spines except at their smooth bare caps. The neck is nearly bare and smoothly tapered to the shaft. The tapered shaft is smooth on the upper half while the lower half bears reclined spines increasing in length to the parabolic lower tip. The second scopule, a tyloscopule (Fig. 18D), is very rare — only two complete spicules were found, one from each surface. They have 4–5 straight divergent tines covered in fine recurved spines except for their bare lower quarter and the caps of the tyles; the spines increase in length on the sides of the tyles. The neck is short and consists of four swellings. The tapered shaft is mostly bare but is covered with fine spines on the lower third, and ends in an abruptly tapered sharp tip. Although these scopules are rare, they are unlikely to have infiltrated from a foreign source; there are no known candidates at the collection station or region from which they might have originated. The uncinates (Figs 17I, 18E) are normal for the family, with well-developed brackets and barbs moderately inclined from the spicule surface.

Microscleres (Table 9) are all very rare; 98% are oxyhexasters, together with a few hemioxyhexasters and very few oxyhexactins, and 2% are discohexasters and hemidiscohexasters. The oxyhexasters (Figs 17K, 18F) and their variants have short primary rays, each of which bear 1–3 straight or slightly curved terminal rays; they appear smooth in LM but are entirely covered in fine spines in SEM. The discohexasters (Figs 17L, 18G) and hemidiscohexasters are spherical in form; each short primary ray bears 1–4 straight or slightly undulating terminal rays ending in discs with 5–8 marginal spines. The terminal rays are covered with coarse reclined spines visible in LM while the primary rays are smooth even in SEM.

Etymology: The species in named in honour of Dr Dennis Gordon for his guiding leadership in the inventory of New Zealand biodiversity.

Remarks: This specimen clearly belongs to *Conorete*, but it cannot be assigned to either of the two known species. The two major differences between the New Zealand and all of the E Pacific forms are 1) the shape of the rhachis of the dermal pinules, slender and stylote in the new form and bulbous and clavate in all of the latter, and 2) the relative size of the macrospines on the pentactins, longer than ray thickness in the new form and shorter than ray thickness in the E Pacific forms. Oxyhexasters, the most abundant microsclere in the new form, are absent in *C. erectum erectum* (Schulze, 1899), *C. erectum tubuliferum* (Wilson, 1904), *C. erectum gracile* (Wilson, 1904), and *C. erectum* forma D (Lendenfeld, 1915). The new form appears most closely related to *C. mucronatum* in that both have oxyhexasters. Presumably *C. mucronatum* lacks discohexasters, but that

Table 9. Spicule and framework dimensions (µm) of *Conorete gordoni* n. sp.

Parameter	**Holotype NIWA 43426**			
	mean	**s. d.**	**range**	**no.**
Dermal pinular hexactin:				
pinular ray length	130	13	97–157	50
pinular ray width	4.3	0.6	3.3–6.3	50
tangential ray length	91	11	70–118	50
tangential ray width	3.9	0.6	2.8–5.5	50
proximal ray length	113	31	54–242	50
proximal ray width	4.1	0.6	3.1–6.5	50
Atrial pentactin:				
axial spine length	11.4	4.5	6.1–33.8	50
tangential ray length	229	35	157–289	50
tangential ray width	7.5	1.3	4.8–10.9	50
proximal ray length	233	52	119–332	50
proximal ray width	7.2	1.2	4.0–9.6	50
Subtyloscopule length	721	73	588–892	32
head length	130.0	7.5	110.0–144.6	50
tine length	109.6	6.7	96.4–122.4	50
Tyloscopule length	387	n.a.	369–405	2
head length	91	n.a.	83–98	2
tine length	79	n.a.	73–86	2
Uncinate length	1353	274	906–2273	50
width	8.8	1.3	5.0–10.6	50
Oxyhexaster diameter	112	11	87–136	50
primary ray length	7.7	1.4	4.8–12.2	50
secondary ray length	49.1	4.9	38.0–57.0	50
Discohexaster diameter	55	12	31–74	15
primary ray length	7.5	1.1	6.1–10.5	15
secondary ray length	20.4	5.7	9.6–26.4	15
Framework:				
longitudinal beam length	540	110	302–815	50
transverse beam length	286	64	176–471	44
Beam width	68	11	51–110	50
atrial spur length	388	78	248–540	38

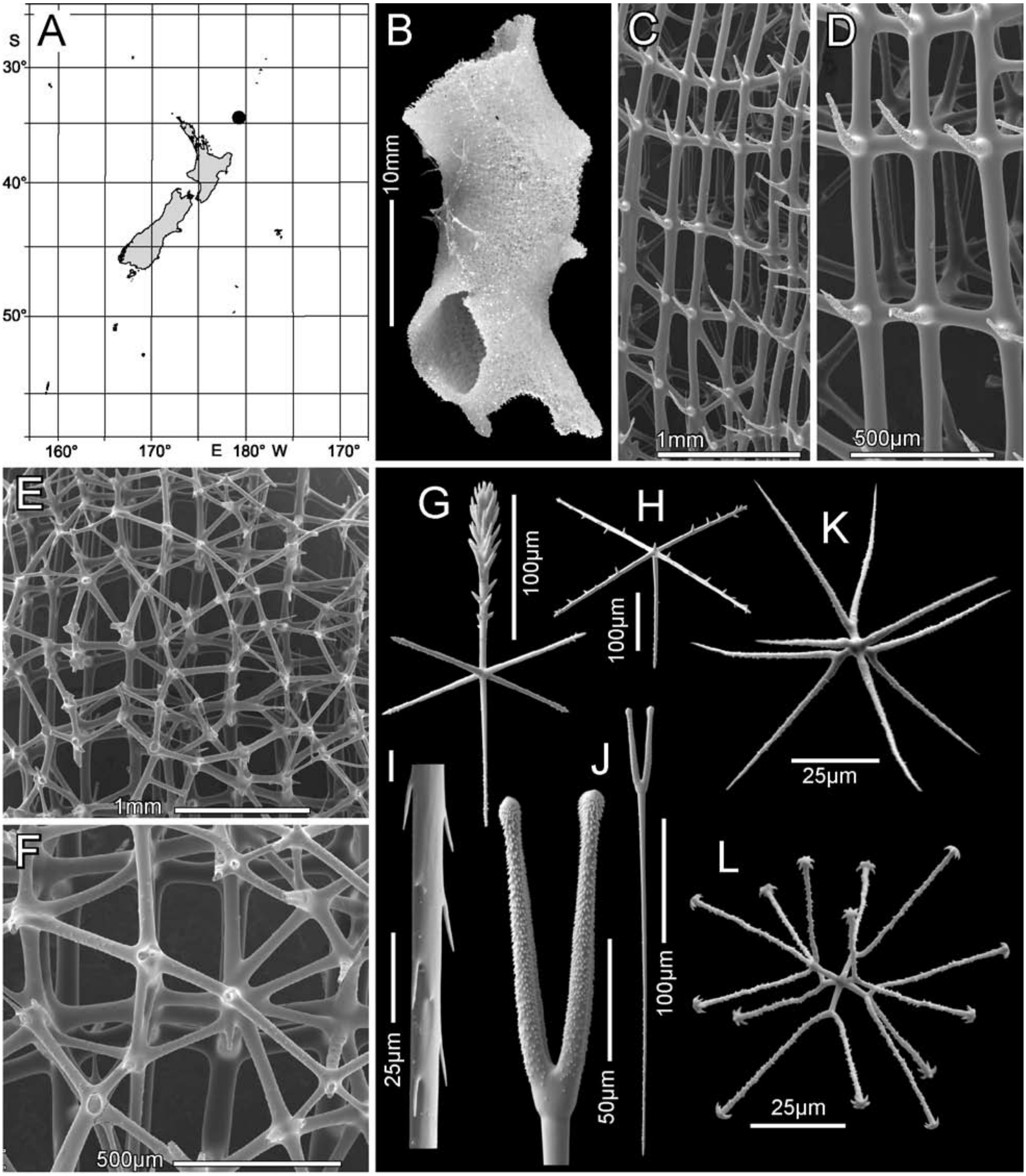


Figure 17. *Conorete gordoni* n. sp., holotype NIWA 43426. A, distribution in New Zealand waters. B, holotype. C, atrial surface of cleaned dictyonal framework, growth direction upward. D, magnified portion of C showing smooth beams and details of spurs. E, dermal surface of cleaned dictyonal framework. F, magnified portion of E showing microspined beams and broken spurs. G, dermal pinular hexactin. H, atrial macrospined pentactin. I, middle segment of uncinate. J, subtyloscopule, whole and magnified head end. K, oxyhexaster. L, discohexaster.

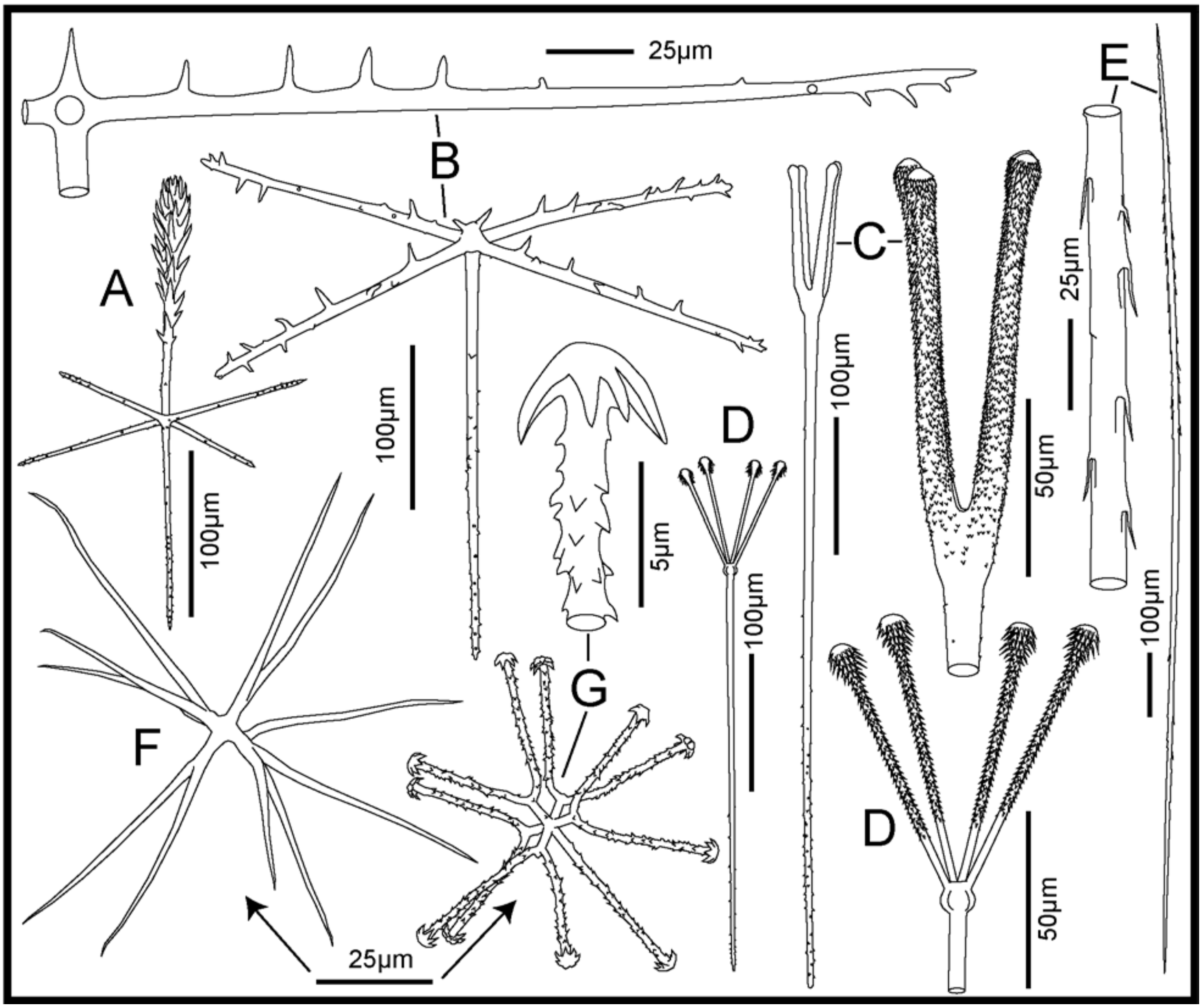


Figure 18. Spicules of *Conorete gordoni* n. sp., holotype NIWA 43426. A, dermal pinular hexactin. B, atrial macrospined pentactin, whole and enlargement of tangential ray. C, subtyloscopule, whole and enlargement of head end. D, tyloscopule, whole and enlargement of head end. E, uncinate, whole and enlargement of middle segment. F, oxyhexaster. G, discohexaster, whole and enlargement of secondary ray tip.

is not clearly stated by its describer. Wilson (1904) did not elaborate on spiculation of *C. mucronatum*, except to state it resembles *C. erectum tubuliferum* in all other respects except the oxyhexasters. From this, it is inferred that *C. mucronatum* shares the bulbous clavate form of pinular rhachis of *C. erectum tubuliferum* figured by him (Wilson, 1904), which differs strikingly from the rhachis in the New Zealand form. Thus the New Zealand form, the first member of *Conorete* from outside the E Pacific, differs from all known species and subspecies and is here designated *C. gordoni* n. sp.

An important aspect of the structure of *Conorete* is the occurrence of a single layered, rectangular-meshed primary framework in some parts of most and perhaps all specimens, as noted previously by both Schulze (1899) and Wilson (1904). This framework is clearly farreoid in the sense of Reid (1964) and thus constitutes an exception to general distinction between Farreidae and Euretidae by the number of primary framework layers. Not all Euretidae have euretoid frameworks.

KEY DIAGNOSTIC CHARACTERS:

- Body form is thin-wall tubular stock with alternating lateral oscula
- Primary dictyonal framework is a farreoid network
- Dermalia are pinular hexactins
- Atrialia are macrospined pentactins
- Two forms of scopules are present, a subtyloscopule and a tyloscopule
- Microscleres are mainly oxyhexasters and spherical discohexasters

Homoieurete n. gen.

Euretidae with microscleres predominately oxyoid (oxyhexasters, hemioxyhexasters, and oxyhexactins) and a small proportion of stellate discohexasters.

Type species: *Homoieurete macquariense* n. gen. n. sp., this report.

Etymology: The new genus name is formed from *homoios*, Greek for 'like; likeness' and the existing genus name, *Eurete*, a Greek and Latin combination meaning 'true net'; the gender is neuter.

Remarks: The genus *Eurete* presently contains 12 species, all of which have only oxyhexaster microscleres in conformity with the previous generic diagnosis. Discovery of a new form with a minor complement of stellate discohexasters has necessitated the establishment of a new genus to accommodate the additional form of microsclere.

Homoieurete macquariense n. gen. n. sp.

(Figs 19, 20)

Material examined:

Type material: **Holotype** QM G331847, NIWA Stn TAN0803/84, Seamount 7, Macquarie Ridge (Australian EEZ), 53.704° S, 159.115° E, 998–1100 m, 13 Apr 2008. **Paratype** QM G331848, NIWA Stn TAN0803/103, Seamount 9, Macquarie Ridge (Australian EEZ), 56.286° S, 158.451° E, 1170–1420 m, 16 Apr 2008.

Non-type material: *Seamount 7*, *Macquarie Ridge* (*Australian EEZ*): QM G331849, NIWA Stn TAN0803/79, 56.715° S, 159.131° E, 770–810 m, 12 Apr 2008.

Hartless Seamount, *Graveyard seamount complex*, *Chatham Rise*: NIWA 53233, NIWA Stn TAN0905/44, 42.671° S, 179.924° W, 1140 m, 18 Jun 2009.

Admiralty Seamount, *Ross Sea*, *Antarctica*: NIWA 39275, NIWA Stn TAN0802/309, 67.127° S, 170.896° E, 696 m, 14 Mar 2008.

Type locality: Macquarie Ridge.

Distribution: Known from two locations on Macquarie Ridge, on Chatham Rise (Fig. 19A), and from Admiralty Seamount in the Ross Sea.

Habitat: Attached to hard substratum; depth range 998–1420 m.

Description:

Morphology of the holotype is an irregular fragment of short, relatively thick-walled, medium-calibre branching tubes emanating from the wall of an axial large-calibre tube (Fig. 19B; see Fig. A of the frontispiece for the form in life), probably a fragment of a funnel forming stock. The paratype is a short tubular segment (Fig. 19C) of a specimen of unknown overall morphology.

Dimensions of the holotype fragment are 32.4 x 28.2 x 18.0 mm with tubes 5.7–6.8–7.7 mm in external diameter and wall thickness of 1.0–1.4–1.8 mm. The paratype is 7.2 mm long, 9.1 mm in external diameter and has a wall thickness of 1.3–1.4 mm.

Texture is stony hard and brittle.

Surfaces of both specimens are unchannelised and appear smooth with naked eye but under a dissecting microscope, both dermal and atrial surfaces of the holotype are seen to have small holes 0.17–0.35–0.61 mm in diameter (n = 62) in the surface spicule lattices (Fig. 19D, E). Aporhyses relating to these openings cannot be identified on the atrial surface framework where rectangular dictyorhyses have similar dimensions (Fig. 19F). Oval openings slightly larger than the general triangular dictyorhyses occur on the dermal surface (Fig. 19G), and these may be related to the holes in the covering lattice. They are too slight to be called epirhyses. There are no such holes in the covering of the paratype.

Colour of both specimens is beige, the holotype darker than the paratype, icy white in life.

Main choanosomal skeleton an irregular euretoid dictyonal framework without channelisation. The primary framework consists of two to three layers of longitudinal strands joined by discontinuous single or short serial lateral beams to form rectangular meshes on the atrial side (Fig. 19F). A secondary framework or cortex, appended on the outer (dermal) side, consists of two to three layers of dictyonalia fused without regular arrangement, forming triangular to polygonal meshes (Fig. 19G). Beams are very finely spined but nodes are mostly smooth (Fig. 19H). Nodes are not swollen and there are no small oxyhexactins attached to beams. Spurs of both surfaces are tapered, thin, and lightly tuberculate, varying in tip shape from sharp without inflation to slightly, raggedly or spherically inflated (Fig. 19H). Loose choanosomal spicules include uncinates and microscleres.

Ectosomal dermal and atrial skeletons consist of loose spicules including pentactins, scopules, uncinates, and microscleres.

Megascleres (Table 10) are pentactins, one type of discoscopule, and uncinates. Dermalia and atrialia are thin pentactins (Figs 19I, 20A); all rays are cylindrical, evenly covered by fine conical spines, and have slightly inflated tips. The scopules (Figs 19J, 20B) have very small, often lobate necks bearing 2–5 straight tines ending in distinct discoid caps with marginal spines. All surfaces are covered by small reclined spines. The shaft tip ends rather abruptly in a moderately sharp or parabolic tip, without inflation. The uncinates (Figs 19N, 20C) are of moderate size, with well-developed brackets and barbs curving out rather strongly from the shaft.

Microscleres (Table 10) are mainly oxyoid (91.5% of 200 randomly encountered in spicule preparation transects), including oxyhexasters (82.5%), hemioxyhexasters (7.0%), oxydiasters (1.5%), and rare oxyhexactins (0.5%); stellate discohexasters constitute a small but significant proportion (8.5%) of microscleres. The branching oxyoid microscleres, oxyhexasters (Figs 19K, 20D), hemioxyhexasters (Fig. 20E), and oxydiasters (not figured) are entirely covered with reclined spines easily seen in LM. They have 1–4 straight and relatively long primary rays (mean primary to secondary ray length = 0.74). The oxyhexactins (Fig. 20F) are similar but smaller. The discohexasters (Figs 19L, M, 20G, H) are small, highly variable, and usually irregular in shape; the heavily or sparsely spined primary rays each bear 2–7, mostly 4–6 longer, rough terminal rays (mean primary to secondary ray length = 0.61). Most terminal rays end in arched discs with 4–8 marginal teeth (Fig. 20I), but some individual ray ends on spicules that are otherwise clearly discohexasters are onychoid. Discohexasters are more abundant in the paratype, making up 23% of 100 random microscleres encountered, but oxyhexasters remain the most abundant microsclere type.

Etymology: The species name *macquariense* reflects the site of collection, Macquarie Ridge.

Remarks: There is no place in the present taxonomic system for Euretinae with dermal and atrial pentactins and both oxyhexaster and discohexaster microscleres. The alternatives to make a place for such forms are to either erect a new genus for them or to modify the diagnosis of *Eurete* to allow inclusion of them there. We have elected the former action to partition such forms from the more typical *Eurete* species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is thick-wall branching tubular stock
- Primary dictyonal framework is euretoid
- Dermalia and atrialia are pentactins
- Scopules have discoid tine tips
- Microscleres are mainly oxyhexasters but a small proportion are stellate discohexasters

Table 10. Spicule and framework dimensions (µm) of *Homoieurete macquariense* n. gen. n. sp.

Parameter	**Holotype QM G331847**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	247	35	196–337	50
tangential ray width	9.0	1.9	6.4–19.2	50
proximal ray length	260	47	192–414	50
proximal ray width	8.8	1.7	6.5–15.2	50
Scopule total length	266	22	222–311	50
tine length	51.6	5.9	30.9–62.6	50
head length	59.1	5.7	40.2–69.2	50
Uncinate length	967	214	631–1612	50
width	5.7	0.9	4.0–8.0	50
Oxyhexaster diameter	69.1	10.1	39.4–88.3	50
primary ray length	15.1	3.0	7.0–21.5	50
secondary ray length	20.3	2.7	11.1–26.3	50
Oxyhexactin diameter	58.6	11.7	36.0–87.9	50
Discohexaster diameter	37.0	7.5	23.5–59.8	100
primary ray length	7.1	1.7	3.2–12.1	100
secondary ray length	11.6	2.7	5.5–18.7	100
Dermal frame beam length	383	115	175–762	50
beam width	66	18	33–116	50
spur length	202	40	134–330	50
Atrial frame beam length	351	173	129–850	50
beam width	57	15	28–103	50
spur length	259	64	136–404	50

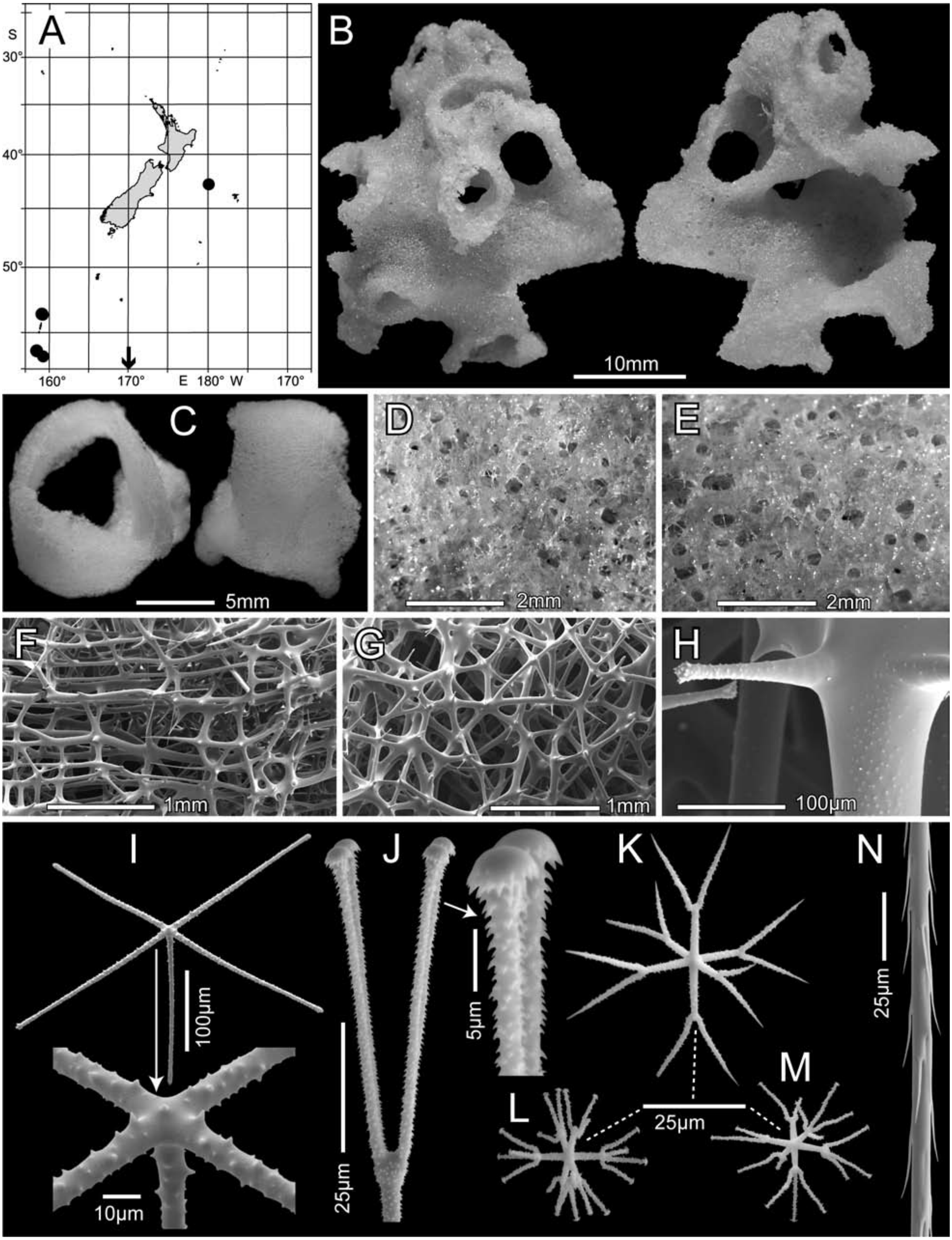


Figure 19. *Homoieurete macquariense* n. gen. n. sp., holotype QM G331847. A, distribution in New Zealand waters. B, holotype. C, paratype QM G331848 in end and side views. D, dermal surface of the holotype. E, atrial surface of the holotype. F, atrial surface of the holotype framework. G, dermal surface of the holotype framework. H, magnified view of atrial holotype framework surface. I, surface pentactin with central part magnified. J, discoscopule with magnified tine ends. K, oxyhexaster. L, M, stellate discohexasters. N, middle section of uncinate.

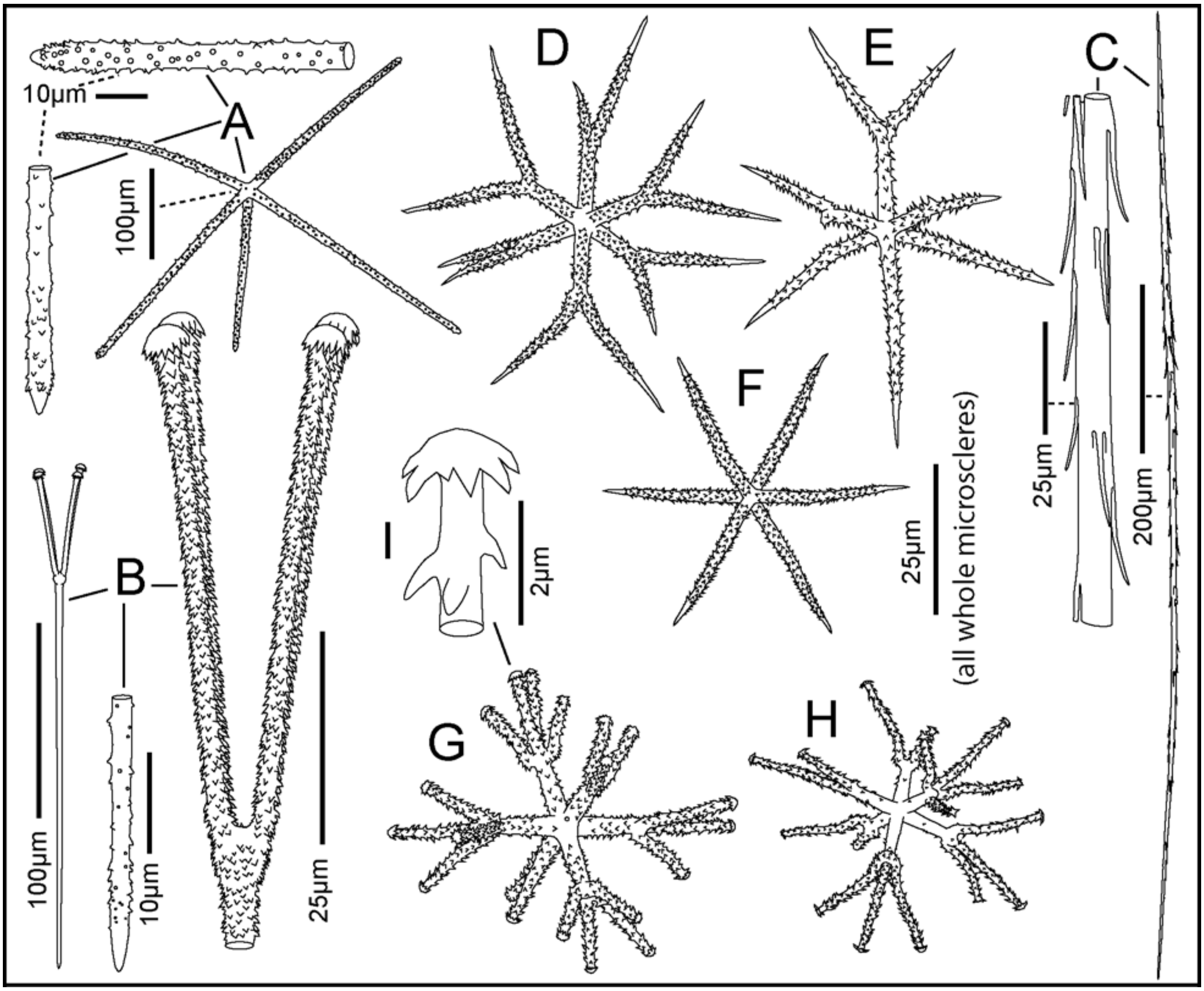


Figure 20. Spicules of *Homoieurete macquariense* n. gen. n. sp., holotype QM G331847. A, dermal pentactin and enlargement of tangential and proximal ray ends. B, discoscopule, whole and enlargement of upper and lower ends. C, uncinate, whole and enlargement of middle segment. D, oxyhexaster. E, hemioxyhexaster. F, oxyhexactin. G, H, discohexasters. I, enlargement of secondary ray tip.

Gymnorete Ijima

Gymnorete Ijima, 1927: 165; de Laubenfels 1936: 187; Reid 1958: 18; Reiswig & Wheeler 2002: 1309.
Eurete (*Gymnorete*) Reid 1963: 224.

Stock as a network of short tubes, either separate or branching and anastomosing or of unknown form, with dermalia as rare pentactins or entirely absent and atrialia entirely absent; with or without narrow epirhyses channelising only cortical layer; framework coarsely thorned throughout; fine uncinates with very small barbs occur in small bundles on only external surface or both surfaces or dispersed throughout the body wall; one or two distinctive scopule types with club or disc tips; microscleres as stellate discohexasters, with or without oxyhexasters with very short terminal rays, alternately interpretable as onychohexactins with long claws, with or without onychohexasters (modified from Reiswig & Wheeler 2002).

Remarks: The genus *Gymnorete* has remained monospecific since its erection by Ijima (1927), known only from the type species, *Eurete alicei* Topsent, 1901b, from the eastern Atlantic Ocean, which entirely lacked both dermalia and atrialia. Addition of two new species, *G. pacificum*, from the Kermadec Islands, and *G. stabulatum*, from the South Fiji Basin, requires slight modification of the generic diagnosis. The new species share virtually all framework details and spiculation with the type species but *G. pacificum* differs in presence of rare pentactine dermalia. This poorly known genus now contains three species.

Type species: *Eurete alicei* Topsent, 1901b.

Gymnorete pacificum n. sp. (Figs 21, 22)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NMNZ POR.000482, NNE of Herald Islets, Raoul Island, Kermadec Islands, 29.200° S, 177.822° W, 1188–1225 m, RV *Acheron*, 05 Apr 1973. **Paratype** NIWA 62154, NIWA Stn TAN0905/42, Voodoo Seamount, Graveyard seamount complex, Chatham Rise, 42.746° S, 179.924° W, 1051 m, 18 Jun 2009.

NON-TYPE MATERIAL: *Bounty Trough, southern edge of Chatham Rise*: NIWA 70635, NZOI Stn F751, 45.383° S, 175.484° E, 1277 m, 18 Aug 1966.

TYPE LOCALITY: Herald Islets, Kermadec Islands.

DISTRIBUTION: Known from type locality, Chatham Rise, and Bounty Trough to the south of the South Island (Fig. 21A).

HABITAT: Attached to hard substratum; depth range 1188–1225 m.

DESCRIPTION:

Morphology as four fragments (Fig. 21B) culled from a bag also containing fragments of a farreid; all four fragments contain the same set of free spicules and were probably parts of the same original specimen which was most likely an irregular plate, from one side of which arise short tubes with thin walls. The overall shape of the original specimen cannot be confidently determined from the fragments since some appear to have been lost.

Dimensions of the fragments are 2–6 cm in length with wall thickness of 2.5–4 mm.

Texture stony hard and brittle.

Surface of the convex, presumed dermal side of the best preserved fragment (Fig. 21C) has a cortex 0.6 mm thick which is smooth, dense, and channelised by small epirhyses with apertures 0.26–0.64–1.12 mm in diameter extending through the cortex and ending on the main internal framework. The opposite surface, presumed atrial, and all surfaces inside the short tubes are supported by an unchannelised, rectangular, euretoid framework (Fig. 21D), identical and continuous with the frame at the inner surface of the epirhyses; the atrial surface thus lacks any cortical development.

Colour light tan.

Choanosomal skeleton is a euretoid framework without channelisation, 2–4 mm in thickness (Fig. 21G, H); longitudinal strands are well-developed but are without thickening; meshes are mainly rectangular with only very slight indication of alignment of transverse beams so transverse septa are not developed; beams bear small sharp conical spines as ornamentation; nodes are not swollen; the few intact spurs are thin, rough, often curved, and end in sharp points.

Ectosomal skeleton of the dermal side is irregular in form without longitudinal strands (Fig. 21E, F); meshes are mainly triangular, but some are rectangular and polygonal; many beams connect directly to other beams forming false nodes; beams are generally shorter and thicker than those of the main framework, and ornamenting tubercles are larger, coarser, and often thickened to small smooth knobs; nodes are not swollen; spurs are robust, thickly-spined, and either cylindrical with rounded tips or stepped in thickness with thin sharp tips. No small hexactins are fused to beams of either framework. Loose spicules of both the main and cortical framework regions include uncinates and microscleres.

Ectosomal skeleton of the dermal side consists mainly of two types of scopules, uncinates, rare pentactins, and two types of microscleres. Loose spicules of the atrial side consist of the same set of spicules, but without pentactins.

Megascleres (Table 11) are rare dermal pentactins, two forms of scopules occurring on both surfaces, and very abundant, small, thin uncinates generally distributed. The dermal pentactin (Fig. 22A) is regularly cruciate in form, entirely rough, with cylindrical rays tapering slightly to abruptly pointed, rounded or inflated club-shaped tips. The claviscopule (Figs 21I–K, 22B) usually has four, rarely 2–3, tines spreading at a moderate angle of about 26° at their origin, and projecting straight to club-shaped tips; all surfaces except the middle section of the shaft are densely covered with small reclined thorns; the end of the shaft is inflated before ending in a conical hastate tip (Fig. 21K). The smaller discoscopule (Figs 21L, 22C) also has four tines with a smaller angle of spread at their origin, c. 18°, projecting straight or slightly curved outwards to end in small discs with 4–6 marginal teeth; it is ornamented like the claviscopule; the shaft tapers without inflation to a fine point. The uncinate (Figs 21M, 22D) is small, curved or sinuous, almost never straight, with long shallow brackets underlying very short barbs, both of which are barely detectable with LM but clearly evident in SEM.

Microscleres (Table 11) consist of 90% oxyhexasters (alternately interpretable as onychohexasters with very long claws), 10% stellate discohexasters, and rare oxyhexactins. The oxyhexaster (Figs 21N, 22E) has 2–4–5 very short greatly divergent terminal rays on each primary ray; it appears smooth in LM but is finely and sparsely spined in SEM; occasional hemihexaster variants occur. The discohexaster (Figs 21O, 22F) likewise appears smooth in LM but is entirely finely spined in SEM; each primary bears 4–5–7 short, tightly bunched terminal rays ending in small discs with 4–5 marginal teeth; rare variants occur as discohexactins and discodiasters. The oxyhexactin (Fig. 22G) varies considerably in size and ray thickness; each ray carries 5–20 proclined spines which are easily visible in LM; the rays are often unequal in length, cylindrical, and end in short, abruptly tapered tips.

Etymology: The name *pacificum* reflects this first record for *Gymnorete* in the Pacific Ocean.

Remarks: This specimen is prohibited from assignment to most genera of Euretidae by details of skeletal framework and spiculation, but could belong to either *Gymnorete* or *Eurete*, neither of which it fits without difficulty. The present diagnosis of *Eurete* allows membership only to forms with both dermalia and atrialia as pentactins and microscleres only as oxyhexasters. Assignment of the new form to *Eurete* would require two major modifications of its diagnosis, allowing forms without atrialia and with discohexasters as microscleres. The most recent diagnosis of the monotypic *Gymnorete* (Reiswig & Wheeler 2002) allows only forms lacking both dermalia and atrialia, fine uncinates without barbs (but not yet examined in SEM), tyloscopules, and microscleres as onychexactins, onychexasters, and discohexasters (also without SEM examination). This diagnosis was based upon the only species presently recognised in the genus, *G. alicei* (Topsent, 1901b) from the Atlantic Ocean, off the Azores and Morocco.

The new species agrees with *G. alicei* in all details of the framework. Both species also have two scopule forms, described in *G. alicei* as tyloscopules (from LM only) but compatible with designations claviscopule and discoscopule in the new species. In both species the larger scopule has inflated shaft end and the smaller scopule has gradually tapered shaft end. The unusual 'onychexaster' of *G. alicei* is essentially identical with the microsclere of the new form here identified as an oxyhexaster with short terminal rays. Both species are also from moderately deep water, 1130–2460 m for *G. alicei* and 1189–1226 m for the new form.

The three differences between the two species are the absence of dermalia in *G. alicei* (rare pentactins in the new species), the presence of onychexasters in *G.*

Table 11. Spicule and framework dimensions (µm) of *Gymnorete pacificum* n. sp.

Parameter	**Holotype NMNZ POR.000482**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	270	32	216–344	41
tangential ray width	9.9	2.2	6.2–15.5	50
proximal ray length	338	4	335–341	2
proximal ray width	9.8	2.4	6.5–11.8	4
Claviscopule total length	652	88	508–837	50
tine length	117	20	85–157	50
head length	127	20	93–165	50
Discoscopule total length	431	42	350–556	50
tine length	63	10	43–88	50
head length	69	10	47–97	50
Uncinate length	725	207	388–1449	50
width	2.7	0.8	1.6–5.7	50
Oxyhexaster diameter	77.6	9.6	52.4–101.2	50
primary ray length	30.9	3.5	23.8–38.5	50
secondary ray length	12.4	1.8	8.7–16.3	50
Discohexaster diameter	50.4	7.6	35.2–68.1	50
primary ray length	14.7	2.7	9.0–22.0	50
secondary ray length	10.6	1.8	5.0–14.6	50
Oxyhexactin ray length	96	20	54–156	50
Main frame beam length	242	69	137–469	50
beam width	15.6	2.5	9.5–22.2	50
Cortex frame beam length	162	4.5	44–256	50
beam width	21.9	7.2	10.6–46.8	50

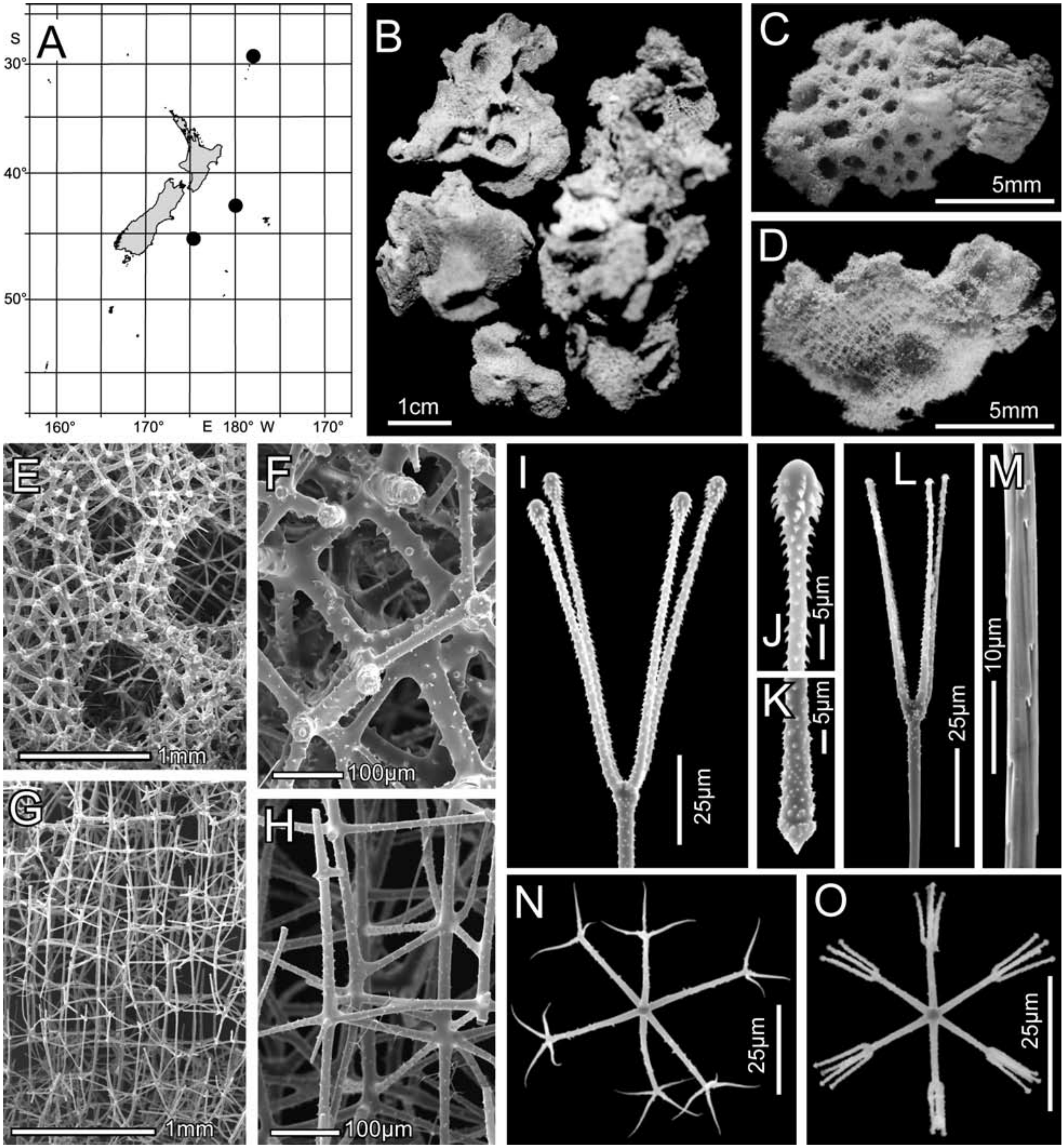


Figure 21. *Gymnorete pacificum* n. sp., holotype NMNZ POR.000482. A, distribution in New Zealand waters. B, complete set of holotype fragments. C, dermal surface of best preserved fragment. D, atrial surface of same. E, cleaned dermal cortex surface. F, magnified view of dermal cortex surface. G, cleaned atrial framework surface. H, magnified view of atrial framework surface. I, claviscopule head. J, tine of claviscopule. K, inflated shaft tip of claviscopule. L, discoscopule head. M, middle section of uncinate. N, oxyhexaster. O, stellate discohexaster.

alicei (absent in the new species), and the body form of *G. alicei* consisting of a network of branching and anastomosing tubes (body form unknown in the new form but unlikely to be strictly tubular). The complete absence of surface spicules in *G. alicei* has been suspected to be an artifact of washout of surface spicules during collection, but absence of atrialia in the new species is certainly authentic since scopules remain undamaged and in place on the atrial surface. Occurrence of rare pentactine dermalia, as found in the new species, is neither surprising nor unexpected. The differences in body form, unknown in the fragmented new species,

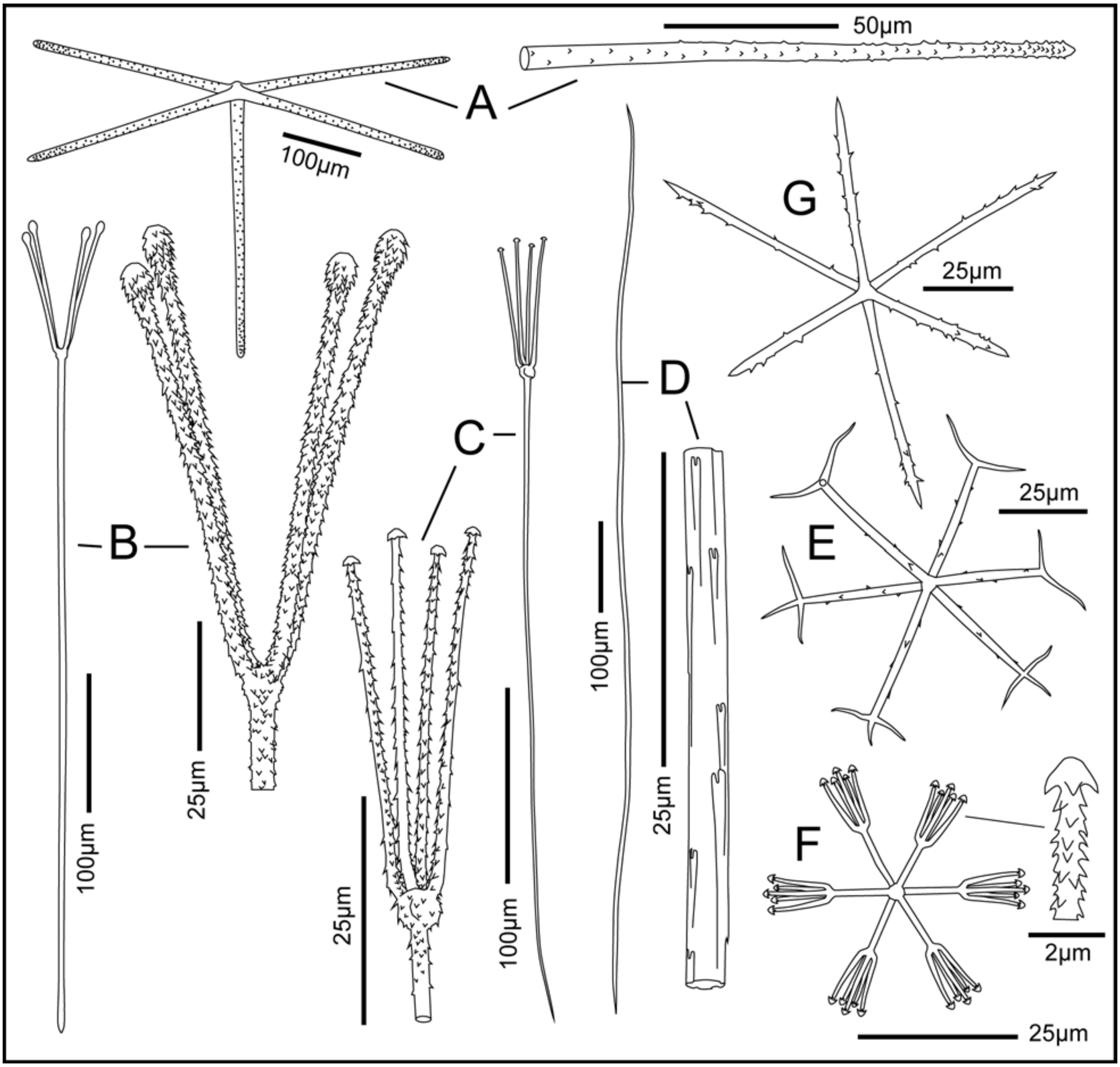


Figure 22. Spicules of *Gymnorete pacificum* n. sp., holotype NMNZ POR.000482. A, dermal pentactin and enlargement of tangential ray. B, claviscopule, whole and enlargement of upper end. C, discoscopule, whole and enlargement of upper end. D, uncinate, whole and enlargement of middle segment. E, oxyhexaster. F, discohexaster, whole and enlargement of terminal ray end. G, oxyhexactin.

and the presence of a single additional category of microsclere in *G. alicei* (which may be a developmental stage of the discohexaster) are not major problems to accepting a close relationship between these two forms. Assignment of the new Kermadec Island form to *Gymnorete*, with slight but acceptable modification of the generic diagnosis, seems the most parsimonious solution to its placement.

KEY DIAGNOSTIC CHARACTERS:

- Body form is unknown but may be a curved plate or cup with short lateral tubes
- Dermal cortex is dense with small deep holes 0.25 mm to over 1 mm diameter as epirhyses
- Primary dictyonal framework is a euretoid network of thin beams with longitudinal strands
- Two forms of scopules occur, club-end scopules with an inflated shaft end, and discoscopules with a thin tapered shaft end
- Microscleres are mainly distinctive oxyhexasters with very short terminal rays and stellate discohexasters

Gymnorete stabulatum n. sp. (Figs 23, 24)

MATERIAL EXAMINED:

TYPE MATERIAL: Holotype NIWA 62114, South Fiji Basin, 28.146° S, 175.448° E, 550–1484 m, RV *Tangaroa*, 20 Oct 1999.

TYPE LOCALITY: South Fiji Basin.

DISTRIBUTION: Known only from type locality (Fig. 23A).

HABITAT: Attached to hard substratum; depth range 550–1484 m.

DESCRIPTION:

Morphology as three fragments, the two largest shown in Fig. 23B–E, all clearly from the same original specimen. The basal plate is a very extensive spreading encrustation from which pillars and ridges extend vertically and fuse laterally forming a thick cover layer or roof. Oval apertures left on sides and roof of this double-layered structure lead into a labyrinthine internal atrial space. Margins of some apertures of the cover layer extend vertically to form larger short, smooth, thick-walled chimneys or tubes with occasional lateral apertures (Fig. 23D, E). Internally the vertical tubes communicate directly with the labyrinthic atrial space of the basal encrustation. Three specimens of an aegid isopod, provisionally identified as *Epulaega* sp., were found in the internal atrial spaces.

Dimensions of the fragments are 2.9–7.4 cm in length and 1.6–1.9 cm in height. The large vertical tubes are 7.4–13.6 mm in external diameter with terminal oscula 3.3–6.8 mm in diameter. The smaller apertures (parietal oscula) leading into the internal atrial spaces are 1.0–2.2–4.2 mm in diameter. Wall thickness is 1.6–2.3 mm.

Texture stony hard and brittle.

Surface of the external (dermal) side bears an overtly smooth 0.5 mm thick cortex, without epirhyses, but is microscopically ornamented with vertical tufts of uncinates and long digitate spurs (Fig. 23F upper). Walls of the internal atrial system are ornamented with tufts of scopules (Fig. 24F lower) projecting out from the margins of exhalant canals 0.2–0.4–0.7 mm in diameter. Aporhyses are not present

Colour greyish yellow to gold.

Choanosomal skeleton is a rather irregular euretoid framework without channelisation; oblique longitudinal strands are easily recognized in most areas (Fig. 23G left), but throughout most of the wall, they are obscured by addition of secondary dictyonalia. Meshes are primarily rectangular but triangular meshes are common. All beams and nodes bear large sharp conical spines as ornamentation (Fig. 23H); nodes are not swollen; the few intact choanosomal spurs are thin, rough, straight, and end in sharp points.

Table 12. Spicule and framework dimensions (µm) of *Gymnorete stabulatum* n. sp.

Parameter	**Holotype NIWA 62114** **mean**	**s. d.**	**range**	**no.**
Claviscopule total length	665	78	408–839	50
head length	144	18	71–171	50
tine length	132	17	62–160	50
Uncinate length	312	51	208–418	50
width	2.3	0.4	1.5–3.2	50
Discohexaster diameter	40.9	3.3	32.7–50.4	50
primary ray length	10.5	1.3	8.2–13.7	50
secondary ray length	10.0	1.2	7.6–12.6	50
Dictyonal framework:				
Dermal beam length	219	57	95–387	50
beam width	80	18	40–131	50
Internal beam length	184	41	98–282	50
beam width	31.3	7.0	18.2–47.5	50
Atrial beam length	188	42	103–270	50
beam width	25.9	4.3	18.9–36.7	50
Dermal spur length	196	42	118–288	48
spur tip width	23.1	10.3	10.4–69.5	50

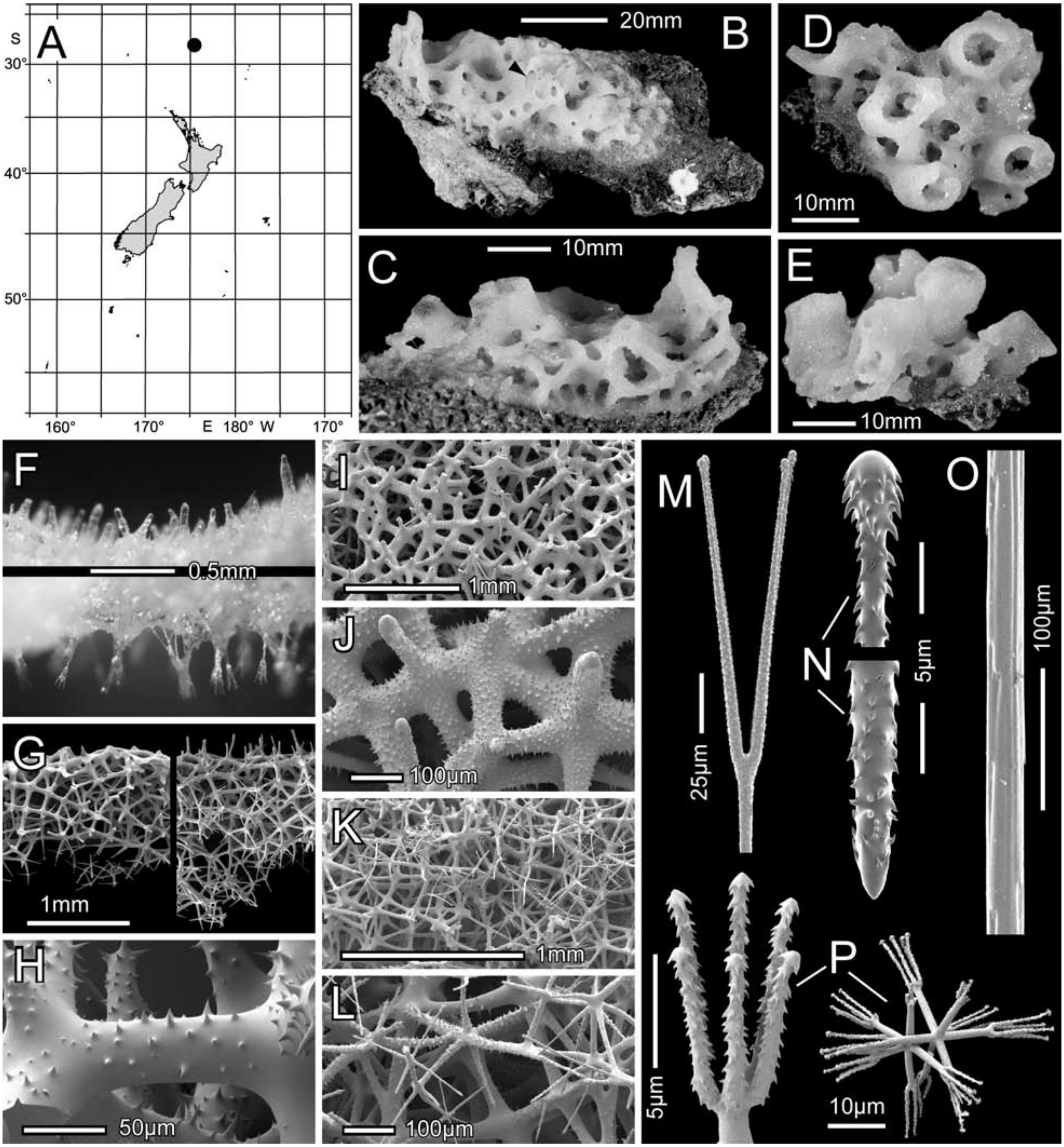


Figure 23. *Gymnorete stabulatum* n. sp., holotype NIWA 62114. A, distribution in New Zealand waters. B, largest fragment with encrusting base, top view. C, same, side view. D, fragment with vertical tubes, top view. E, same, side view. F, tangential views of intact dermal surface with projecting spurs (top) and atrial surface with scopule tufts (bottom). G, vertical sections of cleaned body wall showing longitudinal strands (left, dermal spurs broken off during preparation) and section at right angle to strands with dermal spurs intact (right). H, magnified view of choanosomal framework beam. I, external dermal cortex surface. J, higher magnification of same. K, internal atrial surface. L, higher magnification of same. M, head of claviscopule. N, tine and shaft tip of claviscopule. O, middle segment of an uncinate. P, stellate discohexasters, two whole ones and enlarged secondary ray tuft.

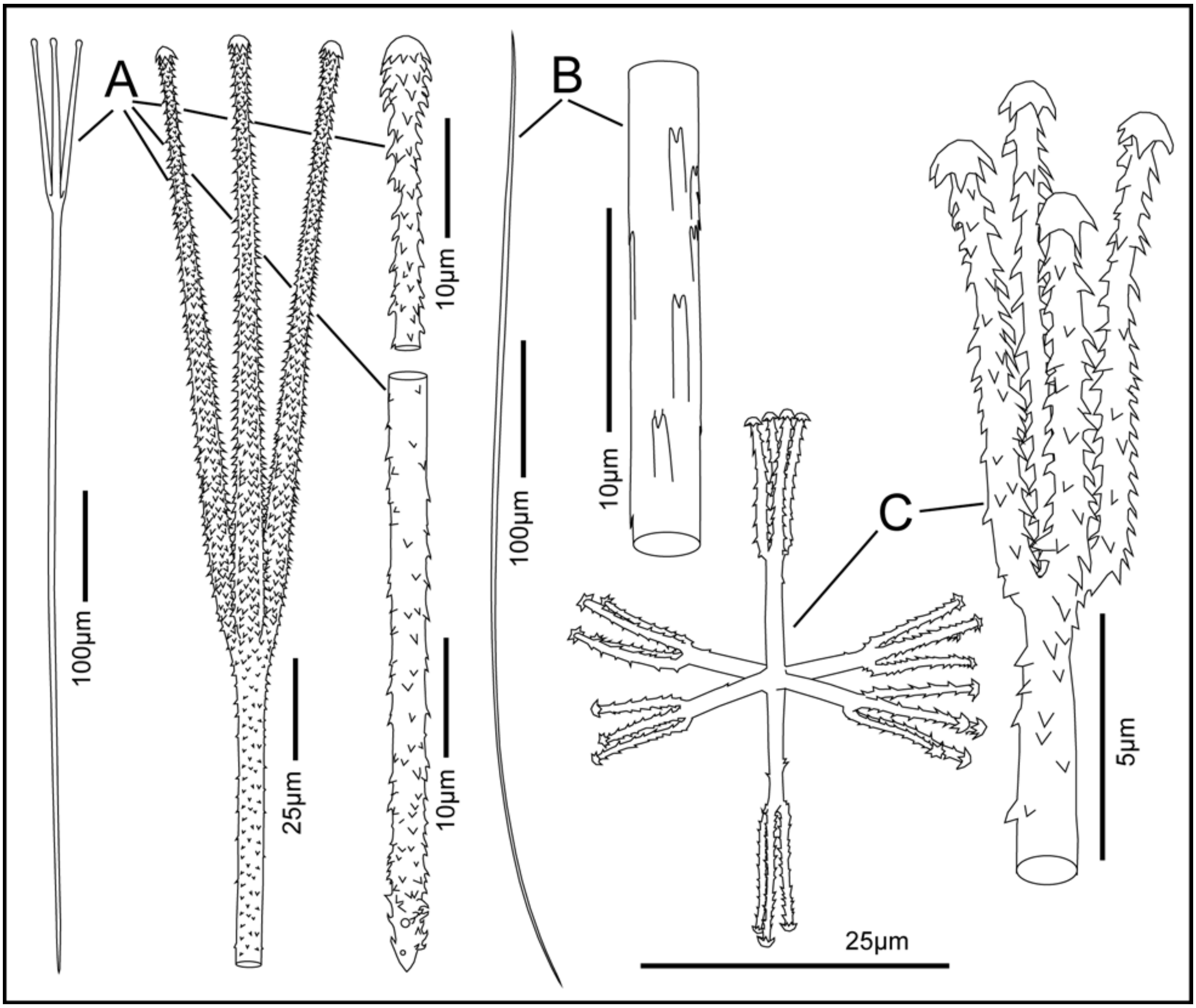


Figure 24. Spicules of *Gymnorete stabulatum* n. sp., holotype NIWA 62114. A, claviscopule, whole, head, tine, and shaft tip. B, uncinate, whole and enlargement of middle segment. C, stellate discohexaster, whole and secondary ray tuft.

Ectosomal skeleton of the dermal surfaces is an irregular, slightly hypersilicified strong cortex without longitudinal strands (Fig. 23I, J); meshes are rectangular, triangular, and polygonal; many beams connect directly to other beams forming false nodes; beams are generally longer and thicker than those of the main internal framework (Table 12). Nodes are not swollen; spurs are robust, densely-spined, and either cylindrical with rounded tips or club-shaped with inflated tips (Fig. 23G right, J). Loose spicules of the cortical ectosomal framework include uncinates projecting vertically from the surface in tufts, rare scopules, and microscleres.

Ectosomal skeleton of the atrial surfaces is an irregular network of thin rough hexactins added onto the main primary dictyonalia (Fig. 23K, L); the surface is ragged without smooth morphology. Loose spicules are primarily tufts of projecting scopules, microscleres.

Megascleres (Table 12) consist of one type of scopule, one type of uncinate, and one type of stellate discohexaster. The claviscopule (Figs 23M, N, 24A) is nearly entirely restricted to the atrial surfaces where it occurs in tufts; it has four, rarely 2–3, tines spreading at a moderate angle of about 14° at their origin, and projecting straight to club-shaped tips; all surfaces except the middle section of the shaft are densely covered with small reclined thorns; the shaft ends in a simple parabolic tip without inflation (Figs 23N, 24A). The uncinate (Figs 23O, 24B) is entirely restricted to the outer dermal surfaces. It is small, straight, simply curved or sinuous, with long shallow brackets extending behind very short barbs, both of which are barely detectable with LM but clearly evident in SEM.

Microscleres (Table 12) consist entirely of small generally-distributed stellate discohexasters (Figs 23P, 24C). Each sparsely thorned primary ray bears 2–6, usually four, tightly bunched and completely thorned secondary rays which are either simply curved or slightly s-shaped. The secondary rays end in small discs with 4–8 marginal spines. Primary and secondary ray lengths are variable but overall are approximately equal, primary to secondary length ratio is 0.68–1.06–1.53.

ETYMOLOGY: The name *stabulatum* is derived from the Latin word for 'stable', or 'stabled', and describes the aegid isopods that dwell, or are stabled, within its atrial spaces.

REMARKS: The holotype was collected in excellent condition, without mud contamination and with soft tissues intact. There is no question that the lack of dermalia and atrialia is real. This new form shares with the other two species of *Gymnorete* a near or total absence of dermalia and atrialia, a profusely spined euretoid dictyonal framework, claviscopules with straight divergent tines, small uncinates with extremely small barbs, and stellate discohexaster microscleres. It differs from the other species in its extensive encrusting base, absence of shallow epirhyses, and in the lack of any oxy-tipped microscleres. The South Fiji Basin specimen is clearly unique and is here designated as a new species, *Gymnorete stabulatum*.

KEY DIAGNOSTIC CHARACTERS:

- Body form is an extensive, thick basal encrustation bearing short separate upright tubes
- Dermal cortex is a dense slightly hypersilicified crust without epirhyses
- Primary dictyonal framework is a profusely spined euretoid network of moderately thick beams with longitudinal strands
- One form of claviscopule occurs without an inflated shaft tip
- Microscleres are only small stellate discohexasters

Lefroyella Thomson

Lefroyella Thomson, 1877: 403; Schmidt 1880: 47; Schulze 1887: 301; Ijima 1927: 210; Reid 1963: 225; Reid 1964: cxiv.
Syringidium Schmidt, 1880b: 46; Schulze 1887a: 15; Reid 1963: 225; Reid 1964: cxiv.

Euretinae with funnel-like, erect body with deep atrial cavity and moderately thick walls (to 1 cm); constructed of a layer of small-calibre (1–3mm diameter) longitudinal tubes forming longitudinal ridges separated by deep longitudinal grooves on atrial lining; tubes unchannelised and constructed of a primary framework of longitudinal dictyonal strands forming long sides of rectangular mesh; short mesh sides aligned in ranks forming lamellae; nodes not swollen; beams smooth or microtuberculate; megascleres include uncinates, surficial pentactins and rare hexactins, scopules with strongylote to tylote tine tips; microscleres consist of oxyhexasters and discohexasters, with or without hemioxyhexasters, oxyhexactins, and onychohexasters. Small smooth hexactins commonly appended to dictyonal framework in older regions (modified from Reiswig & Wheeler 2002).

REMARKS: The genus *Lefroyella* includes two extant species, *L. decora* Thomson, 1877 and *L. ceramensis* Ijima, 1927, plus at least two fossil species, *L. favoidea* Shrammen, 1912 and *L. montenati* Brimaud and Vachard, 1987. Interpretation of the *Lefroyella* wall composition as either a ring of small conjoined longitudinal tubules or a folded structure, and thus the type of channelisation present, remains controversial. Although several well-preserved specimens of *L. decora* have been available for study, the specimen described below is the first member of *L. ceramensis* with intact spiculation.

TYPE SPECIES: *Lefroyella decora* Thomson, 1877.

Lefroyella ceramensis Ijima, 1927 (Figs 25, 26)

Lefroyella ceramensis Ijima, 1927: 210; Reid 1964: cxiv; Tabachnick 1988: 61; Hooper *et al*. 2000: 192; Reiswig & Wheeler 2002: 1313.

MATERIAL EXAMINED:

West Norfolk Ridge: NIWA 62084, NIWA Stn TAN0308/142, 34.279° S, 168.401° E, 1246–1249 m, 02 Jun 2003; NIWA 62073, NIWA Stn TAN0308/151, 34.569° S, 168.941° E, 1013–1340 m, 03 Jun 2003.

NON-TYPE MATERIAL (NO FREE SPICULES): *Lord Howe Island seamount chain*: NIWA 62101, 62128, NZOI Stn Q68, 29.233° S, 159.001° E, 1045 m, 1 Jun 1978.

West Norfolk Ridge: NIWA 62118, 62129, NIWA Stn Z11104, 34.805° S, 169.853° E, 800–1107 m, 19 Jul 2002.

DISTRIBUTION: Western Pacific Ocean, from five locations ranging from Indonesia, northeast to the Magellan Seamounts in the Western Pacific Seamounts Province, and south to western Norfolk Ridge and Lord Howe Island Seamount Chain (Fig. 25A).

HABITAT: Attached to hard substratum; depth range within New Zealand area 1013–1340 m, elsewhere 1595–2005 m.

Description:

Morphology as a moderately thick-walled funnel, the live specimen NIWA 62984 flattened laterally and fused at two points within the funnel to form three distinct but conjoined funnels; flaring outwards at margins (Fig. 25B); unequally broken around all edges but attachment disc intact with fragments of calcareous substratum adhering. The second, washed-out specimen is a basal single funnel of a much larger, thicker-walled specimen.

Dimensions of the live specimen are 10.0 cm in height, 14.8 x 6.5 cm in width, and 12.0 cm in radial length (centre of base to most distant margin); walls are 3.2–3.9 mm in thickness. The second basal funnel is 8.7 cm in height, 7.2 cm in diameter at the broken upper margin with wall thickness of 8.3 to 9.6 mm.

Texture is stony and brittle.

External (*dermal*) *surface* of both specimens bear conspicuous small cylindrical tubules 2.5–6.2 mm in diameter extending from summits of volcano-like cones of variable height from 0.5–6.5 mm; the terminal tubule openings are circular, 0.8–1.7–3.5 mm in diameter, and considered structurally to be parietal oscula; the apertures, whether flush with surrounding surface or raised on cones, tend to occur in poorly defined longitudinal rows; in the live specimen, the great majority (over 95%) of the apertures house single actinarian polyps (probably family Edwardsiidae, D. Fautin, pers. com.); low ridges join adjacent cones.

Table 13. Spicule and framework dimensions (µm) of *Lefroyella ceramensis* Ijima, 1927.

Parameter	**NIWA 62084**			
	mean	**s. d.**	**range**	**no.**
Dermal pentactin:				
tangential ray length	205	29	132–265	50
tangential ray width	11.7	3.8	5.0–22.7	50
proximal ray length	227	42	81–293	50
proximal ray width	12.6	2.8	7.3–22.6	50
Atrial pentactin:				
tangential ray length	212	36	143–281	50
tangential ray width	10.9	3.5	3.8–18.7	50
proximal ray length	204	39	111–301	50
proximal ray width	11.7	2.8	6.2–16.9	50
Scopule total length	334	35	279–454	50
tine length	61.2	6.4	47.4–77.6	50
head length	72.2	6.8	56.7–87.7	50
Uncinate length (mm)	1.96	0.59	1.00–3.57	50
width	11.8	1.9	7.4–17.1	50
Oxyhexaster diameter	68.4	6.8	52.9–85.2	50
primary ray length	18.6	2.8	13.6–28.2	50
secondary ray length	17.2	2.1	13.3–22.1	50
Oxyhexactin diameter	68.6	6.1	58.6–78.8	24
Discohexaster diameter	30.9	3.8	23.8–41.9	50
primary ray length	8.1	1.4	5.3–11.7	50
secondary ray length	7.2	1.2	4.8–11.1	50
Framework:				
atrial ridge width (*mm*)	1.17	0.41	0.72–2.16	10
atrial groove width (*mm*)	1.11	0.33	0.75–1.78	15
parietal oscula diameter (*mm*)	1.58	0.53	0.86–3.48	58
epirhyses diameter (*mm*)	1.12	0.21	0.58–1.62	35
dermal beam length	350	98	191–588	50
dermal beam width	47.5	13.8	19.9–88.6	50
atrial cortical beam length	307	146	73–712	50
atrial longitudinal beam length	558	128	323–925	50
atrial beam width	51.2	16.5	6.6–85.4	50

Atrial surface of the live specimen is smoother in profile and is mostly occupied by longitudinal series of ridges and grooves of uniform dimensions across the entire atrial surface (Fig. 25C); holes and slits about 1 mm wide are the surface openings into the 2.5 mm-deep longitudinal grooves; the grooves are continuous but bridges between ridges interrupt their surface openings to short slits and holes; the ridges appear wider than the grooves when tissues are in place, but framework dimensions of these features are similar (Table 13); ridges and grooves increase in numbers distally by either branching of ridges (new grooves arising within ridges) or branching of grooves (new ridges arising within grooves). Local areas of the atrial surface are developed into projecting tubules-on-cones like those on the outer dermal surface. Both the dermal external apertures on cones and the atrial groove slits are completely open and uncovered by a lattice of loose surface spicules. The open dermal apertures communicate directly by straight cylindrical passages with apertures on the floors of the atrial grooves, hence alignment of the parietal oscula in longitudinal rows reflects their positioning over the corresponding atrial grooves. Small anthozoan polyps like those in the dermal parietal oscula are commonly found retracted in the atrial slits (Fig. 25C arrowheads); they are probably symbionts. In the thicker washed-out specimen, the slitted atrial skeleton has been overgrown by additional dictyonal growth, resulting in a new internal surface bearing low circumferential ridges and lateral series of round apertures 1.0–1.9–2.6 mm in diameter in the grooves between ridges.

Colour yellowish grey.

Choanosomal skeleton is a dictyonal framework of euretoid form with longitudinal strands associated with the rectangular-meshed atrial frame but no longitudinal strands on the irregularly meshed cortical dermal frame. Parietal oscula on conical tubules and occasional flush parietal oscula communicate directly with the atrial cavity by cylindrical channels opening on the floor of atrial grooves. The dermal frame between the parietal oscular cones bears large numbers of openings of shallow epirhyses (Fig. 25D) that penetrate into both the 1 mm thick dermal body wall and lateral walls of the atrial ridges; general dermal surface meshes are irregularly triangular to polygonal (Fig. 25E); throughout the entire framework the nodes are unswollen and both beams and nodes are evenly and densely ornamented by small, sharp, conical spines; spurs are rough, long, and end either with sharp tips, or in edges of oscula or epirhyses apertures, with spherical inflations.

The framework of the atrial surface is mixed; that of the grooves (sides and floor of the grooves) is typically euretoid with longitudinal strands and elongate rectangular meshes (Fig. 25F, H), while the exposed outer ridge surfaces are covered by a cortical framework of irregular triangular to polygonal meshes like that of the dermal surface. Sparse shallow channels (aporhyses) similar to the dermal epirhyses penetrate into this cortical meshwork of the ridge surfaces. The depth of the atrial groove (= height of atrial ridges) is 2.2–2.9 mm and when added to the 1 mm thickness of the dermal wall gives a total body wall framework thickness of 3.2–3.9 mm (Fig. 25G). In section the atrial ridges appear to have small longitudinal axial channels 0.3–1.0 mm in diameter, but it remains unknown how far they extend or whether they have open connections with each other or with external surfaces, either terminally or along their course. Loose choanosomal spicules consist of uncinates and microscleres.

Ectosomal skeleton consists mainly of lattices of overlapping loose pentactins which cover all surfaces, including the apertures of epirhyses and aporhyses, atrial ridges and most surfaces of the atrial grooves, but not covering parietal oscula or apertures opening into atrial grooves. Associated with the pentactin lattices are scopules and uncinates normally oriented with anterior ends projecting outwards, and microscleres.

Megascleres (Table 13) are surface pentactins, scopules, and uncinates. Dermalia and atrialia are pentactins or rarely hexactins (Fig. 26A) with cylindrical and entirely microspined rays slightly inflated near the rounded (tangential) or pointed (proximal) tips; ray lengths may differ within single spicules and tangential rays are often slightly bent back towards the proximal ray. Scopules (Figs 25I, 26B) occur as a single class on both surfaces; they are entirely spined and have 4, rarely up to 7, tines, slightly flared outwards, bearing inflated tylote or subtylote tips; occasional oxy-tipped forms are developmental stages; the proximal shaft tip is without inflation and abruptly pointed. The uncinates (Fig. 26C) have well-developed brackets and barbs; barbs are nearly parallel to, or slightly inclined from, the spicule surface; the anterior end is not noticeably bushy.

Microscleres (Table 13) are oxyhexasters and hemioxyhexasters (69%), few oxyhexactins (1%), and discohexasters (30%). The oxyhexasters and hemioxyhexasters (Figs 25J, K, 26D) have primary and secondary rays about equal in length, each primary bearing 1–3, usually 2 secondaries; they appear generally smooth with an occasional large macrospine in LM but are entirely finely spined in SEM. The oxyhexactins (Fig. 26E) are similar to the oxyhexasters in size and texture. The discohexasters (Figs 25L, 26F) are stellate, with each primary ray bearing 4–8 short, very slightly sigmoid or straight terminal rays, arranged with a central one in line with the primary ray and the others in a single whorl around it; each terminal ray ends in a small disc

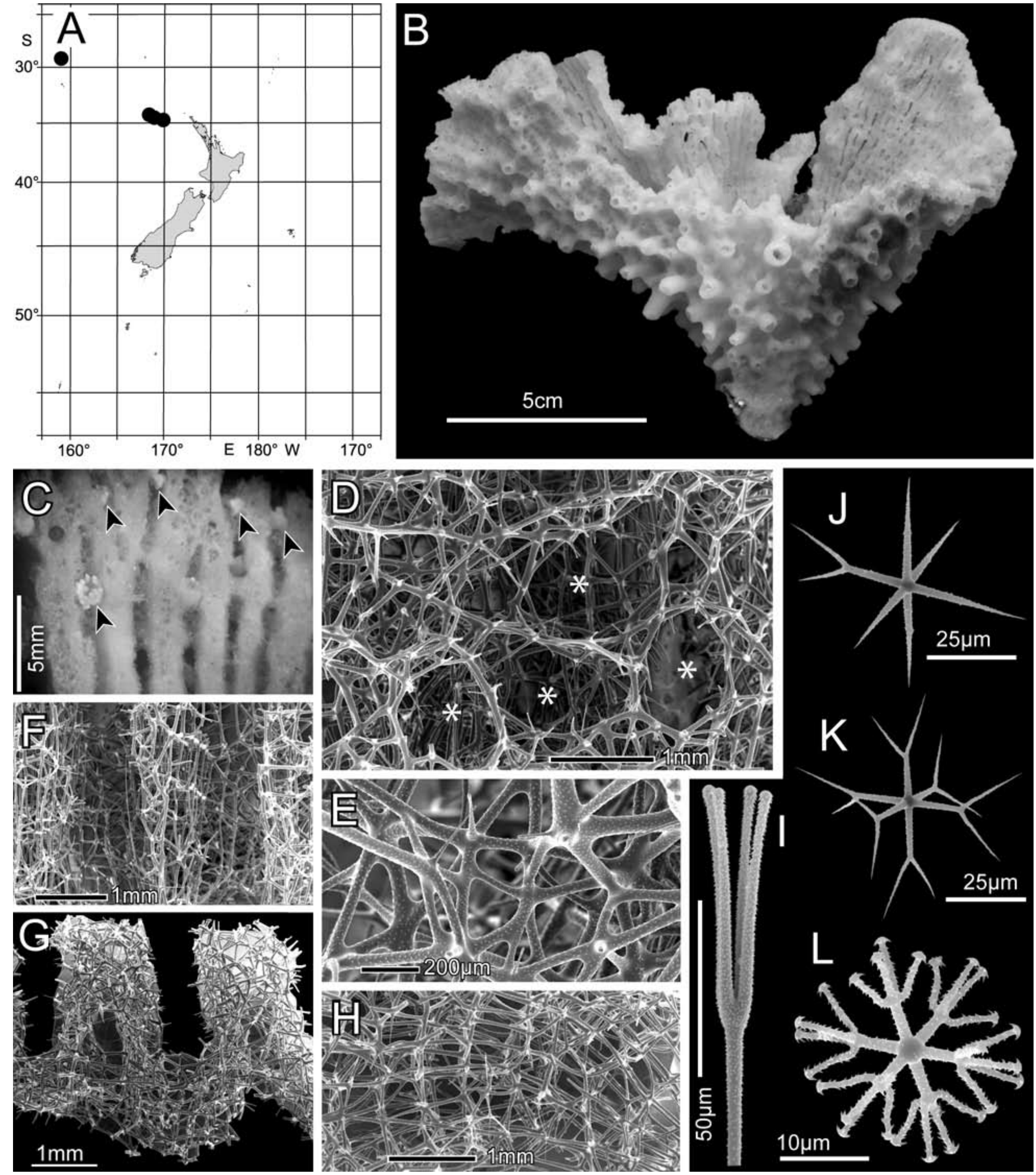


Figure 25. *Lefroyella ceramensis* Ijima, 1927, NIWA 62084. A, distribution in New Zealand waters. B, QM G316666. C, atrial surface with longitudinal grooves and ridges; symbiont anthozoans indicated by arrowheads. D, dictyonal framework of dermal surface, (*) entrances to shallow epirhyses. E, closer view of dermal meshwork. F, cleaned framework of grooved/ridged atrial surface. G, cross-section of two cleaned atrial ridges with small axial cavities; dermal surface and dermal wall towards bottom. H, euretoid framework of the side of a longitudinal ridge, growth direction to left. I, upper end of scopule. J, hemioxyhexaster. K, oxyhexaster. L, discohexaster.

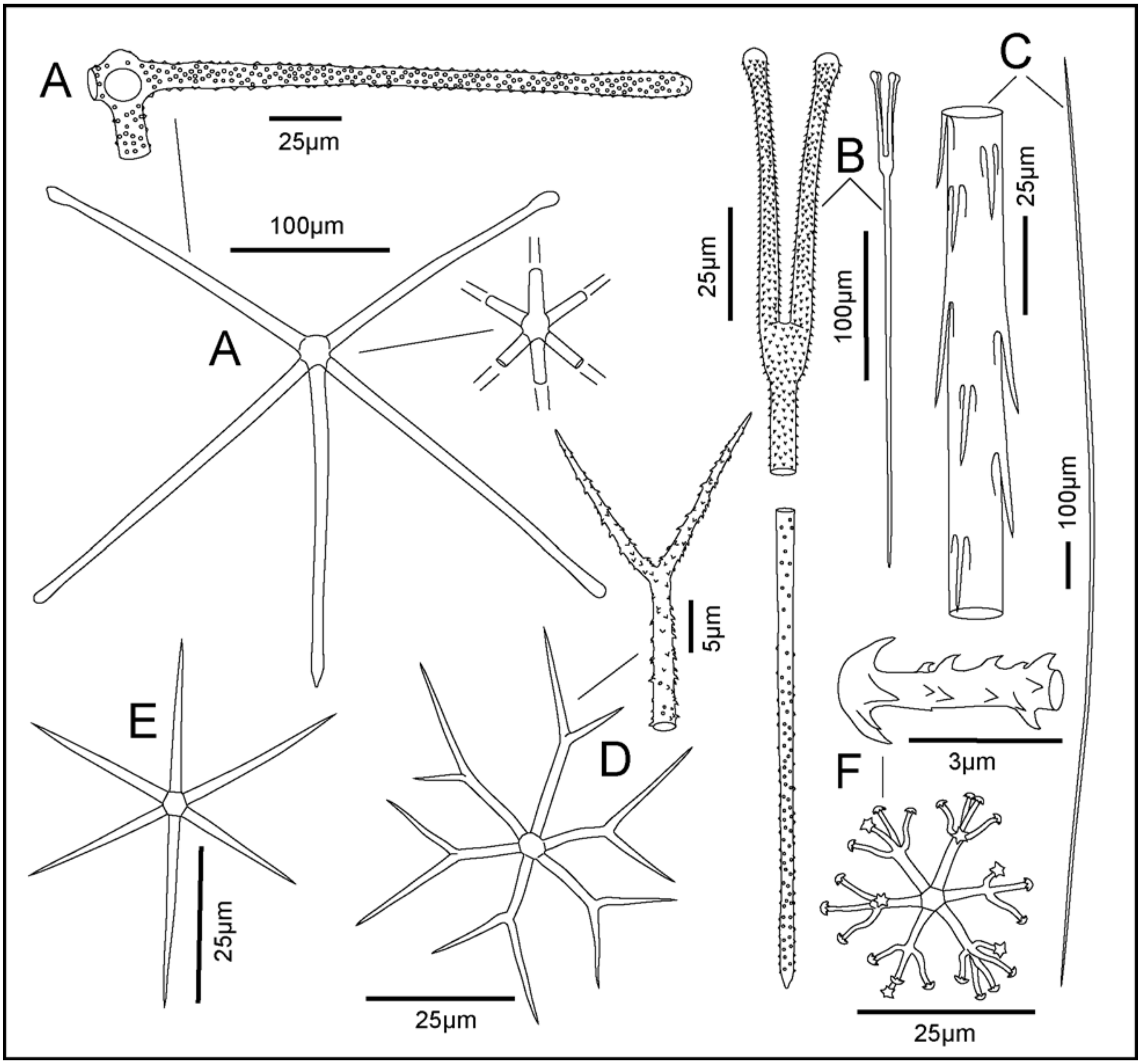


Figure 26. Spicules of *Lefroyella ceramensis* Ijima, 1927, NIWA 62084. A, surface pentactin and centre of rare hexactin. B, subtylote scopule, whole and upper end. C, uncinate, whole and enlargement of middle segment. D, oxyhexaster, whole and enlargement of primary and terminal rays. E, oxyhexactin. F, discohexaster, whole and enlargement of terminal ray end.

with 4–8 marginal teeth; these spicules appear entirely smooth in LM but are clearly entirely covered in small reclined spines in SEM.

Remarks: The specimens agree with the description of *L. ceramensis* given by Ijima (1927) in all particulars except four: 1) beam width ranges to smaller sizes (6.6–88.6 µm vs 40–90 µm in Ijima's description); 2) maximum length of the internal rectangular meshes is smaller (to 925 µm vs to 1.25 mm in Ijima's description); 3) maximum dermal mesh size is larger (588 µm vs 385 µm in Ijima's description); 4) the live specimen is a medium-aspect funnel while Ijima's specimens and the washed-out New Zealand specimen are more tubular and high-aspect. These are considered trivial intraspecific variations and no barrier to assignment of both of the new specimens to *L. ceramensis*.

The live New Zealand specimen is the first member of the species with intact spiculation; it provides a second spiculation pattern for the genus *Lefroyella*. The Pacific *L. ceramensis* and the Atlantic *L. decora* are nearly indistinguishable in body form and dictyonal skeleton, but *L. ceramensis* has no development of the transverse ridges of the dermal surface seen in *L. decora*. The two species differ in many items of spiculation. *Lefroyella decora* has smooth beams, two sizes of scopules, uncinates with bushy anterior ends, and spherical microscleres that bridge onychohexasters and discohexasters in form. *Lefroyella ceramensis* has entirely spined beams, one smaller size scopule, uncinates without bushy anterior ends, and stellate discohexasters clearly not like onychohexasters. The prevalence of small anthozoan polyps in almost all of the tubular dermal structures of the fresh *L. ceramensis* specimen raises the question of whether these symbionts induce formation of the external tubular structures by the sponge. There is no report of similar symbionts in *L. decora*, but they should be searched for in well-preserved wet specimens.

Key diagnostic characters:

- Body form is a moderately thick-walled, rigid funnel
- Outer surface is ragged with numerous short projecting fine tubes up to 6.5 mm long
- Inner surface bears radiating series of fine slits and holes in the live specimen
- Megascleres are pentactins, tyloscopules, and uncinates
- Microscleres are oxyhexasters, hemioxyhexasters, oxyhexactins, and small stellate discohexasters

Farreidae/Euretinae incertae sedis (Fig. 27)

Material examined:

Lord Howe Rise (*Australian EEZ*): QM G331685, NIWA Stn TAN0308/052, 29.239° S, 159.035° E, 1210–1395 m, 21 May 2003; QM G316641, NIWA Stn TAN0308/051, 29.228° S, 159.019° E, 810–1000 m, 21 May 2003; QM G316643, NIWA Stn TAN0308/050, 29.215° S, 158.984° E, 505–900 m, 21 May 2003.

North Norfolk Ridge (*Australian EEZ*): QM G316638, QM G331686, QM G316644, QM G331688, NIWA Stn TAN0308/043, 26.432° S, 167.181° E, 750–774 m, 18 May 2003; QM G331689, NIWA Stn TAN0308/040, 26.421° S, 167.187° E, 714–756 m, 17 May 2003.

Cavalli Seamounts: NIWA 43410, NIWA Stn KAH0204/32, West Cavalli, 34.162° S, 173.962° E, 780–810 m, 17 Apr 2002; NIWA 43398, NIWA Stn KAH0204/29, West Cavalli, 34.163° S, 173.962° E, 782–790 m, 17 Apr 2002; NIWA 43411, NIWA Stn KAH0204/40, West Cavalli, 34.164° S, 173.964° E, 805–820 m, 18 Apr 2002; NIWA 43415, NIWA Stn KAH0204/47, Seamount 441, 34.042° S, 174.817° E, 792–880 m, 19 Apr 2002; NIWA 62069, NIWA Stn KAH0204/07, Main Cavalli, 34.119° S, 174.152° E, 670–800 m, 14 Apr 2002.

Kermadec Ridge: NIWA 43442, NIWA Stn TAN0205/073, ridge west of Volcano L (Brimstone), 30.000° S, 178.0° W, 872–1086 m, 23 Apr 2002; NIWA 43441, NIWA Stn TAN0205/067, Volcano L, 30.046° S, 178.695° W, 414–795 m, 22 Apr 2002; NIWA 43432, NIWA Stn TAN0205/102, Volcano M1, 34.709° S, 178.575° E, 1115–1172 m, 28 Apr 2002; NIWA 43434, 43436, NIWA Stn TAN0205/012, Volcano D (Sonne), 34.091° S, 179.556° E, 1705–1930 m, 13 Apr 2002; NIWA 43435, NIWA Stn TAN0205/039, Volcano H, 32.605° S, 179.602° W, 1175–1252 m, 17 Apr 2002; NIWA 43444, NIWA Stn TAN0205/082, Volcano H, 32.000° S, 179.000° W, 1958–2312 m, 25 Apr 2002; NIWA 43430, NIWA Stn TAN0205/050, Volcano K, 31.084° S, 179.021° W, 981–1029 m, 20 Apr 2002; NIWA 43438, NIWA Stn TAN0205/049, Volcano K, 31.098° S, 179.106° W, 1248–1272 m, 20 Apr 2002; NIWA 43440, NIWA Stn TAN0205/060, Macauley Volcano, 30.160° S, 178.498° W, 636–751 m, 22 Apr 2002; NIWA 62053, NZOI Stn X693, 35.883° S, 177.925° E, 1664-1920 m, 14 Feb 1996.

Hikurangi Margin: NIWA 52962, NIWA Stn TAN0616/07, Rock Garden c. 35 km south-west of Ritchie Ridge, 40.039° S, 178.144° E, 749 m, 4 Nov 2006.

Chatham Rise: NIWA 52505, NIWA Stn TAN0705/189, 42.705° S, 178.341° E, 997–1042 m, 19 Apr 2007; NIWA 62026, NIWA Stn TAN9406/260, 43.858° S, 174.285° W, 754–1000 m, 06 Jul 1994; NIWA 51932, NIWA Stn TAN0104/150, 42.716° S, 179.906° W, 1181–1004 m, 18 Apr 2001; NIWA 51942, NIWA Stn TAN0104/387, 42.726° S, 179.898° W, 1100–1000 m, 20 Apr 2001.

North Chatham Rise, Graveyard seamount complex, Zombie Seamount: NIWA 51954, NIWA Stn TAN0104/337, 42.767° S, 179.923° W, 970–900 m, 20 Apr 2001; NIWA 25123, NIWA Stn TAN0604/009, 42.763° S, 179.925° W, 1019 m, 28 May 2006; NIWA 25149, NIWA Stn TAN0604/021, 42.766° S, 179.926° W, 906 m, 29 May 2006; NIWA 25171, 52532, NIWA Stn TAN0604/044, 42.766° S, 179.927° E, 932 m, 31 May 2006. *Graveyard Seamount*: NIWA 62095, NIWA Stn TAN0604/016, 42.765° S, 179.988° W, 993 m, 29 May 2006; NIWA 25151, NIWA Stn TAN0604/025, 42.758° S, 179.978° W, 1017 m, 29 May 2006; NIWA 25154, NIWA Stn TAN0604/027, 42.761° S, 179.971° W, 757–1095 m, 30 May 2006. *Scroll Seamount*: NIWA 25166, 25169 (part), NIWA Stn TAN0604/039, 42.788° S, 179.999° W, 1021 m, 30 May 2006. *Pyre Seamount*: NIWA 25181, 25235, NIWA Stn TAN0604/053, 42.717° S, 179.906° W, 1050 m, 31 May 2006; NIWA 25229, NIWA Stn TAN0604/104, 42.716° S, 179.906° W, 1005 m, 4 Jun 2006; NIWA 25279, NIWA Stn TAN0604/114, 42.717° S, 179.907° W, 1060 m, 7 Jun 2006. *Diabolical Seamount*: NIWA 25187, NIWA Stn TAN0604/096, 42.791° S, 179.987° W, 930 m, 4 Jun 2006. *Gothic Seamount*: NIWA 25230, NIWA Stn TAN0604/105, 42.727° S, 179.898° W, 992 m, 4 Jun 2006; NIWA 25234, 52526, 52527, 52530, NIWA Stn TAN0604/106, 42.727° S, 179.899° W, 1030 m, 5 Jun 2006; NIWA 25265, NIWA Stn TAN0604/112, 42.727° S, 179.898° W, 990 m, 7 Jun 2006. *Ghoul Seamount*: NIWA 25285, NIWA Stn TAN0604/115, 42.798° S, 179.986º W, 950 m, 7 Jun 2006; NIWA 25289, 25295, NIWA Stn TAN0604/116, 42.797º S, 179.986º W, 950 m, 7 Jun 2006; NIWA 25302, NIWA Stn TAN0604/117, 42.797º S, 179.985º W, 950 m, 7 Jun 2006; NIWA 52558, NIWA Stn TAN0604/118, 42.797º S, 179.988º W, 925 m, 7 Jun 2006.

Diamond Head, *Andes Seamounts*, *Chatham Rise*: NIWA 53558, NIWA Stn TAN0905/96, 44.133° S, 174.728° W, 850 m, 26 Jun 2009; NIWA 62150, NIWA Stn TAN0905/98, 44.147° S, 174.698° W, 720 m, 26 Jun 2009.

Bollons Seamount, *SE of Bounty Plateau*: NIWA 43449, NIWA Stn TAN0307/98, 45.017º S, 177.462º E, 1995–2039 m, 6 May 2003; NIWA 43447, NIWA Stn TAN0307/83, 49.768º S, 175.242º W, 1261–1278 m, 2 May 2003.

Macquarie Ridge: NIWA 52666, NIWA Stn TAN0803/33, Seamount 3, 50.091º S, 163.482º E, 1077–1408 m, 1 Apr 2008; QM G331859, QM G331860, NIWA Stn TAN0803/77, Seamount 7 (Australian EEZ), 53.738 º S, 159.114º E, 925–1014 m, 11 Apr 2008; QM G331861, NIWA Stn TAN0803/81, Seamount 7 (Australian EEZ), 53.731º S, 159.166º E, 1150–1270 m, 12 Apr 2008; QM G331862, NIWA Stn TAN0803/82, Seamount 7 (Australian EEZ), 53.729º S, 159.163º E, 1087–1160 m, 12 Apr 2008; QM G331863, QM G331864, QM G331865, NIWA Stn TAN0803/84, Seamount 7 (Australian EEZ), 53.705º S, 159.115º E, 998–1100 m, 13 Apr 2008; QM G331866, NIWA Stn TAN0803/98, Seamount 9 (Australian EEZ), 56.246º S, 158.506º E, 676–750 m, 16 Apr 2008; QM G331867, NIWA Stn TAN0803/100, Seamount 9 (Australian EEZ), 56.223º S, 158.461º E, 1248–1260 m, 16 Apr 2008; QM G331868, NIWA Stn TAN0803/102, Seamount 9 (Australian EEZ), 56.242º S, 158.462º E, 790–1025 m, 16 Apr 2008; QM G331869, NIWA Stn TAN0803/102, Seamount 9 (Australian EEZ), 56.242º S, 158.462º , 790–1025 m, 16 Apr 2008; NIWA 41088, NIWA Stn TAN0803/114, Seamount 10 (International waters), 59.065º S, 158.935º E, 1775–1973 m, 19 Apr 2008; NIWA 41093, NIWA Stn TAN0803/117, Seamount 10 (International waters), 59.051º S, 158.922º E, 1596–1781 m, 19 Apr 2008; NIWA 52658, 52663, NIWA Stn TAN0803/118, Seamount 10 (International waters), 59.047º S, 158.901º E, 1400–1615 m, 19 Apr 2008.

NON-TYPE MATERIAL DESIGNATED FARREIDAE/EURETINAE: *Casket Seamount*, *Graveyard seamount complex*, *Chatham Rise*: NIWA 53076, NIWA Stn TAN0905/36, 42.835° S, 179.986° E, 799 m, 17 Jun 2009. *Coffin Seamount*: NIWA 53436, NIWA Stn TAN0905/68, 42.772° S, 179.899° E, 1073 m, 22 Jun 2009. *Crypt Seamount*: NIWA 53060, NIWA Stn TAN0905/33, 42.627° S, 179.941° W, 1150 m, 17 Jun 2009. *Hartless Seamount*: NIWA 53254, NIWA Stn TAN0905/45, 42.671° S, 179.923° W, 1083 m, 18 Jun 2009. *Headstone Seamount*: NIWA 53263, NIWA Stn TAN0905/46, 42.675° S, 179.957° W, 1020 m, 18 Jun 2009. *Mummy Seamount*: NIWA 53279, NIWA Stn TAN0905/48, 42.644° S, 179.881° W, 1052 m, 18 Jun 2009. *Voodoo Seamount*: NIWA 53378, NIWA Stn TAN0905/65, 42.746° S, 179.925° W, 1050 m, 22 Jun 2009.

DISTRIBUTION: From Lord Howe Rise and North Norfolk Ridge (Australian EEZ) throughout southern Kermadec Ridge, south east to Chatham Rise, south to Bollons Seamount (Fig. 27A), and southwest along Macquarie Ridge.

HABITAT: Attached to hard substratum; depth range 414–2312 m.

DESCRIPTION:

The c. 255 fragments are washed-out, eroded frameworks of tubular stocks. Most are single axial tubes, increasing very gradually in diameter from base to the terminal osculum, and bearing lateral oscula, either alternating on opposite sides or distributed in a spiral pattern (Fig. 27B). A few are branching and anastomosing networks of tubules. A small number are merely basal attachment discs with the initial small tube element. Some are merely short tube segments of a stock of unknown shape (Fig. 27C). Some are solid stocks where constituent tubes have undergone thickening and extensive fusion (Fig. 27D). A very few are completely embedded in overgrowing demosponges.

Dimensions of fragments are mostly 20–40 mm in length but range from 6–109 mm. The constituent tubes are 3.3–9.3–21.6 mm (n = 118) in outside diameter.

Texture is stony and brittle.

Surface of all but one of the specimens is smooth; one specimen has a distinctive polygonal pattern of surface ridges bordering shallow pits (Fig. 27C). Channelisation is absent.

Colour varies from white to nearly black; most are shades of brown from light to dark.

Choanosomal skeleton of every one of these dead, eroded fragments is characterised by two, rarely three, primary layers of continuous longitudinal strands on the atrial surface, joined by fairly regular lateral connectives to form the rectangular mesh characteristic of farreoid and euretoid frameworks (Fig. 27E). Most have 1–3 layers of irregularly joined dictyonalia on the dermal side, forming a secondary dermal cortex with triangular meshes (Fig. 27F). In thick-walled forms, the dermal cortex may be composed of up to 10 layers of secondary dictyonalia. In the form with surface polygons, the ridges are built of patterned additions of cortical dictyonalia, the primary layer not being involved in this surface structure. Cortical dictyonalia are usually absent on the atrial surface, but occasional specimens may have an incomplete layer and forms with greatly

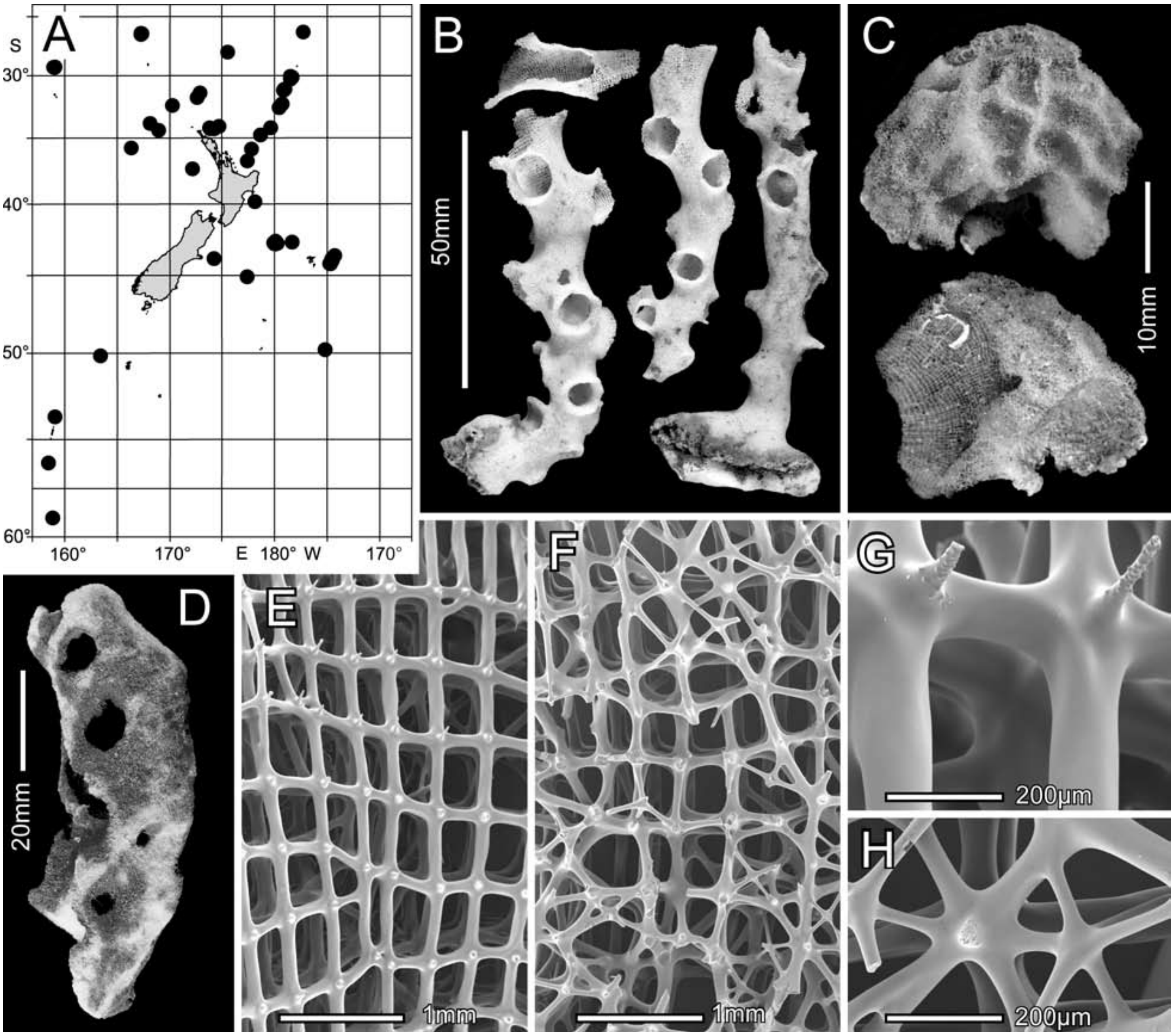


Figure 27. Farreidae/Euretinae incertae sedis, all SEMs from left fragment of panel B in fig., QM G316641. A, distribution in New Zealand and eastern Australian waters. B, typical fragment forms, QM G316641 part. C, fragment with surface ridges and pits, QM G331696. D, thickened form of fused tubes, NIWA 43444. E, atrial surface. F, dermal surface. G, high magnification of atrial surface. H, high magnification of dermal surface.

thickened walls may have two complete atrial cortical layers. Both primary (atrial) and secondary (cortical) dictyonal beams are usually smooth (Fig. 27G, H) but some very small basal fragments have sparsely spined beams. Atrial spurs are rough and digitate in form (Fig. 27G); dermal spurs are usually broken or eroded. Free spicules are entirely absent from these fragments.

Remarks: The presence of primary atrial rectangular-meshed skeletons with continuous longitudinal strands and tubular body forms with lateral oscula or branches indicates that members of Farreidae or Euretinae produced these fragments. Since no portions of the frameworks are single layers, none can be assigned unequivocally to Farreidae, although most of them were probably produced by known species of that family. Without loose spicules, a generic assignment of these specimens is not possible. The single specimen with distinctive polygonal surface ridges and pits, QM G316638, does not conform to any known spicule-bearing form, and once again suggests that more species of Hexactinellida remain to be discovered in the New Zealand and eastern Australian areas.

Key characters:

- Body form is a tubular stock with short or anastomosing lateral branches

- Outer tube diameters vary from 3.3–21.6 mm
- Channelisation and hypersilicification are absent
- Atrial skeletons are two layers of regular rectangular meshes with long continuous longitudinal strands
- A secondary dermal cortical framework of 1–10 layers is present
- Beams of both framework components are generally smooth
- All nodes are simple and unswollen
- Free spicules are entirely lost

Euretinae incertae sedis (Fig. 28)

MATERIAL EXAMINED:

North Norfolk Ridge (*Australian EEZ*): QM G316639, NIWA Stn TAN0308/043, 24.432° S, 167.181° E, 750–774 m, 18 May 2003.

DISTRIBUTION: Known only from North Norfolk Ridge (Australian EEZ) (Fig. 28A).

HABITAT: Attached to hard substratum; depth range 750–774 m.

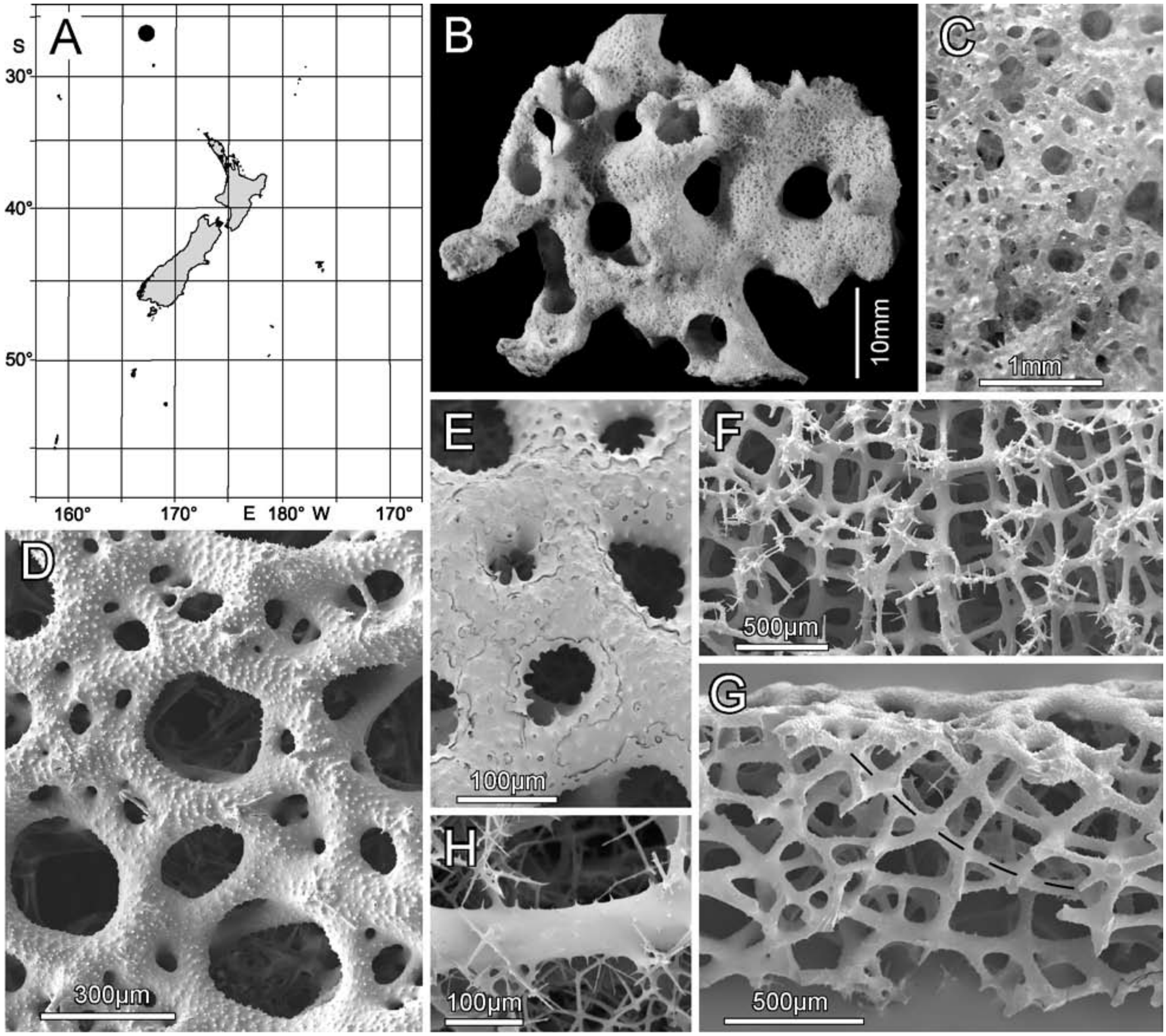


Figure 28. Euretinae incertae sedis. A, distribution in eastern Australian waters. B, largest of 3 fragments of QM G316639. C, outer surface with epirhyses apertures (LM). D, outer surface of least hypersilicified fragment showing apertures of large epirhyses and smaller dictyorhyses. E, outer surface of most hypersilicified and eroded fragment. F, atrial surface with longitudinal strands running vertically and apppended cortical dictyonalia and microhexactins. G, longitudinal section showing longitudinal strands curving to thickened dermal surface. H, high magnification of fine-spined beam and appended microxyhexactins.

DESCRIPTION:

The three fragments are washed-out, eroded frameworks of branching and anastomosing tubular stocks, with attachment base retained only in the largest fragment (Fig. 28B).

Dimensions of fragments are 46 x 51 mm, 30 x 35 mm, 29 x 33 mm; all are about 20 mm in the third dimension. Tubules are 5.6–7.0–7.9 mm (n = 16) in outside diameter with 0.8–1.3–1.6 mm (n = 15) thick walls.

Texture is stony and brittle.

Surface of the relatively smooth outer surfaces of the tubules is permeated by small shallow apertures of epirhyses, 0.14–0.30–0.65 mm in largest diameter (Fig. 28C–E).

Colour light beige.

Choanosomal skeletons of these dead, eroded fragments are dominated by hypersilicification of the outer dermal layer (Fig. 28D, E, G). The degree of hypersilicification is uniform within each fragment but differs between them, suggesting these are from three different specimens belonging to the same species. Dermal beams are 13–82–176 µm in thickness but this character varies greatly with the degree of hypersilicification. Dictyorhyses openings between the epirhyses apertures of the outer surface are 10–50–105 µm in diameter but grade down to nothing where openings are completely occluded by silica deposition. Small conical spines spaced 7.4–19.2–32.5 µm (n = 87) apart cover the external thickened beam surfaces; surface spurs are absent (Fig. 28D, E), possibly enclosed by hypersilicification. The atrial surfaces have longitudinal strands joined by lateral beams to form fairly regular rectangular meshes, but the surface is obscured by small appended oxyhexactins, ray lengths 41–90–150 µm (n = 68), attached to atrial spurs (Fig. 28F). The longitudinal strands do not run continuously along the atrial surface, but are short in length and curve outwards to the dermal surface (Fig. 28G). A clear distinction between primary and secondary dictyonal layering is absent; the internal meshwork is relatively uniform. Internal beams are 153–275–388 µm (n = 50) in length and 26–60–95 µm (n = 60) in width. All internal beams are covered with small conical spines (Fig. 28H) similar to those of the outer surface. All internal nodes are simple and not swollen. In many places of the larger fragment, the small oxyhexasters fused to beams occur in dense nests with extensive synapticula development between them. No proper free spicules remain associated with these frameworks.

REMARKS: These fragments can be confidently assigned to the subfamily Euretinae by their possession of a pseudo-euretoid framework (longitudinal strands with mainly rectangular meshes), their branching tubular form, and lack of schizorhyses. They are very unlikely to have been formed by a member of Farreidae because of the lack of continuous longitudinal strands as primary framework elements. The combination of epirhyses, spined beams, simple unswollen nodes, and surface hypersilicification prevent their assignment to any of the known Euretinae, either with or without spicules. Until specimens with spicules are collected, these fragments cannot be placed to genus, and must remain incertae sedis within Euretinae.

KEY CHARACTERS:

- Body form is a network of branching and anastomosing 5.6–7.9 mm diameter tubes
- Small epirhyses are present and the outer surface is hypersilicified
- Longitudinal strands are short and curve to the dermal surface
- There are no distinct primary and secondary dictyonal layers
- All beams are ornamented with small conical spines
- All nodes are simple and unswollen
- Free spicules have been entirely lost

CHONELASMATINAE Schrammen

Chonelasmatidae Schrammen, 1912: 190.
Chonelasmatinae Reid 1958: 15; Reiswig & Wheeler 2002: 1318.

Euretidae with the basic body form of a tube, funnel, fan, or blade, with or without lateral oscula, sometimes on projections of the body wall, but without dichotomous branching of the main body axis. Primary osculum represented by terminal aperture in tube or funnel body forms, or the expanded exhalant surface of blade- or fan-shaped forms; accessory oscula may be apertures flush on the lateral body or on projected short or extended, sometimes branching, tubule systems; channelisation may be absent or consist of epirhyses with or without aporhyses, or amararhyses in one genus; very elongate rectangular dictyonal meshes and conspicuous transverse lamellae are common in the primary framework of most genera but may be absent in some; dermalia and atrialia (where differentiable) are pentactins or pinular hexactins; uncinates and scopules are present in all but one genus; microscleres are oxyhexasters and/or discohexasters (modified from Reiswig & Wheeler 2002).

REMARKS: Prior to this work, only two species of Chonelasmatinae were known from New Zealand waters, *Chonelasma lamella* Schulze, 1886, and *C. hamatum* Schulze, 1886, both reported from the original HMS *Challenger* collections. They are included in the summaries of both Hutton (1904) and Dawson (1993). New specimens of both are reported here and three new species are described.

TYPE SPECIES: *Chonelasma lamella* Schulze, 1886.

Chonelasma Schulze

Chonelasma Schulze, 1886: 76; Schulze 1887: 320; Ijima 1927: 165; Reiswig & Mehl 1994: 153; Reiswig & Wheeler 2002:1320.
Leptophragmella Reid, 1963: 226.

Chonelasmatinae of funnel- or fan-shaped or unascertained body form with walls composed of a primary layer with elongate rectangular meshes and nodes aligned transversely to form dictyonal lamellae (ranks); an irregular-meshed cortical layer with epirhyses always present on dermal side; atrial surface with or without a cortex that may bear aporhyses; dictyonal beams sparsely spined but thicker strands often smooth; dermalia and atrialia are usually pentactins bearing conspicuous large spines on outer surfaces or may be hexactins with small spines; spiny choanosomal mesohexactins, uncinates, and scopules with indistinct tine tip swellings in all species; microscleres include oxyhexactins and oxyhexasters and/or discohexactins and discohexasters grading to onychohexactins and onychohexasters (modified from Reiswig & Wheeler 2002).

REMARKS: Prior to this report, the genus contained four species, *C. lamella* (Kermadec Islands, New Zealand), *C. doederleini* Schulze, 1886 (Japan), *C. choanoides* (North Atlantic to Antarctica, Indian Ocean?), and *C. ijimai* Topsent, 1901b (East Atlantic). The poorly known *C. hamatum* (Kermadec Islands, New Zealand) was transferred with hesitancy to *Heterochone* by Ijima (1927), but new material shows it is unquestionably a member of *Chonelasma* and it is here returned to its original position. Three new species are also described, bringing the genus content to eight species. *Chonelasma* is worldwide in distribution with previous known occurrences concentrated mainly in North Atlantic and Antarctic waters; depth range is 823–5600 m.

TYPE SPECIES: *Chonelasma lamella* Schulze, 1886.

Chonelasma lamella Schulze, 1886 (Figs 29, 30)

Chonelasma lamella Schulze, 1886: 76; Schulze 1887: 320; Ijima 1927: 165; Reid 1964: xcix; Reiswig & Mehl 1994: 153; Reiswig & Wheeler 2002: 1320.
not *Chonelasma lamella* Barthel & Tendal 1994: 61 (mixture).
not *Chonelasma lamella choanoides* Schulze & Kirkpatrick, 1910a: 302; 1911: 48.

MATERIAL EXAMINED:

Lord Howe Rise: NIWA 69563, NIWA Stn TRIP3246/7, 34.191° S, 162.652° E, 443–503 m, 26 Dec 2010.

West Norfolk Ridge: NIWA 62120, 62127, NIWA Stn Z10989, 33.887° S, 167.938° E, 1082 m, 22 Jan 2002; NIWA 66079, NIWA Stn TRIP2886/3, 34.017° S, 167.501° E, 767–1044 m, 21 Jun 2009; NIWA 70614, NIWA Stn TRIP2474/41, 34.488° S, 168.745° E, 890–1026 m, 3 Aug 1982.

Three Kings Ridge: NIWA 34862, NZOI Stn U582, 31.862° S, 172.453° E, 790 m, RV *Rapuhia*, 5 Feb 1988; NIWA 70609, NIWA Stn Z9803, 31.321° S, 172.639° E, 810 m, 23 Jun 1999; NIWA 70634, NZOI Stn U603, 31.893° S, 173.143° E, 1780 m, 8 Feb 1988; NIWA 70641, NZOI Stn U601, 31.332° S, 173.085° E, 1570 m, 9 Feb 1988.

West of Three Kings Islands: NIWA 70608, NIWA Stn Z9815, 34.446° S, 171.617° E, 934 m, 22 Jun 1999.

North of North Cape: NIWA 70613, 70639, NIWA Stn Z9801, 34.799° S, 171.673° E, 884 m, 21 Jun 1999.

West of North Cape, *Northland*: NIWA 69038, NIWA Station Z9817, 34.805° S, 171.670° E, 934 m, 19 Jun 1999; NIWA 70611, NIWA Stn Z9818, 34.591° S, 171.821° E, 974 m, 22 Jun 1999; NIWA 70612, NIWA Stn Z9817, 34.805° S, 171.671° E, 934 m, 19 Jun 1999; NIWA 70638, NIWA Stn Z9816, 34.805° S, 171.668° E, 938 m, 18 Jun 1999.

Northland Northeast Continental Shelf: NIWA 70637, NIWA Stn TRIP2414/6, 34.197° S, 175.063° E, 710–900 m, 21 Apr 2007.

Cavalli Seamounts: NIWA 43417, NIWA Stn KAH0204/50, Seamount 441, 34.049° S, 174.808° E, 800–790 m, 19 Apr 2002; NIWA 43420, NIWA Stn KAH0204/52, Seamount 441, 34.055° S, 174.808° E, 910–820 m, 19 Apr 2002; NIWA 43397, NIWA Stn KAH0204/29, West Cavalli, 34.163° S, 173.962° E, 790–782 m, 17 Apr 2002.

Bay of Plenty: NIWA 70610, NIWA Stn Z9181, 37.023° S, 176.718° E, 972 m, 20 Jul 1998.

Northeast of Challenger Plateau: NIWA 62170, NIWA Stn KAH0006/50, 37.505° S, 172.228° E, 960–1060 m, 24 Apr 2000.

Southern Kermadec Ridge: NIWA 70616, NZOI Stn X665, 35.336° S, 178.539° E, 1260–1312 m, 12 Feb 1996.

Northeast Chatham Rise: NIWA 43451, NIWA Stn TAN0408/23, 42.829° S, 177.422° E, 824–826 m, 13 Jul 2004; NIWA 50609, NIWA Stn TRIP2626/32, 44.672° S, 175.263° W, 1089–1211 m, 17 May 2008. *Graveyard seamount complex*, *Coffin Seamount*: NIWA Stn TAN0905/68, 42.772° S, 179.899° E, 1073 m, 22 Jun 2009.

East Chatham Rise, *Andes Seamounts*, *Diamond Head*: NIWA 53652, 62148, NIWA Stn TAN0905/98, 44.147° S, 174.698° W, 720 m, 26 Jun 2009; NIWA 54113, NIWA

Stn TAN0905/114, 44.151° S, 174.768° W, 830 m, 27 Jun 2009.

Off Banks Peninsula: NIWA 70617, NZOI Stn X491, 43.858° S, 174.285° W, 754–1000 m, 6 Jul 1994.

COMPARATIVE MATERIAL: Lectotype NHMUK 1877.10.20.135, HMS *Challenger* Stn 170A, off Raoul Island, Kermadec Islands, 29.750° S, 178.183° W, 1152 m, 14 Jul 1874.

DISTRIBUTION: Circum New Zealand waters, from Lord Howe Rise, south to Kermadec Ridge and Three Kings Ridge, both sides of North Cape and Chatham Rise (Fig. 29A). Reports of this species from other locations are incorrect species determinations (Reiswig & Wheeler 2002).

HABITAT: Attached to hard substratum by a basal plate; depth range 782–1152 m.

DESCRIPTION:

Morphology of the original *Challenger* fragment was a slightly undulating, nearly flat plate-like fragment lined by a loose pentactin lattice overlying small openings to vertical channels on both surfaces (see cover image, lower left, and Fig. B of Frontispiece, for probable form in life). It was redescribed by Reiswig and Mehl (1994) and Reiswig and Wheeler (2002). The new specimens consist of 85 broken fragments (Fig. 29B, C), most of which are slightly curved plates of moderate and even thickness, most having the same surface forms as the original type specimen, a lattice covering small openings of vertical epirhyses and aporhyses channels. The largest, thickest, and clearly most mature specimen, NIWA 69038, has on the dermal surface thick ridges that lack a clear orientation (Fig. 29D). The atrial surface of the same fragments have ridges and aporhyses arranged longitudinally (Fig. 29E), radiating to the growth margin. Some fragments

Table 14. Spicule and framework dimensions (µm) of *Chonelasma lamella* Schulze, 1886.

Parameter	**NIWA 34862** **mean**	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	167	43	92–250	50
tangential ray width	12.6	4.6	5.6–23.3	50
proximal ray length	247	143	96–613	50
proximal ray width	12.5	4.4	6.4–22.2	50
Scopule length	164	22	125–225	50
head length	16.7	2.9	11.1–25.3	50
tine length	12.8	2.7	7.1–20.2	50
Uncinate length	2656	531	1562–4032	50
width	11.9	2.2	7.4–17.9	50
Mesoxyhexactin ray length	101	14	73–131	50
Oxyhexaster diameter	77.1	10.8	53.7–98.2	50
primary ray length	4.8	0.9	3.2–6.5	50
secondary ray length	32.8	3.8	26.3–42.6	50
Microxyhexactin diameter	79.3	7.8	66.2–103.1	50
Dermal cortex framework:				
epirhysis major diameter	775	125	549–1104	50
beam length	377	79	218–558	50
beam width	64.4	15.2	32.8–106.8	50
Primary layer, septa spacing	605	195	357–717	42
longitudinal beam width	80	19	43–103	15
transverse/radial beam length	490	93	357–717	18
transverse/radial beam width	85	14	62–113	19
Atrial cortex framework:				
aporhysis major diameter	914	244	545–1667	46
beam length	375	103	146–575	50
beam width	74.9	22.4	33.8–138.5	50

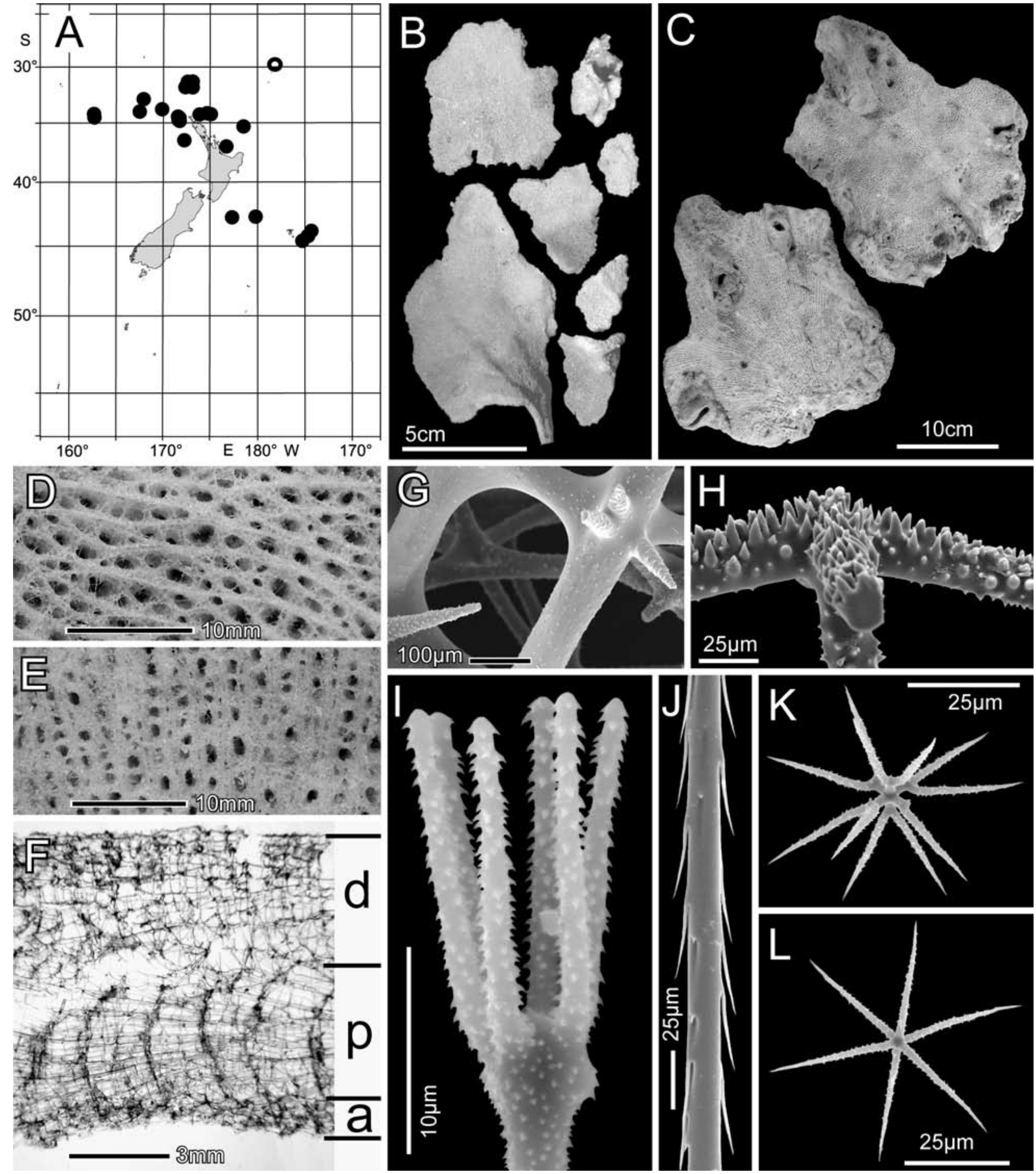


Figure 29. *Chonelasma lamella* Schulze, 1886, NIWA 34862. A, distribution in New Zealand waters; open circle is original lectotype location; filled circles location of new collections. B, NIWA 34862 from Three Kings Islands. C, largest fragment of NIWA 69038 from WSW of North Cape, upper right dermal view, lower left atrial view. D, close view of dermal surface of NIWA 69038. E, close view of atrial surface of same. F, cleaned vertical-longitudinal section of the dictyonal framework of same, growth direction to left; d = dermal cortex, p = primary dictyonal layer, a = atrial cortex (LM). G, close view of dermal cortex. H, central part of pentactin. I, upper end of scopule. J, middle part of uncinate. K, oxyhexaster. L, microxyhexactin.

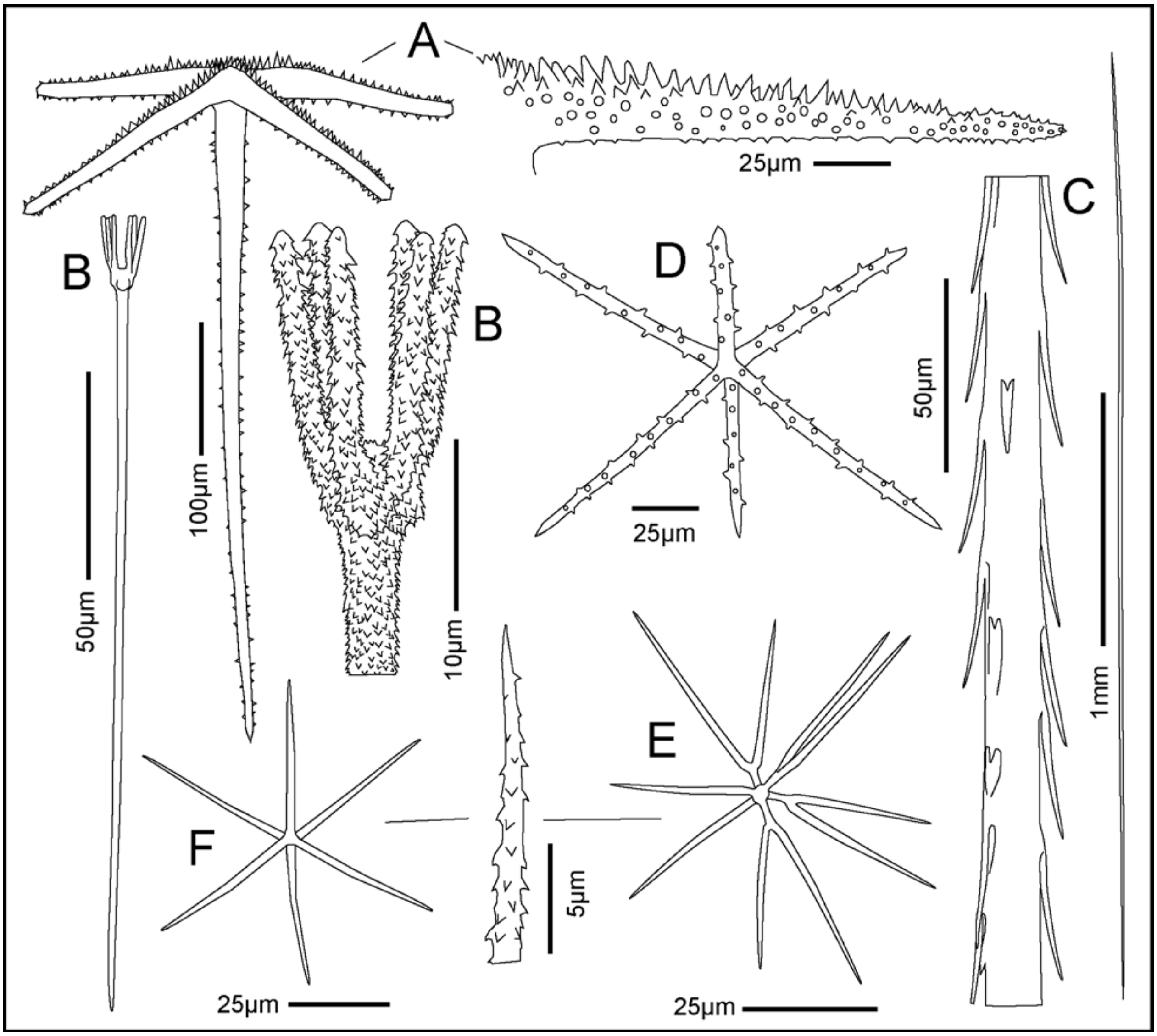


Figure 30. Spicules of *Chonelasma lamella* Schulze, 1886, NIWA 34862. A, surface pentactin, whole and enlargement of tangential ray. B, strongylote scopule, whole and upper end. C, uncinate, whole and enlargement of middle segment. D, mesoxyhexactin. E, F, hemioxyhexaster and oxyhexactin, respectively, with enlargement of ray tip.

appear to be tight foldings of the plates with fusion of the two reflected surfaces. Spiculation of all fragments with spicules is identical and it is likely that single specimens were encountered at each of the six new stations and broken during collection. Overall body form is a single or series of leaf-like fronds forming a planar fan, quite thick (>1.5 cm) in the largest sponges. Surfaces are differentiated here as dermal and atrial on the basis of known differences in other hexactinellids where fragment curvature is consistent: dermal surface is usually exterior and convex while the atrial surface is usually interior and concave. An additional signature for *Chonelasma* species is the greater thickness of the dermal cortex and relatively thin atrial cortex (Fig. 29F).

Dimensions of largest plate-like fragment are 26.4 x 22.8 cm in length and breadth, with general wall thickness of the plate being 16.5 mm. Horizontal dimensions of the other fragments are typically 1.7–10 cm, with general wall thicknesses of 3–10 mm.

Texture is stony hard and brittle.

Surface is smooth overall without large prostalia; uncinates project in abundance from all surfaces but they are not generally apparent to the naked eye.

Colour light beige.

Choanosomal skeleton is mainly a fused dictyonal framework of simple hexactins forming three very distinct layers, a dermal cortex, a primary (middle) layer, and an atrial cortex (Fig. 29F). The dermal cortex is constructed of dictyonalia connected irregularly, forming mostly triangular and quadrangular meshes without longitudinal strands. This layer is 0.2–5.7 mm in thickness and is penetrated by numerous epirhyses, the openings of which are obvious in surface view. The atrial cortex may be similar to the dermal cortex in structure, but while openings to aporhyses are slightly larger they are usually not as apparent since this cortex is often thinner. The thicker and less dense middle (primary) layer, 1.9–6.0 mm in thickness, is constructed of dictyonalia organised with appreciable regularity although addition of secondary dictyonalia may obscure the order in places; nodes are aligned transversely to form septa or ranks oriented vertically and parallel to the growing margin (Fig. 29F); longitudinal beams are aligned to form longitudinal strands. Individual longitudinal strands can be followed over 5–10 meshes but they are not continuous through extended regions of the framework since they curve gently toward both dermal and atrial surfaces and merge into the irregular cortices. Meshes in the middle layer are prismatic, elongate in the direction of growth and narrower in both radial and lateral directions. Although many dictyonalia appear to be added onto the primary framework, these attain dimensions of the regular dictyonalia; short-rayed hexactins commonly added to dictyonal frameworks of other species are not present in this skeleton. Spurs in all regions of the framework are rough, long, and sharply pointed. All beams are uniformly ornamented with small conical spines (Fig. 29G). Nodes are not swollen. Loose spicules in the choanosomal region include spiny mesoxyhexactins, uncinates, and microscleres.

Ectosomal skeleton consists mainly of a lattice of loose pentactins overlying all surfaces and covering entrances to epirhyses and aporhyses. Scopules associated with the surface pentactins project vertically, head outwards. Uncinates project anterior end outwards on all surfaces. Microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 14) are surface pentactins, scopules, uncinates, and mesoxyhexactins. The pentactins (Figs. 29H, 30A) which occur on both dermal and atrial surfaces are medium-size and characterised by large spines borne on outer and lateral surfaces of the tangential rays; tangential rays taper to bluntly rounded or rarely sharply pointed tips; tangential rays are bent backwards (down) 5–20° from the perpendicular to the proximal ray; proximal ray length is highly variable from approximately the same as tangential rays to three times their length. Scopules (Figs. 29I, 30B) occur as a single type and class, with short head composed of a wide neck carrying 2–4–6 slightly spreading tines ending in strongylote (finger-like) ends; the shaft tapers smoothly to a sharp point; they are entirely covered with small hook-like spines inclined towards the shaft end. The uncinates (Figs. 29J, 30C) are of normal size and form for the genus, with well-developed brackets and moderately long barbs projecting up to 10° from the spicule surface; many appear biserial with well developed barbs in two opposite series while only small undeveloped barbs occur on the intermediate faces. Mesohexactins (Fig. 30D) are sparsely but coarsely spined with cylindrical rays ending in sharp tips; the largest of these approach the smallest pentactins in size.

Microscleres (Table 14) are predominately oxyhexasters and hemioxyhexasters (63%), oxyhexactins (32%) and a few abnormal oxystauractins, oxypentactins, and spiroxyhexactins (together about 5%). Oxyhexasters (Fig. 29K) and hemioxyhexasters (Fig. 30E) have very short primary rays, each bearing 1–2–4 long, straight, robust, tapering secondary rays; all surfaces are rough in LM, and covered in short reclined hooks in SEM. The oxyhexactins (Figs. 29L, 30F) and rare abnormal forms all have the same ray shape and ornamentation. No onycho- or disco-tipped microscleres were observed.

REMARKS: The new specimens agree fairly well with the single previously known fragment of *C. lamella* but there are some differences between the two; note that spicule dimensions were obtained only for NIWA 34862. The lectotype is 12.5 mm in thickness, intermediate among the new specimens. Mean spacing of the primary layer septa of the lectotype is 1.38 mm vs. 0.61–1.03 mm in the new specimens. Spicule dimensions of the lectotype (in Reiswig & Mehl 1994) are mostly 30% (5–55%) larger than those of NIWA 34852. The characters which are here considered important in deciding assignment of the new specimens to *C. lamella* are 1) the overall skeletal framework form is identical in both, 2) the set of megasclere types is identical in both, 3) scopule size is similar, 123 vs 101 µm mean total length, 4) scopule shape is identical in both; mean head length to total length ratio is 0.010 in both, and 5) predominance of oxy-tipped microscleres, 84 vs 100% in both. In view of these strong similarities and the lack of more details on the range of variation of skeletal elements of *C. lamella*, it is concluded that the new specimens are most likely members of the local *C. lamella* population and they are assigned to this species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is likely to be planar fan of leaf-like fronds
- Both sides bear small canal openings about 1 mm in diameter
- Dictyonal framework is three-layered with outer layers irregular in structure

- Middle layer is less dense, with elongate meshes and radio-lateral septa
- Loose pentactins have very large spines on distal surfaces
- Scopules consist of a single type and are less than 200 µm in mean length
- Microscleres are predominately oxyhexasters, hemioxyhexasters, and oxyhexactins

Chonelasma glaciale n. sp. (Figs 31, 32)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 70546, Stn Trip 2474/37, S edge of Norfolk Ridge, 34.533° S, 168.792° E, 820–926 m, FV *Hiroshima*, 2 Aug 2007.

TYPE LOCALITY: S edge of Norfolk Ridge.

DISTRIBUTION: Known only from the type locality (Fig. 31A).

HABITAT: Probably attached to hard substratum but no attachment points present; depth 820–926 m.

DESCRIPTION:

Morphology as a single extremely thick, irregular ovoid plate, cut into five pieces after collection to fit into available containers (Fig. 31B). The more convoluted (dermal) side bears closely-spaced, small, round apertures as terminal openings of vertical channels (epirhyses) easily visible to the naked eye, with a loose spicule lattice covering most (Fig. 31C, D), but worn off small areas of that surface. The other flatter (atrial) side has conspicuous, thick, parallel, longitudinal framework bands of the primary layer visible just below the outer surface (vertical light structures in Fig. 31E, F), which are overlaid by much thinner transverse ridges. Proximal ends of the epirhyses channels are visible between the thick primary bands; small actiniarian polyps occur sparsely in pockets of the atrial surface. Aporhyses are not present on the atrial side.

Dimensions of the original plate, reconstructed from joined fragments, are 22 x 17 x 6.5 cm; the three largest fragments range from 11.8–17.2 cm in length, 3.5–7.7 cm in breadth, and 3.6–6.5 cm in thickness.

Texture is stony hard and friable.

Surface has considerable undulation of the dermal side but topology at finer level is smooth.

Colour light beige.

Choanosomal skeleton is a fused dictyonal framework of simple hexactins forming two somewhat indistinct layers, a very thick dermal cortex (24–58 mm) and a moderate primary layer (5–6.5 mm) (Fig. 31G, H). The dermal cortex is bipartite, the lower main sublayer is constructed of extensions of the longitudinal strands of the primary layer that gradually curve outwards 90° to become radial strands and form the main support members of radial epirhyses walls; connecting beams are mainly perpendicular and meshes of this region are mainly elongate-quadrangular. Radial strands continue into the distal sublayer of the dermal cortex (4 mm thick (upper dark layer in Fig. 31G, H)) but beams are thickened and connecting beams are more closely spaced and irregularly oriented here, resulting in a finer triangular meshwork forming the distal epirhyses walls. The transition between dermal cortex and primary layer is indistinct, defined either by the beginning of longitudinal strand curvature or bottom of epirhyses. In the primary layer, main dictyonalia are regularly organised with nodes of the longitudinal strands aligned in radio-lateral planes (traditional septa) and meshes being elongate and prismatic. Regularity is obscured by addition of secondary dictyonalia. Longitudinal strands are not distributed evenly throughout this layer but in the lower half are grouped into tight bands forming the dense parallel longitudinal structures visible by eye under the atrial surface. The spaces between bands have no skeleton and constitute a unique system of longitudinal channels 1.4–1.9–2.5 mm in diameter (Fig. 31G bottom), unknown in any other member of the genus. Occasional lateral connections occur between these channels, but their distribution has not been systematically investigated. In the lowermost part of the primary layer dictyonalia in septal areas are thickened; supplementary dictyonalia are added here, and the thickened septal areas project slightly from the atrial surface. This specialised area remains part of the primary layer since the basic dictyonalia remain unchanged and the elongate prismatic meshes extend to the atrial surface. There is thus no atrial cortex and no aporhyses. Although sparse dictyonalia are appended to beams throughout the framework, most of these attain dimensions of the loose mesohexactins or regular dictyonalia; the short-rayed microxyhexactins commonly added to dictyonal frameworks of other dictyonal hexactinellids are absent. Spurs in all regions of the framework are rough, long and either sharply pointed or terminally inflated. All beams are uniformly ornamented with small conical spines (Fig. 31J). Nodes are not swollen. Loose spicules in the choanosomal region include spiny mesoxyhexactins, uncinates, and microscleres.

Ectosomal skeleton of the dermal surface consists of a quadrangular lattice of loose pentactins covering the framework and epirhyses apertures. The loose pentactins of the atrial surface, however, are restricted to the ridges; they do not form a continuous quadrangular lattice over gaps between ridges. Scopules associated with the surface pentactins project vertically, head outwards; they are extremely sparse on the dermal surface but abundant on the atrial surface. Uncinates project anterior end outwards on all surfaces. Microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 15) are surface pentactins, scopules, uncinates, and mesoxyhexactins. Medium size pentactins (Figs. 31K, 32A, B) occur on both dermal and atrial surfaces but they differ somewhat in shape. Both are characterised by large spines borne on outer and lateral surfaces of the tangential rays which are reclined 2–10° and taper to bluntly rounded or rarely sharply pointed tips. Proximal ray length is highly variable from much shorter to three times the length of tangential; although there is considerable overlap in size and shape, those from the dermal side have longer proximal rays while atrial pentactins have shorter proximal rays. Scopules (Figs 31L, 32D) occur as a single type and class, with long head composed of a smoothly tapering neck carrying 2–4–6 straight, slightly spreading tines ending in very small discs; the shaft tapers smoothly to a sharp point; they are entirely covered with small hook-like spines inclined towards the shaft end. Uncinates (Figs 31M, 32E) are very large

Table 15. Spicule and framework dimensions (µm) of *Chonelasma glaciale* n. sp.

Parameter	**NIWA 70546** **mean**	**s. d.**	**range**	**no.**
Dermal pentactin:				
tangential ray length	276	42	169–399	50
tangential ray width	20.8	5.5	8.2–33.3	50
proximal ray length	424	171	99–751	50
proximal ray width	20.4	5.2	6.7–30.4	50
Atrial pentactin:				
tangential ray length	263	52	161–422	50
tangential ray width	17.3	7.2	7.9–58.1	50
proximal ray length	252	159	102–835	50
proximal ray width	17.1	6.1	7.6–48.2	50
Scopule length	479	95	297–656	50
head length	66.3	12.0	38.2–84.1	50
tine length	55.4	10.3	30.9–72.5	50
Uncinate length	4519	990	2425–6321	52
width	22.3	3.9	12.1–29.3	52
Mesoxyhexactin ray length	212	46	119–374	50
width	10.7	3.0	4.7–21.1	50
Microxyhexactin diameter	90.1	12.8	64.9–115.5	50
ray width	1.6	0.4	1.0–2.8	50
Hemioxyhexaster diameter	96.9	14.8	58.8–116.7	25
primary ray length	5.8	1.2	3.9–9.6	25
secondary ray length	42.7	6.9	24.5–53.3	25
Dermal cortex framework:				
epirhysis major diameter	1616	309	856–2753	50
beam length	499	140	260–887	50
beam width	67.2	26.3	21.3–138.8	50
Primary layer, septa spacing:	1835	213	1468–2142	10
longitudinal band spacing	3459	560	2300–4852	50
longitudinal beam length	1092	583	154–2132	50
longitudinal beam width	38.8	18.7	14.6–84.3	50
transverse/radial beam length	362	103	137–600	50
transverse/radial beam width	45.5	14.6	26.6–97.0	50
Atrial framework:				
beam length	440	146	151–910	50
beam width	101	40	40–192	50

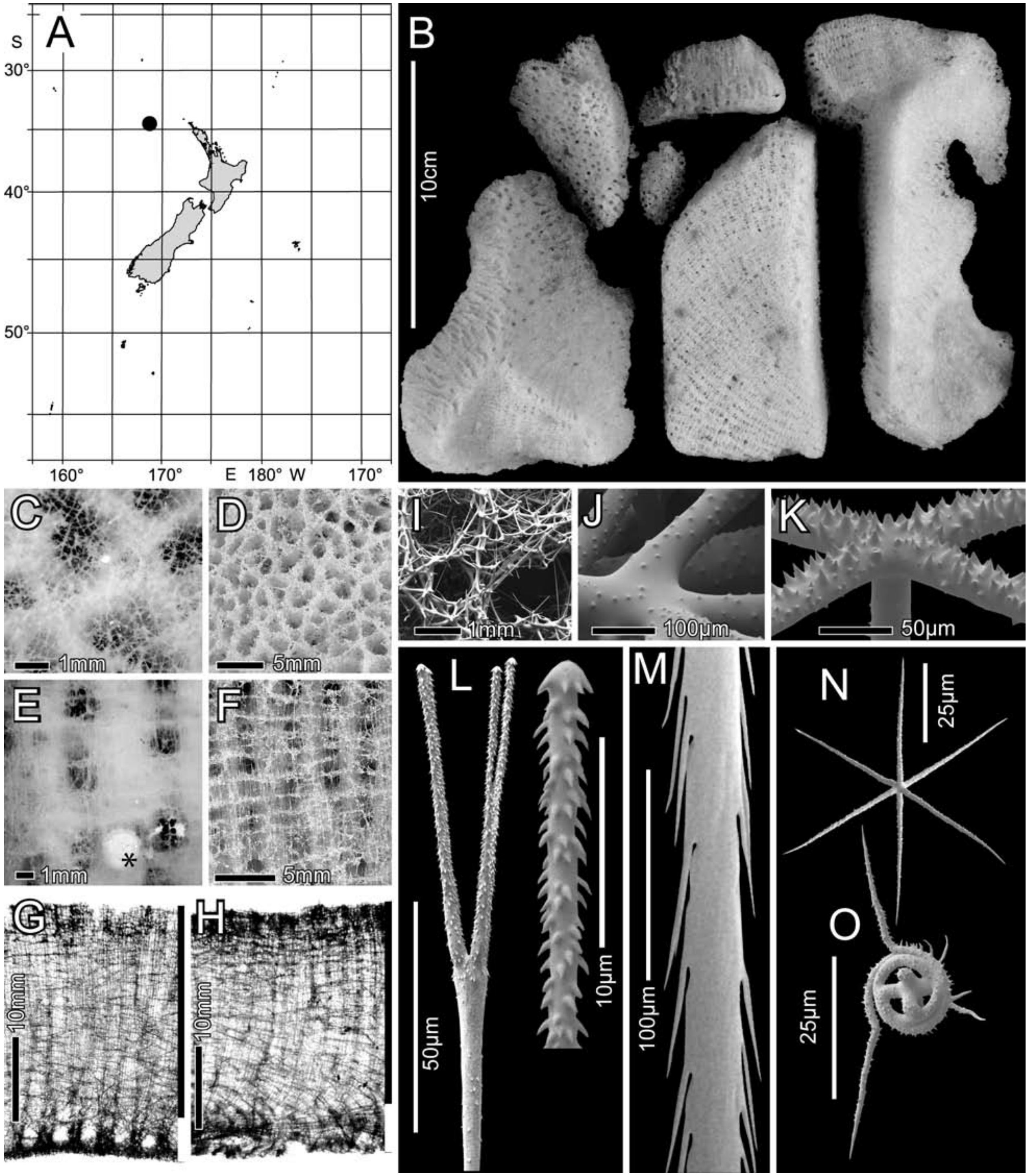


Figure 31. *Chonelasma glaciale* n. sp., NIWA 70546. A, distribution in New Zealand waters. B, holotype fragments from S Norfolk Ridge. C, dermal surface with tissues and spicules. D, cleaned dermal framework. E, atrial surface with tissues and spicules. F, cleaned atrial framework, growth direction upwards. G, H, vertical cross-section (G) and longitudinal section (H) of cleaned framework; black bar on right = dermal cortex, lower white bar = primary dictyonal layer. I, close view of dermal surface showing epirhyses. J, framework beams with ornamentation. K, centre of dermal pentactin. L, discoscopule, whole and tine end. M, middle part of uncinate. N, oxyhexactin. O, spiro-oxydiactin.

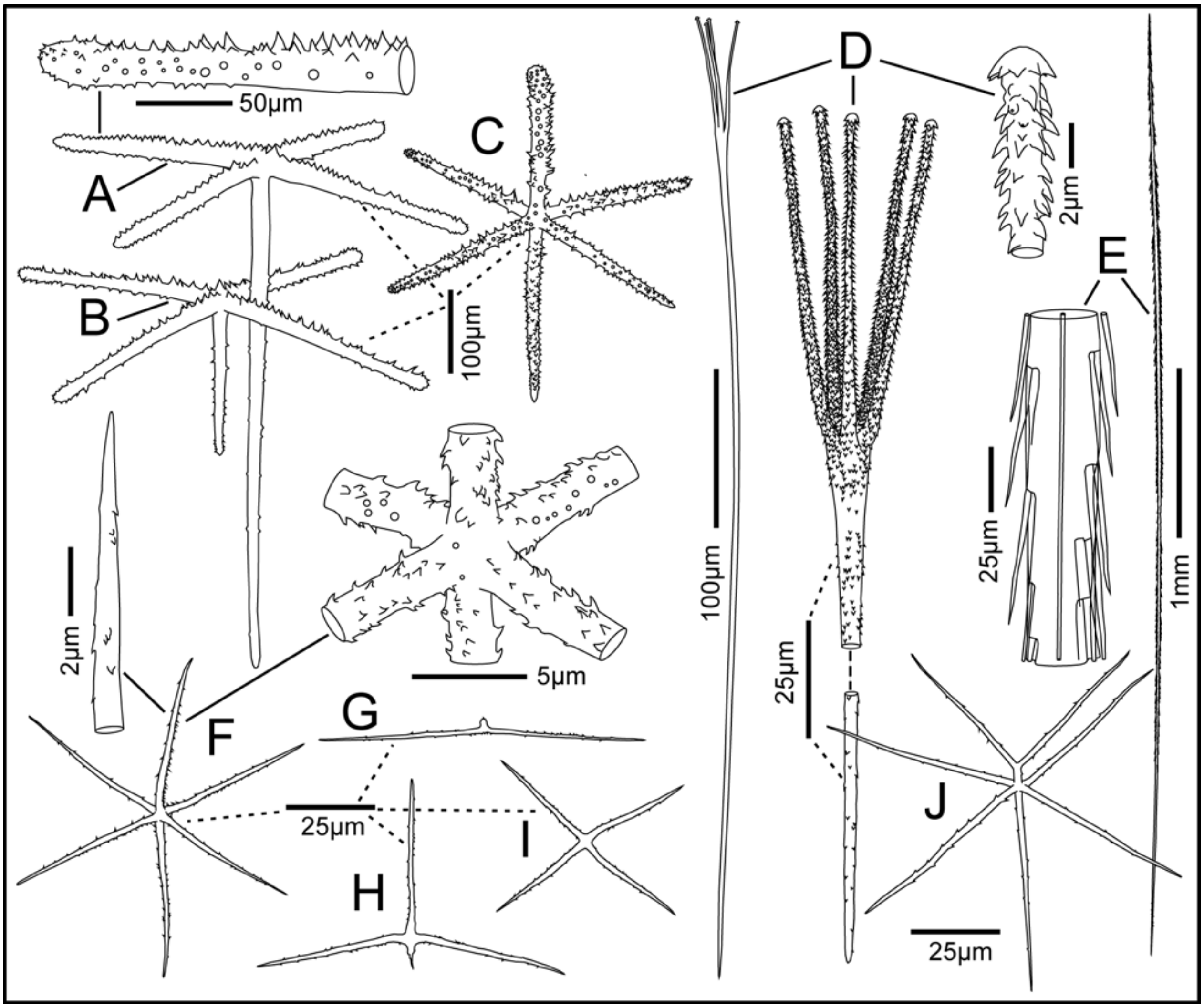


Figure 32. Spicules of *Chonelasma glaciale* n. sp., NIWA 70547. A, dermal pentactin, whole and enlargement of tangential ray end. B, atrial pentactin. C, mesoxyhexactin. D, discoscopule, whole, enlarged head, shaft end, and tine end. E, uncinate, whole and enlargement of mid-anterior segment. F, oxyhexactin with enlargement of centre and ray end. G, oxydiactin. H, oxytriactin. I, oxystauractin. J, hemioxyhexaster.

with well-developed brackets and long barbs projecting 7–10° from the spicule surface and overlapping in the middle area; some areas appear biserial with well-developed barbs occurring only on two opposite sides with neither brackets nor barbs on the intermediate faces. Mesohexactins (Fig. 32C) are evenly covered with coarse perpendicular spines; their cylindrical rays end in sharp tips or, if one is much shorter, that one ends in a rounded or slightly inflated club end.

Microscleres (Table 15) are all oxy-tipped; of 200 spicules surveyed, most were oxyhexactins (65%), with significant numbers of variants including oxytriactins (11.5%), spiral oxydiactins (10%), oxystauractins (8.5%), spiral oxystauractins (3%), and rare hemioxyhexasters (2%). Oxyhexactins (Figs 31N, 32F) and variant triactins, stauractins, and diactins (Figs 31O, 32G–I) have very thin straight rays appearing smooth in LM but entirely finely spined in SEM; spiralling of short proximal parts is common in stauractins and diactins but rare in hexactins. The rare hemioxyhexasters (Fig. 32J) usually have only one ray branched close to the centrum and it bears two terminal rays; they are otherwise similar to hexactins. No onycho- or disco-tipped microscleres are present.

ETYMOLOGY: The species name *glaciale* reflects the chunky ice-like morphology of the holotype.

REMARKS: The new specimen shares possession of only oxy-tipped microscleres with *C. lamella* but differs from that close relative in several features. It has much larger scopules, length 297–656 vs 125–277, and these differ in form, being discoscopules with long tines vs stronglyoscopules with short tines in *C. lamella*. Its microscleres are much thinner and much more finely spined than those of *C. lamella*. Its uncinates are much larger; mean length of 4.52 mm is nearly a full mm longer than those of the holotype of *C. lamella* (Reiswig & Mehl 1994). It has a unique system of subatrial longitudinal skeletal channels in the lower primary layer that is absent in *C. lamella*. On the basis of these differences, the new specimen is regarded as the first known member of a new species, here designated as *C. glaciale*.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a massive, thick plate
- Skeletal channels open only on the dermal side
- Primary layer has a unique system of longitudinal skeletal channels
- Loose pentactins have very large spines on distal surfaces
- Scopules consist of a single type and are over 400 µm in mean length
- Microscleres are predominately oxyhexactins

Chonelasma hamatum Schulze, 1886

(Figs 33, 34)

Chonelasma hamatum: Schulze, 1886: 77; Schulze, 1887: 223, pl. XC1; Topsent, 1892: 32; Schulze, 1899: 117; Topsent, 1901a: 40; Hutton, 1904: 323; Schulze, 1904: 217, pl. LI fig 8a; Schrammen, 1912: 182; Arnesen, 1920: 10; Ijima, 1927: 284; Reiswig, 1990: 742; Mehl, 1992: 63; Dawson, 1993: 55; Reiswig & Mehl, 1994: 152; Reiswig & Tsurumi, 1996: 767.

Heterochone hamata: Reiswig, 1990: 737; Reiswig, 2002a: 1285; Reiswig, 2001: 127.

Heterochone hamatum: Ijima, 1927: 284; Reiswig & Mehl, 1994: 152.

MATERIAL EXAMINED:

North Norfolk Ridge (*Australian EEZ*): QM G316669, NIWA Stn TAN0308/038, 26.426° S, 167.189° E, 734–754 m, 17 May 2003; QM G316668 [NIWA 62093 (voucher)], NIWA Stn TAN0308/033, 28.489° S, 167.786° E, 1056–1116 m, 16 May 2003. *Three Kings Ridge*: NIWA 3287, NZOI Stn Z9803 (SEX9901/08), 31.321° S, 172.639° E, 810 m, FV *Seamount Explorer*, 23 Jun 1999.

COMPARATIVE MATERIAL: Holotype NHMUK 1887.10.20.136, HMS *Challenger* Stn 170A, off Raoul Island, Kermadec Islands, 29.750° S, 178.183° W, 1152 m, 14 Jul 1874.

DISTRIBUTION: Known from off Raoul Island on the Kermadec Ridge, the Three Kings Ridge, and the North Norfolk Ridge (Australian EEZ) (Fig. 33A).

HABITAT: Apparently attached to hard substratum (holotype) but no attachment points present in new specimens; depth range 734–1152 m.

DESCRIPTION:

Morphology as flat smooth blades with slightly thickened central axes and thin rounded edges (Fig. 33B); both surfaces bear small vertical channels visible to the naked eye; those of one side (dermal) are clearly covered by the bounding lattices of smooth spicules (Fig. 33C), but the openings on the other side (atrial) are mostly open and uncovered but in some undisturbed areas are also covered suggesting the surface lattice has been rubbed off on most of this side (Fig. 33D). Branching form is suggested by the shape of the thickened areas of QM G316669.

Dimensions of the five known fragments range from 4.5–8.7 cm in width, 9.0–22.4 cm in length, and 3.0 to 5.1 mm in thickness.

Texture is stony hard and friable.

Surface is smooth with slight surface undulation.

Colour light beige to white.

Choanosomal skeleton is a three-layered dictyonal framework composed of a channelised dermal cortex, an unchannelised middle (primary) layer, and a channelised atrial cortex (Fig. 33E). Dermal and atrial surfaces are differentiated by the more elongate form of the channel apertures in rows, and by the thicker cortex on the dermal side. The regular meshes of both cortices are irregularly triangular to polygonal, with dictyonalia joined without detectable organisation (Fig. 33G, H). Apertures of the dermal epirhyses are longitudinally elongate (Fig. 33G) and arranged in vague longitudinal rows, whereas apertures of atrial aporhyses are round (Fig. 33H) and without obvious arrangement. The dermal cortex is thicker, occupying about half of the wall thickness while the atrial cortex occupies only one-quarter of wall thickness. The middle (primary) layer, which occupies the remaining one-quarter of the wall thickness, is constructed of rectangular, longitudinally-elongate, prismatic meshes forming elements of longitudinal strands (Fig. 33F, I). Channels of the dermal and atrial cortices extend to, but do not continue through, the middle layer. Ranking of nodes to form septa in the primary layer is not detectable. Most robust beams are smooth, but the thinner beams are sparsely microspined; nodes are not swollen; the long thin pointed spurs and very abundant small oxyhexactins appended to beams throughout the skeleton are profusely microspined. Loose choanosomal spicules include uncinates and discohexaster microscleres.

Ectosomal skeleton consists of a lattice of loose hexactins overlying all choanosomal framework surfaces and entrances to epirhyses but not most of the openings of aporhyses, probably due to abrasion during collection. Scopules associated with the surface hexactins project vertically, head outwards. Uncinates project anterior end outwards on all surfaces. Microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 16) are surface hexactins, discoscopules, and uncinates. Surface hexactins (Fig. 34A) have short distal rays, sometimes expanded to clavate tips; tangential rays are cylindrical and abruptly pointed; proximal rays are often twice as long or equal in length to tangential rays; all rays are mostly profusely microspined but smooth in their proximal parts. Scopules occur as a single type (Figs 33J, 34B), usually with a narrow neck but occasionally expanded with lateral expansions, bearing 2–4 extremely thin, straight rough tines capped with small marginally toothed discs; the shaft is mostly smooth except for a short terminal region bearing procurved spines, and ends in a sharply pointed tip without inflation. The uncinates (Figs 33K, 34C) are unremarkable, with well-developed brackets and barbs that curve out from the spicule surface; some barbs are undeveloped.

Microscleres (Table 16) are only discohexasters. The discohexasters (Figs 33L, 34D) are stellate in form, each primary ray bearing 2–6 sigmoid terminal rays which end in small discs with 4–7 marginal teeth or hooks; all rays are entirely ornamented with short recurved spines but the spherical centrum remains smooth; considerable variation occurs in the relative lengths of primary and secondary rays and the degree of curvature of secondary rays.

Remarks: All four of the new fragments agree completely with the earlier description of the only previously known specimen of this species, the holotype fragment,

Table 16. Spicule and framework dimensions (µm) of *Chonelasma hamatum* Schulze, 1886.

Parameter	**QM G316669** **mean**	**s. d.**	**range**	**no.**
Surficial hexactin:				
distal ray length	100	24	53–162	50
distal ray width	7.1	2.1	3.1–13.0	50
tangential ray length	110	20	72–154	50
tangential ray width	6.8	1.8	3.1–10.2	50
proximal ray length	177	44	87–277	50
proximal ray width	7.4	1.7	3.5–10.6	50
Scopule total length	469	75	359–663	50
head length	63	14	37–98	50
tine length	54	12	30–85	50
Uncinate length	965	30	598–1557	50
width	5.2	1.0	3.2–7.2	50
Discohexaster diameter	33.9	4.6	26.0–44.2	50
primary ray length	6.5	1.0	4.6–8.2	50
secondary ray length	10.4	1.5	7.6–13.8	50
Dermal cortex framework:				
epirhyses major diameter	639	192	294–1188	70
dermal beam length	203	57	102–353	50
dermal beam width	34	10	18–57	50
Primary layer framework:				50
longitudinal beam length	494	166	192–777	27
longitudinal beam width	64	19	30–111	50
Atrial cortex framework:				
aporhyses diameter	629	100	496–834	16
beam length	230	55	132–365	50
beam width	38	12	16–65	50

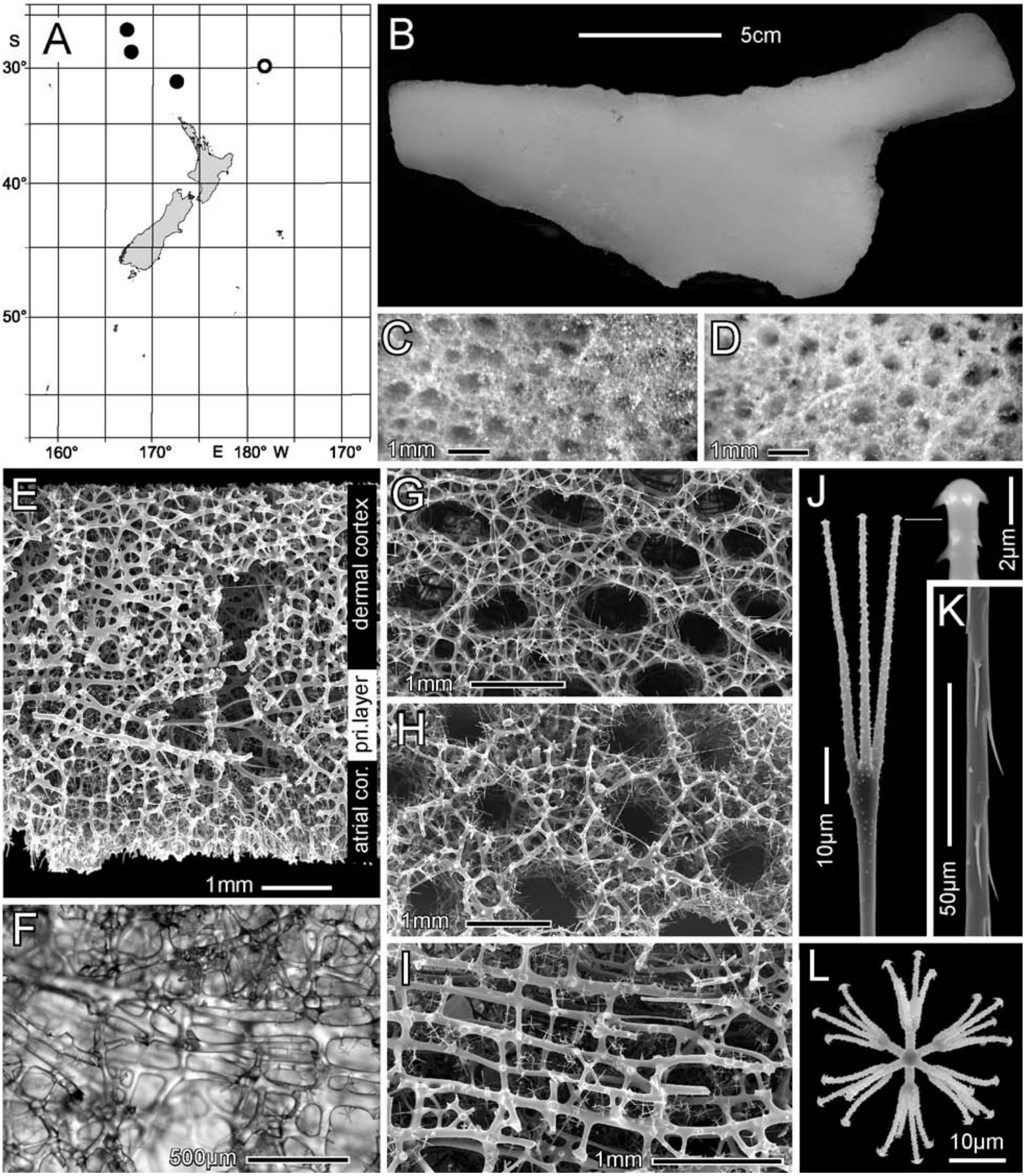


Figure 33. *Chonelasma hamatum* Schulze, 1886, QM G316669. A, distribution in eastern Australian and New Zealand waters; open circle is original holotype location; filled circles are locations of new specimens. B, QM G316669. C, D, dermal and atrial surfaces, respectively, with tissues intact. E, longitudinal section of cleaned framework, dermal surface at top; layers indicated at right. F, longitudinal section of middle primary layer with longitudinal strands, and parts of bounding cortices (LM). G, dermal cortex with epirhyses in surface view. H, atrial cortex with aporhyses in surface view. I, middle layer in frontal view after removal of dermal cortex. J, scopule upper end and enlargement of tine tip. K, middle part of uncinate. L, discohexaster.

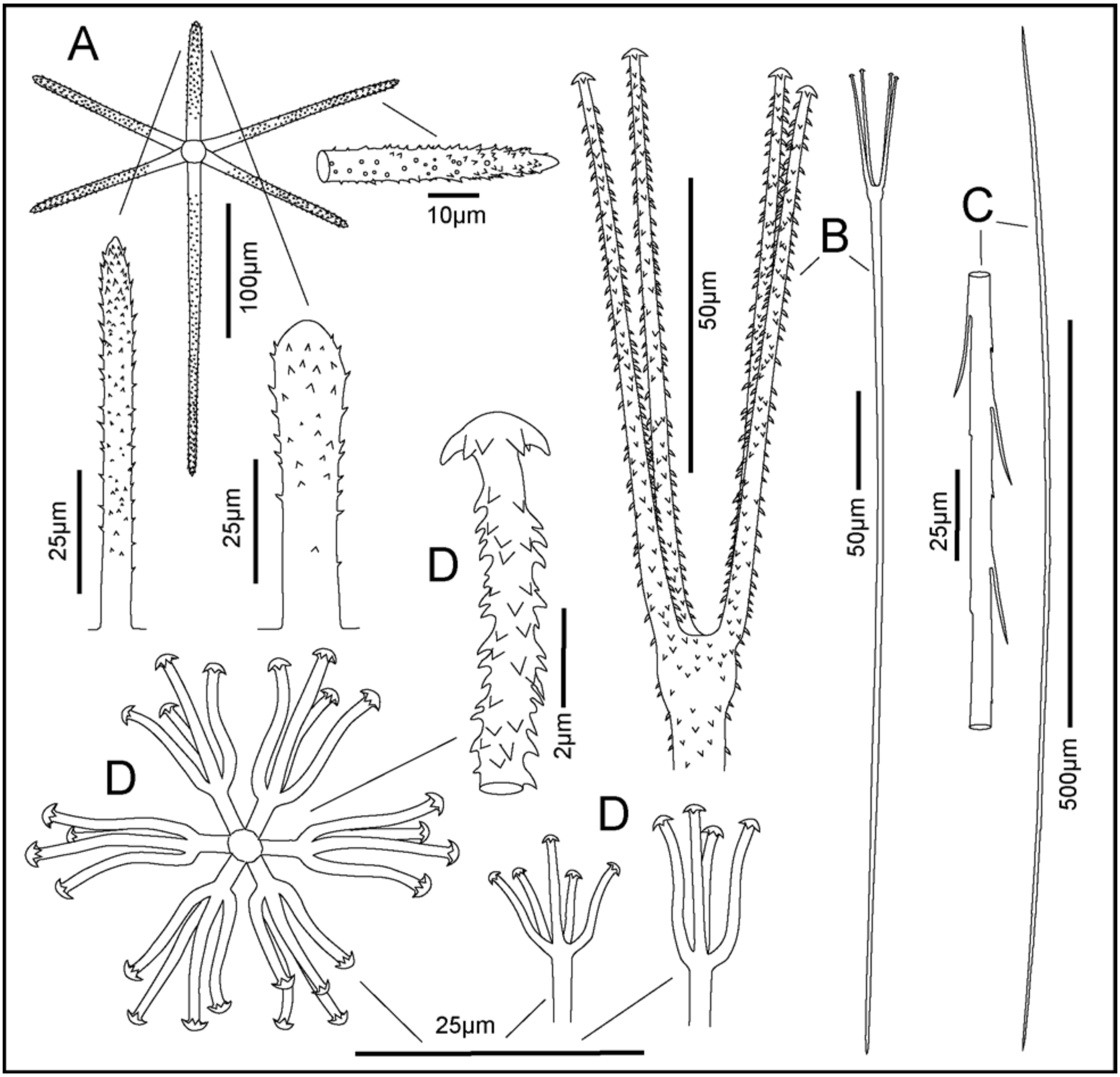


Figure 34. Spicules of *Chonelasma hamatum* Schulze, 1886, QM G316669. A, surface hexactin with enlargements of tangential ray tip and two distal rays, sometimes expanded to clavate tips. B, discoscopule, whole and upper end. C, uncinate, whole and enlargement of middle segment. D, discohexaster with variations in terminal group and enlargement of terminal ray.

by Schulze (1886, 1887), excepting for his lack of recognition of a middle dictyonal layer. Indeed, the middle layer is particularly thin in the holotype but its presence has been verified by reinspection. The absence of diarhyses and presence of non-overlapping epirhyses and aporhyses requires removal of this species from *Heterochone* (family Aphrocallistidae), to which it was transferred by Ijima (1927), and its return made here to its original position in *Chonelasma* (family Euretidae) as *C. hamatum*. This species differs from *C. lamella* in almost all free spicules; the surface spicules are hexactins rather than pentactins; the scopules have a completely different shape, and the microscleres are discohexasters rather than oxyhexasters and oxyhexactins. It may not be possible to distinguish washed-out frameworks of the two species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a thin, smooth, rigid blade which may branch
- Dictyonal framework with three distinct layers, two cortices around a middle layer with longitudinal strands

- Surface spicules are hexactins with non-pinulate, short distal rays
- Scopules are thin discoscopules
- Microscleres are only stellate discohexasters

Chonelasma australe n. sp. (Figs 35, 36)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 52483, NZOI Stn F127, NE edge of Campbell Plateau, 49.367° S, 176.267° W, 1280 m, HMNZS *Endeavour III*, 08 Jan 1965.

TYPE LOCALITY: NE edge of Campbell Plateau.

DISTRIBUTION: Known only from the type locality (Fig. 35A).

HABITAT: Probably attached to hard substratum but no attachment points present in any of the four fragments; depth 1280 m.

DESCRIPTION:

Morphology as flat fragments with irregular broken edges (Fig. 35B); surfaces of both sides bear very numerous, closely-spaced, small, round, vertical channels easily visible to the naked eye; apertures are open; most of the expected covering loose spicule lattice was apparently lost during collection but fragments are lodged within the channels. The two surfaces differ in that the canal apertures on one side are more oval rather than circular, tend to be aligned in rows and the surface framework is thicker (channels are deeper); this side is interpreted as dermal. The atrial side has circular apertures, without alignment, and has a thinner surface framework. The distinctly septate structure of the middle layer can be seen through the more transparent atrial surface and by inspection of the broken edges of the fragments. The original shape of the intact specimen remains unknown.

Dimensions of the four fragments range from 5 x 6 to 13 x 14 cm in horizontal dimensions and 2.6–3.2 mm in thickness.

Texture is stony hard and friable.

Table 17. Spicule and framework dimensions (μm) of *Chonelasma australe* n. sp.

Parameter	**Holotype NIWA 52483**			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	177	45	77–294	50
tangential ray width	14.3	4.9	7.7–28.1	50
proximal ray length	203	103	67–525	50
proximal ray width	15.5	5.3	4.8–27.9	50
Scopule length	348	57	235–476	50
head length	58.8	12.9	31.8–84.6	50
tine length	50.5	12.7	25.7–75.0	50
Uncinate length	2714	465	1547–4115	50
width	11.3	1.8	7.3–16.4	50
Discohexaster diameter	56.4	6.3	41.8–72.7	50
primary ray length	5.6	1.0	2.4–7.5	50
secondary ray length	23.0	2.9	16.4–29.9	50
Dermal cortex framework:				
epirhysis major diameter	757	117	567–947	14
beam length	337	101	88–542	50
beam width	29.4	9.5	16.5–61.2	50
Primary layer, septa spacing	977	229	560–1456	20
longitudinal beam width	31.0	9.1	14.0–54.9	50
transverse/radial beam length	295	85	147–533	50
transverse/radial beam width	26.2	4.7	14.3–34.8	50
Atrial cortex framework:				
aporhysis major diameter	766	109	611–945	17
beam length	354	128	148–732	50
beam width	32.0	8.1	17.9–52.6	50

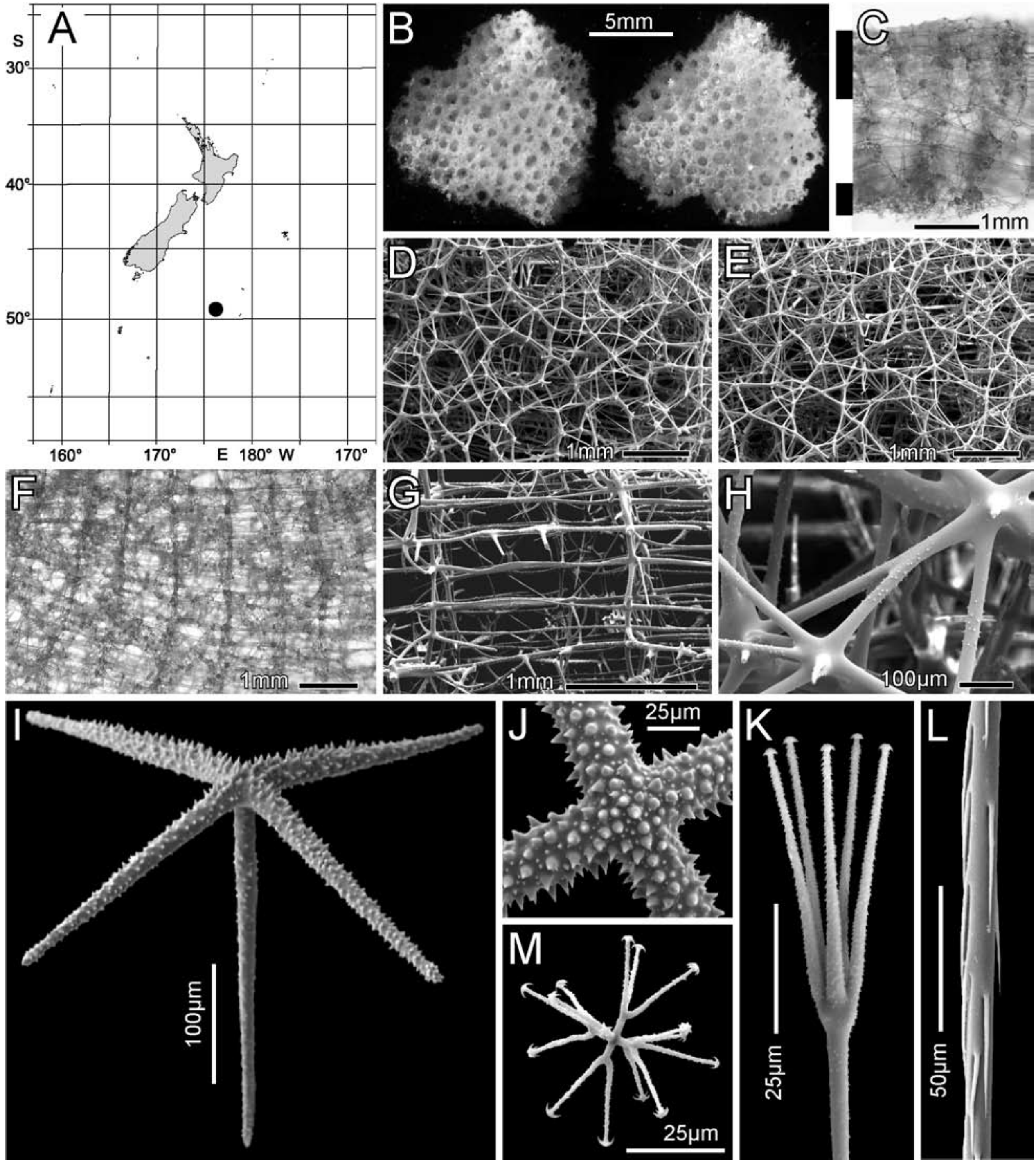


Figure 35. *Chonelasma australe* n. sp., holotype NIWA 52483. A, distribution in New Zealand waters. B, the largest fragment of the holotype, dermal side on left, atrial side on right. C, longitudinal section of the framework showing extents of dermal cortex (upper black bar), middle (primary) layer (white bar), and atrial cortex (lower black bar). D, cleaned dermal surface. E, cleaned atrial surface. F, frontal view of middle framework layer after removal of the atrial cortex, showing regularity of lateral node ranking and resulting septa. G, elongate meshes and longitudinal strands of the middle framework layer. H, dermal beams showing typical spination pattern. I, surface pentactin.
J, coarse spination of the pentactin outer surface. K, discoscopule upper end. L, middle part of uncinate with barbs appressed to shaft. M, discohexaster.

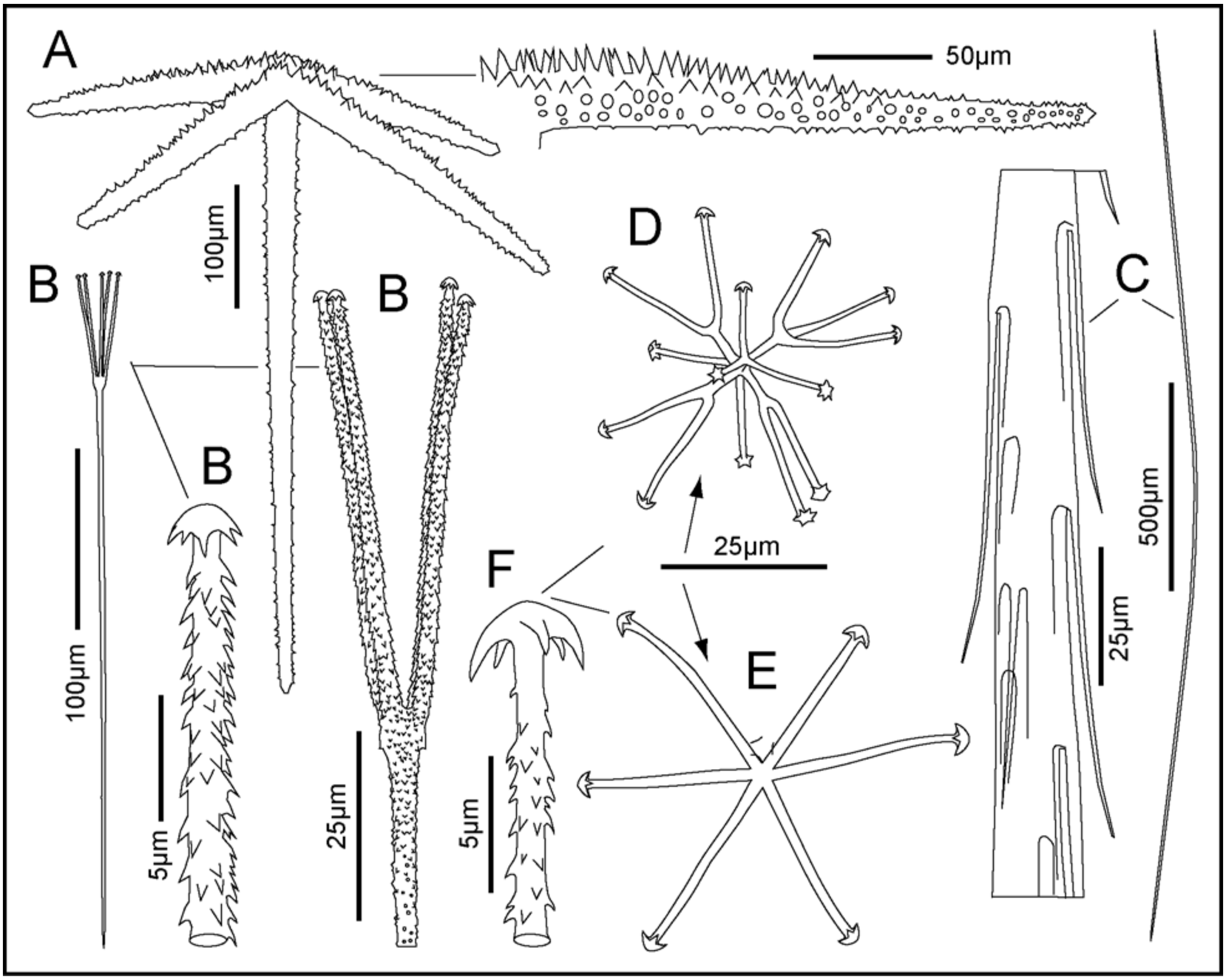


Figure 36. Spicules of *Chonelasma australe* n. sp., holotype NIWA 52483. A, surface pentactin, whole and enlargement of tangential ray. B, discoscopule, whole, upper end, and tine tip. C, uncinate, whole and enlargement of middle segment. D, discohexaster. E, discohexactin. F, ray tip of discohexaster but equally appropriate for discohexactin.

Surface is smooth with slight surface undulation and openings of the cortical canals.

Colour light beige.

Choanosomal skeleton is a three-layered dictyonal framework composed of a channelised dermal cortex, an unchannelised middle (primary) layer, and a channelised atrial cortex (Fig. 35C). Dermal and atrial surfaces are differentiated as noted above. The dermal cortex is generally twice as thick as the atrial cortex. The meshes of both cortices are irregularly triangular to polygonal, with dictyonalia joined without detectable organisation (Fig. 35D, E). Apertures of both dermal epirhyses are oval and longitudinally elongate while atrial aphorhyses are circular, without detectable arrangement. The middle (primary) layer, which occupies 40–50% of wall thickness, is constructed of rectangular, longitudinally-elongate, prismatic meshes forming elements of longitudinal strands (Fig. 35C, F, G). Channels of the dermal and atrial cortices extend to, but do not continue through the middle layer. Ranking of nodes to form transverse septa is very obvious in longitudinal and frontal sections of this layer. Most beams are rough with dense microtuberculate areas in the centre of beams (Fig. 35H), but the nodes and some patches of beams are smooth; nodes are not swollen; spurs are long, thin, and sharply pointed; small oxyhexactins are not appended to beams. Loose choanosomal spicules are uncinates and discohexasters.

Ectosomal skeleton has apparently been rubbed from all four fragments during collection or later handling. Spicule types known to be surface elements are found displaced in the skeletal channels. The original surface bore a lattice of loose pentactins overlying all choanosomal framework surfaces and entrances to epirhyses; whether aporhyses were covered remains unknown. Scopules associated with the surface pentactins projected vertically, head outwards. Uncinates projected anterior end outwards on all surfaces. Microscleres were scattered in and under both dermal and atrial surfaces.

Megascleres (Table 17) are surface pentactins, discoscopules, and uncinates. Surface hexactins (Figs 35I, 36A) are robust with heavy stout conical thorns on the distal and lateral surfaces of the reclined tangential rays (Fig. 35J); other surfaces bear small spines. Occasional diactins and stauractins of similar dimensions and ray form also occur. Scopules occur as a single disco-type (Figs 35K, 36B), with a slightly inflated neck carrying 4–6 straight, rough, moderately spread tines ending in small marginally toothed discs; the shaft is smooth in LM, but entirely rough in SEM; the shaft is straight and tapers to a sharp tip without inflation. Uncinates are large, with well-developed brackets and long barbs that either lie close to (Fig. 35L) or curve out from (Fig. 36C) the spicule surface.

Microscleres (Table 17) are mostly discohexasters and rare discohexactins. Discohexasters (Figs 35M, 36D) are within the margin between spherical and stellate in form; the short primary rays each bear 1–3 fairly straight or very slightly sigmoid terminal rays which end in small discs with 5–8 marginal teeth; all rays are entirely ornamented with short recurved spines in SEM; the centrum is unswollen. Discohexactins (Fig. 36E) have the same dimensions and ornamentation as the discohexasters.

ETYMOLOGY: The species name *australe* is chosen to reflect the location of this species to the south of New Zealand.

REMARKS: This form clearly belongs to *Chonelasma* by virtue of its septate middle layer and spiculation. It differs from each of the four previously (five presently) recognised valid species by significant features. Absence of oxy-tipped microscleres prevents its assignment to *C. lamella* and *C. choanoides*. The pentactin surface spicules prevent its assignment to *C. hamatum* and *C. doederleini*, both of which have hexactin surface spicules. It cannot be assigned to *C. ijimai* since it has only one scopule type (two types in *C. ijimai*), its microscleres are mainly discohexasters (*C. ijimai* has mainly discohexactins), and its occurrence is remote from that of *C. ijimai*, the Azores. These differences require the new form to be assigned a new species name, *C. australe*.

KEY DIAGNOSTIC CHARACTERS:

- Body form is unknown, but when broken produces small plate-form fragments
- Dictyonal framework of three distinct layers, two cortices with vertical channels around a middle layer with longitudinal meshes and strands
- Surface spicules are pentactins with very robust spines on distal surfaces
- Scopules are thin discoscopules
- Microscleres are mainly discohexasters, between spherical and stellate in form
- Oxy-tipped microscleres are absent

Chonelasma biscopulatum n. sp. (Figs 37, 38)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 52485, NZOI Stn F127, NE edge of Campbell Plateau, 49.367° S, 176.267° W, 1280 m, HMNZS *Endeavour III*, 08 Jan 1965.

TYPE LOCALITY: NE edge of Campbell Plateau.

DISTRIBUTION: Known only from the type locality (Fig. 37A).

HABITAT: Probably attached to hard substratum but no attachment points present in the single fragment; depth range 1280 m.

DESCRIPTION:

Morphology as a single slightly curved discoid fragment with irregular broken edges (Fig. 37B); surface of one side bears what appear to be small round holes which proved not to be skeletal channels but rather density patterns of soft tissues outlining water passageways. The two surfaces do not differ otherwise and have no other characters of note. Growth direction is just discernable as a directional splay of combined skeleton and tissue in the lower right image of Fig. 37B progressing from right to left. Original shape of the intact specimen remains unknown.

Dimensions of the fragment are 8.0 x 6.4 mm with a wall thickness of 2.0–2.6 mm. The visible water passageways are 0.38–0.59–0.85 mm in diameter.

Texture is stony and fragile.

Surface is curved and smooth.

Colour white.

Choanosomal skeleton is a two-layered dictyonal framework. No skeletal channels are detected on either surface. A thin unchannelised cortex, only 200 µm thick, is present on the convex side, interpreted here as dermal. The main part (95% of wall thickness) of the framework is an unchannelised primary layer (Fig. 37C) that extends to the concave surface. The dermal cortex is composed of dictyonalia fused together irregularly, ray-to-node and ray-to-ray, without forming strands or other detectable organisation (Fig. 37D); meshes are mainly triangular but many beams are broken. The primary layer is constructed of rectangular, longitudinally elongate, prismatic meshes forming elements of longitudinal strands (Fig. 37C, E). Longitudinal beams are not differentially thickened. Ranking of nodes to form transverse septa is very obvious in longitudinal cross and frontal sections of this layer. In other members of the genus, the primary layer is usually sandwiched between cortices on both sides, but an atrial cortex is not developed in this specimen. Most beams are rough with dense microtuberculate areas in the middle parts of beams, but the nodes and some patches of beams are smooth (Fig. 37F, G). Nodes are not swollen; spurs are long, thin, and hastate-pointed or occasionally round-tipped; small oxyhexactins appended to beams are moderately abundant (Fig. 37E, F). Loose choanosomal spicules are uncinates, mesohexactins, discohexasters, and discohexactins.

Ectosomal skeleton consists mainly of a lattice of loose pentactins overlying all choanosomal framework surfaces. Scopules associated with the surface pentactins project vertically, head outwards. Uncinates project anterior end outwards on all surfaces. Mesohexactins and microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 18) are surface pentactins, two forms of scopules, uncinates, and mesohexactins. Surface pentactins (Fig. 38A) of both dermal and atrial surfaces are mostly of medium thickness with few scattered low tubercles on all rays; a few (c. 5%) are more robust with abundant tall sharp spines on the outer surfaces, but these are likely contaminants from *Chonelasma australe* taken in the same haul. Tangential rays taper to rounded, sharp, occasionally inflated tips; the proximal ray is longer, equal to, or shorter than the tangential rays and tapers to a sharp tip; tangential rays are usually depressed about 15° from their surface plane. Scopules occur in two very distinct forms, smaller strongyloscopules and very large discoscopules. The strongyloscopules (Figs 37H–J, 38B, C) are extremely abundant; their abruptly swollen neck, sometimes with four knobs, carries 6–10 nearly parallel tines ending in rounded marginally spined hemispherical caps not set off from the tine shafts as distinct discs; entire spicule is covered with very fine reclined spines but appears smooth in LM. Irregular forms with widely flaring tines or tines projecting laterally or even backwards occur. The larger discoscopules (Figs 37H–J, 38C) are relative-

Table 18. Spicule and framework dimensions (μm) of *Chonelasma biscopulatum* n. sp.

Parameter	**Holotype NIWA 52485** **mean**	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	272	54	119–363	50
tangential ray width	14.8	3.1	6.9–22.2	50
proximal ray length	253	91	119–487	20
proximal ray width	12.8	3.5	5.6–20.8	25
Scopule 1 length	201	40	151–337	50
head length	29.3	6.5	20.5–46.3	50
tine length	24.2	5.4	17.8–37.1	50
Scopule 2 length	809	111	521–1116	44
head length	145	11	118–170	47
tine length	129	11	102–156	47
Uncinate length	2515	501	1407–3086	17
width	12.7	3.2	6.0–20.2	50
Mesohexactin ray length	129	31	75–202	28
ray width	5.8	1.6	3.4–9.7	28
Discohexaster diameter	68.1	8.3	39.4–85.4	50
primary ray length	7.0	1.5	4.9–13.1	50
secondary ray length	28.0	3.9	11.7–37.0	50
Dermal cortex framework:				
beam length	301	108	82–497	50
beam width	24.8	5.2	15.3–41.1	50
Primary layer, septa spacing	701	226	378–1169	19
longitudinal beam width	23.6	4.5	14.1–33.6	50
transverse/radial beam length	312	68	162–479	30
transverse/radial beam width	21.0	3.9	13.2–29.0	37

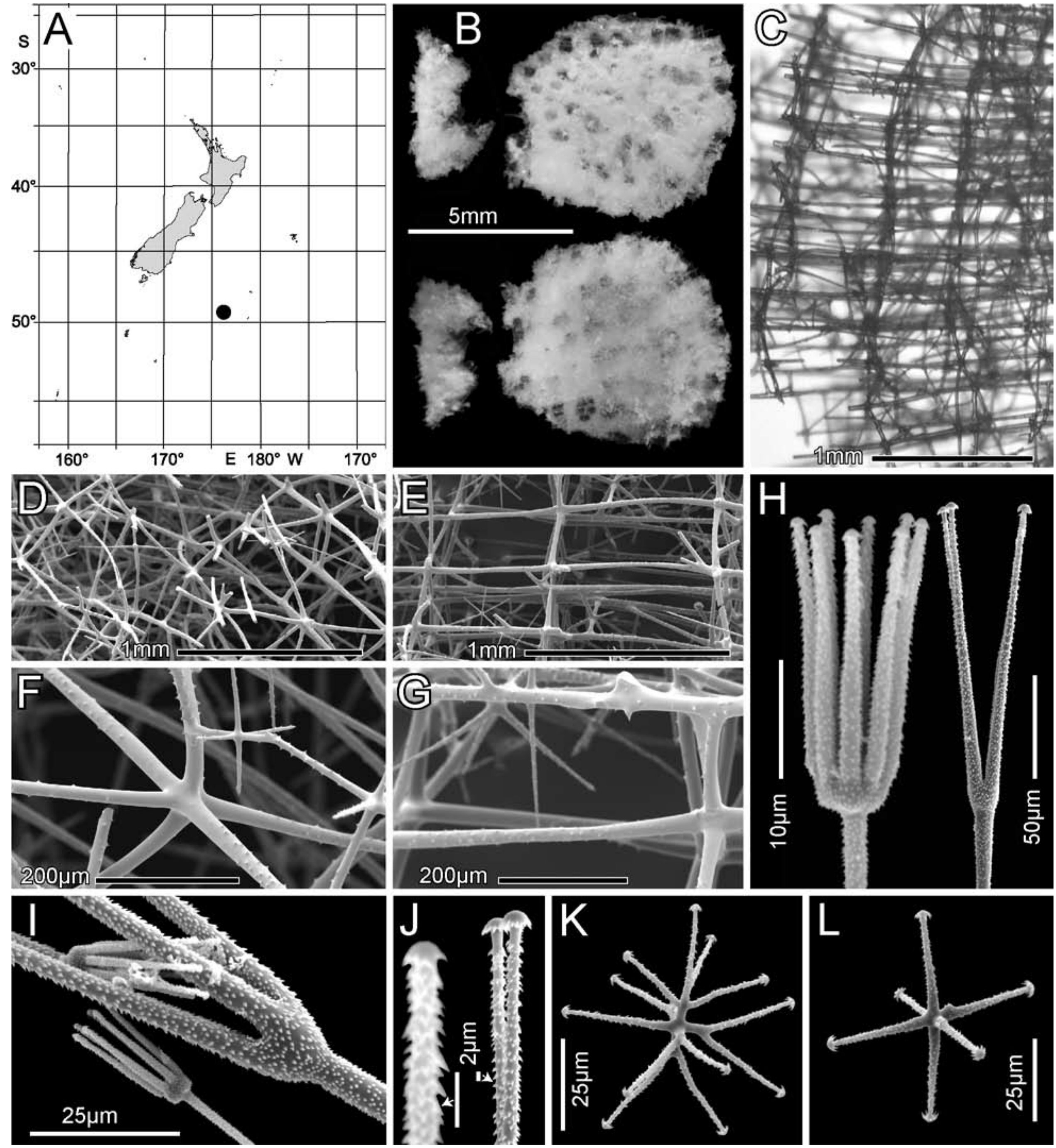


Figure 37. *Chonelasma biscopulatum* n. sp., holotype NIWA 52485. A, distribution in New Zealand waters. B, the holotype, from northeastern edge of Campbell Plateau, in dermal (above) and atrial (below) views. C, cleaned skeleton viewed from atrial side showing septa (LM). D, dermal ectosome in surface view. E, atrial surface (primary layer) of cleaned framework. F, dermal surface at higher magnification. G, atrial surface at higher magnification. H, two types of scopule heads, strongyloscopule (left) and discoscopule (right). I, the two scopule types viewed together to show size difference. J, magnified tine ends of the two scopule types. K, discohexaster. L, discohexactin.

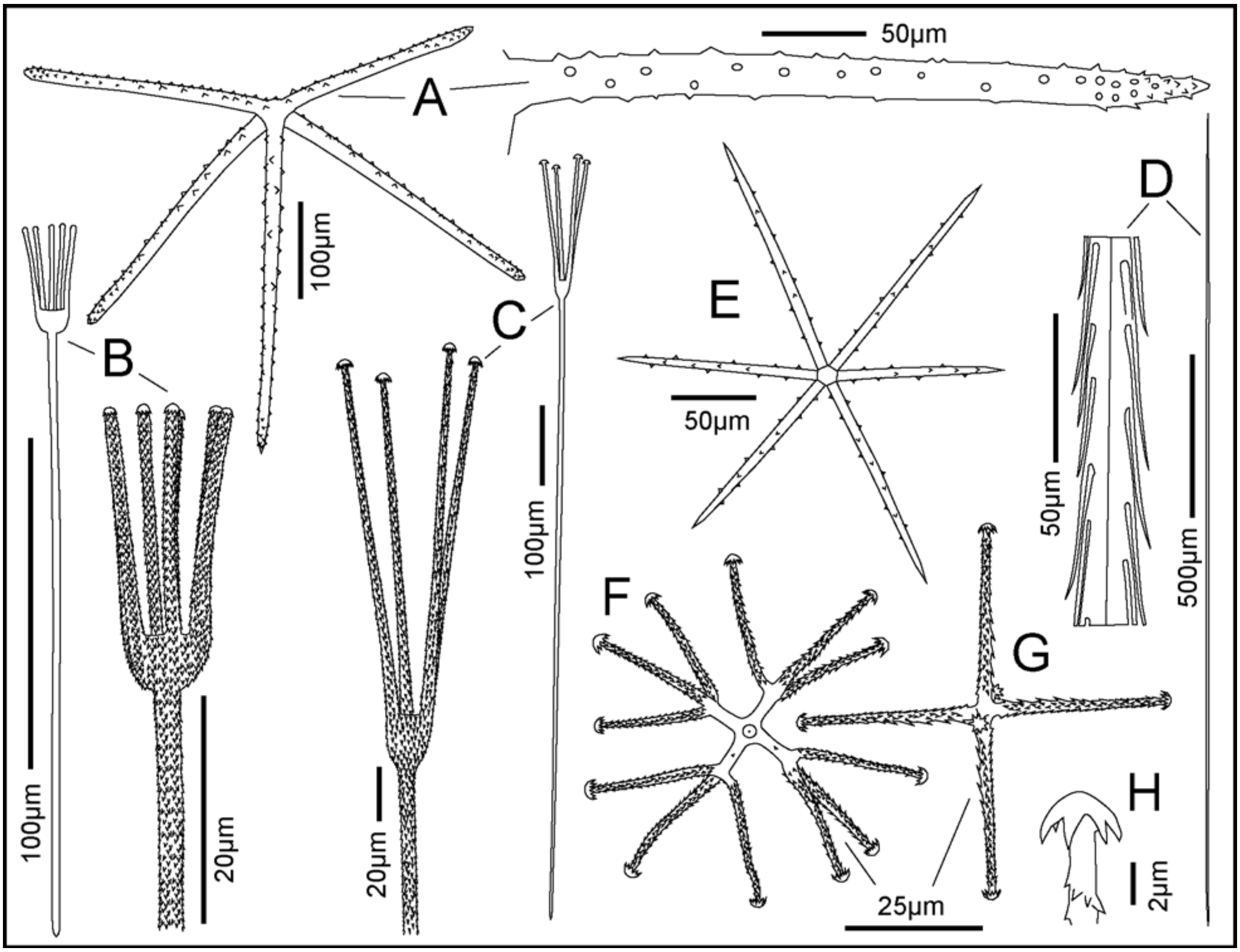


Figure 38. Spicules of *Chonelasma biscopulatum* n. sp., holotype NIWA 52485. A, surface pentactin, whole and enlargement of tangential ray. B, strongyloscopule, whole and upper end. C, discoscopule, whole and upper end. D, uncinate, whole and enlargement of middle segment. E, mesohexactin. F, discohexaster. G, discohexactin. H, tip of discohexaster terminal ray, also appropriate for discohexactin.

ly rare (ratio of strongyloscopules to discoscopules is c. 500:1); their narrow neck carries 4–6 straight, slightly divergent (c. 18°) tines, each of which ends in a very distinct disc with 12–18 marginal teeth; tines, neck, and upper head are covered in dense reclined spines easily visible in LM, but most of the shaft is smooth; the shaft tail, ornamented with low uncinate-like spines, tapers to a sharp tip without inflation. Uncinates (Fig. 38D) are large with well-developed and closely set brackets and barbs which are moderately inclined from the spicule surface; some have regions where bracket-barb elements occur only on opposite sides. Mesohexactins (Fig. 38E) are not abundant; their rays are straight, slightly tapered, and sparsely spined.

Microscleres (Table 18) consist only of disco-tipped hexasters, hemihexasters, hexactins, and abnormal variants. Discohexasters and discohemihexasters are spherical with terminals longer than primary rays; the smooth primary rays each bear 1–4 finely and densely thorned terminals ending in discs with 5–12 marginal teeth. Discohexactins are rare (c. 1% of microscleres) and are similar to discohexasters in size and ornamentation. A few abnormal disco-tipped triactins and diactins and other irregular forms also occur.

Etymology: The name *biscopulatum* reflects the presence of two very distinct scopule types in this species.

Remarks: Although this species consists of only a small fragment, it is approximately the size of fragments routinely used for identification and description of skeletons of larger specimens. The spiculation of this specimen is too distinctive to allow it to be simply ignored. Although the specimen was collected at the same station with *Chonelasma australe*, the scopules of the two forms are entirely different in form or size. The new fragment clearly belongs to *Chonelasma* by virtue of its septate primary layer and spiculation.

Absence of an atrial cortex and channelisation of the dermal cortex are not unexpected in young stages of this genus. Presence of two distinct scopule types sets this specimen apart from all other Pacific species of the genus, including those described here, above and below. The only other *Chonelasma* species bearing scopules of two different sizes and shapes is *C. ijimai* from the Azores (Atlantic Ocean). The new form differs from *C. ijimai* in, among other differences, the sizes of its scopules (mean lengths are 201 and 809 µm vs. 125 and 360 µm in *C. ijimai*), and in the form of its major microsclere (discohexasters vs. discohexactins in *C. ijimai*). In overall pattern of spiculation, the new form is most similar to Topsent's *C. ijimai*, but not to specimens attributed to that species by Tendal (1973), which were probably *C. choanoides*. These distinctions in spiculation warrant recognition of the form as a new species, here designated *C. biscopulata*.

KEY DIAGNOSTIC CHARACTERS:

- Body form is unknown, but when broken produces small plate-form fragments
- Dictyonal framework of two distinct layers, the thicker one having longitudinal strands and septa
- Surface spicules are pentactins with sparse low tubercles on distal surfaces
- Two very distinct classes of scopules are present
- Microscleres are mainly spherical discohexasters
- Oxy-tipped microscleres are absent

***Chonelasma chathamense* n. sp.** (Figs 39, 40)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NMNZ POR.000710, N edge of Chatham Rise, 42.700º S, 178.000º W, FV *Cordella*, 1025–1055 m, 13 Aug 1989.

TYPE LOCALITY: N edge of Chatham Rise.

DISTRIBUTION: Known only from the type locality (Fig. 39A).

HABITAT: Probably attached to hard substratum but no attachment points present in either of the two fragments; depth range 1025–1055 m.

DESCRIPTION:

Morphology as two slightly curved blade-like fragments with smooth edges (photo of entire fragments unavailable but pieces shown in Fig. 39B); surface of one side, considered dermal, is densely covered with evenly distributed round to oval apertures of vertical water canals (Fig. 39C), while water canals on the opposite side, considered atrial, are present but indistinct and traversed by skeletal beams. The surface lattice of loose spicules has been lost from most of both surfaces but small intact patches of it can be found. As true for all members of this genus, shape of the intact specimen remains unknown. Overall body form remains elusive but may be a series of leaf-like fronds forming a planar fan (see cover image for an example of the probable form).

Dimensions of the two fragments are 25 x 60 and 35 x 110 mm with a wall thickness of 3.0–3.5 mm. Largest diameters of dermal canal openings are 0.28–0.96–2.37 mm.

Texture is stony, brittle, and fragile.

Surface is curved and smooth.

Colour beige.

Choanosomal skeleton is mainly a two-layered dictyonal framework consisting of a channelised dermal cortex and an unchannelised primary layer with longitudinal dictyonal strands (Fig. 39D). A very thin, single layer of dictyonalia is sparsely present in places on the atrial surface suggesting formation of an atrial cortex has just begun. The dermal cortex, occupying one-half to two-thirds of the wall thickness, is an irregular fusion of dictyonalia joined ray-to-ray or ray-to-node forming triangular meshes; the layer is completely penetrated by cylindrical epirhyses opening on the outer surface (Fig. 39E) and extending down to the primary layer (Fig. 39D). The water canals seen with tissues intact in external view probably correspond to the skeletal epirhytic channels, but the water canals are significantly larger in diameter than the skeletal channels. This suggests that the transparent lining skeletal elements lie within the canals but are not perceived when the relatively opaque tissues are present. The primary layer is formed by dictyonalia regularly fused to form elongate rectangular meshes and longitudinal strands (Fig. 39D, F); the entire layer and component strands undulate radially (Fig. 39D); nodes are not ranked, so transverse and radial connecting beams do not form septa. Beams are mostly smooth but microspines occur in patches (Fig. 39G); small rough oxyhexactins are appended to beams throughout the framework. Nodes are not swollen; spurs are long, rough, and tapered to rounded or sharp points. Loose choanosomal spicules include uncinates, rare mesohexactins, and both discohexaster and onychohexaster microscleres.

Ectosomal skeleton consists mainly of a lattice of loose pentactins overlying all choanosomal framework surfaces. Scopules associated with the surface pentactins project vertically, head outwards. Uncinates project anterior end outwards on all surfaces. Mesohexactins and microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 19) are surface hexactins, scopules, uncinates, and mesohexactins. Surface hexactins (Fig. 40A) of both dermal and atrial surfaces are moderately robust with short abruptly pointed or rounded distal ray; the spicules are entirely ornamented with scattered low tubercles; ray branching close to the spicule centre is relatively common (c. 16%) resulting in unusual spicule forms; tangential rays are cylindrical or gently taper to rounded tips; tangential rays are arrayed perpendicular to the proximal ray without depression. Very rarely the distal ray is reduced to a small knob rendering the spicule pentactine. Scopules occur as one intermediate-sized form, a strongylo scopule (Figs 39H, I, 40B); their narrow neck carries 2–4 straight, slightly diverging tines that appear in LM to end in a small button, but which proves not to be distinctly larger in diameter than the tine shaft in SEM (Fig. 39I). The scopules are usually entirely rough but some have smooth middle parts of the shaft; the shaft tapers to a sharp or occasionally rounded tip without inflation. Uncinates (Fig. 40C) are highly variable in size; the larger ones have well-developed brackets and barbs that are moderately inclined from the spicule surface. Mesohexactins (Fig. 40D) are rare and entirely densely spined; rays are cylindrical and end in round or abruptly pointed tips.

Microscleres (Table 19) consist of discohexasters and onychohexasters in ratio of about 10:1. Discohexasters (Figs 39J, 40E) are stellate, robust, compact, and quite variable in size and shape; each short primary ray carries 4–7 longer, sigmoid terminal rays which end in a disc with 5–10 marginal teeth; all rays are

Table 19. Spicule and framework dimensions (µm) of *Chonelasma chathamense* n. sp.

Parameter	**Holotype NMNZ POR.000710** **mean**	**s. d.**	**range**	**no.**
Surficial hexactin:				
distal ray length	91	48	24–211	50
distal ray width	11.0	3.0	5.1–18.3	50
tangential ray length	193	40	105–293	50
tangential ray width	10.8	2.3	6.3–16.7	50
proximal ray length	353	105	148–610	50
proximal ray width	11.3	2.3	6.5–16.6	50
Scopule total length	434	43	343–589	50
head length	51.5	7.5	37.5–67.0	50
tine length	42.2	6.8	31.5–57.6	50
Uncinate length	1654	352	873–2515	50
width	6.7	1.5	4.3–11.0	50
Mesohexactin ray length	61	26	24–109	10
Discohexaster diameter	39.8	6.2	27.7–51.9	50
primary ray length	6.8	1.5	3.8–11.5	50
secondary ray length	13.1	2.4	8.0–18.4	50
Onychohexaster diameter	45.8	4.8	36.3–57.0	50
primary ray length	7.0	0.8	5.4–8.9	50
secondary ray length	16.4	2.1	11.7–20.4	50
Dermal cortex framework:				
epirhysis major diameter	681	219	309–1263	50
dermal beam length	250	86	115–526	50
dermal beam width	35.5	8.1	18.0–57.3	50
Primary layer framework:				
longitudinal beam length	643	199	287–1243	50
longitudinal beam width	45.1	8.1	23.5–66.8	50
transverse/radial beam length	318	95	137–543	50
transverse/radial beam width	34.3	9.2	20.3–58.3	50
Atrial cortex framework:				
aporhysis major diameter	640	128	441–839	29
atrial beam length	233	55	137–358	50
atrial beam width	34.5	8.9	18.9–54.3	50

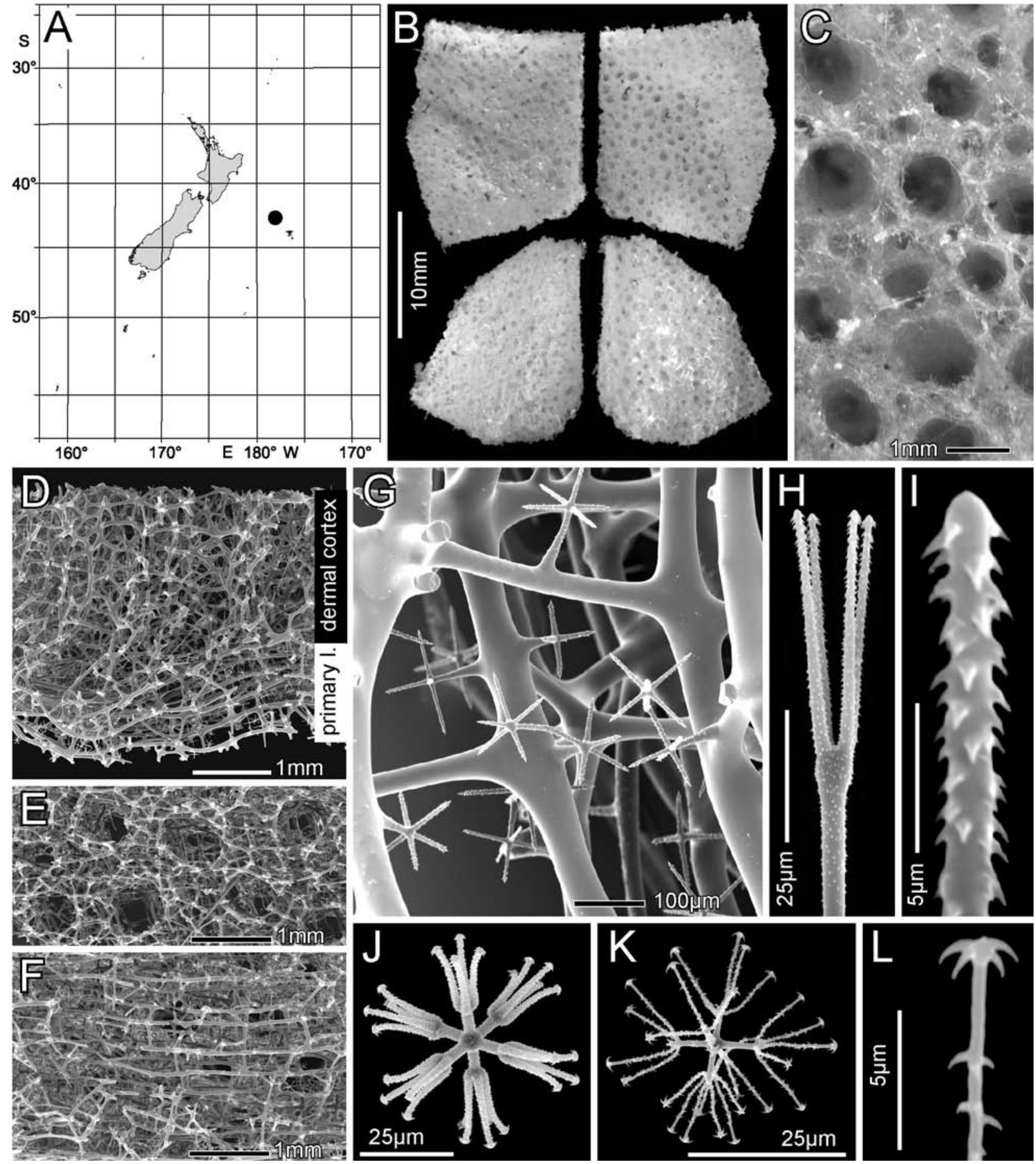


Figure 39. *Chonelasma chathamense* n. sp., holotype NMNZ POR.000710. A, distribution in New Zealand waters. B, subfragments of the two holotype fragments in dermal (right) and atrial (left) views. C, closer view of dermal surface with tissues intact showing distribution and form of water canals (LM). D, longitudinal section of clean choanosomal framework with dermal cortex and primary layer indicated. E, dermal ectosome in surface view showing apertures of epirhyses channels. F, atrial surface showing exposed primary layer of cleaned framework since atrial cortex is present only in traces at lower left. G, primary layer framework magnified to show lack of beam ornamentation and abundance of oxyhexactins appended to skeletal beams. H, scopule head. I, magnified scopule tine tip. J, stellate discohexaster. K, spherical onychohexaster. L, tip of onychohexaster terminal ray.

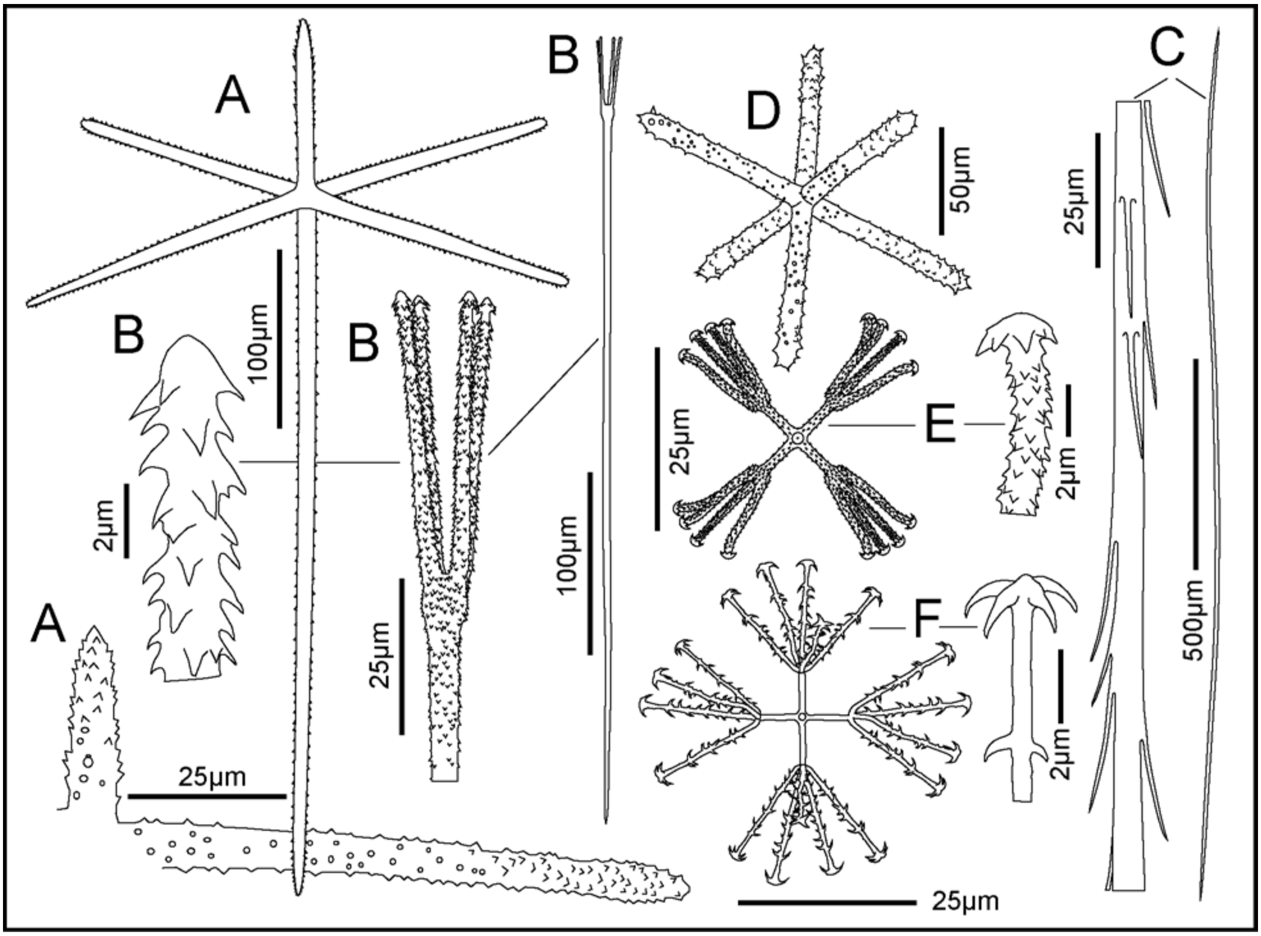


Figure 40. Spicules of *Chonelasma chathamense* n. sp., holotype NMNZ POR.000710. A, surface hexactin, whole and enlargement of distal and tangential ray. B, strongyloscopule, whole, upper end, and tip of tine. C, uncinate, whole and enlargement of middle segment. D, mesohexactin. E, discohexaster, whole and terminal ray end. F, spherical onychohexaster, whole and terminal ray end.

rough in SEM but the primary rays appear smooth in LM. Onychohexasters (Figs 39K, L, 40F) are spherical, thin, and delicate; each short, smooth primary ray carries 4–7 terminal rays ending in 3–5 claws projecting perpendicularly from the end knob; the terminal rays bear sparse but prominent recurved thorns easily seen in LM.

ETYMOLOGY: The species name *chathamense* refers to the location of collection, the Chatham Rise.

REMARKS: Presence vs. absence and relative thickness of cortical layers are not considered important taxonomic characters within *Chonelasma* since these must vary with growth stage and age. Hexactin surface spicules, however, are distinctive and are known in only two other members of *Chonelasma*, *C. doederleini* from Japan, and *C. hamatum*, known only from New Zealand waters and re-described above. The new form described here differs from *C. doederleini* in having simple non-pinulate distal rays on the surface hexactins, in the stellate form of its discohexasters, and in its onychohexasters; *C. doederleini*, in contrast, has pinulate distal hexactin rays, spherical discohexasters, and no onychohexasters. The new form differs from *C. hamatum* in, among other characters, the strongylote form of its scopules, the presence of mesohexactins with cylindrical rays, and presence of onychohexasters; *C. hamatum*, in contrast, has discoscopules with distinctly enlarged terminal discs, no mesohexactins, and no onychohexasters. Since many characters are shared between the new form and *C. hamatum*, the new form could be assigned as a subspecies of *C. hamatum*. However, the presence of a distinctive new microsclere form, the spherical spined onychohexaster, suggests the populations of these forms have been separate for a considerable time. Future collections may prove that intermediate variations exist between the few specimens now available for these forms, but it seems prudent to presently recognise the distinctive Chatham Rise form as a new species, *C. chathamense*.

It is further noteworthy that all of the *Chonelasma* species with hexactin surface spicules also lack ranking and septa formation in the primary layer. These two very distinctive shared characters set this small group apart from the larger set of species with pentactin surface spicules and well-developed ranking and septation of the primary framework. These shared features may be the basis for subgeneric division of the genus in future revision.

KEY DIAGNOSTIC CHARACTERS:

- Body form likely to be leafy blades forming a fan-shaped body
- Dictyonal framework of two or three distinct layers, one having longitudinal strands without septa
- Surface spicules are hexactins with short non-pinulate distal rays
- One class of scopule is present, a strongyloscopule without terminal discs
- Microscleres are robust stellate discohexasters and delicate spherical onychohexasters
- Oxy-tipped microscleres are absent

Chonelasma sp. (Fig. 41)

MATERIAL EXAMINED:

North Norfolk Ridge (*Australian EEZ*): QM G316670, NIWA Stn TAN0308/034, 28.518° S, 167.795° E, 1040–1091 m, 16 May 2003; QM G316580, NIWA Stn TAN0308/040, 26.421° S, 167.188° E, 714–756 m, 17 May 2003; QM G331687, NIWA Stn TAN0308/043, 26.432° S, 167.181° E, 750–774 m, 18 May 2003.

South Norfolk Ridge: NIWA 46016, NZOI Stn E870, 42.083° S, 168.167° E, 1488 m, MV *Taranui*, 10 Mar 1968. *West Norfolk Ridge*: NIWA 62079, NIWA Stn TAN0308/145, 34.297° S, 168.430° E, 1251–1268 m, 2 Jan 2003.

Lord Howe Rise (*Australian EEZ*): QM G316391, QM G331684, NIWA Stn TAN0308/052, 29.239° S, 159.035° E, 1210–1395 m, 21 May 2003.

Cavalli Seamounts, *West Cavalli*: NIWA 43407, 43409, NIWA Stn KAH0204/38, 34.159° S, 173.963° E, 780–800 m, 18 Apr 2002; NIWA 43399, NIWA Stn KAH0204/29, 34.163° S, 173.962° E, 782–790 m, 17 Apr 2002. *Seamount 441*: NIWA 43413, NIWA Stn KAH0204/46, 34.046° S, 174.814° E, 790–820 m, 19 Apr 2002; NIWA 43419, NIWA Stn KAH0204/52, 34.055° S, 174.808° E, 820–910 m, 19 Apr 2002; NIWA 43414, NIWA Stn KAH0204/47, 34.0425° S, 174.817° E, 792–880 m, 19 Apr 2002.

Bay of Plenty, *Rungapapa Seamount*: NIWA 31187, NIWA Stn TAN0413/118, 37.554° S, 176.969° E, 154–190 m, 13 Nov 2004.

Southern Kermadec Ridge: NIWA 62051, NZOI Stn X700, 35.841° S, 177.908° E, 1760–1765 m, 15 Feb 1996.

North Chatham Rise, *Graveyard seamount complex*, *Graveyard Seamount*: NIWA 51921, NIWA Stn TAN0104/001, 42.760° S, 179.988° W, 770–979 m, 15 Apr 2001; NIWA 51957, NIWA Stn TAN0104/394, 42.761° S, 179.989° W, 771–920 m, 21 Apr 2001; NIWA 25138, NIWA Stn TAN0604/016, 42.765° S, 179.988° W, 993 m, 29 May 2006; *Zombie Seamount*: NIWA 25117, NIWA Stn TAN0604/009, 42.763° S, 179.925° W, 1019 m, 28 May 2006; *Morgue Seamount*: NIWA 25132, NIWA Stn TAN0604/011, 42.716° S, 179.961° W, 935 m, 28 May 2006. *Gothic Seamount*: NIWA 25231, 25237, NIWA Stn TAN0604/106, 42.7268° S, 179.899° W, 1030 m, 5 Jun 2006. *Ghoul Seamount*: NIWA 25297, NIWA Stn TAN0604/117, 42.797° S, 179.985° W, 950 m, 7 Jun 2006.

Bollons Seamount, *SE of Bounty Plateau*: NIWA 43448, NIWA Stn TAN0307/85, 49.547° S, 177.028° W, 1906–2040 m, 2 May 2003.

Solander Trough, *southern New Zealand*: NIWA 62054, NIWA Stn Z9588, 50.067° S, 165.918° E, 1000–1250 m, 4 Dec 1998.

SW of Macquarie Ridge: NIWA 3290, NIWA Stn Z10308, 48.625° S, 150.450° E, 913–1148 m, 31 Jul 2000.

Table 20. Framework dimensions (μm) of *Chonelasma* sp.

Parameter	**NIWA 46016**			
	mean	**s. d.**	**range**	**no.**
Dermal cortex framework:				
epirhysis major diameter	967	396	393–1869	50
beam length	n/a	n/a	n/a	n/a
beam width	119	38	44–229	50
Primary layer, septa spacing	1930	403	1123–2999	23
longitudinal beam width	79	43	36–179	50
transverse/radial beam length	701	295	319–1632	23
transverse/radial beam width	98	47	48–258	50

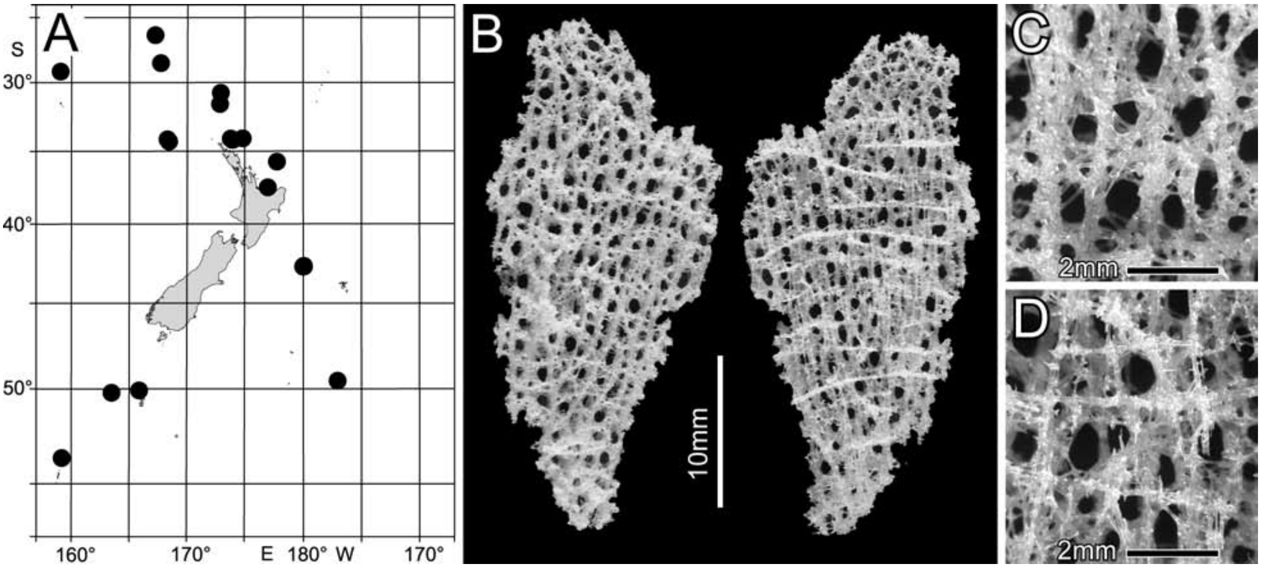


Figure 41. *Chonelasma* sp., NIWA 46016. A, distribution in New Zealand and eastern Australian waters. B, one of the NIWA 46016 fragments in dermal view (left) with epirhyses tending to alignment, and atrial view (right) with remnants of the transverse septa of the primary layer. C, closer view of dermal surface with epirhyses. D, closer view of atrial surface with transverse septa remnants.

Non-type material designated *Chonelasma* sp. incertae sedis: *Macquarie Ridge*: NIWA 39764, 52668, NIWA Stn TAN0803/33, 50.090º S, 163.482º E, 1077–1408 m, 01 Apr 2008; NIWA 40468, NIWA Stn TAN0803/77, 53.738º S, 159.114º E, 1014–925 m, 11 Apr 2008.

Distribution: *Chonelasma* sp. reported here have been collected from the North Norfolk Ridge and Lord Howe Rise (Australian EEZ) to North Cape, Bay of Plenty, Chatham Rise, Bollons Seamount, Solander Trough, and Macquarie Ridge (Fig. 41A).

Habitat: Probably attached to hard substratum but attachments are not present in any of the 87 fragments; depth range is 154–2040 m.

Description:

Morphology of all fragments except NIWA 43448 is fairly flat and blade-like and, where intact, with smooth edges. The severely eroded fragments (NIWA 46016, Fig. 41B) have a channelised cortex only on one surface (dermal) with openings to epirhyses (Fig. 41C); the opposite surface has been worn away and remnants of the primary layer are exposed showing longitudinal strands and transverse septa (Fig. 41D). NIWA 43448 is a basal cup with the outer layer severely eroded, exposing the primary layer. All other specimens have channelised cortices on both surfaces, with epirhyses openings as elongate ovals with clear tendency of longitudinal alignment; aporhyses on the other side are round and evenly distributed without alignment. Loose spicules are entirely lost from these dictyonal frameworks, the remnants of specimens that had been dead for some time before collection.

Dimensions of the fragments range from 20 x 34 to 55 x 104 mm in horizontal dimensions and 2.9–5.3 mm in thickness. Epirhyses range from 545–967 µm in mean long diameter; aporhyses range from 519–989 µm in mean diameter.

Texture is stony, brittle, and fragile.

Surface is smooth.

Colour white to beige.

Choanosomal skeleton generally a three-layered dictyonal framework in most fragments consisting of a thick channelised dermal cortex, a thinner unchannelised primary layer with longitudinal dictyonal strands, and a channelised atrial cortex of variable thickness. The dermal cortex is easily identifiable by its elongate, slit-like epirhyses openings tending to alignment in longitudinal rows; dictyonalia are fused without organisation, resulting in triangular meshes. The primary layer is formed by dictyonalia fused in longitudinal rows resulting in elongate rectangular meshes and longitudinal strands; nodes are not ranked in most specimens, so transverse septa are absent except in NIWA 46016 (Fig. 41B, D), the framework data of which are provided in Table 20. The atrial cortex, present in all specimens other than NIWA 46016, is channelised by cylindrical aporhyses and, like the dermal cortex, constituent dictyonalia are irregularly fused resulting in triangular meshes. Beams are mostly smooth but microspines occur in patches; small rough oxyhexactins are appended to beams of some specimens, but where they occur, they are present in all fragments from that collection. Nodes are not swollen; spurs are long, rough, and tapered to rounded or sharp points. Loose choanosomal spicules have been entirely lost.

Remarks: Unidentifiable skeletal frameworks of *Chonelasma* have been reported from the Atlantic Ocean (Azores, Bermuda, Bay of Biscay, Madeira, Morocco, St Thomas), the Southern Ocean (Crozet Islands, Antarctica) and the Pacific Ocean (Alaska, Hawaii, Japan, Paumoto Islands, mid-western Pacific) but not previously from New Zealand or eastern Australian waters. All of the specimens are similar in general morphology to local known species, but all fragments from northwest of New Zealand lack septa in the primary dictyonal layer. All fragments from near North Cape and to the south, excepting NIWA 43448, have septa in the primary layer. Since *C. lamella*, *C. australe*, and *C. biscopulata* all have primary layer septa, the latter group of washed out skeletons cannot be certainly assigned to either of these species; but since only *C. lamella* is known from near North Cape, those specimens probably belong to that species. The non-septate fragments from northwest of New Zealand probably belong to *C. hamatum* since that species is non-septate and the region is the primary habitat of that species. However, without diagnostic loose spicules, these fragments are all best presently considered *Chonelasma* sp. since they could conceivably be members of the species so far only known to occur south of New Zealand or of other yet undescribed species. All fragments of *Chonelasma* species known so far are consistent with a frond-like body or branching form with frond-like appendages similar to that suggested by Tabachnick (1991).

Key characters:

- Body form is unknown, but when broken produces blade-like fragments
- Dictyonal framework usually of three distinct layers
- Both surface layers permeated by holes about 0.75 mm in diameter
- Middle layer with continuous elongate silica strands and with or without septa
- Loose spicules completely washed out

Periphragella Marshall

Periphragella Marshall, 1875: 177; Carter 1885: 394; Schulze 1887: 299; Ijima 1927: 203; Reiswig & Wheeler 2002: 1324.

Chonelasmatinae of funnel-like body form with deep atrial cavity from which emanate thin-walled radial tubes; the latter branch and anastomose externally forming a poorly defined thick body wall; atrium developed directly from expanded lumen of originating tubular unit with primary unchannelised dictyonal wall composed of elongate rectangular meshes; main beams form longitudinal strands; connecting beams aligned in transverse laminae; secondary dictyonal structures of irregular mesh; beams uniformly microspined; megascleres include pentactins or hexactins with short distal ray as dermalia and atrialia, tyloscopules and uncinates; microscleres include oxyhexasters with or without discohexasters (modified from Reiswig & Wheeler 2002).

Remarks: The genus presently contains six valid species occurring in Japan, Indonesia, the N Atlantic (Azores), and Antarctica, with overall depth range of 256–1919 m. It has not previously been reported from New Zealand waters.

Type species: *Periphragella elisae* Marshall, 1875.

Periphragella elisae Marshall, 1875 (Figs 42, 43)

Periphragella elisae Marshall, 1875: 177; Carter 1885: 394; Schulze 1887: 299; Ijima 1927: 204; Okada 1932: 50; Reid 1964: lxxx; Reiswig & Wheeler 2002: 1324.

Material examined:

Non-type specimen: *Bay of Plenty*, *Otara Seamount*: NIWA 43453, NIWA Stn TAN0413/40, 36.961° S, 177.297° E, 1652–1669 m, 9 Nov 2004.

Comparative material: Holotype RMNH Porifera no. 28, Moluccas, Indonesia, dry.

Distribution: Known only from north of Bay of Plenty in New Zealand waters (Fig. 42A). Elsewhere known from the western Pacific, Mollucas to Japan.

Habitat: Attached to hard substratum by a basal plate. Previously recorded depth range 183–675 m, but New Zealand specimen extends this to 1669 m.

Description:

The new sample consists of one small complete specimen (Fig. 42B) and 6 fragments that are probably parts of a second slightly smaller specimen. The complete specimen is saccate in form with thick walls and a slightly eccentric osculum opening into a deep tubular atrial cavity slightly wider than wall thickness. The relatively even external surface is sculpted by interrupted series of deep grooves oriented longitudinally, with irregular pits on the intervening ridges. The free spicule lattice has been lost from most of the external surface during collection thus it is unknown if the grooves were covered by a lattice when alive. The internal surface of the atrial cavity is covered with large apertures that open into a series of longitudinal grooves similar to, and alternating laterally with, those opening on the outer dermal surface. No connections have been found between these two series of grooves, thus if considered skeletal channels, they must be interpreted as epirhyses and aporhyses.

Dimensions of complete specimen are 13.8 mm in diameter, 23.4 mm in length, and 4 mm wall thickness. Longitudinal grooves of dermal and atrial systems are 1.0–1.5 mm in width.

Texture is firm but fragile.

Surface is smooth overall without large prostalia; uncinates and scopules project in abundance from all surfaces but they are not generally apparent to the naked eye.

Colour light beige.

Choanosomal skeleton is mainly a fused dictyonal framework of simple hexactins, never more than three or four meshes in thickness at any location due to occupation of most of the wall by alternating dermal and atrial longitudinal grooves. The dermal surface and lateral walls of the dermal grooves have longitudinal strands connected by short beams forming elongate rectangular meshes (Fig. 42C), a fairly typical variant of a euretoid framework. The floor of the grooves has more irregular triangular and polygonal meshes. The framework of atrial surface is obscured by fusion of large numbers of fine-spined microhexactins onto all components; some areas with fewer additions have irregular meshes (Fig. 42D), with only hints of longitudinal strands and rectangular-meshed internal layer expected here. Beams throughout the framework are fairly uniform in thickness and evenly microspined (Fig. 42F). Nodes are not swollen and tend to be smoother than beam surfaces. Spurs of the atrial surface

Table 21. Spicule and framework dimensions (µm) of *Periphragella elisae* Marshall, 1875.

Parameter	**NIWA 43453**			
	mean	**s. d.**	**range**	**no.**
Dermal pentactin/hexactin:				
tangential ray length	238	66	97–366	50
tangential ray width	11.0	2.8	4.6–18.5	50
proximal ray length	266	79	108–414	50
proximal ray width	11.5	3.0	7.2–17.6	50
distal ray length	38	29	14–122	20
distal ray width	18.8	4.0	11.9–25.3	20
Atrial pentactin/tetractin:				
tangential ray length	185	42	100–311	50
tangential ray width	8.8	2.2	4.6–13.8	50
proximal ray length	213	81	73–410	50
proximal ray width	9.1	2.8	4.6–19.1	50
Uncinate length	1174	453	667–2515	27
width	8.7	3.2	5.1–16.3	50
Scopule length	387	49	310–562	50
head length	103	13	79–148	50
tine length	92	11	68–133	50
shaft width	4.9	1.2	3.0–8.9	50
Oxyhexaster diameter	65.4	10.2	34.7–88.6	50
primary ray length	16.7	3.0	10.2–25.1	50
secondary ray length	17.9	2.4	12.9–22.7	50
Discohexaster diameter	37.1	4.6	29.8–50.7	50
primary ray length	9.7	1.6	6.7–13.2	50
secondary ray length	9.1	1.3	6.9–12.7	50
Dermal frame beam length	560	220	213–1190	61
beam width	48	14	22–93	98
spur length	331	148	89–950	54
Atrial frame beam length	407	192	89–895	63
beam width	53	14	18–82	63
spur length	292	153	104–756	29

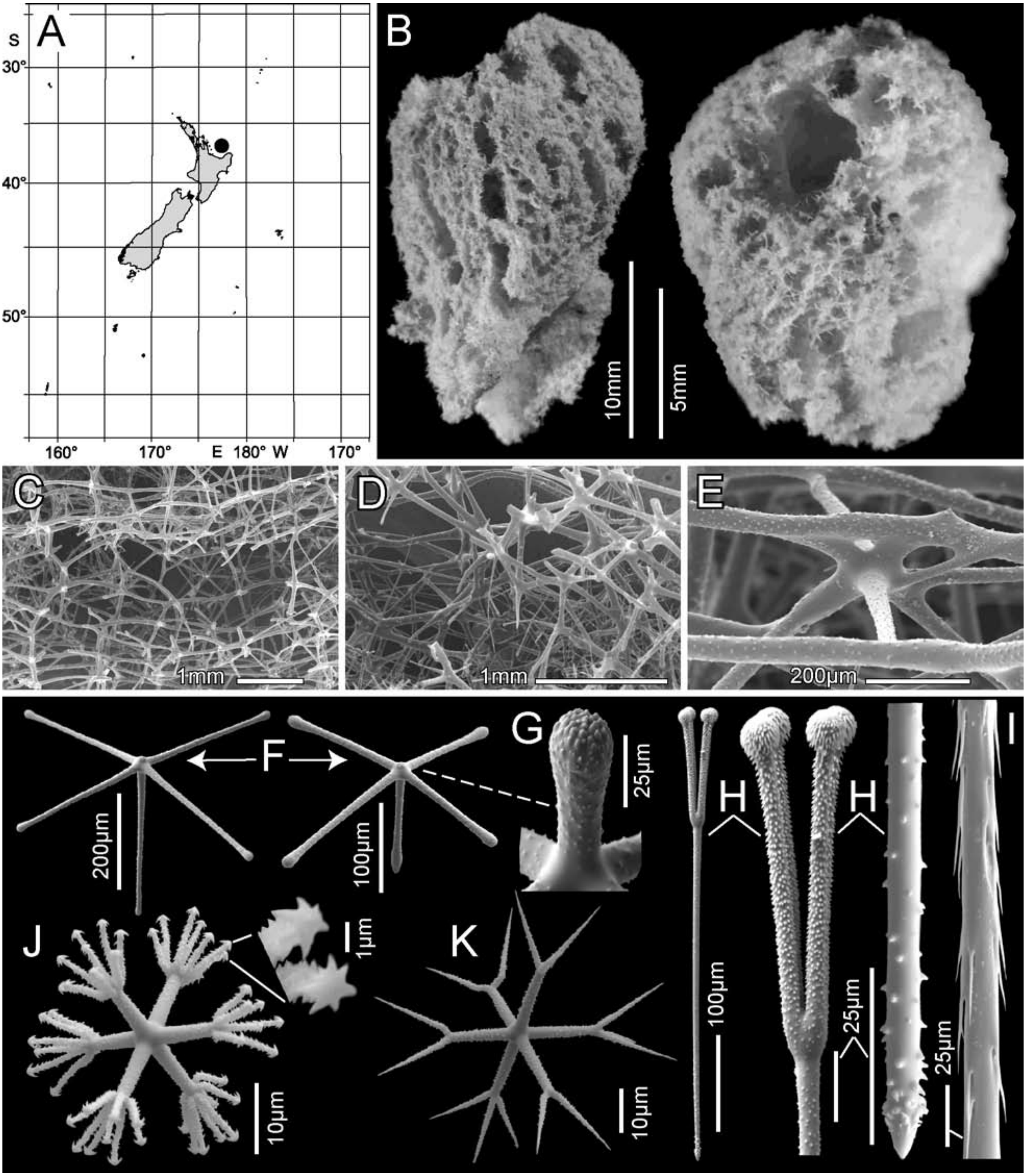


Figure 42. *Periphragella elisae* Marshall, 1875, NIWA 43453. A, distribution in New Zealand waters. B, NIWA 43453 in side view (left) and oblique view of the osculum (right). C, dermal framework. D, atrial framework. E, close-up of dermal beam ornamentation. F, dermal pentactins. G, distal ray of dermal subhexactin. H, tyloscopule, whole and magnified head and proximal tip. I, uncinate segment. J, discohexaster with magnified secondary ray tips. K, oxyhexaster.

are always rough and are either digitate or slightly clavate in form; dermal spurs could not be characterised due to their being largely broken off. Loose spicules in the choanosomal region include spiny uncinates and microscleres.

Ectosomal skeleton is worn off most of the sample but residual material exists in some places; it consists mainly of a lattice of loose pentactins and subhexactins that overlies all surfaces and probably covered the apertures of the longitudinal grooves. Scopules associ-

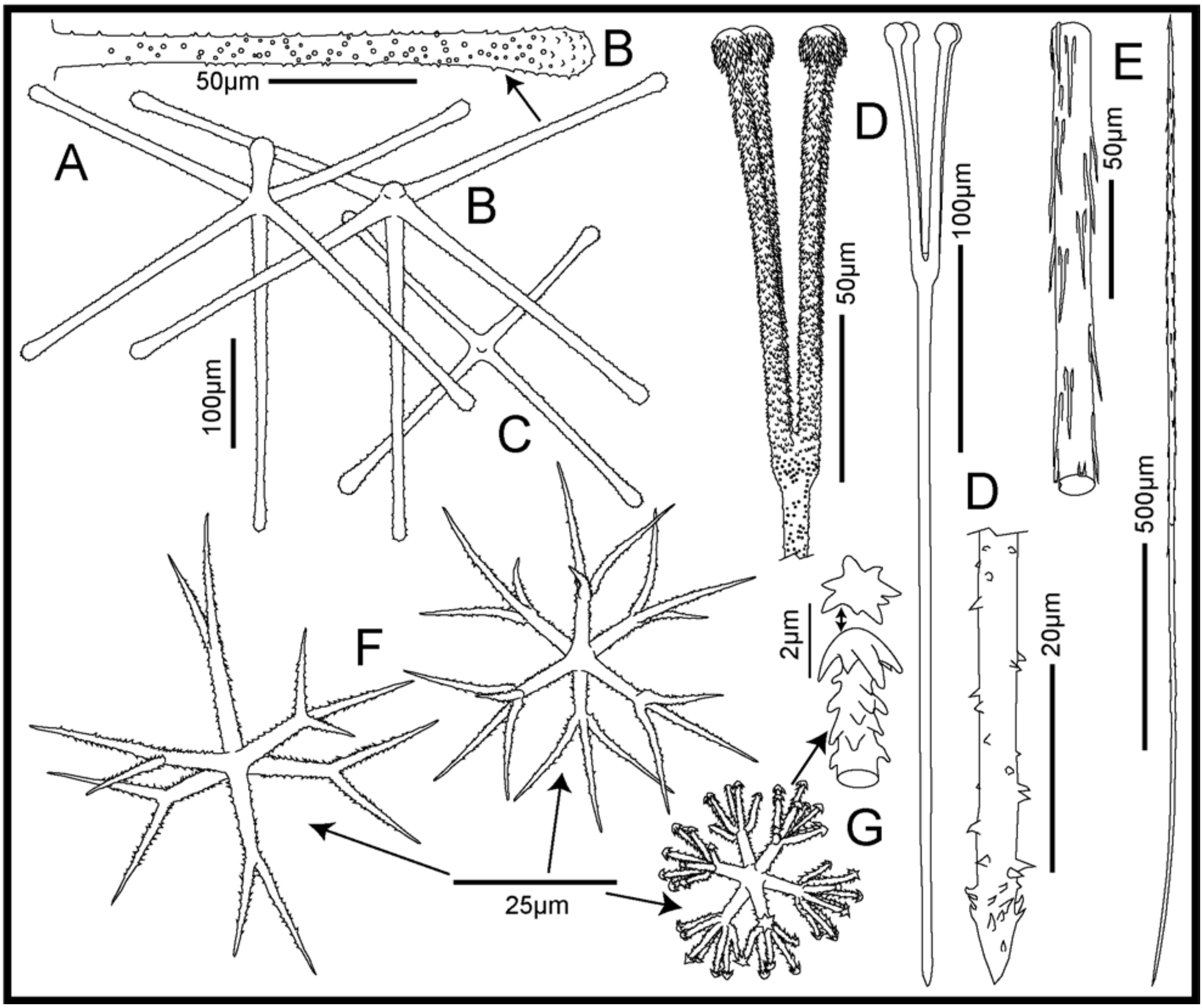


Figure 43. Spicules of *Periphragella elisae* Marshall, 1875, NIWA 43453. A, dermal subhexactin. B, dermal and atrial pentactin with enlargement of tangential ray. C, atrial tetractin. D, tyloscopule, whole and enlargement of head and proximal end. E, uncinate and segment of upper region. F, two oxyhexasters with straight and curved secondary rays. G, discohexaster with enlargement of secondary ray tip and end disc.

ated with the surface pentactins project vertically, head outwards. Uncinates project anterior end outwards on all surfaces. Microscleres are scattered in and under both dermal and atrial surfaces.

Megascleres (Table 21) are surface pentactins, subhexactins and tetractins, tyloscopules, and uncinates. Dermalia are subhexactins (Figs 42G, 43A) and pentactins (Figs 42F, 43B) while atrialia are pentactins and tetractins, often with a short knob for the fifth ray (Fig. 43C); these are all uniformly microspined and have clavate ray tips. The tyloscopules (Figs 42H, 43D) occur only on the dermal surface and entrances to the dermal grooves. The small necks bear four slightly curved or straight tines ending in spherical knobs; the tines and sides of the terminal knobs are profusely covered with fine recurved spines but the distal surfaces of the knobs are bare; most of the shaft is sparsely spined but spines increase in size on the proximal end where the shaft is slightly inflated before ending in an abrupt sharp tip. Uncinates (Figs 42I, 43E), which occur in a wide size range, have well-developed brackets and barbs inclined very slightly from the spicule surface.

Microscleres (Table 21) are oxyhexasters and discohexasters in about equal abundance, and rare hemioxyhexasters and oxyhexactins. Oxyhexasters (Figs 42K, 43F) and hemioxyhexasters have primary and secondary rays about equal in length (primary to secondary length ratio = 0.93), each primary ray bears 1–7 straight or out-curved secondary rays; they appear smooth in LM but are entirely covered in short reclined hooks in SEM. The smaller discohexasters are stellate in form (Figs 42J, 43G) with also about equal ray lengths (primary to secondary length ratio = 1.07). Each primary ray bears 3–11 secondary rays ending in discs with 4–8 marginal spines; they appear smooth in LM but are found to be entirely covered with fine recurved hooks in SEM.

REMARKS: The new specimens differ in many basic features from five of the six known species of *Periphragella*, but it should be noted that the 'tylohexasters' described for several of these will probably prove to be discohexasters when examined in SEM. The new specimens agree fairly well with descriptions of *P. elisae*, although they are from a depth over twice that previously recorded for this species. They differ from known *P. elisae* in having no indication of external tubule structure, in having larger microscleres with proportionately longer primary rays, and in having no scopules in the atrial lining. Some of the noted differences might be attributed to the unusual depth and small size of the new specimens. In view of the many similarities to *P. elisae*, the few differences are not considered sufficient to warrant formation of a new taxon. This assignment represents a major, but not entirely surprising, range extension for this species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is saccate with a deep, narrow atrial cavity
- Apertures in both surfaces open into longitudinal grooves in the body wall
- Dictyonal framework is euretoid with longitudinal strands
- Surface spicules are pentactins, subhexactins, and tetractins with clavate tips
- Scopules consist of a single type and have conspicuous tylote tips
- Microscleres are predominately small oxyhexasters and discohexasters

Chonelasmatinae incertae sedis (Fig. 44A–E)

MATERIAL EXAMINED:

West Norfolk Ridge: NIWA 70546, NIWA Stn TRIP2474/37, 34.533° S, 168.792° E, 820–926 m, 2 Aug 2007.

Cavalli Seamounts, West Cavalli: NIWA 43402, NIWA Stn KAH0204/32, 34.162° S, 173.962° E, 780–810 m, 17 Apr 2002.

North Chatham Rise, Graveyard seamount complex, Dead Ringer Seamount: NIWA 53477, NIWA Stn TAN0905/70, 42.737° S, 179.691° W, 840 m, 22 Jun 2009. *Ritchie Seamount*: NIWA 53865, NIWA Stn TAN0905/106, 44.175° S, 174.553° W, 704 m, 26 Jun 2009.

East Chatham Rise, Andes Seamounts, Diamond Head: NIWA 62149, NIWA Stn TAN0905/98, 44.147° S, 174.698° W, 720 m, 26 Jun 2009.

Macquarie Ridge, Seamount 9 (Australian EEZ): QM G331870, NIWA Stn TAN0803/100, 56.223° S, 158.461° E, 1248–1260 m, 16 Apr 2008.

DISTRIBUTION: Known from the West Norfolk Ridge and Cavalli Seamounts (Fig. 44A, filled circle), south to the Chatham Rise and Macquarie Ridge.

HABITAT: Presumably attached to hard substratum; depth range 780–810 m.

DESCRIPTION:

Morphology of the small flat fragment is a short segment of a presumably blade-shaped sponge; it consists of a dead, washed out skeletal framework (Fig. 44B), and is colonised by a thin encrusting demosponge, *Hamacantha* sp. It is widest in the middle and tapers gently towards the lateral margins.

Dimensions of fragment are 40 mm in breadth, 324.3 mm in length, 4.8 mm in thickness.

Texture is stony.

Surface is relatively smooth and even with slight longitudinal grooves section (Fig. 44C).

Colour light beige.

Choanosomal skeleton of this fragment, inspected in transverse and longitudinal sections, consists of slightly off-centre primary framework sheet of one to two meshes of cubic-meshed dictyonal layers. Cortical layers are appended to both sides, about 10 on the presumed atrial side and about 20 on the presumed dermal side (Fig. 44C, D). The dictyonalia of the cortices are joined in a fairly regular cubic arrangement, allowing vertical and transverse elements to be easily recognised. There is no indication of channelisation. Beams are smooth and relatively uniform in thickness, nodes are not swollen, and small smooth microxyhexactins are appended to the beams in small numbers (Fig. 44E).

REMARKS: This fragment is almost certainly from a member of Euretidae; it lacks the longitudinal rectangular mesh of Farreidae, and lacks the channelisation characteristic of other Hexactinosida families. Within Euretidae, its form is consistent with Chonelasmatinae, but its characters are not consistent with any of its presently known genera. This fragment is most likely from a species of Chonelasmatinae as yet unknown in the New Zealand area.

KEY CHARACTERS:

- Body form a flat smooth blade about 5 mm in thickness
- Channelisation is lacking
- The primary dictyonal skeleton consists of 1–2 layers of dictyonalia forming cubic (not elongate) meshes

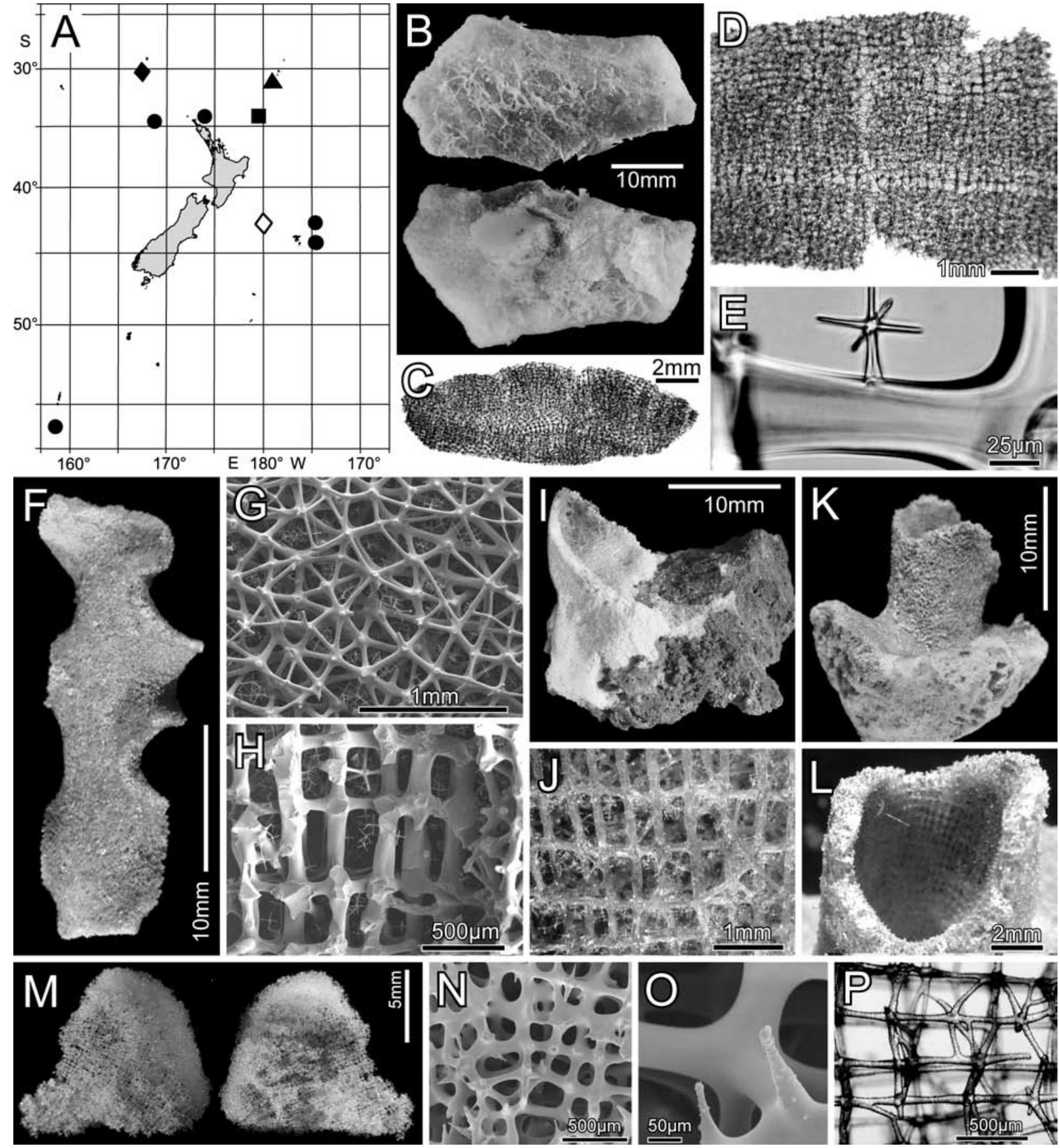


Figure 44. Chonelasmatinae incertae sedis, Farreidae/Euretidae incertae sedis, and Euretidae incertae sedis. A, distributions in New Zealand and Australian waters, Chonelasmatinae as circles; Farreidae/Euretidae as square (NIWA 43434, 62064) and triangle (NIWA 43437); Euretidae as diamonds, filled (QM G316495) and empty (NIWA 51925). B–E Chonelasmatinae NIWA 43402 . B, both sides of fragment. C, cross-section (LM). D, same magnified to show primary layer (LM). E, beam and appended smooth microxyhexactin (LM). F–L, Farreidae/Euretidae. F, NIWA 62064, fragment. G, dermal cortex of same. H, same dissected to show primary layer. I, NIWA 43434, one of two bases. J, primary layer of same exposed on atrial surface. K, NIWA 43437, basal fragment. L, primary layer of same exposed on atrial surface. M–P, Euretidae. M, both sides of fragment QM G316495. N, surface of convex side. O, beams and spurs of convex surface. P, framework of NIWA 51925 (LM).

- Dermal and atrial cortices are 10–20 cubic-meshed layers in thickness
- Beams are smooth, nodes are simple and unswollen
- Free spicules remain unknown

Farreidae/Euretidae incertae sedis

(Fig. 44A, F–L)

Material examined:

Southern Kermadec Ridge and volcanic arc, *Volcano D* (*Sonne*): NIWA 43434, 62064, NIWA Stn TAN0205/012, 34.091° S, 179.556° E, 1705–1930 m, 13 Apr 2002. *Volcano K*: NIWA 43437, NIWA Stn TAN0205/48, 31.087° S, 179.900° W, 944–1129 m, 19 Apr 2002.

Distribution: Known from two locations on Kermadec Ridge (Fig. 44A, filled square and triangle).

Habitat: Presumably all attached to hard substratum; depth range 944–1930 m.

Description:

The four small specimens included here are an unattached segment of an elongate blade with ruffled edges (Fig. 44F), and three attachment bases, two of which are crescentic laminae attached to hard substratum on one side (one shown in Fig. 44I) and a tubular base attached centrally by an expanded disc (Fig. 44K). All consist of long-dead frameworks devoid of loose spicules.

Dimensions of the ruffled blade are: length 30.6 mm, width 10.5 mm, thickness 1.5 mm. The crescentic laminar bases are: height 12.0 and 15.6 mm, width 19.3 and 16.5 mm, wall thickness 1.0 mm. The tubular base is 11.8 mm in height, 8.1 mm in diameter, and 1.2 mm in wall thickness.

Textures of all four are stony hard.

Surfaces of all fragments are smooth, without any channelisation.

Colour of the ruffled blade medium brown; that of the three bases light beige.

Choanosomal skeleton of the ruffled blade consists of secondary dictyonal cortices on both sides of a distinct primary dictyonal framework. The cortices, each about five dictyonal layers thick, are composed of dictyonalia connected regularly but without orientation, forming triangular and polygonal meshes but no longitudinal strands (Fig. 44G). Small smooth microxyhexactins are attached to beams singly and in compound nests. The primary framework forms a central sheet throughout the entire blade; it consists of two layers of typical farreoid/euretoid network with longitudinal strands and regular rectangular meshes (Fig. 44H). The small attached microxyhexactins also occur here.

The three basal fragments all have two-layered farreoid/euretoid primary frameworks exposed on the inner atrial surfaces (Fig. 44J, L). In all of these, most of the wall thickness consists of 2–6 layers of irregular dermal cortex similar to those of the blade described above, appended to the outer side of the primary framework. Small smooth microxyhexactins are appended to framework beams of all three basal fragments. In both the ruffled blade and the basal fragments, beams are smooth, while nodes are simple and unswollen.

Remarks: These four fragments all share possession of a farreoid/euretoid primary framework with added secondary cortices and thus could be remnant frameworks of either Farreidae or Euretidae. The three basal fragments provide no indication of body form and could be from species already known and described above. The ruffled blade fragment, however, has a clear indication of body form, similar to that of *Farrea laminaris* Topsent, 1904a which is so far unknown within New Zealand waters; it could also be a fragment of an unknown member of Euretidae. It indicates once again that the present inventory of New Zealand Hexactinellida remains incomplete.

Key characters:

- All fragments have a 2-layered farreoid/euretoid primary framework and appended cortical frameworks of unorientated dictyonalia
- Beams are smooth, nodes are simple and unswollen
- Channelisation is lacking
- Loose spicules are unknown in all fragments
- Body form of the basal fragments is unknown
- The body form of the ruffled blade fragment is locally unknown and probably represents a yet to be discovered new species

Euretidae incertae sedis (Fig. 44M–P)

Material examined:

North Norfolk Ridge (*Australian EEZ*): QM G316495, NIWA Stn TAN0308/014, 30.204° S, 167.447° E, 755–782 m, 14 May 2003.

North Chatham Rise, *Graveyard seamount complex*, *Graveyard Seamount*: NIWA 51925, NIWA Stn TAN0104/002, 42.765° S, 179.989° W, 757–875 m, 15 Apr 2001.

Distribution: Known from North Norfolk Ridge (Australian EEZ) and Chatham Rise (Fig. 44A, filled and empty diamond, respectively).

Habitat: Presumably attached to hard substratum; depth range 755–875 m.

Description:

The larger fragment, QM G316495, is a dictyonal framework in the form of a curved chip (Fig. 44M). The smaller fragments of NIWA 51925 are too small to show a definite body form but the largest has longitudinal curvature suggestive of a wall fragment of a small calibre tubular body. Both specimens consist of dead frameworks without proper loose spicules.

Dimensions of QM G316495 are 11.8 x 13.2 mm; thickness is 2.3 mm. The minute fragments of NIWA 51925 have horizontal dimensions of 9.5 x 5.7 mm, 6.0 x 4.3 mm, and 3.5 x 2.4 mm; wall thickness varies from 1.7–2.1 mm.

Textures of both are rigid but fragile.

Surface of QM G316495 is smooth but worn externally; the concave internal surface is uneven, with shallow pits and ridges without discernable pattern (Fig. 44M right). The surface structure of the small fragments of NIWA 51925 cannot be determined due to their size.

Colour is white for all fragments.

Choanosomal skeleton of QM G316495 is a robust dictyonal network 5–8 layers in thickness composed of longitudinal strands which curve to the concave surface, presumed atrial, and end irregularly there. Short lateral and radial beams form mainly square meshes and all elements are relatively thick (Fig. 44N). There is no channelisation and no primary framework component on the atrial surface of a farreoid-like structure, only one or more layers of continuous rectangular meshes. Two or three layers of smaller thick dictyonalia are appended irregularly to the ends of the strands on the atrial surface forming a very erratic and uneven atrial cortex. Spurs are sparsely rough, short, stout, and conical in form (Fig. 44O). Beams are smooth; nodes are simple and not swollen. A few smooth microxyhexactins are attached to beams. No free spicules are present.

The choanosomal framework of NIWA 51925 is very different; it is a delicate dictyonal framework of longitudinal strands with perpendicular connecting beams forming an isotropic network of nearly cubic meshwork (Fig. 44P). There is no channelisation and no differentiation of primary and secondary framework components. All beams are finely spined and the few spurs present are long, thin, and end in rounded points. Nodes are simple and not swollen. No microxyhexactins are appended to the beams. Small clumps of free spicules include many types from both demosponges and hexactinellids, but none can be identified as intrinsic to the fragments.

Remarks: The combination of features of QM G316495 allow its placement within only the family Euretidae, probably within the Chonelasmatinae but that cannot be verified due to small size of the sample. It cannot be from any of the species now known from New Zealand or eastern Australian waters, and is thus a fragment of a species yet to be discovered and described from this area. Specimen NIWA 51925 could be washed-out fragments of the known euretids *Gymnorete pacificum* or *Periphragella elisae* described above, or possibly of the tretodictyid *Hexactinella acanthacea* described below. Without evidence of channelisation it is best to designate these fragments as Euretidae incertae sedis; they are not indicative of a new undescribed species.

Key characters:

- Both specimens are dead washed-out dictyonal skeletal frameworks
- Body form is a curved chip in one, too small to determine in the other
- Channelisation is lacking
- The dictyonal skeletons have longitudinal strands but lack a farreoid atrial framework
- An atrial cortex is present in one specimen but it is patchy and discontinuous
- Beams are smooth in one, fine-spined in the other
- Nodes are simple and unswollen

TRETODICTYIDAE Schulze

Sclerothamnidae Schulze, 1885: 451.
Volvulinidae Schulze, 1885: 451.
Tretodictyidae Schulze, 1886: 78.
Tretocalycidae Schulze, 1904: 178; Schrammen 1912: 190.
Hexactinellidae de Laubenfels, 1936: 185 (not Schmidt, 1870).

Hexactinosida with body form varying from branching and anastomosing solid cylinders to branching and anastomosing tubes to funnel, cup, and irregular globular forms; with three-dimensional, small-meshed, euretoid dictyonal framework several dictyonalia in thickness at the growing edge; primary dictyonal frame consists at least in part of four-sided (square or rectangular) meshes; rays of dictyonalia extend only one-mesh in length to the next adjacent dictyonal centrum; longitudinally oriented dictyonal rays aligned and fused side-by-side to form longitudinal strands; schizorhysial channelisation developed by growth of framework in narrow vertical (dermal to atrial) and longitudinal oriented septa bridged by small patches of dictyonalia; such growth leaves a confluent system of small gauge channels 1–2 mm wide running mainly longitudinally, but connected transversely. Superficial cortices usually not developed but hypersilicification of dermal surfaces with swollen surface nodes occur in three genera; attachment of small hexactins to frameworks is rare; spiculation includes strongyloscopules in all but one genus; uncinates of intermediate size with poorly developed brackets and barbs are typical (modified from Reiswig 2002c).

Remarks: No representatives of the presently defined Tretodictyidae have previously been reported from New Zealand waters. The species *Euryplegma auriculare*, listed in Tretodictyidae by Dawson (1993), has been moved to Order Aulocalycoida.

Type species: *Tretodictyum tubulosum* Schulze, 1886.

Anomochone Ijima

Anomochone Ijima, 1927: 268; Reiswig 2002c: 1343.

Tretodictyidae of either irregular, thin-walled funnel-form body with tendency to extreme lateral plication (branching), or thick-walled globose body, both with deep atrium either wide or narrow, respectively; with large terminal osculum and small lateral oscula; attached to solid substratum by narrow basal disc; with typical schizorhyses opening by surface grooves in upper marginal regions but obscured in main and lower body parts by dictyonal encroachment into channels; dictyonal framework entirely sparsely spined with triangular meshes and multiradiate nodes very swollen in dermal layer; dictyonal spurs as short sharp spikes; poorly known spiculation includes strongyloscopules and two sizes of uncinates; surface spicules and microscleres have been previously unknown (modified from Reiswig, 2002c).

Type species: *Anomochone expansa* Ijima, 1927.

Remarks: The genus was erected by Ijima (1927) for two species of tretodictyids, *A. expansa* Ijima, 1927, and *A. globosa* Ijima, 1927, collected by the *Siboga* at two stations in the Banda Sea from a depth range of 90–204 m. Most specimens were completely macerated; only one of the nine specimens contained a few spicules. No subsequent material has been reported since the original account.

Anomochone expansa Ijima, 1927 (Fig. 45)

Anomochone expansa Ijima, 1927: 269; de Laubenfels 1936: 185; Reiswig 2002c: 1343.

Material examined:

Lord Howe Rise (*Australian EEZ*): QM G331690, NIWA Stn TAN0308/050, 29.215° S, 158.984° E, 505–900 m, 21 May 2003.

Distribution: Known from Lord Howe Rise (Australian EEZ) (Fig. 45A); reported originally from south of Kur Island, Banda Sea, Indonesia.

Habitat: Attached to hard substratum. Depth range within eastern Australian waters 505–900 m, Banda Sea 90–204 m.

Description:

Morphology is a small irregular thin-walled funnel arising from an oblique basal attachment disc, extending asymmetrically on one side over a secondary substratum attachment (Fig. 45B) where a tubular branch projects almost horizontally; five circular, parietal (lateral) oscula on the outer walls (Fig. 45C–E) project slightly outwards and downwards and are hooded by a more extensive wall projection above them. Within the funnel, oblique foliose sheets of dictyonal tissue (framework) extend from the body wall across the atrium (Fig. 45C), subdividing and layering it, resulting in a labyrinth of interconnected spaces, some of which are atrial (exhalant) but some of which are ornamented like the external surface and probably inhalant. The sponge that formed this skeleton had been dead for some time at collection, as evidenced by the complete lack of free spicules and eroded condition of axial canals of the dictyonal elements. The free margins are extensively broken, suggesting this skeletal structure was originally considerably larger.

Dimensions of specimen are 20.0 mm in height, by 28.5 and 20.7 mm in widths; parietal oscula are 2.0–2.8 mm in diameter; the somewhat rectangular basal disc is 10.7 by 11.3 mm; wall thickness is 1.1–1.6 mm.

Texture is stony hard and fragile.

Surface is generally uneven with shallow longitudinal grooves and unorientated depressions; the entire outer surface is pocked with numerous small, round, 0.3–1 mm diameter openings to skeletal channels, most of which are blind-ending and thus categorized as epirhyses (Fig. 45E); some communicate internally and a very few of these progress entirely through the wall, thus constituting schizorhysial channels. Lower parts of the stems arising from the two attachment sites are smooth but still bear epirhyses apertures. The entire outer skeletal surface is moderately hypersilicified, more extensively in lower parts, forming a strong external framework.

Colour white.

Choanosomal skeleton is a moderately eroded dictyonal framework (Table 22). The external surface network (Fig. 45G) is composed of dictyonalia fused tip to node without formation of strands; meshes are mainly triangular; beams are ornamented with abundant small conical spines arranged randomly or in poorly defined transverse lines (Fig. 45H); nodes are swollen and ornamented with conical spines like those on the beams, but slightly larger and more widely spaced. All dermal elements are moderately hypersilicified so mesh openings have rounded corners and nodes are too inadequately delineated to allow their measurement; spurs are broken or eroded away. The atrial surface of the body wall, in most places, retains the exposed primary framework consisting of dictyonalia fused in lines to form longitudinal strands (Fig. 45F, I); meshes are mainly rectangular with sharp corners; beams and nodes are ornamented like those of the outer surface; nodes are swollen but clearly delineated (Fig. 45J); spurs are conical, finely rough, and sharply pointed. In several places the atrial framework is covered by patches of a very fine meshwork of tightly fused, small dictyonalia without swollen nodes. Within the wall, nodes are either swollen or unswollen and mostly multiradiate with 7–9 beams radiating from each.

REMARKS: Of all known Hexactinosida, the small eroded skeleton agrees best with Ijima's (1927) *Anomochone expansa* collected from the Banda Sea, Indonesia. It shares many characters including the irregular funnel shape, hooded down-facing lateral oscula 2–4 mm in diameter, numerous small channels up to 1 mm in diameter penetrating the wall, irregular trabecula-like connections between internal walls, microtuberculate ornamentation of beams, larger and sparser tubercles (spines) on nodes, swollen nodes on both inner and outer wall surfaces; interior nodes multiradiate, and patches of fine-meshed dictyonalia without swollen nodes on the atrial surface. The lack of vermicular grooves on the upper parts described in Ijima's specimens can be attributed to erosion of the small specimen. Wall thickness of the eastern Australian specimen is slightly smaller and beam dimensions are slightly larger than those of Ijima's specimens. Free spicules of *A. expansa* remain unknown except for the few uncinates and the bulbous-tipped scopule of questionable origin reported by Ijima (1927).

KEY DIAGNOSTIC CHARACTERS:

- Body form is an irregular funnel with small, down-facing lateral oscula
- Atrial cavity is subdivided by sheets of dictyonal framework growing across it
- Primary dictyonal framework of the atrial wall surface has longitudinal strands
- Nodes are markedly swollen on both surfaces and ornamented with simple conical spines
- External surface is moderately hypersilicified but meshes are still easily resolvable

Anomochone furcata n. sp. (Figs 46, 47)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** QM G316368, NIWA Stn TAN0308/055, Lord Howe Rise (Australian EEZ), 29.219° S, 159.008° E, 292–330 m, 21 May 2003. **Paratype** QM G331691, NIWA Stn TAN0308/043, North Norfolk Ridge (Australian EEZ), 26.432° S, 167.181° E, 750–774 m, 18 May 2003.

TYPE LOCALITY: Lord Howe Rise.

DISTRIBUTION: Known only from Lord Howe Rise and the North Norfolk Ridge (Australian EEZ) (Fig. 46A).

HABITAT: Attached to hard substratum; depth range 292–774 m.

DESCRIPTION:

Morphology of the spicule-bearing holotype is two small fragments of a thin-wall dictyonal sponge of distorted, foliose, funnel form with an irregular slit on one side (Fig. 46B). The upper parts are composed of short tubules and curved wall-like sheets emanating from both inner and outer body wall surfaces at any point. Five hooded parietal oscula open downward at upper marginal parts of the external surface (Fig. 46C); these are openings of tubular elements formed on the upper

Table 22. Framework dimensions (μm) of *Anomochone expansa* **Ijima, 1927.**

Parameter	QM G331690			
	mean	s. d.	range	no.
Dermal epirhyses diameter	615	162	294–979	56
Dermal beam length	275	51	157–381	50
width	95	35	35–182	50
Atrial node diameter	150	20	112–194	50
Atrial beam length	330	94	161–584	50
width	63	11	47–90	50
Atrial spur length	123	37	52–177	20

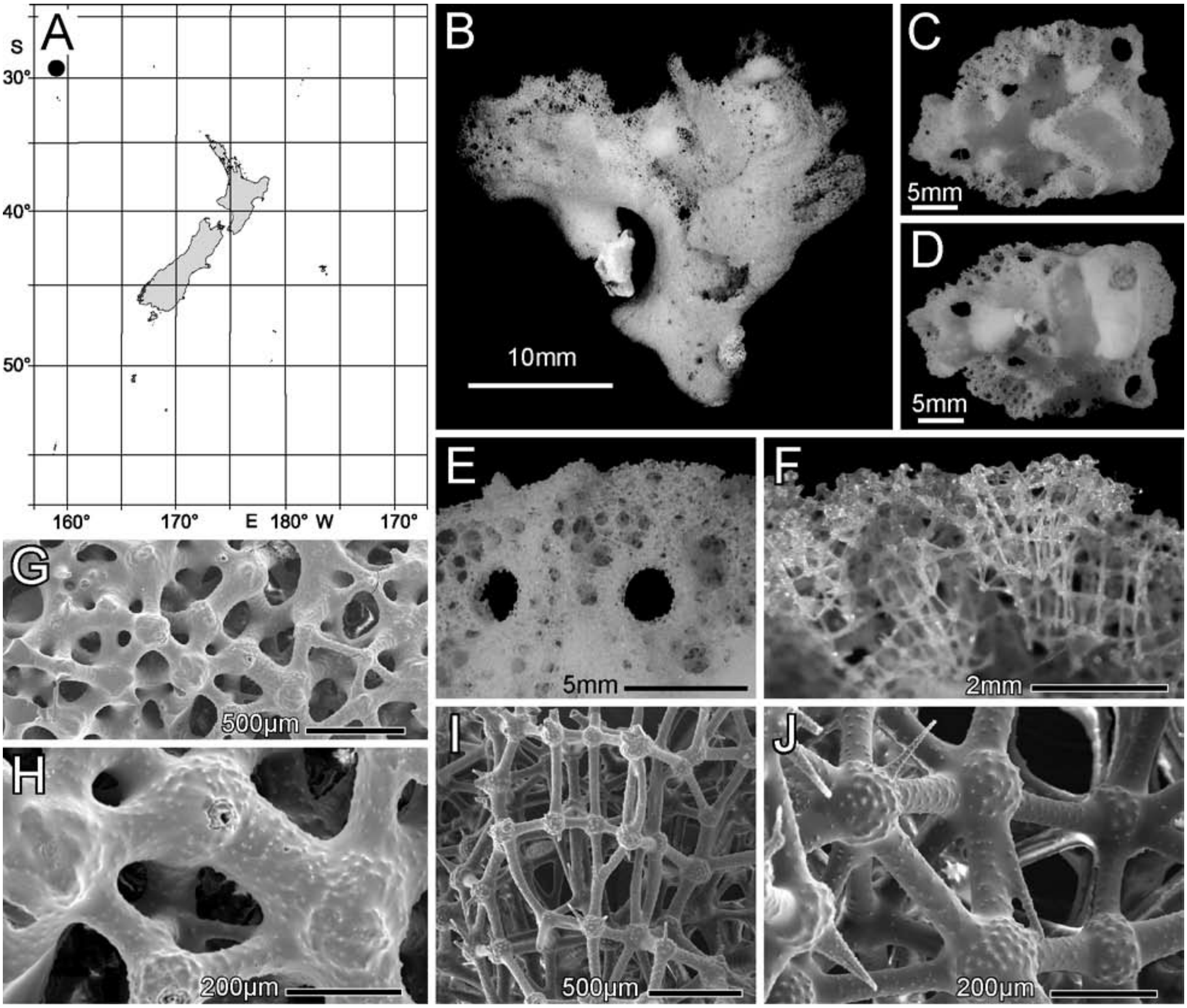


Figure 45. *Anomochone expansa* Ijima, 1927, QM G331690. A, distribution in eastern Australian waters. B–D, QM G331690. E, outer surface of upper edge with two parietal oscula and numerous epirhyses openings. F, atrial surface (primary layer) of upper edge showing longitudinal strands and rectangular meshes. G, hypersilicified outer dermal surface with swollen nodes and rounded meshes. H, higher magnification of dermal surface showing ornamentation of nodes and beams and eroded spurs. I, atrial surface of body wall. J, atrial surface at higher magnification showing swollen nodes, ornamentation and spurs.

body wall. The fragments probably represent a nearly complete organism missing only the attachment base. The washed-out paratype appears to be a nearly intact skeleton; its morphology is similar but it has an intact attachment base.

Dimensions of the largest holotype fragment are 17 mm in height, diameter of the outer funnel margin is 22 x 25 mm. Body wall thickness is 1.5–2.3 mm with tissues in place, 1.3–2.0 mm for cleaned framework. Parietal oscula openings are 1.7–2.2–2.4 mm in diameter. The paratype is 15.4 mm in height and 23 x 24 mm in lateral diameters; the broad attachment base is nearly circular, 13.4 mm in diameter.

Texture is stony hard but fragile.

Surface is very convoluted and irregular without significant smooth areas. Openings of epirhyses about 0.5 mm in diameter (Table 23) are common but not abundant on all parts of the external surface; most end blindly within the wall but a few penetrate through to the atrium without lateral communication with others, and could be considered diarhyses. The outer framework surface is not hypersilicified but nodes are slightly swollen and tuberculate.

Colour greyish yellow.

Choanosomal skeleton is a dictyonal framework with external cortical dictyonalia fused tip to node forming both triangular and rectangular meshes (Fig. 46D, F). Beams are ornamented with abundant small conical spines scattered randomly or, rarely, in poorly defined transverse lines. Most nodes are swollen and covered with raised warts bearing 3–10 small spines (Fig. 46F, H), but small patches of fine dictyonal mesh with unswollen nodes occur scattered on external and internal surfaces. The atrial framework is similar to that of the dermal surface, and bears shallow pits as aporhyses (Fig. 46G), which are similar in dimensions to the dermal epirhyses, but often have indistinct and overlapping margins. Longitudinal strands with rectangular meshes occur in the lower body wall where they are quite obvious after removal of the overlying cortical dictyonalia (Fig. 46E). Spurs of both surfaces are long, rough, basally tapered, and distally cylindrical, ending in rounded or pointed tips (Fig. 46F, H). The outer choanosomal framework of the holotype is not thickened relative to its inner framework, but the outer framework of the paratype is very clearly hypersilicified in its lower parts. Loose spicules of the choanosome include uncinates and microscleres.

Ectosomal skeleton on both dermal and atrial surfaces consists mainly of a lattice of loose pentactine megascleres with overlapping tangential rays. Scopules occur positioned along the proximal rays of pentactins, oriented with their tine-bearing heads towards the surface of the wall. Uncinates are oriented mainly vertical to the wall surfaces with anterior end projecting to or through the surface. Microscleres are scattered in both surface and subsurface tissue layers.

Megascleres (Table 23) are surface pentactins, scopules, and uncinates. Dermalia and atrialia are thin pentactins, occasionally hexactins and stauractins,

Table 23. Spicule and framework dimensions (µm) of *Anomochone furcata* n. sp.

Parameter	Holotype QM G316368			
	mean	**s. d.**	**range**	**no.**
Surface pentactin:				
tangential ray length	143	25	94–209	50
tangential ray width	6.1	1.6	3.8–10.3	50
proximal ray length	202	70	77–379	50
proximal ray width	6.1	1.6	3.2–10.4	50
Scopule length	273	65	166–437	50
head length	38.2	11.5	18.4–66.4	50
tine length	32.4	10.7	11.6–59.4	50
Uncinate length	699	261	204–1210	50
width	3.8	1.2	1.5–5.8	50
Oxyhexaster diameter	67.8	8.6	49.7–88.7	50
primary ray length	5.7	1.3	2.4–8.6	50
secondary ray length	28.4	4.3	21.8–41.4	50
Discohexaster diameter	44.2	5.0	34.2–54.9	50
primary ray length	5.8	0.9	3.5–7.4	50
secondary ray length	16.6	2.3	12.9–21.8	50
Onychohexaster diameter	46.8	n.a.	39.7–50.7	3
primary ray length	5.3	n.a.	4.7–5.9	3
secondary ray length	17.7	n.a.	14.3–19.7	3
Monaxon hook	82.3	10.2	65.9–96.8	8
Dermal epirhyses diameter	556	122	331–979	36
beam length	222	52	161–382	50
beam width	37.7	7.8	24.1–65.9	50
swollen node diameter	107	13	91–138	27
spur length	188	60	101–413	34
Atrial beam length	244	63	120–429	50
beam width	48.6	7.7	35.3–70.4	50
swollen node diameter	110	12	90–134	26
spur length	176	58	61–313	29

with cylindrical rays completely covered with small sharp spines (Fig. 47A); in thin immature spicules all ray tips have sharp points but in mature spicules the tangential ray tips are rounded and often slightly inflated; pentactins have a short knob in place of the sixth (distal) ray. Scopules are delicate and variable in form (Figs 46I, 47B) with significant numbers of deformed heads and swellings or even tines projecting from any point along the shaft. The most common and normal tyloscopule form has a small neck bearing 3–7 straight, curved or geniculate tines ending in swollen club-like tips; all tines are profusely ornamented with reclined spines; shafts are completely but sparsely ornamented with small conical spines. Tine tips are highly variable with ca 10% bifurcate or rarely trifurcate in both abnormal and otherwise normally shaped scopules; other tine tips may be lanceolate, discoid or styloid in form; monoscopules occur but are rare. Uncinates (Fig. 47C) are relatively scarce, small and vary widely in size; brackets and barbs of small ones are present but insignificant, while even those of the larger forms are only moderately well-developed, the brackets always remaining insignificant.

Microscleres (Table 23) are oxyhexasters, hemioxyhexasters, oxydiasters, discohexasters, onychohexasters, and unusual rare monaxon hooks. The abundant spherical oxyhexasters (Figs 46J, 47D) and rare hemioxyhexasters have short primary rays which each bear 1–4 long, straight or curved secondary rays; they are entirely but very sparsely microspined in SEM. A few oxydiaster variations of the oxyhexaster occur. The less abundant stellate discohexasters (Figs 46K, 47E) have short sparsely spined primary rays, each bearing 3–7 s-curved, secondary rays which are copiously covered with reclined spines and end in discs with 4–8 recurved marginal spines; some secondary rays occasionally originate below the main tuft. The rare onychohexasters (Figs 46L, 47F) are similar in form but slightly larger than the discohexasters; they are more delicate and the secondary rays each terminate in 2–4 claws standing perpendicular to the ray axis. Rare monaxon hooks (Figs 46M, 47G) are j-shaped spicules; each has an axial cross in a small inflated end from which emanates a single curved, acutely pointed ray; they are entirely ornamented with small reclined spines; they could be regarded as small megascleres but due to their small size, they are here considered as unusual microscleres.

ETYMOLOGY: The species name *furcata* refers to the very unusual branching of scopule tines.

REMARKS: The species description is based upon the spicule-bearing holotype fragments. Although the paratype is washed-out, it is identical to the holotype in body form and framework details and is assigned to the same species. The holotype fragments were first considered conspecific with *Anomochone expansa*, described above, because the two forms are so similar in morphology and occur in adjacent locations. Hypersilicification of the *A. expansa* external framework is not considered an important differential character since it appears to be an age-related phenomenon in this genus. The two species differ, however, in one point that is presently considered significant: *A. expansa* has swollen nodes with simple spines while *A. furcata* has swollen nodes with warts. It may eventually be found that this difference is also age-related or variable within a species, but evidence for this is presently lacking.

Warty swollen nodes are known to occur in four genera: three (*Myliusia*, some *Iphiteon*, and *Cyrtaulon* which has a distinctive microsclere lacking here) lack proper scopules, and for the other species of *Anomochone*, *A. globosa*, the spicules remain unknown. The present specimens could alternately be assignable to *A. globosa*, to which details of arrangement and dimensions of the framework of the new form are very similar. However *A. globosa*, known only from the Banda Sea, differs from the new eastern Australian specimens in being subglobose or ovoid in body shape, rather than funnel-form, and has a schizorhysial system of grooves and septa on the upper body parts which are lacking in the new specimens. Because of these differences and the taxonomic problems that would arise should a new specimen of *A. globosa* with different spiculation eventually be found in Indonesian waters, it is considered prudent to erect a new species name, *Anomochone furcata*, for the new eastern Australian specimens. There is concern over the fact that both of the eastern Australian *Anomochone* forms described here lack any indication of the schizorhysial groove system seen in the Indonesian specimens. This may eventually require formation of a new genus for the eastern Australian forms when more intact specimens become available from both locations.

KEY DIAGNOSTIC CHARACTERS:

- Body is an irregular funnel with small, hooded, downward-facing, lateral oscula
- Atrial cavity is subdivided by sheets of dictyonal framework forming small tubules
- Primary dictyonal framework in lower body wall has longitudinal strands
- Dictyonal nodes are swollen and warty
- A significant proportion of scopules have bifurcated tine tips

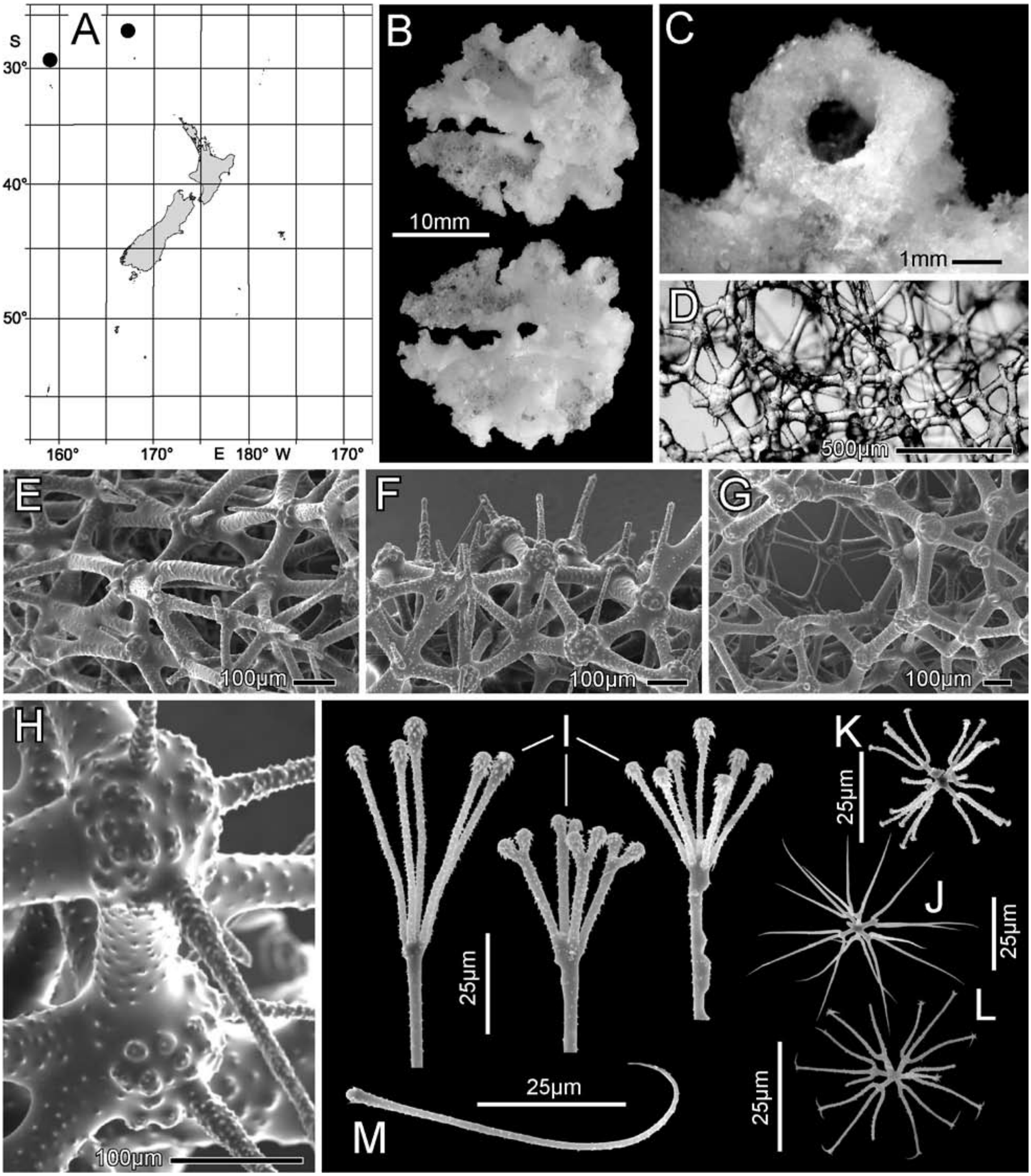


Figure 46. *Anomochone furcata* n. sp., holotype QM G316368. A, distribution in eastern Australian waters. B, holotype main fragment in superior (upper) and inferior (lower) views. C, one of the hooded lateral oscula with tissues intact. D, cleaned dermal framework. E, longitudinal strands in lower body wall after removal of cortical dictyonalia. F, dermal framework surface with swollen warty nodes and spurs. G, atrial framework surface with aperture of an aporhysis. H, swollen warted dictyonal nodes and spurs of the dermal framework. I, three upper scopule ends; middle one has distinctive bifurcate tines. J, spherical oxyhexaster. K, stellate discohexaster. L, onychohexaster. M, monaxon hook.

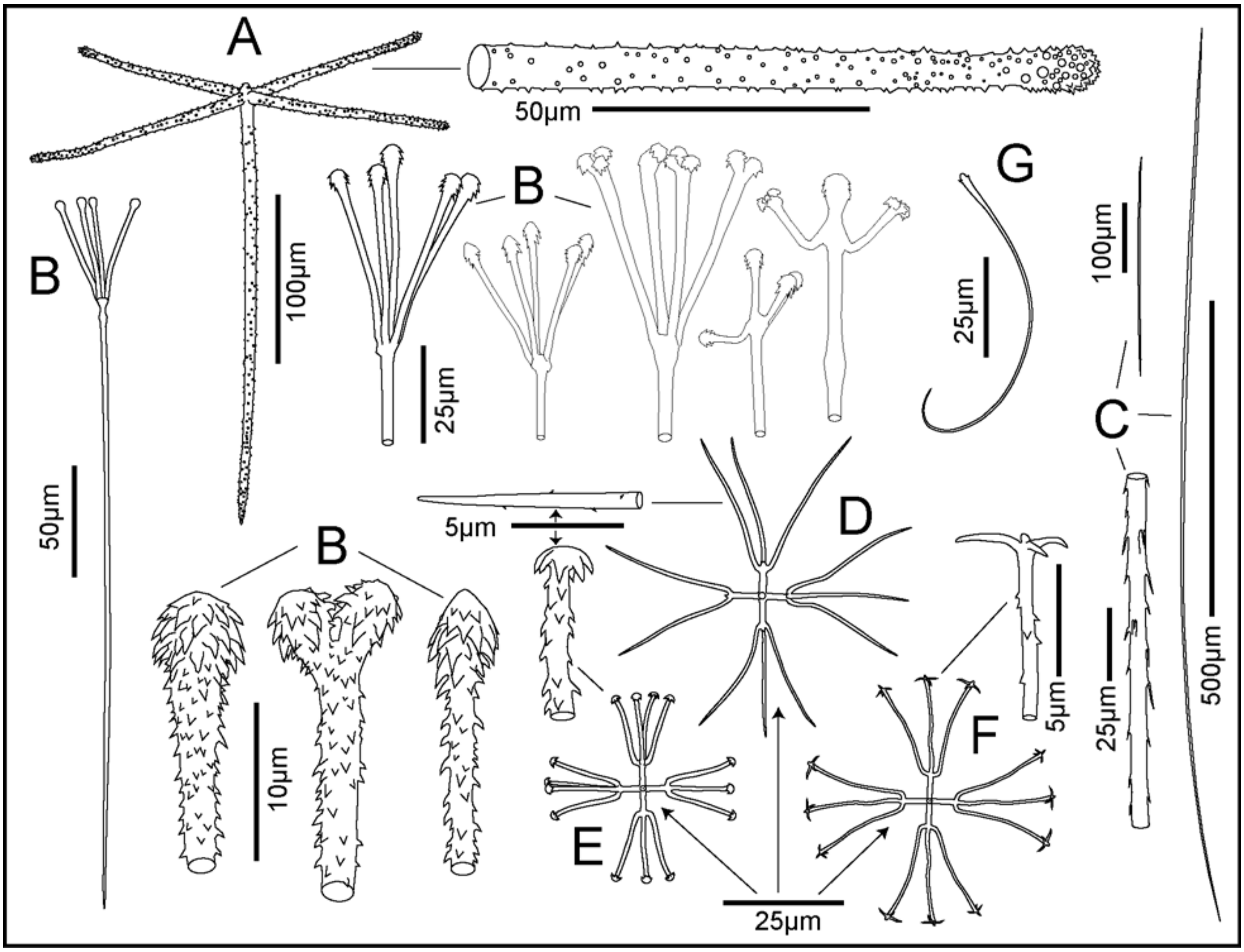


Figure 47. Spicules of *Anomochone furcata* n. sp., holotype QM G316368. A, surface pentactin, whole and enlargement of tangential ray. B, tyloscopules, whole, most common upper end, two less common upper ends and two abnormal forms (thin lined), and three common tine tips (below). C, uncinates, whole small and large forms with magnified middle segment of large form. D, oxyhexaster, whole and terminal ray end. E, discohexaster, whole and terminal ray end. F, onychohexaster, whole and terminal ray end. G, monaxon hook.

Hexactinella Carter

Hexactinella Carter, 1885: 397; Schulze 1887: 327 (in part), 1904: 171; Ijima 1927: 231; Reiswig 2002c: 1345.
Tretodictyum Schulze, 1886: 78 (in part).

Tretodictyidae of variable shape from funnel-, vase- or bowl-like to branching tubules; choanosomal channelisation as cleftform to labyrinthine schizorhyses delimited by radial septa oriented mainly longitudinally; dictyonal beams microtuberculate either scattered or in transverse rows; entire external surface including labyrinthine schizorhysial entrances covered by a dermal lattice of loose pentactins or subhexactins; similar atrial lattice is not continuous over exhalant apertures; discohexasters or variants always present; oxyhexasters present or absent; scopule usually strongyliform but tylote and oxyote tine tips may occur; raphidial uncinates common, with or without indications of brackets and barbs; spicules remain unknown for several species (modified from Reiswig *et al*. 2008).

Remarks: The genus diagnosis of Reiswig *et al*. (2008) is emended to include new features of species described below. There are presently eleven species recognised as valid members of *Hexactinella*.

Type species: *Hexactinella ventilabrum* Carter, 1885: 397 (by monotypy).

***Hexactinella acanthacea* n. sp.** (Figs 48, 49)

Material examined:

Type material: **Holotype** NMNZ POR.000722, RV *Tangaroa* Stn TAN9203/187, Hawke Bay, 40.001° S, 178.182° E, 618–952 m, 01 Apr 1992. **Paratype**: NIWA 43392, NIWA Stn KAH0204/08, Cavalli Seamount, 34.115º S, 174.145º E, 610–640 m, 14 Apr 2002.

Type locality: Hawke Bay.

Distribution: Known only from the type locality, off Hawke Bay, and Cavalli Seamount, northeastern New Zealand (Fig. 48A).

Habitat: Probably attached to hard substratum but base not recovered; depth range 610–952 m.

Description:

Morphology of the holotype is a single small, flat flake from a dictyonal sponge, with spicules in place (Fig. 48B). The original free surfaces are on the edges, not the faces, of the fragment, indicating this is from a thick-walled specimen of unknown overall form. It is probably a single structural septum in the sense used for Tretodictyidae. The paratype (Fig. 48C) consists of 26 fragments, probably all from a single specimen; the largest fragments are perforated by channels and have grooves on the surfaces. Some of the larger fragments possess a few spicules, but most are washed out. Overall form of both original specimens remains unknown.

Dimensions of the holotype fragment are 11 x 7 mm in its largest diameters by 3 mm in thickness. The paratype fragments range in size from 10.0 x 5.4 mm down to 1.2 x 1.1 mm.

Texture is stony hard and brittle.

Surface of the holotype retained on two edges, consists of smoothly curved areas bearing dictyonal spurs and a residual lattice of smooth subhexactine spicules. The fragment is too small to show skeletal channelisation typical of the genus. The larger paratype fragments have channels, presumably schizorhyses, 1.2–1.5–1.7 (n = 6) mm in diameter. Their outer surfaces are grooved but otherwise smooth.

Colour beige.

Choanosomal skeleton is a dictyonal framework composed of longitudinal strands running longitudi-

Table 24. Spicule and framework dimensions (µm) of *Hexactinella acanthacea* n. sp.

Parameter	Holotype NMNZ POR.000722			
	mean	**s. d.**	**range**	**no.**
Surface hexactin:				
distal ray length	90	18	59–141	50
distal ray width	19.6	6.0	5.8–30.2	50
tangential ray length	270	62	153–477	50
tangential ray width	13.4	4.4	4.1–24.5	50
proximal ray length	481	194	209–1179	31
proximal ray width	16.4	5.7	4.7–28.7	50
Scopule length	560	48	430–644	50
tine length	71	12	34–84	50
head length	84	12	45–102	50
Uncinate length	394	111	218–678	50
width	1.6	0.4	0.7–2.7	50
Discohexaster diameter	52.8	5.4	36.8–64.6	50
primary ray length	15.0	2.1	10.1–20.6	50
secondary ray length	11.3	1.7	6.8–14.9	50
Onychohexaster diameter	72.0	8.2	57.0–85.2	29
primary ray length	15.0	2.4	9.2–18.5	29
secondary ray length	21.7	4.0	14.2–28.4	29
Oxyhexaster diameter	76.2	7.0	54.2–87.4	30
primary ray length	14.4	1.8	11.6–19.7	30
secondary ray length	26.1	3.6	14.0–31.4	30
Framework beam length	228	79	87–387	50
beam width	23.5	3.9	15.6–35.0	50

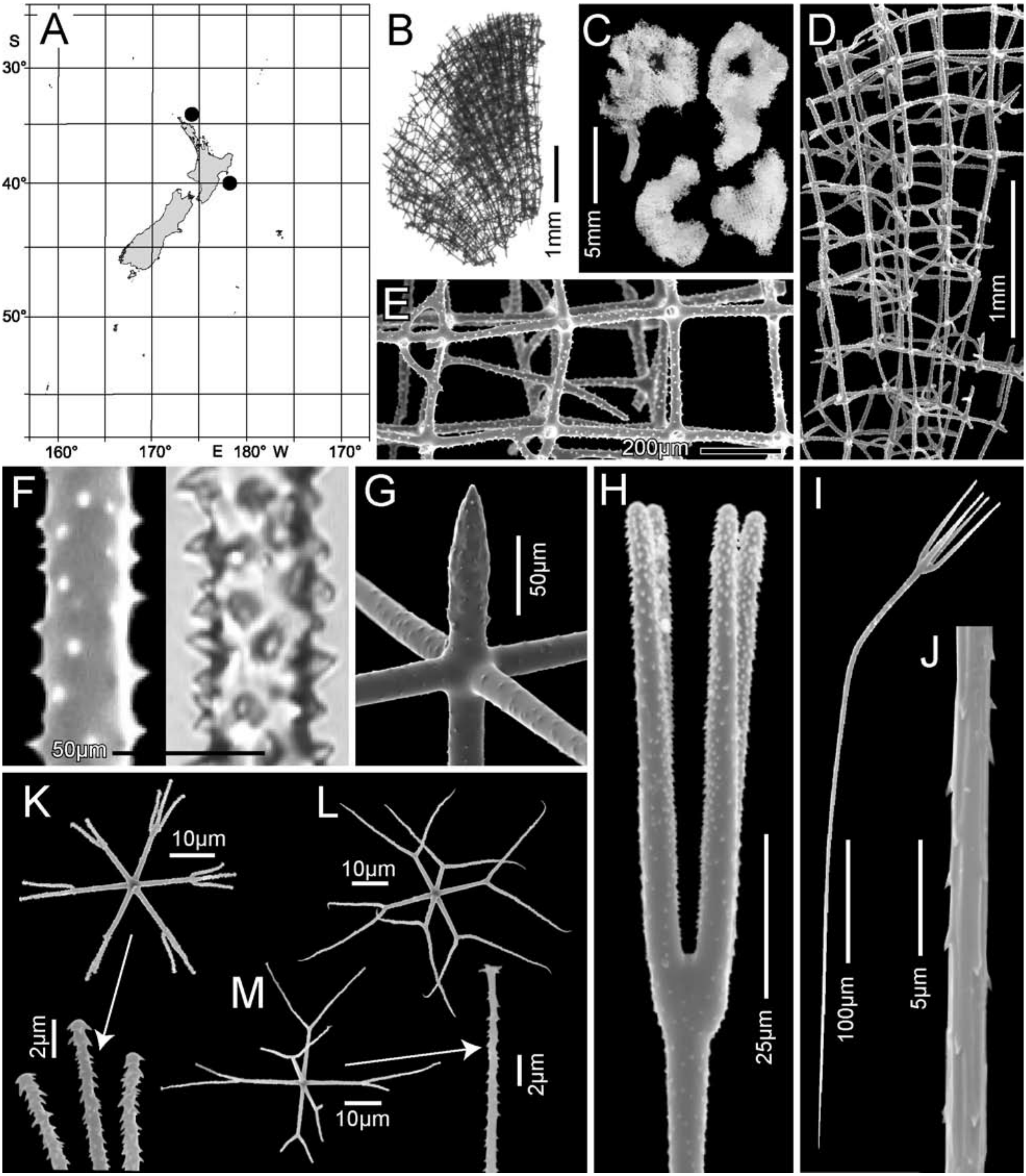


Figure 48. *Hexactinella acanthacea* n. sp. A, distribution in New Zealand waters. B, holotype NMNZ POR.000722, cleaned dictyonal framework showing longitudinal strands extending upwards and curving left to dermal surface (LM). C, paratype NIWA 43392, four largest fragments with some tissues still intact. D-M from holotype NMNZ POR.000722. D, dictyonal framework with longitudinal strands and aligned connecting beams. E, dictyonal framework showing rectangular meshes and coarse beam spination. F, coarsely spined beams in SEM (left) and LM (right). G, central part of surface subhexactin. H, upper end of scopule. I, bent scopule. J, central segment of uncinate. K, discohexaster with close-up of secondary ray ends. L, oxyhexaster. M, onychohexaster and close-up of secondary ray end.

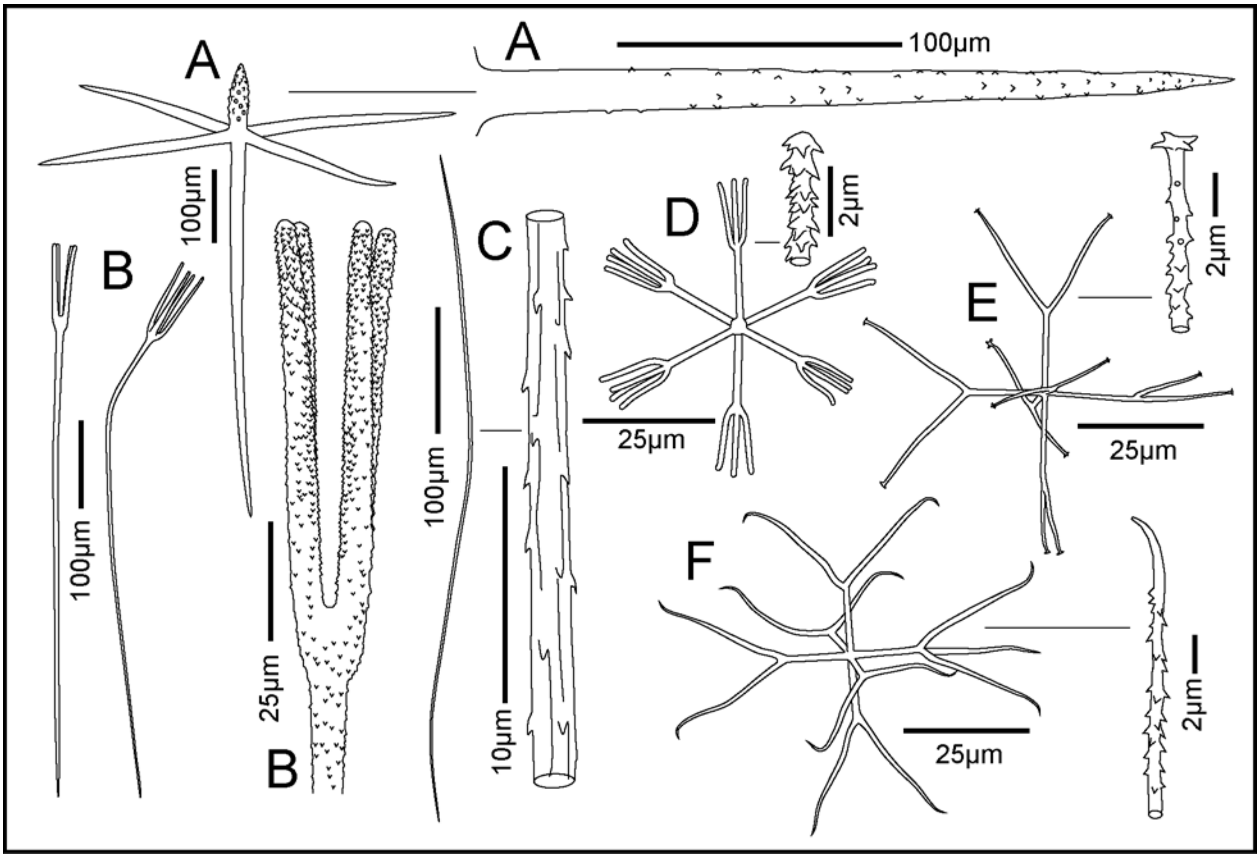


Figure 49. Spicules of *Hexactinella acanthacea* n. sp., holotype NMNZ POR.000722. A, surface subhexactin, whole and enlargement of tangential ray. B, strongyloscopules, two whole and one enlarged upper end. C, uncinate, whole and enlargement of middle segment. D, discohexaster, whole and enlargement of secondary ray end. E, onychohexaster, whole and secondary ray end. F, oxyhexaster, whole and secondary ray end.

nally and curving out to the dermal surface (Fig. 48B). Meshes are fairly regularly rectangular with connecting beams joined node to node and aligned to form easily detectable ranks (Fig. 48D). Beams are heavily ornamented with robust conical spines (Fig. 48E). Beam length and width vary relatively little (Table 24). Nodes are regular, neither swollen nor ornamented. Spurs which occur only on the free surfaces (Fig. 48D left) are rough, conical, and sharply pointed. Adherent small hexactins are not present. Free choanosomal spicules are microscleres and a few small uncinates.

Ectosomal skeleton of both dermal and atrial surfaces (edges of the flake) consists mainly of a lattice of loose subhexactine megascleres with overlapping tangential rays. Scopules occur positioned along the proximal rays of pentactins, oriented with their tine-bearing heads towards the surface of the wall. Fine uncinates are oriented vertical to the surfaces with anterior end projecting to or through the surface. Microscleres are scattered in both surface and subsurface tissue layers.

Megascleres (Table 24) are surface subhexactins, scopules, and uncinates. Dermalia and atrialia are subhexactins with long tapering, sharp-tipped tangential and proximal rays sparsely ornamented with very small sharp spines (Figs 48G, 49A); the distal ray is very short, slightly inflated, sharply pointed, and ornamented with very low scale-like spines, curved distally as in a pinulus, but which remain tightly fused to the ray rather than emergent. Scopules are moderate in size and strongylose in form, either straight or with a sharp inflection in the shaft (Figs 48H, I, 49B); the small tapered neck bears 3–5 straight tines ending in rounded tips; tines are ornamented with very fine reclined spines which are more dense at the tips and inner surfaces; the shaft is either smooth in the middle or entirely but sparsely ornamented with very small reclined spines; it tapers to a sharp tip. Uncinates (Figs 48J, 49C) are very small and poorly developed; brackets and barbs are present but nearly undetectable in LM.

Microscleres (Table 24) include discohexasters (73%), onychohexasters (13%), and oxyhexasters (14%). The abundant stellate discohexasters (Figs 48K, 49D) have moderately long primary rays which each bear 3–4 shorter straight or s-curved secondary rays terminating in discs with 5–6 marginal teeth; in SEM they are entirely finely microspined except for the centrum. The onychohexasters (Figs 48M, 49E) have short primary rays, each bearing 2–3 straight or crooked secondary rays which terminate in a group of 2–4 very short claws; they are entirely sparsely spined in SEM. The oxyhexasters (Figs 48L, 49F) are similar in size, form, and ornamentation to the onychohexasters but the terminal rays end in hooked, pointed tips.

ETYMOLOGY: The species name *acanthacea* refers to the very coarsely spined dictyonal framework.

REMARKS: Selection of NMNZ POR.000722 as the holotype for the new species is based on its better retention of spicules; the paratype fragments have better retention of channelisation, but the spicules are less well retained. Although this form is known only as small fragments, its distinction from all other known hexactinellids in the area by its very spiny dictyonal framework and spiculation warrant description of it as a new species. Its framework, with longitudinal strands and arrangement of connecting beams in ranks, and spiculation enable assignment only to the genus *Hexactinella*. The new form differs in details of spiculation from the seven species of *Hexactinella* for which spicules are known; it is most similar to *H. grimaldi* Topsent, 1890, but that north Atlantic species has rounded distal tips of the surface subhexactins. The new form cannot be assigned to any of the three species for which spiculation is presently unknown by beam thickness (all of those forms have thicker beams) and beam spination (those have small spines or spines in transverse rows). It is concluded that the small fragment collected from off Hawke Bay and Cavalli Seamount, New Zealand, represents a new species, *H. acanthacea*, whose body form remains unknown, but when new specimens of it become available, it will now be readily recognisable as belonging to this species. As already noted, the very small specimen NIWA 51925 from Graveyard Seamount, Chatham Rise, described above as Euretidae incertae sedis may also be a framework fragment of this species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is unknown but of at least 7 mm wall thickness
- Channels 1.2–1.7 mm in diameter penetrate the wall
- Dictyonal framework with longitudinal strands and connecting beams in ranks
- Dictyonal beams heavily spined
- Pinular ray of surface subpentactins has cryptic scale-like spination and sharp tip
- Microscleres include stellate discohexasters, onychohexasters, and oxyhexasters

Hexactinella simplex n. sp. (Figs 50, 51)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 49244, NIWA Stn TAN9506/76, SE of East Cape, 37.948° S, 179.047° E, 1000–1248 m, 8 May 1995. **Paratypes** NIWA 49245, NZOI Stn E902, SE edge of Caledonia Trough, 37.945° S, 172.139° E, MV *Taranui*, 1064 m, 6 Mar 1968; NIWA 51969, NIWA Stn TAN0104/337, North Chatham Rise, Graveyard seamount complex, Zombie Seamount, 42.767° S, 179.923° E, 900–970 m, 20 Apr 2001; NMNZ POR.000711, N edge of Chatham Rise, 42.700° S, 178.017° W, RV *Cordella*, 1025–1055 m, 13 Aug 1989; NMNZ POR.000476, Pantin Banks, SE of Table Cape, 39.478° S, 178.407° E, FRV *James Cook* Stn JP/23/89, 743–925 m, 17 Sep 1989; NMNZ POR.000487, Challenger Plateau, 37.265° S, 167.292° E, FV *Willwatch* Stn WIL/90/168, 825–1000 m, 25 Jul 1990.

Non-type material: *Lord Howe Rise*: NIWA 66080, NIWA Stn TRIP2894/122, 35.417° S, 165.317° E, 931–940 m, 23 Jul 2009; NIWA 69122, NIWA Stn Z9730, 37.101° S, 167.368° E, 1170 m, 4 Mar 1999.

West Norfolk Ridge: NIWA 69123, NZOI Stn U566, 35.083° S, 169.162° E, 979 m, 2 Feb 1988.

Southern end of New Caledonian Trough: NIWA 69124, NZOI Stn E903, 37.550° S, 172.083° E, 952 m, 27 Mar 1968.

Northeast of Challenger Plateau: NIWA 62168, NIWA Stn KAH0006/50, 37.505° S, 172.228° E, 960–1060 m, 24 Apr 2000.

East Chatham Rise, Andes Seamounts, Dickies Seamount: NIWA 53738, 62153, NIWA Stn TAN0905/102, 44.127° S, 174.571° W, 845 m, 26 Jun 2009.

TYPE LOCALITY: East Cape.

DISTRIBUTION: Known from both east and west of New Zealand across a narrow latitudinal band between 37 and 43° S, from Challenger Plateau to Chatham Rise (Fig. 50A), and north to Lord Howe Rise.

HABITAT: Probably attached to hard substratum but base not recovered; depth range 743–1248 m.

DESCRIPTION:

Morphology of the intact sponge remains unknown; all specimens are fragments, consisting mostly of flat plates but some have sharp bends suggestive of more complex branching. Dermal surfaces are sculpted into a honeycomb pattern of raised ridges circumscribing pits (Fig. 50B); the ridge/pit system is usually very high/deep (Fig. 50D), but may be low/shallow in young specimens or regions with thin wall (Fig. 50E). Atrial surfaces are smooth (Fig. 50C). Occasional large

4–7 mm diameter holes, about the same size as the dermal pits, occur through the entire wall; their nature is unknown. All specimens except NIWA 51969 contain at least some spicules and are judged to have been alive at collection.

Dimensions of the four holotype fragments are 8.5 x 7.0, 6.2 x 6.2, 8.0 x 3.5, and 3.0 x 2.0 cm horizontally and 10–11 mm in thickness. Paratype fragments range from 3.4 x 2.5 up to 18.4 x 11.8 cm horizontally, and 5.2 to 20.3 mm in thickness.

Texture is stony hard and brittle.

Surface of the dermal side has apertures of the schizorhysial channel system opening on the sides and tops of ridges (0.5–1.2–1.9 mm diameter) and on surfaces of pits (0.2–0.6–1.4 mm diameter) (Fig. 50D, E). The atrial surface has large circular or longitudinally elongate schizorhysial apertures (length 1.1–1.9–4.1 mm, width 0.5–1.1–1.8 mm) distributed evenly in poorly defined longitudinal rows (Fig. 50C) and smaller non-schizorhysial openings scattered between them (Fig. 50F).

Colour beige.

Choanosomal skeleton is a dictyonal framework interrupted by the profusely branching system of 2 mm-wide schizorhysial channels (Fig. 50G). Although typical tretodictyid septa cannot be isolated within the irregular patches of choanosomal framework, the basic structure of the primary longitudinal strands running as a continuous stratum under the pits and curving out strongly into the dorsal ridges is easily seen in longitudinal sections. Very thin cortical layers are added on both dermal and atrial surfaces as a thin band of irregularly connected hexactins. The dermal cortex is hypersilicified on ridges into a hard crust, finely ornamented with small conical spines and free spurs identifiable as small blunt knobs (Fig. 50H). Within the pits the cortex is not hypersilicified but consists of a ragged network of irregularly joined hexactins (Fig. 50I, J). The irregular atrial cortex is only slightly hypersilicified (Fig. 50K, L) but constitutes a second strong hard skeletal layer. Between these bounding cortices, the main choanosomal framework is a tight, fairly regular three-dimensional lattice of short-rayed hexactins; meshes are regularly rectangular (Fig. 50M) with connecting beams joined node to node and aligned to form poorly detectable ranks. Beams are richly ornamented with small conical spines (Fig. 50N). Beam length and width vary moderately (Table 25). Nodes are regular, not swollen but ornamented as the beams are. Spurs, which occur only on the free

Table 25. Spicule and framework dimensions (µm) of *Hexactinella simplex* n. sp.

Parameter	**Holotype NIWA 49244**			
	mean	**s. d.**	**range**	**no.**
Dermal pentactin tangential ray length	287	82	114–543	60
tangential ray width	9.9	1.9	6.5–15.5	46
proximal ray length	259	101	107–597	57
proximal ray width	16.2	5.8	5.9-34.1	50
Dermal hexactin distal ray length	57	36	22–113	7
distal ray width	21.5	4.7	15.3–29.6	7
Choanosomal hexactin ray length	113	30	79–147	6
ray width	5.8	3.2	3.4-11.2	6
Discohexaster diameter	83	7	68–99	50
primary ray length	12.0	2.1	8.0–16.7	50
secondary ray length	29.3	2.9	23.2–36.6	50
angle of tuft (*degrees*)	63.7	6.4	48.4–77.6	50
Dermal pit diameter (mm)	6.7	1.9	4.1–13.2	34
ridge width (*mm*)	4.3	1.5	2.2–7.8	33
ridge aperture diameter (*mm*)	0.81	0.25	0.45–1.71	34
Atrial aperture length (mm)	1.8	0.6	1.1–4.1	53
aperture width (*mm*)	1.0	0.2	0.5–1.5	59
atrial beam width	68.1	15.5	40.1–112.9	50
Choanosomal beam length	289	63	181–465	50
beam width	53.5	8.3	40.1–112.9	50

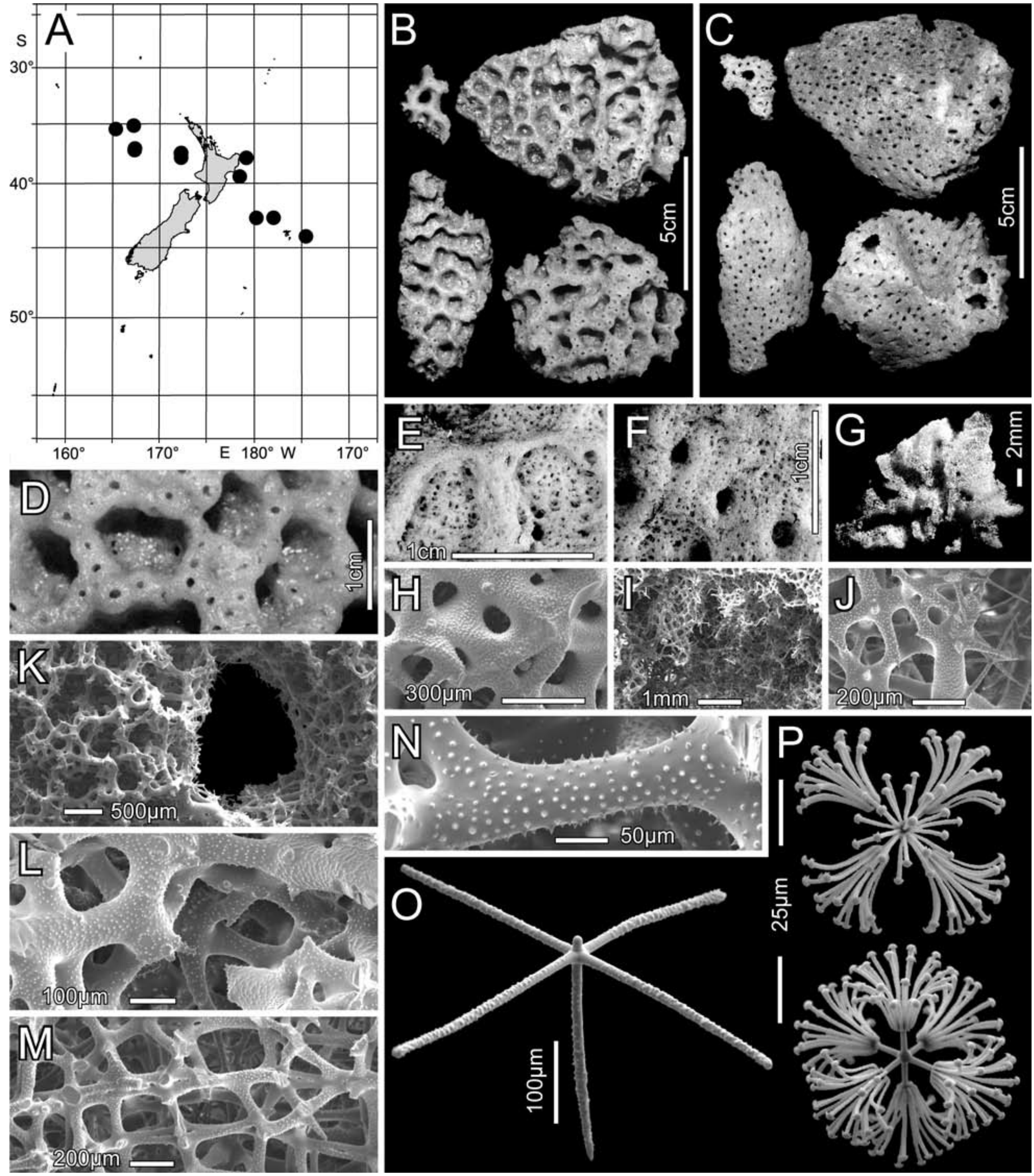


Figure 50. *Hexactinella simplex* n. sp., holotype NIWA 49244. A, distribution in New Zealand waters. B, holotype NIWA 49244, dermal side. C, atrial side of same. D, closer view of dermal surface ridges and pits. E, dermal surface of a thin region with low ridges (cleaned framework), NMNZ POR.000711. F. atrial surface of same, NMNZ POR.000711. G, vertical longitudinal section through framework showing schizorhyses extending to ridge (top), atrial surface (bottom) and dermal pit (left), NMNZ POR.000487. H, hypersilicified framework of dermal ridge top. I, ragged surface of dermal pit framework. J, closer view of same. K, atrial surface with a schizorhysial aperture. L, closer view of slightly hypersilicified atrial surface. M, internal choanosomal framework with rectangular meshes. N, typical beam from same. O, dermal pentactin. P, two views of the stellate discohexasters.

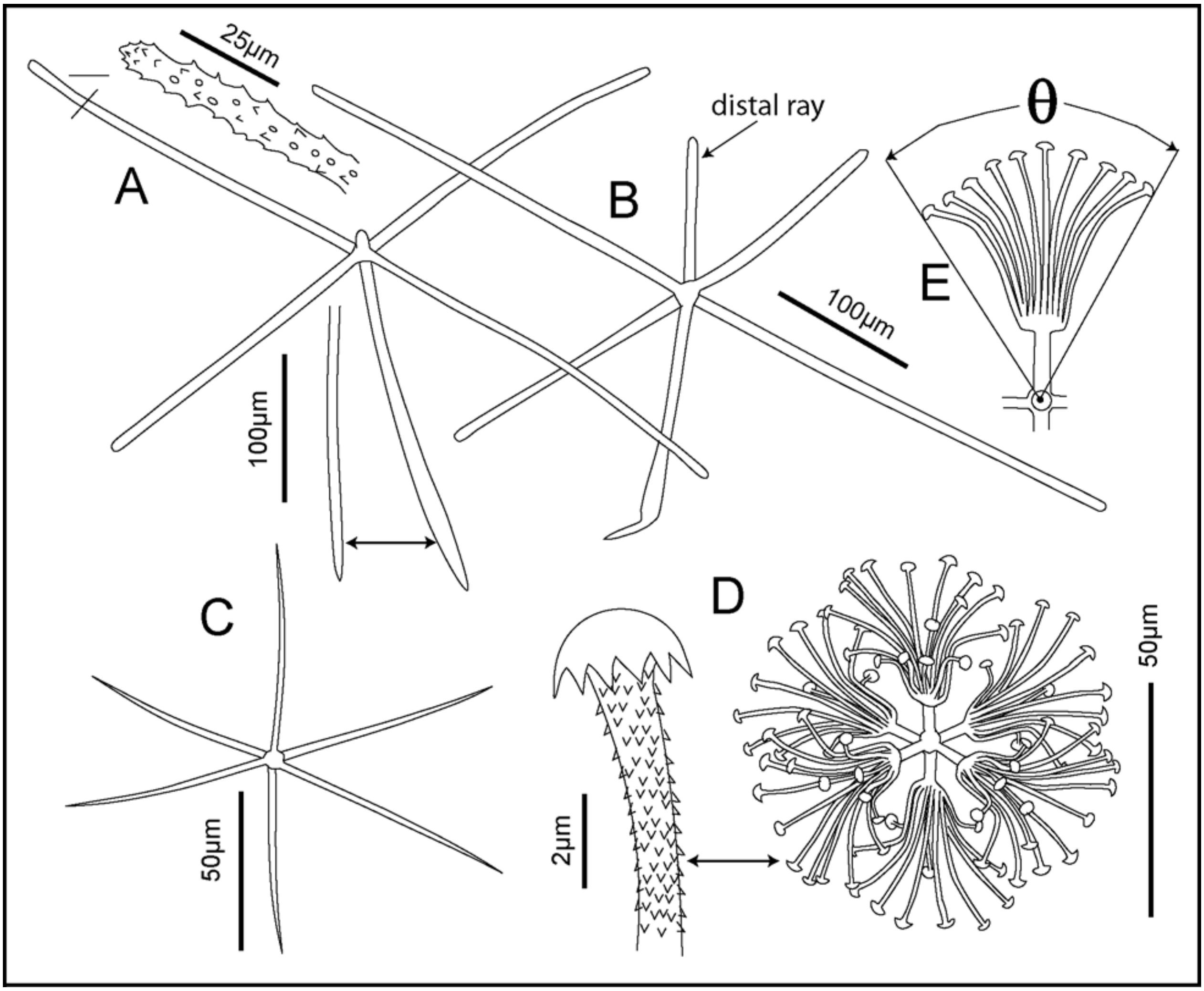


Figure 51. Spicules of *Hexactinella simplex* n. sp., holotype NIWA 49244. A, Surface pentactin, whole with alternate narrow proximal ray and enlargement of tangential ray end. B, Surface hexactin with tangential rays in one axis elongate. C, Small choanosomal oxyhexactin. D, Stellate discohexaster, whole and enlargement of secondary ray end. E, One tuft of discohexaster showing method of angle measurement.

surfaces, are rough, conical, and blunt. Adherent small hexactins are not present on internal beams but spiny oxyhexactins occur on external beams of dermal pits and atrial surfaces. Free choanosomal spicules are small hexactins and microscleres.

Ectosomal skeleton of the dermal pits consists of a lattice of loose pentactine and rare hexactine megascleres with overlapping tangential rays. No other spicules occur here. No loose spicules occur on dermal ridges and atrial surfaces, thus the ectosomal skeletons of these regions are the cortical elements of the frameworks described above. Indeed, spicules occur in very low numbers in all specimens examined. There is abundant evidence that loose pentactins are incorporated onto/into the frameworks of all superficial cortices.

Megascleres (Table 25) are pentactins and rare hexactins in dermal pits and small hexactins in choanosomal tissues. Dermalia are restricted to dermal pits and consist mainly of pentactins with long cylindrical, blunt-tipped tangential rays and sharp-tipped proximal rays sparsely ornamented with very small sharp spines (Figs 50O, 51A); a small knob occurs as remnant of the distal ray; the proximal ray is often inclined from the tangential plane and slightly to strongly inflated distally. A few hexactin dermalia similar to pentactins but with short distal ray (Fig. 51B) are encountered also in the lining of the dermal pits of all specimens with spicules. Proximal rays of both pentactins and hexactins are usually shorter than tangential rays; spicules with long proximal rays common in other hexactinellids do not occur here. Rare choanosomal oxyhexactins have tapered rays ornamented with moderate spines and end in sharp tips.

Microscleres (Table 25) consist only of stellate discohexasters (Figs 50P, 51D, E); these have short primary rays, each bearing 8–25 longer s-curved secondary rays terminating in discs with 8–16 marginal teeth; mean ratio of primary to secondary ray length varies from 0.330 to 0.435 in four specimens surveyed. Secondary rays are typically arrayed in two whorls around an additional central ray. Primary rays have only a few scatted small spines while secondary rays are completely covered in fine reclined spines.

ETYMOLOGY: The species name *simplex* refers to the simplified spiculation of this species, lacking atrialia, scopules, and uncinates.

REMARKS: Selection of NIWA 49244 as the holotype for the new species is based on its better source of loose spicules. Assignment to the genus *Hexactinella* is based upon the presence of a euretoid framework with longitudinal strands, the presence of schizorhyses, pentactin dermalia, and discohexaster microscleres. The surface architecture of dermal ridges and pits is almost identical with that of *H. labyrinthica* Wilson, 1904, from Galapagos, and is less precisely shared with *H. lingua* Ijima, 1927 and *H. spongiosa* Ijima, 1927, from Indonesia. The new species differs from most members of the genus by lack of scopules and uncinates, although these spicule types remain unknown (but not known to be lacking) for two species, *H. spongiosa* and *H. vermiculosa* Ijima, 1927; *H. spongiosa* differs from the new species in body form as a narrow tube or funnel, and in the smaller dimensions of its ridge and pit system. The surface of *H. vermiculosa* is very unlike the new species in being narrowly grooved. Even if the absence of scopules and uncinates is ignored as being an effect of wash-out during collection, a very unlikely occurrence in all five of the spicule-bearing specimens, the new species differs from all known species by combination of body form, surface architecture, pentactin dermalia, and presence of only stellate discohexasters. All other species have different body forms, surface architecture, surface spicule types, and other microsclere combinations. One feature noted as common to the ethanol-preserved spicule-bearing specimens of the new species is that its tissues turn black when exposed to hypochlorite bleach, a feature unknown for any other hexactinellid sponge.

KEY DIAGNOSTIC CHARACTERS:

- Body form unknown but fragments are flat plates with dermal ridges and pits
- Schizorhyses thoroughly penetrate the wall as 2 mm-wide channels
- Dictyonal framework is euretoid with longitudinal strands and connecting beams in ranks
- Dictyonal beams are finely but densely spined
- Surface spicules are pentactins with remnant sixth-ray knob and short proximal ray
- Microscleres consist only of stellate discohexasters

Hexactinella aurea n. sp. (Figs 52, 53)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 43425, NIWA Stn TAN0107/225, Rumble V Seamount, Bay of Plenty, 36.147º S, 178.204º E, 772–951 m, 23 May 2001.

TYPE LOCALITY: Bay of Plenty.

DISTRIBUTION: Known only from the type locality, Rumble V Seamount, Bay of Plenty (Fig. 52A).

HABITAT: Probably attached to hard substratum but base not recovered; depth range 772–951 m.

DESCRIPTION:

Morphology of the holotype is branching tubes; the larger fragment (Fig. 52B) consists of a branch point with one complete and several partial tubes extending at large angles. The tubular elements project separately from the branch point and do not share walls. The smaller fragment is a segment of a tubular element. Overall form of the complete stock remains unknown.

Dimensions of the larger fragment are 23.7 x 15.7 x 16.5 mm; the smaller fragment is 11.3 x 7.8 x 6.7 mm. The tubular elements are 3.6–7.6–9.2 mm in outside diameter. Tube wall thickness varies greatly from 0.8–1.8–2.8 mm due to its irregular structure.

Texture is stony hard and brittle.

Surface of both fragments are severely damaged; the dermal lattice is not preserved intact anywhere. The surface thus consists of the exposed irregular choanosomal skeleton of longitudinal beams and deep depressions between these structures.

Colour light orange or gold.

Choanosomal skeleton is a dictyonal framework two to five meshes in thickness (Fig. 52C). It is composed of conspicuous longitudinal strands joined by irregular connecting beams oriented in all directions, some perpendicular and some oblique to the longitudinal strands (Fig. 52D). Typical tretodictyid longitudinal septa, grooves, and schizorhyses are not present. Mesh shapes are highly variable, including rectangular, triangular, polygonal, and some large apertures of irregular shape. Beams are ornamented with closely and evenly spaced very small conical spines (Fig. 52E). Beam length and width vary greatly (Table 26). Nodes are not swollen and ornamented like the beams; many of them are false nodes. Spurs occur on all surfaces and are long, thin, and sharply pointed. Adherent small hexactins are not present. Free choanosomal spicules are microscleres and large numbers of small uncinates.

Table 26. Spicule and framework dimensions (µm) of *Hexactinella aurea* n. sp.

Parameter	Holotype NIWA 43425			
	mean	**s. d.**	**range**	**no.**
Dermal subhexactin:				
distal ray length	50	15	24–85	50
distal ray width	16.7	4.8	6.9–26.9	50
tangential ray length	286	69	150–533	50
tangential ray width	13.2	3.0	7.7–23.4	50
proximal ray length	671	293	139–1330	50
proximal ray width	14.7	4.0	7.1–26.4	50
Scopule total length	621	162	348–1060	50
head length	75	13	40–107	50
tine width	63	13	27–91	50
Uncinate length	775	196	272–1183	50
width	4.8	1.0	2.7–7.5	50
Discohexaster diameter	107	13	70–143	50
primary ray length	29.8	5.0	14.5–41.9	50
secondary ray length	23.7	3.0	18.4–29.4	50
Framework beam length	618	273	207–1422	57
beam width	77	37	33–217	58
spine spacing	7.1	1.5	3.4–9.8	50
Dermal spur length	400	242	108–997	36
Atrial spur length	726	431	113–1995	72

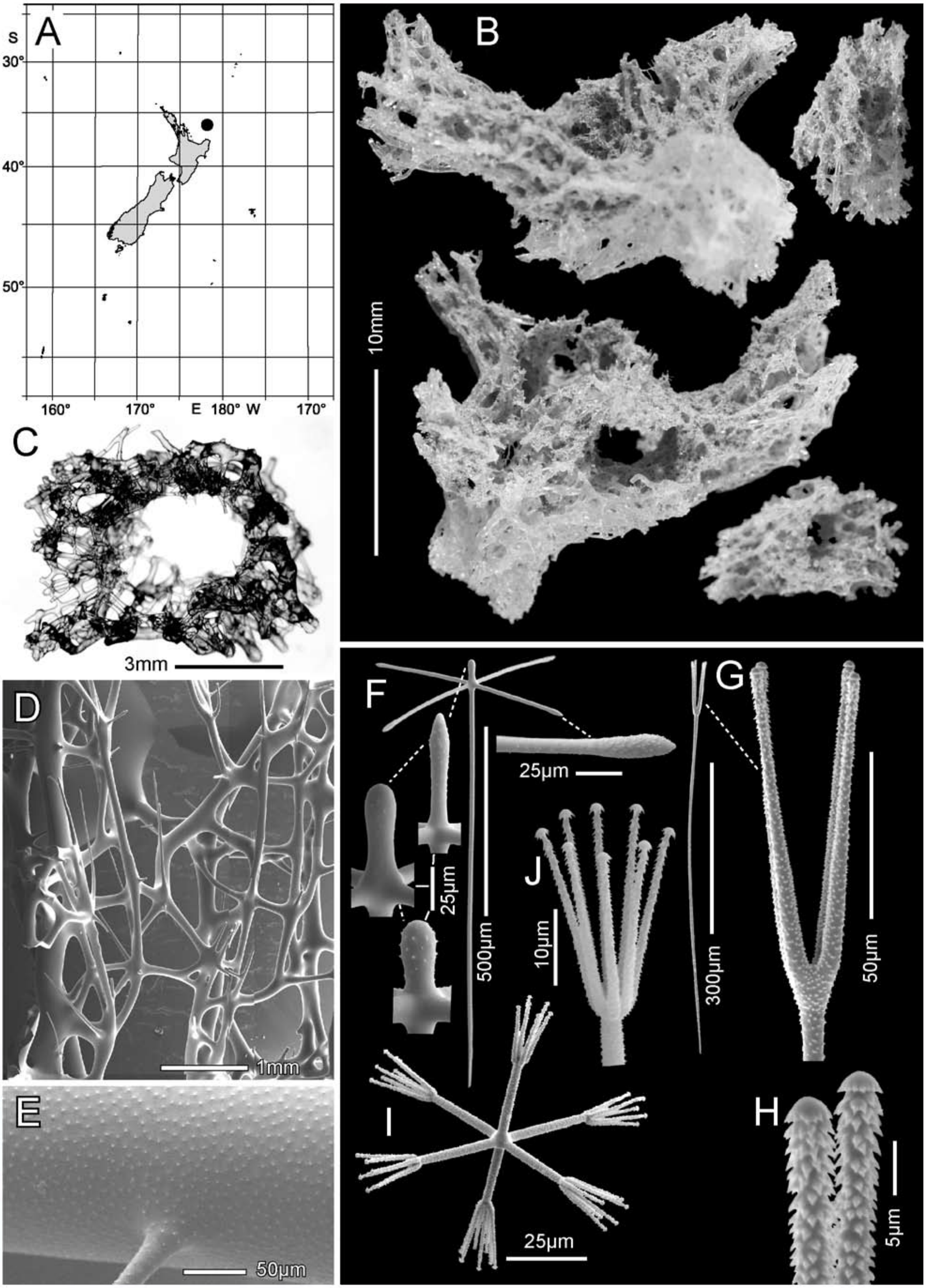
Ectosomal skeleton is worn off and remains as fragments in the depressions of the choanosomal skeleton. It consists of loose subhexactins, scopules, large numbers of small uncinates, and microscleres. The original positions of these spicules cannot be recreated, but they are expected to be like those of other *Hexactinella*.

Megascleres (Table 26) are surface subhexactins, scopules, and uncinates. Dermalia and possibly atrialia are subhexactins (Figs 52F, 53A), typically with cylindrical, sparsely spined short tangential and very long proximal rays. The proximal rays end simply in blunt pointed tips but the tangential rays are distinctly inflated subterminally and end either simply rounded or in blunt pointed tips. The short distal ray is usually slightly inflated and simply rounded (Fig. 53B) and ornamented with small or larger scale-like spines (Fig. 52F). Scopules are moderately large strongyloscopules, either straight or slightly curved (Figs 52G, 53C); the small tapered neck bears 3–5 straight tines ending in smooth, rounded disk-like tips which are not larger in diameter than the tines (Fig. 52H). Head, upper and lower shaft are ornamented with very fine reclined spines but the main shaft is smooth. Uncinates (Fig. 53D) are extremely abundant; they are small to moderate in size and have poorly developed brackets and barbs which are nearly undetectable in LM.

Microscleres (Table 26) consist only of relatively sparse stellate discohexasters (Figs 52I, 53E). They are moderately large and entirely covered with fine reclined spines. Each of the long primary rays bears a tuft of 5–9 straight or slightly curved secondary rays which end in small marginally-serrated discs (Fig. 52J). Oxyhexasters found in all preparations were considered foreign in origin.

ETYMOLOGY: The species name *aurea* refers to the golden color of the specimen.

Figure 52 (*opposite*). *Hexactinella aurea* n. sp., holotype NIWA 43425. A, distribution in New Zealand waters. B, holotype NIWA 43425, both sides of the two fragments. C, end view of the cleaned skeleton of the smaller fragment. D, atrial frame surface of larger fragment. E, evenly distributed fine spines on framework beam. F, surface subhexactin with enlargements of three distal rays and one tangential ray end. G, scopule with enlarged head. H, two scopule tine ends. I, discohexaster. J, tuft of secondary rays of discohexaster.


A
S
30°
40°
50°
160°
170°
E 180° W
170°
B
10mm
C
3mm
D
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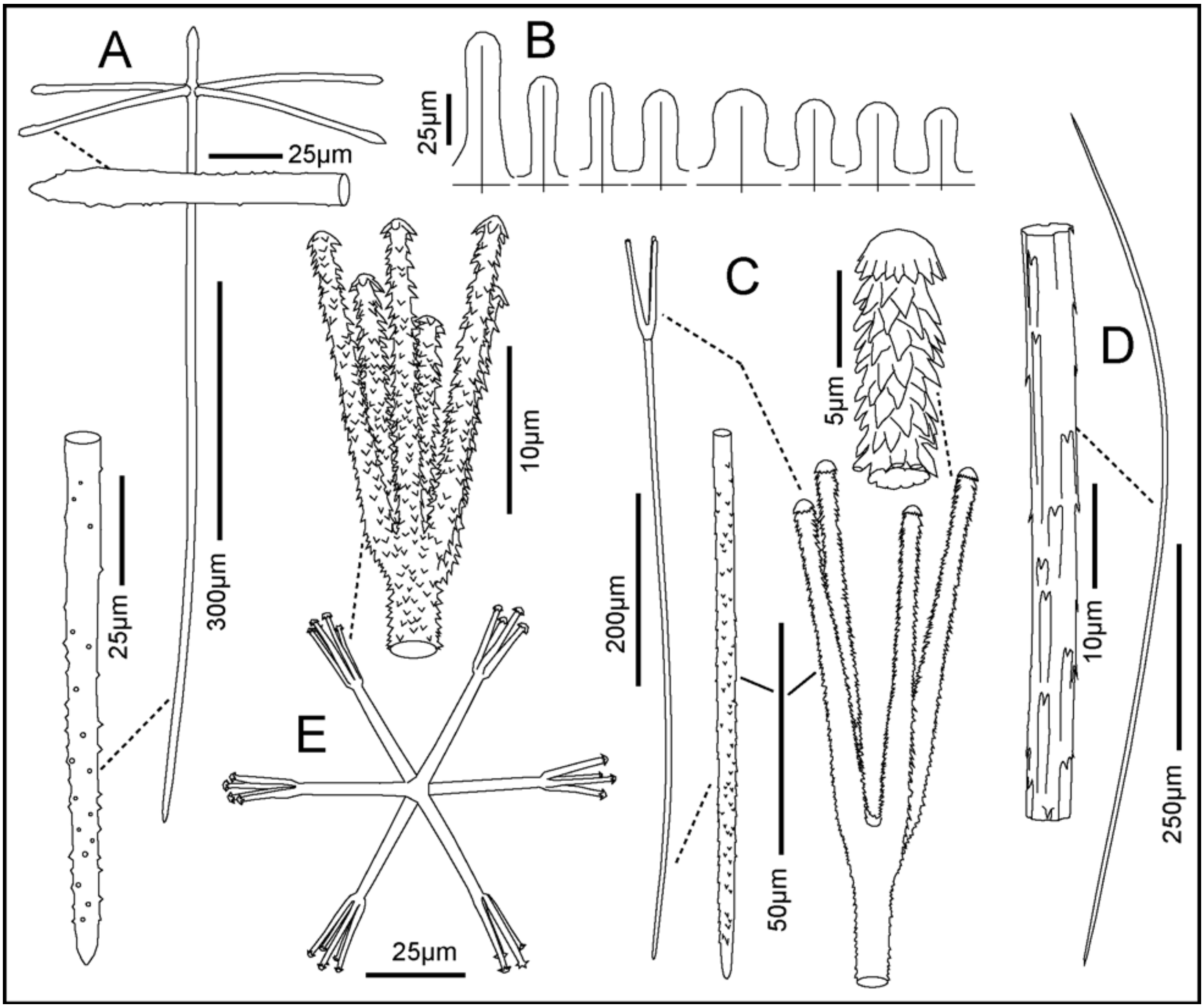


Figure 53. Spicules of *Hexactinella aurea* n. sp., holotype NIWA 43425. A, surface subhexactin, whole and enlargement of tangential and proximal ray ends. B, profiles of distal rays of surface subhexactins with axial filaments indicated as lines. C, scopule, whole and enlargement of basal end, head, and one tine end. D, uncinate, whole and enlargement of middle segment. E, stellate discohexaster, whole and enlargement of secondary ray tuft.

Remarks: The two fragments of the holotype were collected at station TAN0107/225 along with *Farrea occa occa* (NIWA 43422 and 43423) and *Auloplax* incertae sedis (NIWA 43424), the spicules of which cross-contaminate all specimens. There was little difficulty in separating those of this new *Hexactinella* from the others, but it is not certain that some of the oxyhexasters considered proper to both of the other species might also be proper spicules of the new *Hexactinella*. The decision to assign this specimen to *Hexactinella* was not entirely straightforward; although its spiculation is typical of *Hexactinella*, its skeletal framework is more like *Auloplax* in its irregularity, but lacks the thin-wall sieve areas typical of that genus. In this case, where spiculation is clear, but overall form of the skeleton framework is somewhat limited by condition and size of the available specimen, the evidence from spiculation is given primary weight for assignment. We do not consider it appropriate to modify the diagnosis of the genus since framework details are so restricted at this time.

The new species differs from *H. acanthacea* (above), *H. carolinensis* Reiswig *et al*., 2008, *H. divergens* Tabachnick, 1990, *H. labyrinthica*, *H. lata* Schulze, 1886, *H. lingua*, *H. monticularis* Lendenfeld, 1915, and *H. ventilabrum* in its complete lack of spherical discohexasters. It differs from *H. grimaldi*, *H. rugosa* Ijima, 1927, *H. simplex* (above), *H. spongiosa*, and *H. vermiculosa* Ijima, 1927 in its small tubule form as opposed to the plate or vase form in those species. It is not possible to determine a nearest relative of the new species since uncertainty remains in overall body form, skeletal framework, and origin of oxyhexasters. The clavate form of the subhexactin tangential ray appears distinctive and could serve as an indicator of close relationship should a similar form be found among other *Hexactinella* species.

KEY DIAGNOSTIC CHARACTERS:

- Body form is system of branching tubes about 4–9 mm in diameter
- Schizorhyses are not present
- Dictyonal framework has longitudinal strands and irregularly oriented connecting beams
- Dictyonal beams are finely and evenly spined
- Surface subhexactins have distinctly clavate tangential ray tips
- Microscleres consist only of stellate discohexasters; proper oxyhexasters cannot be certainly discounted

Psilocalyx **Ijima**

Psilocalyx Ijima, 1927: 265; Reiswig 2002c: 1346.
?*Nitidus* de Laubenfels, 1955: E86; Reid 1963: 229.

Tretodictyidae of thick-walled cup shape with wide labyrinthine schizorhyses opening dermally and atrially by rounded apertures; external dictyonal skeleton hypersilicified as a crust-like cortex; lacking a dermal spicule lattice; spicules: thin uncinates, strongyloscopules, and long-principalled strongylhexasters (Reiswig 2002c).

TYPE SPECIES: *Psilocalyx wilsoni* Ijima, 1927.

REMARKS: The genus contains only a single recent species, *Psilocalyx wilsoni*, from the Arafura and Banda Seas, Indonesia, 984–1595 m depth. Inclusion of the fossil genus, *Nitidus*, remains questionable.

Psilocalyx wilsoni Ijima, 1927 (Figs 54, 55)

MATERIAL EXAMINED:

North Norfolk Ridge (*Australian EEZ*): QM G331693, NIWA Stn TAN0308/043, 26.432° S, 167.181° E, 750–774 m, 18 May 2003.

Lord Howe Island Seamount Chain: NIWA 62099, NZOI Stn Q68, 29.233° S, 159.000° E, 1045 m, 1 Jun 1978.

Bay of Plenty, *Mahina Seamount*: NIWA 43455, NIWA Stn TAN0413/175, 37.324° S, 177.121° E, 424–534 m, 16 Nov 2004; NIWA 43456, NIWA Stn TAN0413/177, 37.312° S, 177.066° E, 550–725 m, 16 Nov 2004.

North Chatham Rise, *Graveyard seamount complex*, *Graveyard Seamount*: NIWA 51937, NIWA Stn TAN0104/288, 42.761° S, 179.988° W, 890–972 m, 19 Apr 2001.

Diamond Head, *Andes Seamounts*, *East Chatham Rise*: NIWA 54051, NIWA Stn TAN0905/113, 44.151° S, 174.757° W, 519 m, 27 Jun 2009.

DISTRIBUTION: The genus has been previously known only from the Arafura and Banda Seas, Indonesia. This report adds five new locations, the Lord Howe Island Seamount Chain, the North Norfolk Ridge (Australian EEZ), N of Bay of Plenty, New Zealand, and Graveyard Seamount, Chatham Ridge (Fig. 54A) as a major range extension.

HABITAT: Previously known to be attached to hard substratum but base not included in any of the four fragmentary new specimens; depth range within eastern Australian and New Zealand area is 424–972 m; previously recorded in Indonesia from 984–1595 m.

DESCRIPTION:

Morphology of all the new specimens is as slightly curved fragments of the outer body wall of thick-walled cups; the entire body form is known only from the Indonesian holotype. All of the new fragments are hypersilicified on the outer dermal surface to form a crust which is penetrated by rather evenly spaced, round apertures of schizorhyses (Fig. 54B–D). The inner surfaces consist of the ragged broken edges of pillars of delicate dictyonal meshwork surrounding schizorhyses channels extending from the dermal apertures. It cannot be determined if any proper atrial surface is present on these fragments. Proper loose spicules are present in two specimens, NIWA 43455 and 43456; the other two specimens are entirely washed-out.

Dimensions of the outer surfaces of the 15 fragments range from 43.4 x 24.4 mm (Fig. 54D) down to 2.5 x 3.0 mm; they range in thickness from 11.1 to 2.0 mm. Surface schizorhyses holes range from 1.4–2.5–3.5 mm diameter (n = 62), but a few apparently torn openings are up to 5.36 mm long.

Texture of the outer surface is stony hard; the internal framework is fragile.

Surface is generally evenly curved, with areas between schizorhyses apertures slightly raised.

Colour white in washed-out and beige in tissue-bearing fragments.

Choanosomal skeleton is uncertain in extent since living tissue analysis has not been carried out on this species. It is here assumed the dermal crust is ectosomal. The internal choanosomal skeleton is a delicate dictyonal framework composed of dictyonalia fused by aligned-ray-pairing in formation of dictyonal strands and unpaired rays joined tip-to-node to form connecting beams. The network is relatively open and uncluttered (Fig. 54J), without addition of small hexactins and intercalation of supplementary dictyonalia. Meshes are mainly rectangular and triangular; internal beams are ornamented with dense, medium to very large conical spines distributed evenly on the thin beams (Fig. 54K); nodes are smooth and not swollen; the few unconnected spurs are rare and similar to regular connected beams; they are not specialised. It is uncertain if any proper atrial spurs are retained in the damaged fragments. Loose spicules consist of scopules, uncinates, and discohexaster microscleres.

Ectosomal skeleton consists of a thickened porous crust formed by hypersilicification of the outer layer of the dictyonal framework (Fig. 54E–I); it is continuously fused with the delicate choanosomal framework (Fig. 54I) and is clearly a modification of the bounding outer layer. A loose surface spicule lattice is lacking even in living specimens. The dictyonal nodes are recognisable as spherical inflations while the connecting beams are often so thickened as to be almost unrecognisable as such (Fig. 54F); meshes of the original outer framework are reduced to small irregular openings with rounded contours between the thickened beams and nodes. The outer and lateral surfaces of all parts of the outer crust are densely ornamented with fine conical spines. Spurs of the outer thickened dictyonalia are almost totally enclosed by the added silica layers but they remain detectable in some areas as small mammelons, one on the outer surface of each spherical node of the crust (Fig. 54F, I); a few short finger-like spurs project into the margins of the large schizorhytic apertures (Fig. 54F bottom). Loose spicules consist of scopules and uncinates projecting from the margins of dermal surface apertures.

Megascleres (Table 27) are scopules and uncinates; proper dermalia and atrialia are lacking. Scopules are strongylote in form (Figs 54L, 55A), with 3–7 straight, slightly splayed tines ending in simple rounded or very slightly inflated tips; tines and head are ornamented with dense, small reclined spines while the upper shaft is nearly smooth. The lower shaft bears larger spines (Fig. 54L left) and tapers to a sharp point without inflation. The extremely numerous uncinates are small, thin, and raphidial in form (Figs 54N, 55C); they have very short barbs which are nearly invisible in LM and do not project from the bracket grooves (Figs 54N right, 55C).

Microscleres (Table 27) consist only of stellate discohexasters (Figs 54M, 55B). Each primary ray, only slightly longer than the terminals, carries a single whorl of 8–16 straight or s-shaped secondary rays that end in minute discs with 4–8 marginal spines. They are entirely rough.

REMARKS: The four new fragmentary specimens of *P. wilsoni* discovered from eastern Australian and New Zealand waters agree very well with Ijima's description of *Psilocalyx wilsoni* from Indonesia. As noted elsewhere, microscleres determined to be tylohexasters on the basis of LM, invariably turn out to be discohexasters when viewed with the higher resolution

Table 27. Spicule and framework dimensions (µm) of *Psilocalyx wilsoni* Ijima, 1927.

Parameter	**NIWA 43455** **mean**	**s. d.**	**range**	**no.**
Scopule length	803	102	563–977	50
head length	125	18	100–166	50
tine length	110	18	80–153	50
Uncinate length	697	157	344–1030	50
width	3.0	0.6	1.9–4.3	50
Discohexaster diameter	75.6	7.1	61.0–96.0	50
primary ray length	20.0	2.4	14.7–25.3	50
secondary ray length	18.0	2.1	13.1–24.7	50
Framework, external:				
schizorhyses diameter (mm)	2.7	0.5	2.0–3.4	12
knob diameter	162	18	127–213	50
knob-knob distance	232	51	121–379	50
beam width	76	16	46–106	50
Framework, internal:				
beam length	229	55	105–372	50
beam width	22,8	5.4	11.8–31.9	50
spine length	13.0	4.7	2.0–21.7	50

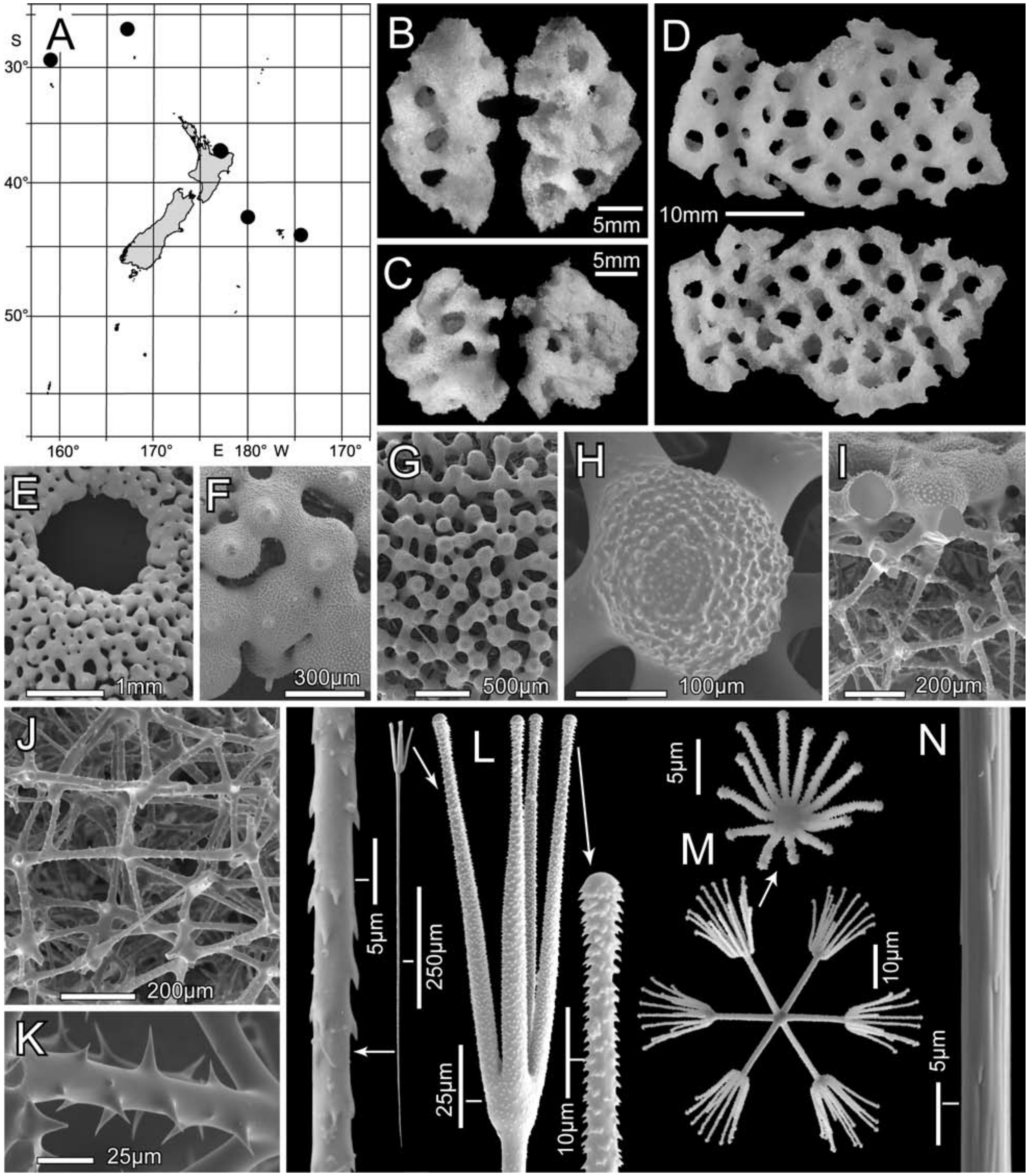


Figure 54. *Psilocalyx wilsoni* Ijima, 1927, spicules from NIWA 43455. A, distribution in eastern Australian and New Zealand waters. B, C, largest fragments of NIWA 43455, external (left) and internal (right) sides. D, largest fragment of NIWA 43456, external (above) and internal (below) sides. E, F, extreme hypersilicified external surface showing a schizorhysial aperture and closer view of mamillate nodes and thickened beams (QM G331693). G, H, less silicified surface with nodes and joining beams still distinct (NIWA 43455). I, vertical section of surface crust and its junction with the delicate internal framework (QM G331693). J, K, internal framework with rectangular and triangular meshes and beam with large sharp conical spines (NIWA 43455). L, strongyloscopule including whole spicule, lower shaft (left), head, and tine. M, discohexaster with end view of a tuft of secondary rays. N, middle segment of an uncinate.

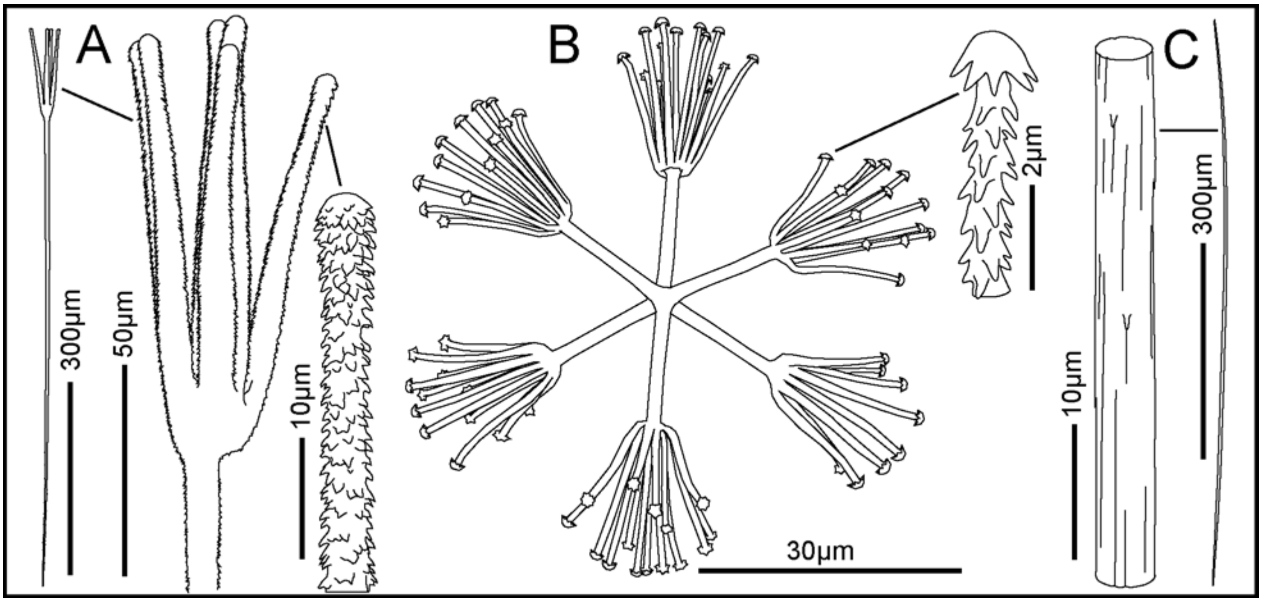


Figure 55. Spicules of *Psilocalyx wilsoni* Ijima, 1927, NIWA 43455. A, strongyloscopule, whole, enlargement of head and single tine end. B, discohexaster, whole and end of secondary ray. C, uncinate, whole and enlargement of middle segment.

of SEM, as is the case here. The silicified external crust is a rare feature in Recent hexactinellids, although it was apparently not uncommon in fossil forms. The hypersilicified crust probably provides effective external armour,but, when initiated, prevents further growth if it covers the entire body as suggested by Ijima's (1927) description of the nearly complete holotype of *P. wilsoni*. Since smaller specimens must lack the surface crust, it probably should not be used as a diagnostic feature of the genus or species. Small, young specimens which still lack crust development are expected to have free dermalia, spicules which are presently unknown for this genus, but likely to be similar to those of *Hexactinella*. *Psilocalyx wilsoni* is indeed very similar to *Hexactinella acanthacea* in all aspects except dermal crust development, and young specimens of these may be very difficult to distinguish. The species has also been recognised as a probable component of the fossil fauna of the Tutuiri Greensand deposits of Chatham Island (Kelly & Buckeridge 2005).

KEY DIAGNOSTIC CHARACTERS:

- External surface of mature form is a hypersilicified porous crust which is probably lacking in young stages
- Lateral openings of 1.4–3.5 mm diameter are evenly distributed on the external surface
- Internal skeleton is a delicate network of thin and coarsely spined dictyonalia
- Loose spicules consist of strongyloscopules, raphidial uncinates, and stellate discohexasters
- Dermalia and atrialia are lacking in all known specimens but probably are present in young stages

Tretodictyidae incertae sedis (Fig. 56)

MATERIAL EXAMINED:

North Norfolk Ridge (*Australian EEZ*): QM G331692, NIWA Stn TAN0308/043, 26.432° S, 167.181° E, 750–774 m, 18 May 2003.

Lord Howe Rise (*Australian EEZ*): QM G316723, NIWA Stn TAN0308/056, 29.227° S, 159.042° E, 740–800 m, 21 May 2003.

West Cavalli Seamount: NIWA 43408, 62065, NIWA Stn KAH0204/38, 34.159° S, 173.963° E, 780–800 m, 18 Apr 2002.

Mahina Seamount, *Bay of Plenty*: NIWA 43454, NIWA Stn TAN0413/131, 37.344° S, 177.094° E, 459–750 m, 14 Nov 2004.

North Chatham Rise, *Graveyard seamount complex*, *Scroll Seamount*: NIWA 25170, 52542, NIWA Stn TAN0604/039, 42.788° S, 179.999° W, 1021 m, 30 May 2006.

DISTRIBUTION: Known from North Norfolk Ridge and Lord Howe Rise (Australian EEZ), West Cavalli and Mahina Seamounts, and the Graveyard seamount complex of the Chatham Rise (Fig. 56A).

HABITAT: All were presumably attached to hard substratum but only NIWA 43454 includes the attachment base; depth range 459–1055 m.

DESCRIPTION:

The seven specimens are all washed-out frameworks of several different morphologies. QM G331692 (Fig.

56B) consists of two fragments of curved external body wall penetrated by evenly spaced, moderately large, cylindrical schizorhytic channels that intercommunicate within the wall. QM G316723 (Fig. 56C) is composed of intercommunicating cylindrical schizorhytic channels of a wide variety of diameters, bounded by such thin walls that the structure is alveolar i.e., individual channel sections are very short and the entire structure consists of more cavity than framework. NIWA 43408 (Fig. 56D, E) is a compact chip of framework penetrated by unevenly distributed small calibre schizorhytic channels; no part of the fragment can be identified as a surface of the original specimen. NIWA 62065 (Fig. 56F) consists of four dense lamellar or cylindrical fragments of eroded body wall penetrated by small-diameter, cylindrical schizorhytic channels; the walls are constructed of alternating high and low density sheets of framework characteristic tretodictyid groove-ridge structure (Fig. 56N). NIWA 43454 (Fig. 56G) is a small basal cup, partially divided into two short funnels, the radiating walls of which are penetrated by very small calibre intercommunicating schizorhytic channels; its walls are also constructed of radiating high and low density framework sheets. The specimens from Chatham Rise are similar to NIWA 62065.

Dimensions of the two QM G331692 fragments are 15.5 x 11.4 x 3.2 mm and 18.4 x 8.0 x 7.8 mm. Those of QM G316723 are 36.7 x 34.9 x 16.2 mm. Those of NIWA 43408 are 18.2 x 17.5 x 7.3 mm. The four fragments of NIWA 62065 range from 43.4 x 35.3 to 31.3 x 10.7 mm in length and width; they range in thickness from 6.5–11.0 mm. NIWA 43454 is 31.9 mm long, 15.6 mm wide and 14.2 mm in height.

Texture of all fragments is rigid but fragile.

External surface of QM G331692 is smoothly round-

Table 28. Spicule and framework dimensions (µm) of Tretodictyidae incertae sedis specimens.

Parameter	**mean**	**minimum**	**maximum**	**s. d.**	**no.**
Channel width (mm):					
QM G331692	1.79	1.06	2.98	0.45	38
QM G316723	3.37	1.14	7.04	1.51	26
NIWA 43408	1.44	0.66	4.08	0.63	56
NIWA 62065	0.98	0.62	1.41	0.17	38
NIWA 43454	0.69	0.45	1.17	0.16	29
Pillar/septum width (mm):					
QM G331692	1.26	0.59	2.15	0.39	33
QM G316723	1.42	0.78	2.13	0.34	32
NIWA 43408	n/a	n/a	n/a	n/a	n/a
NIWA 62065	0.85	0.56	1.07	0.56	22
NIWA 43454	0.30	0.26	0.40	0.50	8
Beam length (µm):					
QM G331692	331	180	508	67	123
QM G316723	241	148	366	50	44
NIWA 43408	476	216	775	140	98
NIWA 62065	688	309	1441	254	73
NIWA 43454	495	203	816	131	35
Beam width (µm):					
QM G331692	69	33	125	19	87
QM G316723	43	27	67	10	72
NIWA 43408	68	32	113	15	100
NIWA 62065	84	28	169	30	71
NIWA 43454	74	39	118	21	59
Spine spacing (µm):					
QM G331692	14.8	4.0	24.3	4.4	108
QM G316723	14.8	7.3	25.7	4.2	39
NIWA 43408	16.2	7.2	28.3	4.8	41
NIWA 62065	13.4	8.6	21.1	2.8	47
NIWA 43454	5.0	2.2	9.8	1.8	49

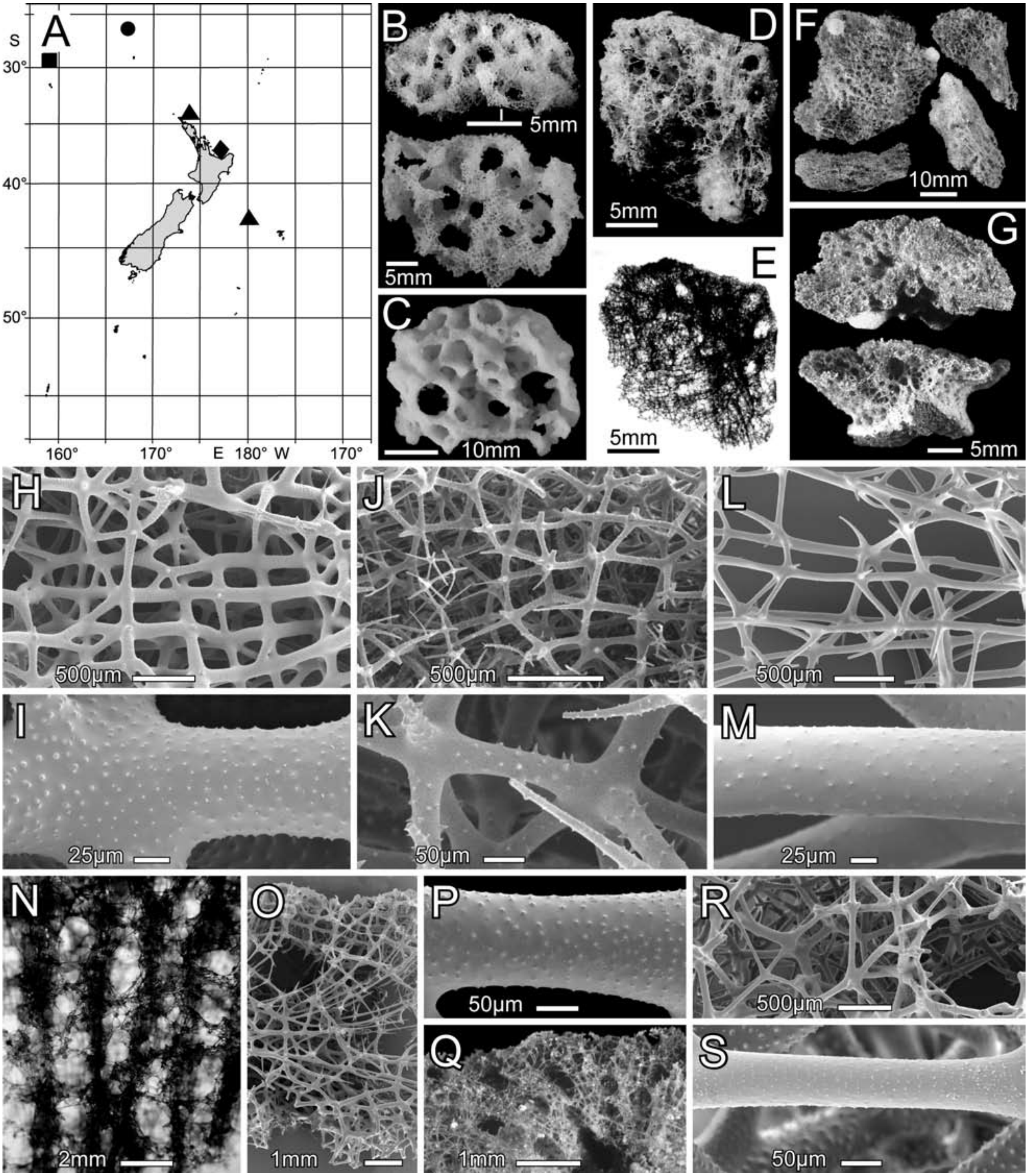


Figure 56. Tretodictyidae incertae sedis. A, distributions in eastern Australian and New Zealand waters, QM G331692 as circle, QM316723 as square, NIWA 43408 and 62065 as triangles, NIWA 43454 as diamond. B, QM G331692 fragments. C, QM G316723. D, E, NIWA 43408 before cleaning in incident light (D) and after cleaning in transmitted light (E). F, NIWA 62065. G, NIWA 43454 in top (above) and side view (below). H, I, QM G331692 framework of pillar (H) and beam surface (I). J, K, QM G316723 framework of pillar (J) and beam and spurs (K). L, M, NIWA 43408 framework of septum (L) and magnified beam (M). N–P, NIWA 62065 dense septa and low-density strands (N) (LM), lateral view of septal framework (O), magnified beam (P). Q–S, NIWA 43454 surface of atrium showing dense septa and schizorhyses apertures (Q) (LM), framework of septa (R), and beams with fine spination in foreground and coarse spination in background (S).

ed; that of QM G316723 is irregular in profile, with raised rims around the larger apertures. The external surface of NIWA 43408 cannot be ascertained. The surfaces of NIWA 62065 are rough and variably worn. NIWA 43454 has smoothly flaring lateral surfaces but the upper margins are broken and frayed.

Colour of QM G331692 and QM G316723 white; NIWA 43408 and 62065 brown; NIWA 43454 very dark brown, almost black.

Choanosomal skeleton measurements of the five distinct forms are given in Table 28. The choanosomal framework of QM G331692 is irregularly alveolar in overall aspect, consisting of a confluent network of pillars that delimit a similar labyrinthic schizorhysial system of channels of slightly larger dimensions. The dictyonal meshes of the pillars are mainly rectangular but sometimes triangular and form clear longitudinal strands (Fig. 56H). Beams and nodes are evenly finely spined (Fig. 56I) and nodes are not swollen. Hypersilicification of both beams and nodes is present along a restricted surface that may have been an oscular margin. Spurs are rare; most are short, thick, conical, and sharp-pointed but a few internal spurs are thin. No appended microxyhexactins occur.

Choanosomal framework of QM G316723 is similarly irregularly alveolar but with larger dimensions of both pillars and schizorhysial channels. The dictyonal meshes of the pillars are likewise mainly rectangular with some triangular (Fig. 56J); longitudinal strands are present in the thicker pillars as well as alignment of nodes in radial ranks. Beams are thinner and unevenly and sparsely thorny (Fig. 56K). Nodes are mostly smooth and unswollen. Hypersilicification and appended microxyhexactins are absent. Spurs are long, thin, and gradually tapering to a fine point (Fig. 56K). A few highly eroded loose scopules, uncinates, and thorny oxyhexactins are present but these are not convincingly native to the specimen.

Choanosomal framework of NIWA 43408 is intermediate between alveolar and laminar in form. The framework is laminar with vague dense dictyonal septa radiating from the lower right side of Fig. 56D, E toward the top and left, but these are too irregular to allow measurement of dimensions of the septa and spacing between septa. Schizorhysial channels permeate the lamella irregularly but with clear association with less dense parts of the lamella. Dictyonal meshes of the septa are rectangular and triangular and longitudinal strands are clearly evident (Fig. 56L) without indication of radial alignment of nodes. Beams are evenly and finely spined (Fig. 56M) while nodes are mostly without ornamentation and unswollen. Spurs are long, thin, and taper to pointed tips. Hypersilicification and appended microxyhexactins are absent.

Choanosomal framework of NIWA 62065 and the Chatham Rise specimens is laminar in form with regularly spaced longitudinal dense dictyonal septa alternating with low-density strands (Fig. 56N). Apertures and channels of schizorhyses mostly occupy the low-density interseptal strands, but connections pass through the septa as well. Dictyonalia of the septa form longitudinal strands, which curve to both dermal and atrial surfaces without distinct cortical formations (Fig. 56O). Meshes are irregularly triangular, rectangular, and polygonal; beams are very long and ornamented with fine spines distributed uniformly and in transverse lines (Fig. 56P). Nodes are similarly finely spined and unswollen. Spurs are long, thin, and taper to fine points. Hypersilicification and appended microxyhexactins are absent.

Choanosomal framework of NIWA 43454 is funnel-laminar in form with radiating, longitudinal, dense dictyonal septa alternating with low-density strands; apertures and channels of schizorhyses are mostly restricted to low-density interseptal strands (Fig. 56Q). Dictyonalia of the septa form longitudinal strands without curvature. Meshes are irregularly triangular, rectangular, and polygonal (Fig. 56R); beams are moderately long and ornamented with either coarse conical spines distributed evenly or with very fine spines in transverse lines (Fig. 56S). Nodes may be smooth or ornamented like their associated beams; they are unswollen. Spurs are undifferentiated; they are similar to simply truncated beams, thick with rounded tips. Hypersilicification and appended microxyhexactins are absent.

REMARKS: The seven sets of fragments described here as representing five distinct morphologies are assigned to the Tretodictyidae on the basis of their possession of schizorhyses, longitudinal dictyonal strands without the excessively elongate curved beams of the Aulocalycoida. Each of the five forms differ from each other in their body structure and dimensions given in Table 28, and are distinct from the other Tretodictyidae known from the eastern Australian and New Zealand region described above. They may well be skeletal fragments of species known from other regions, but they cannot be clearly assigned to those species until specimens bearing identifying spicules are found locally. These washed-out skeletons are inadequate for erection of new species, but they prove that several tretodictyids remain to be discovered within the New Zealand and eastern Australian areas. For the present, these must remain Tretodictyidae incertae sedis.

KEY CHARACTERS:

- All specimens are dead, washed-out dictyonal skeletal frameworks
- Schizorhyses are present as skeletal channels

- Structure of fragments varies from alveolar to laminar to funnel-laminar
- The dictyonal skeletons have longitudinal strands but lack a farreoid atrial framework
- Beams are spined in all forms
- Nodes are simple and unswollen; microxyhexactins are not appended to beams

APHROCALLISTIDAE Gray

Aphrocallistidae Gray, 1867: 507; Schulze 1904: 178; Reiswig 2002a: 1282.
Mellitionidae Zittel, 1877: 36; Schulze 1885: 447

Basiphytous Hexactinosida with rigid walls penetrated by cylindrical diarhyses, often closely spaced in a honeycomb pattern. Branching-tubular- to funnel- or cup-shaped main body with cylindrical or flattened mitten-form radial diverticula; wall 0.6–l0 mm thick; dictyonal meshes mainly triangular but occasionally rectangular where broad interdiarhysial septa occur; dermalia usually pinular hexactins but pentactins may predominate; two forms of scopules only on dermal or both surfaces; atrialia as pinular hexactins or large spined diactins; large uncinates and probably spined mesohexactins always present; microscleres include regular hexactins, hexasters, and hemihexasters or forms elongate in one axis, with disco-, oxy-, and onycho-tips (modified from Reiswig 2002a).

Remarks: The family Aphrocallistidae presently includes two genera, *Aphrocallistes* Gray and *Heterochone* Ijima, neither of which has previously been reported from New Zealand waters. The family diagnosis is modified from Reiswig (2002a) to combine the definition and diagnosis sections in that work.

Aphrocallistes Gray

Aphrocallistes Gray, 1858: 114; Schulze 1904: 148; Ijima 1927: 286; Reiswig 2002a: 1282.
Iphiteon Bowerbank (in part), 1869: 76.
Melittiaulus Schulze, 1885: 444.

Body form as simple branching tubules to networks of branching and anastomosing tubules to funnel-form, main body bearing radial closed (rarely open) tubules or hollow mitten-form extensions; sieve plates may be formed across main osculum or atrial lumen; rigid wall from 1–10 mm thick; wall structure as very regular, low-density honeycomb resulting from closely packed diarhyses separated by thin, delicate septa, 1–2 dictyonal meshes thick; dermalia generally pinular hexactins but pentactins may occasionally predominate; scopules as accessory dermalia and occasionally atrialia with tine tips varying from strongylote, subtylote, tylote to oxyote, or ending in buttons or toothed discs; typical uncinates present; atrialia as tuberculate diactins with central knobs; microscleres as discohexasters and/or tylohexasters and/or oxyhexasters, often with secondary branching restricted to the two rays of one extended axis (syngrammous) (from Reiswig 2002a).

Type species: *Aphrocallistes beatrix* Gray, 1858.

Remarks: The genus presently contains only two species, *A. vastus* Schulze, 1886 distributed in the North Pacific and *A. beatrix* Gray, which contains two subspecies, *A. beatrix beatrix* with cosmopolitan distribution and *A. beatrix orientalis* Ijima, 1916, ranging from Japan to the Philippine Islands.

Aphrocallistes beatrix beatrix Gray, 1858
(Figs 57, 58)

Aphrocallistes beatrix Gray, 1858b: 114; Schulze 1887: 305; Reiswig 2002a: 1283.
Iphiteon beatrix: Bowerbank 1869: 75.
Aphrocallistes bocagei Wright, 1870: 4.
Aphrocallistes ramosus Schulze, 1886: 75; Schulze 1887: 319.
Aphrocallistes jejuensis Sim & Kim, 1988: 29.

Material examined:

West Norfolk Ridge: NIWA 62076, NIWA Stn TAN0308/151, 34.569° S, 168.941° E, 1013–1340 m, 3 Jun 2003; NIWA 62077, NIWA Stn TAN0308/141, 34.284° S, 168.358° E, 785–800 m, 2 Jun 2003; NIWA 62078, NIWA Stn TAN0308/145, 34.297° S, 168.430° E, 1251–1268 m, 2 Jun 2003; NIWA 62080, NIWA Stn TAN0308/146, 34.238° S, 168.353° E, 1195–1202 m, 3 Jun 2003; NIWA 62081, 62083, NIWA Stn TAN0308/149, 34.630° S, 168.976° E, 508–560 m, 3 Jun 2003; NIWA 62074, 62075, NIWA Stn TAN0308/156, 34.571° S, 168.942° E, 1013–1350 m, 4 Jun 2003; QM G316635, NIWA Stn TAN0308/102, 33.707° S, 167.450° E (International waters), 1451–1478 m, 28 May 2003; QM G316632, NIWA Stn TAN0308/111, 32.605° S, 167.790° E (Australian EEZ), 1008–1029 m, 29 May 2003.

North Norfolk Ridge (*Australian EEZ*): QM G316634, NIWA Stn TAN0308/040, 26.421° S, 168.187° E, 714–756 m, 17 May 2003.

New Caledonia Trough: NIWA 66084, NIWA Stn TRIP2894/91, 35.951° S, 166.201° E, 809–978 m, 14 Jul 2009.

South Norfolk Ridge: NIWA 62082, NIWA Stn TAN0308/126, 33.390° S, 170.193° E, 469–526 m, 31 May 2003.

South Norfolk Basin: NIWA 62110, NZOI Stn U573, 33.534° S, 170.107° E, 1260 m, 4 Feb 1988.

Three Kings Ridge: NIWA 48689, NZOI Stn U582, 31.862º S, 172.453º E, 790 m, RV *Rapuhia*, 5 Feb 1988; NIWA 62107, NZOI Stn U592, 30.688° S, 172.900° E, 1067 m, 7 Feb 1988; NIWA 69107, NZOI Stn U595, 30.358° S, 173.145° E, 1474 m, 7 Feb 1988; NIWA 69108, NZOI Stn U602, 31.512° S, 172.830° E, 1216 m, 9 Feb 1988.

Cavalli Seamounts, *Seamount 441*: NIWA 43418, NIWA Stn KAH0204/50, 34.050º S, 174.808º E, 790–800 m, 19 Apr 2002. *Cavalli Seamount*: NIWA 43393, NIWA Stn KAH0204/28, 34.096º S, 174.115º E, 490–515 m, 16 Apr 2002; NIWA 43390, 43391, NIWA Stn KAH0204/07, 34.119º S, 174.152º E, 670–800 m, 14 Apr 2002.

Bay of Plenty: NIWA 70650, NIWA Stn Z9000, 37.618° S, 177.232° E, 445–467 m, 20 Jan 1998. *Tumokemoke Seamount*: NIWA 31130, NIWA Stn TAN0413/168, 37.466º S, 176.955º E, 435–474 m, 15 Nov 2004.

Southern Kermadec Ridge: NIWA 69105, NZOI Stn W671, 36.135° S, 178.198° E, 362 m, 16 Mar 1999. *East of Volcano L* (*Brimstone*): NIWA 43443, NIWA Stn TAN0205/77, 30.019° S, 178.651° W, 682–883 m, 23 Apr 2002.

Hikurangi Plateau, *SE of Ritchie Bank*: NMNZ POR.000469, 39.760° S, 178.363° E, RV *James Cook* Stn J9/027/89, 642 m, 18 Sep 1989; NMNZ POR.000816, RV *Tangaroa* Stn TAN9303/88, 39.789° S, 178.366° E, 800–1000 m, 27 Mar 1993. *Ritchie Ridge*: NIWA 27008, 27009, 27015, NIWA Stn TAN0616/12, 40.040° S, 178.144° E, 749 m, 4 Nov 2006; NIWA 52963, NIWA Stn TAN0616/07, 40.039° S, 178.144° E, 749 m, 4 Nov 2006. *Ritchie Ridge*: NIWA 27020, 27024, NIWA Stn TAN0616/21, 39.543° S, 178.336° E, 815 m, 5 Nov 2006; NIWA 27030, 27032, NIWA Stn TAN0616/38, 39.543° S, 178.336° E, 815 m, 6 Nov 2006. *Southern Hikurangi Margin*: NIWA 63650: TAN1004/66, 41.319° S, 179.197° E, 495 m, 21 Apr 2010.

Wairarapa Coast, *Southern Uruti Ridge*: NIWA 27036, NIWA Stn TAN0616/67, 41.295° S, 176.556° E, 731 m, 10 Nov 2006.

North Chatham Rise, *Graveyard seamount complex*, *Gothic Seamount*: NIWA 25134, NIWA Stn TAN0604/015, 42.757° S, 179.922° W, 830 m, 29 May 2006; NIWA 25141, NIWA Stn TAN0604/016, 42.765° S, 179.987° W, 993 m, 29 May 2006; NIWA 25185, NIWA Stn TAN0604/106, 42.727° S, 179.899° W, 1030 m, 4 Jun 2006; NIWA 51935, NIWA Stn TAN0104/153, 42.732º S, 179.898º W, 990–1076 m, 18 Apr 2001; NIWA 62085, NIWA Stn TAN0104/387, 42.726º S, 179.898º W, 1000–1100 m, 20 Apr 2001. *Zombie Seamount*: NIWA 25124, NIWA Stn TAN0604/009, 42.763° S, 179.925° W, 1019 m, 28 May 2006; NIWA 25173, NIWA Stn TAN0604/044, 42.766° S, 179.927° W, 932 m, 31 May 2006; NIWA 51955, NIWA Stn TAN0104/336, 42.768º S, 179.922º W, 890–955 m, 20 Apr 2001; NIWA 69392, 69390, NIWA Stn TAN0604/21, 42.766° S, 179.926° W, 906–1061 m, 29 May 2006. *Scroll Seamount*: NIWA 25169 (part), NIWA Stn TAN0604/039, 42.788° S, 179.999° W, 1021 m, 30 May 2006. *Diabolical Seamount*: NIWA 25189, NIWA Stn TAN0604/096, 42.791° S, 179.987° W, 930 m, 4 Jun 2006; NIWA 25194, NIWA Stn TAN0604/098, 4/06/2006, 42.789° S, 179.985° W, 960 m, 4 Jun 2006. *Morgue Seamount*: NIWA 25203, 25204, NIWA Stn TAN0604/100, 42.716° S, 179.962° W, 985 m, 4 Jun 2006. *Ghoul Seamount*: NIWA 25258, 25259, NIWA Stn TAN0604/111, 42.797° S, 179.988° W, 970 m, 7 Jun 2006; NIWA 25299, NIWA Stn TAN0604/117, 42.797° S, 179.986° W, 950 m, 7 Jun 2006; NIWA 25306, NIWA Stn TAN0604/118, 42.797° S, 179.988° W, 925 m, 7 Jun 2006. *Graveyard Seamount*: NIWA 51851, NIWA Stn TAN0104/001, 42.759° S, 179.988° W, 770–979 m, 15 Apr 2001; NIWA 51922, 51959, NIWA Stn TAN0104/002, 42.765º S, 179.989º W, 757–875 m, 15 Apr 2001; NIWA 51956, NIWA Stn TAN0104/288, 42.761º S, 179.988º W, 890–972 m, 19 Apr 2001; NIWA 51952, NIWA Stn TAN0104/289, 42.765º S, 179.986º W, 757–800 m, 19 Apr 2001; NIWA 70632, NIWA Stn TAN0604/30, 42.765° S, 179.988° W, 951–1076 m, 30 May 2006; NIWA 69391, NIWA Stn TAN0604/3, 42.760° S, 179.989° W, 765–845 m, 28 May 2006. *Pyre Seamount*: NIWA 51931, NIWA Stn TAN0104/150, 42.715º S, 179.906º W, 1004–1181 m, 18 Apr 2001; NIWA 51948, NIWA Stn TAN0104/333, 42.718º S, 179.909º W, 1008–1075 m, 20 Apr 2001; NIWA 51945, NIWA Stn TAN0104/397, 42.716º S, 179.911º W, 1000–1050 m, 21 Apr 2001. *Coffin Seamount*: NIWA 53437, NIWA Stn TAN0905/68, 42.772° S, 179.899° E, 1073 m, 22 Jun 2009. *Dead Ringer Seamount*: NIWA 53497, NIWA Stn TAN0905/71, 42.736° S, 179.691° W, 820 m, 22 Jun 2009.

East Chatham Rise, *Andes seamounts*, *Aloha Seamount*: NIWA 54311, NIWA Stn TAN0905/120, 44.028° S, 174.591° W, 796 m, 28 Jun 2009; NIWA 54353, NIWA Stn TAN0905/121, 44.028° S, 174.591° W, 801 m, 28 Jun 2009. *Iceberg Seamount*: NIWA 53794, NIWA Stn TAN0905/104, 44.158° S, 174.561° W, 681 m, 26 Jun 2009; NIWA 53813, 53816, 53822, NIWA Stn TAN0905/105, 44.157° S, 174.554° W, 485 m, 26 Jun 2009; NIWA 54241, 62143, NIWA Stn TAN0905/119, 44.158° S, 174.555° W, 487 m, 28 Jun 2009. *Ritchie Seamount*: NIWA 53869, 53870, 53871, NIWA Stn TAN0905/106, 44.175° S, 174.553° W, 704 m, 26 Jun 2009; NIWA 54170, NIWA Stn TAN0905/116, 44.175° S, 174.552° W, 716 m, 27 Jun 2009. *Diamond Head*: NIWA 53530, NIWA Stn TAN0905/95, 44.136° S, 174.721° W, 613 m, 25 Jun 2009; NIWA 53594, 53595, NIWA Stn TAN0905/97, 44.147° S, 174.691° W, 440 m, 26 Jun 2009; NIWA 53653, NIWA Stn TAN0905/98, 44.147° S, 174.698° W, 720 m, 26 Jun 2009; NIWA 53698, NIWA Stn TAN0905/99, 44.141° S, 174.721° W, 641 m, 26 Jun 2009; NIWA 53948, 53986, NIWA Stn TAN0905/111, 44.147° S, 174.691° W, 458 m, 27 Jun 2009. *Dickies Seamount*: NIWA 53725, NIWA Stn TAN0905/101, 44.127° S, 174.571° W, 645 m, 26 Jun 2009; NIWA 53928, NIWA Stn TAN0905/110, 44.127° S, 174.571° W, 650 m, 27 Jun 2009.

Chatham Rise: NIWA 44107, NIWA Stn TRIP2520/129, 44.188° S, 174.533° W, 775–1064 m, 25 Nov 2007; NIWA

49091, NIWA Stn TRIP2699/86, 44.172° S, 174.577° W, 802–1057 m, 13 Oct 2008; NIWA 50585, NIWA Stn TRIP2551/94, 43.851° S, 174.357° W, 802 m, 19 Dec 2007; NIWA 62096, NIWA Stn TAN0604/06, 42.766° S, 179.979° W, 1040 m, 28 May 2006; NIWA 66032, NIWA Stn TRIP2911/34, 42.838° S, 176.921° W, 687–903 m, 25 Jul 2009; NIWA 66033, NIWA Stn TRIP2911/7, 44.418° S, 178.637° W, 650–767 m, 18 Jul 2009; NIWA 66088, NIWA Stn TRIP2895/56, 42.843° S, 176.918° W, 689–772 m, 10 Jul 2009; NIWA 69106, NIWA Stn Z10061, 37.047° S, 176.497° W, 949 m, 27 Mar 2000; NIWA 69109, NIWA Stn Z10762, 44.211° S, 174.471° W, 728 m, 11 Jul 2000; NIWA 69527, NIWA Stn TRIP3235/22, 42.887° S, 177.402° E, 432–445 m, 5 Dec 2010.

South edge of Chatham Rise: NIWA 52980, NIWA Stn TAN9812/72, 44.634° S, 176.976° E, 848–898 m, 20 Oct 1998.

Macquarie Ridge, Seamount 7 (Australian EEZ): QM G331858, NIWA Stn TAN0803/77, 53.738º S, 159.114º E, 925–1014 m, 11 Apr 2008.

DISTRIBUTION: Widely distributed around New Zealand, within the Australian EEZ (parts of the West and North Norfolk Ridge) and in International waters (part of West Norfolk Ridge) (Fig. 57A). Outside of New Zealand waters the subspecies is cosmopolitan.

HABITAT: Known to be attached to hard substratum; five of the specimens include the basal attachment disc. Depth range within New Zealand, eastern Australian and West Norfolk Ridge International and eastern Australian waters is 469–1478 m; depth range worldwide is 60–2949 m.

DESCRIPTION:

Morphology as a thin-walled, irregular tube or high aspect ratio funnel, arising from a small attachment base; hollow fistules with rounded tips arise laterally by out-pocketing of the upper body wall, either in a tight spiral pattern (Fig. 57B left; see Fig. C of Frontispiece for form in life) or sparsely and without pattern; the fistules project perpendicularly and are either closed or end in a small terminal osculum. The main osculum of the primary tube may be covered by a rigid sieve plate. The most striking feature of the species is the regular hexagonal honeycomb structure of the wall, easily seen with the naked eye (Fig. 57C). Most of the specimens were dead washed-out frameworks; only four, NMNZ POR.000469, NIWA 31130, NIWA 43418 and NIWA 51922, contained loose spicules.

Dimensions of most available specimens, broken fragments, are 2–7 cm in length; a large specimen may reach 15 cm; the main tube is characteristically about 10 mm in diameter at the base, swelling to 25 mm at the upper end; lateral fistules are 5–10 mm in diameter and up to 25 mm in length. Wall thickness is 0.6–4 mm; pores of the honeycomb wall (diarhyses) are 0.5–1.0 mm in diameter.

Texture is stony hard.

Surface of the live sponge is smoothly cylindrical on both main and lateral tubes, with the pinular rays of the hexactine lattice and slightly projecting ends of uncinates forming a fine fur.

Colour of live sponge beige to light yellow; washed-out frameworks snowy white to dark brown.

Choanosomal skeleton is a dictyonal framework composed of dictyonalia fused in flat sheets to form the septa, or bounding walls, of the honeycomb diarhyses, the channels, which pass completely through the body wall perpendicular to the outer surface (Fig. 57E, F). Thickening of septa, presumably by silica deposition on existing beams, occurs in older specimens, resulting in narrowing of the diarhyses (Fig. 57D). Meshes of the septa are mostly triangular, rarely rectangular, and longitudinal strands are not formed (Fig. 57G, H). The pattern of dictyonal fusion, with most rays of each dictyonalium constrained to a thin plane, is poorly understood but seems to be irregular, including ray to ray and ray to node connections; most nodes appear to be false nodes formed by ray to ray fusion (Fig. 57H). Beams and nodes are sparsely spined but sometimes smooth; nodes are slightly enlarged by spreading of silica in the plane around the margins of the ray junctions, and not by distinct swelling of the nodes themselves as occurs in some other dictyonal sponges. Spurs occur on all surfaces of the framework, including long sharply pointed ones on the faces of the septa and directed outward toward the dermal surface (Fig. 57H), short pointed ones on the dermal margins of the septa (Fig. 57E), and long forms with swollen tips on the atrial septal margins (Fig. 57F). Finely spined knobs of silica are commonly deposited on the atrial spurs (Fig. 57I). Adherent small hexactins are not present. Free choanosomal spicules are microscleres and uncinates.

Ectosomal skeleton of the dermal surface consists of a lattice of loose pinular hexactine megascleres with overlapping tangential rays. Scopules occur positioned along the proximal rays of pentactins, oriented with their tine-bearing heads outwards, towards the surface of the wall. Fine uncinates are oriented vertical to the surfaces with anterior end projecting to or through the surface. The atrial surface is lined by a feltwork of diactine megascleres with scopules projecting as on the dermal surface. Microscleres are scattered in both surface and subsurface tissue layers on both sides of the body wall.

Megascleres (Table 29) are dermal pinular hexactins, two forms of scopules, atrial diactins, and uncinates. Dermal hexactins (Figs 57J, 58A) have a bushy projecting pinular ray; tangential rays are cruciate and cylindrical, spined on the distal third and ending in rounded or bluntly pointed tips; the proximal ray is generally shorter but otherwise similar to the tangential rays. Scopule 1 (Figs 57L, 58B) occurs abundantly on both surfaces; it is long and thin, with 4–8 straight, rough tines spreading slightly and ending in either sharp pointed tips (young), distinct serrated discs (slightly older and thicker stage, Fig. 57B) or slightly inflated smoothly rounded tips (oldest and thickest, Fig. 57L); spination continues over the entire head but the shaft is smooth and acutely pointed. Scopule 2, a less common tyloscopule (Figs 57K, 58C), also occurs on both surfaces; it is shorter with 4–7 rough, flaring, geniculate tines ending in a swollen hemispherical knob; head and shaft appear smooth in LM but are seen to bear sparse small spines in SEM. The atrial diactins (Fig. 58D) are usually bent at the centre where four small knobs occur around the axial cross; the two developed rays are cylindrical and completely spined, with denser spination near the rounded tips. Uncinates (Figs 57M, 58E) are highly variable in size, ranging from forms with well-developed brackets and barbs to thin raphidial forms with only incipient ornamentation; several size classes may be present. Small thin choanosomal hexactins (Fig. 58F) have straight, curved or bent rays covered with sharp conical spines; they are extremely abundant in NIWA 43418 but absent from NMNZ POR.000469, NIWA 31130, and 51922.

Table 29. Spicule and framework dimensions (µm) of *Aphrocallistes beatrix beatrix* Gray, 1858.

Parameter	NZNM POR.000469			
	mean	**s.d.**	**range**	**no.**
Dermal hexactin:				
pinulus ray length	168	33	93–231	50
pinulus total ray width	21.5	3.7	14.5–28.8	50
tangential ray length	104	15	72–144	50
tangential ray width	3.8	0.9	2.2–6.0	50
proximal ray length	72	15	50–142	50
proximal ray width	4.1	0.9	2.1–6.2	50
Scopule 1 total length	711	95	472–928	50
head length	122	17	85–154	50
Scopule 2 total length	405	49	350–457	5
head length	97	12	78–111	5
Atrial diactin length	496	275	264–1519	50
width	5.3	1.3	3.0–8.6	50
Uncinate length	1724	280	1006–2277	50
width	8.8	1.7	5.7–13.8	50
Oxyhexactin, ray length	69.5	18.2	29.0–106.3	50
ray width	2.4	0.4	1.3–3.6	50
Hemioxyhexaster length	74.4	9.5	54.2–93.2	50
width	57.5	7.7	43.9–74.8	50
Oxyhexaster diameter	64.8	6.3	59.5–74.5	7
primary ray length	5.2	1.0	3.9–6.7	7
secondary ray length	27.8	4.4	23.7–34.5	7
Hemidiscohexaster length	51.1	10.4	27.5–65.3	23
width	38.5	7.8	21.5–49.9	23
Microdiscohexaster diameter	25.0	5.9	17.4–45.8	50
primary ray length	4.7	1.0	2.7–7.9	50
secondary ray length	7.8	2.6	4.5–16.0	50
Framework beam length	127	36	55–230	50
beam width	22.2	6.2	13.5–43.3	50
dermal spur length	179	42	87–296	50
channel spur length	245	75	88–501	50

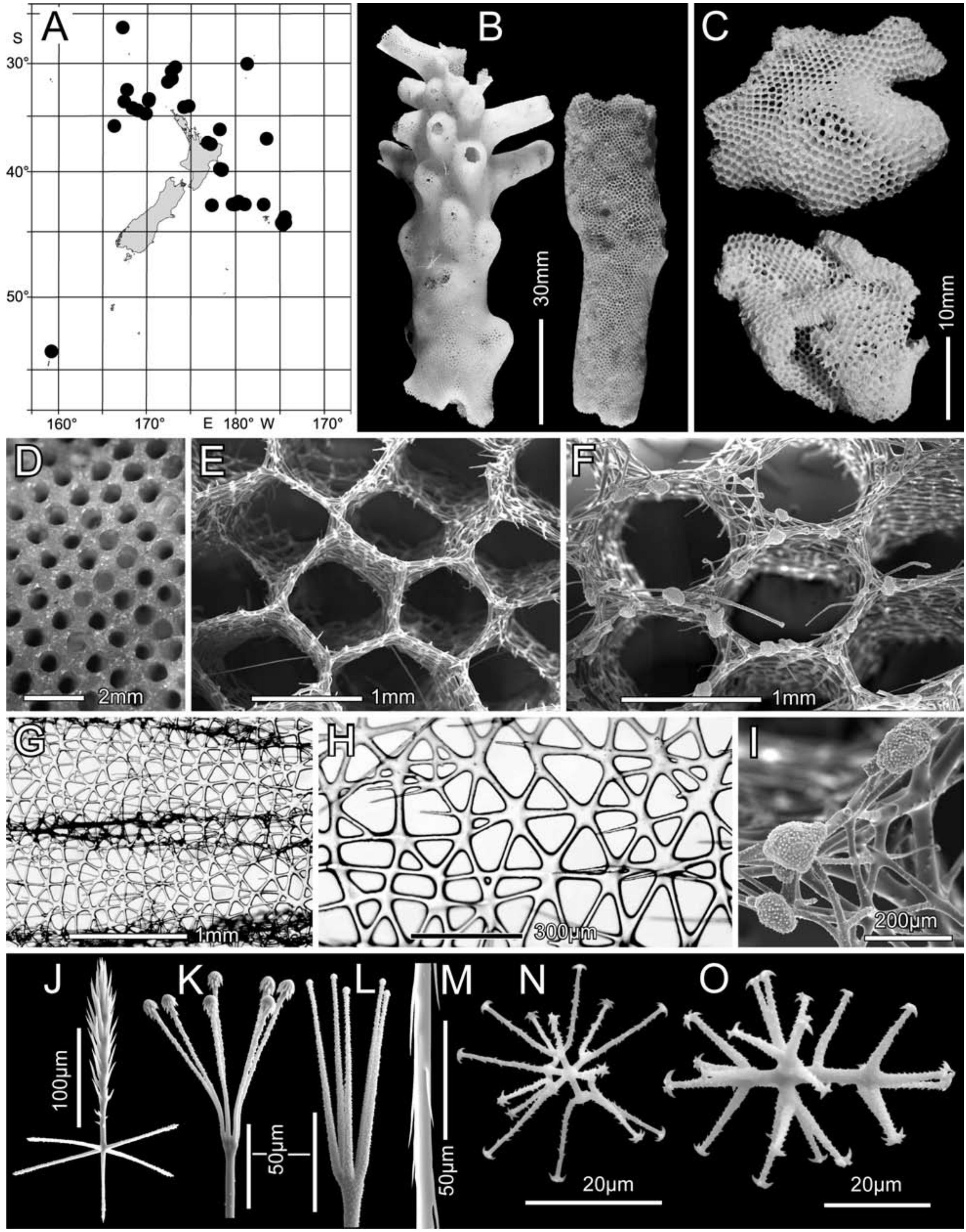


Figure 57. *Aphrocallistes beatrix beatrix* Gray, 1858. A, distribution in New Zealand, eastern Australian, and West Norfolk Ridge International waters. B, body form, NIWA 62077, upper part with lateral fistules (left) and older eroded main tube piece (right). C, clean dictyonal framework fragments of NMNZ POR.000469 with honeycomb diarhyses. D, surface of older specimen of B right, with thickened diarhysial septa. E, cleaned dermal surface of framework of a young specimen, NMNZ POR.000469. F, atrial surface of the same, showing atrial siliceous knobs. G, septal walls of two diarhyses, dermal surface to left (LM). H, magnified part of diarhysial septum of G. I, magnified atrial silica knobs of F. J–O, spicules from NIWA 43418. J, dermal pinular hexactin. K, tyloscopule. L, strongyloscopule. M, uncinate segment. N, microdiscohexaster. O, discohexaster elongate in one axis.

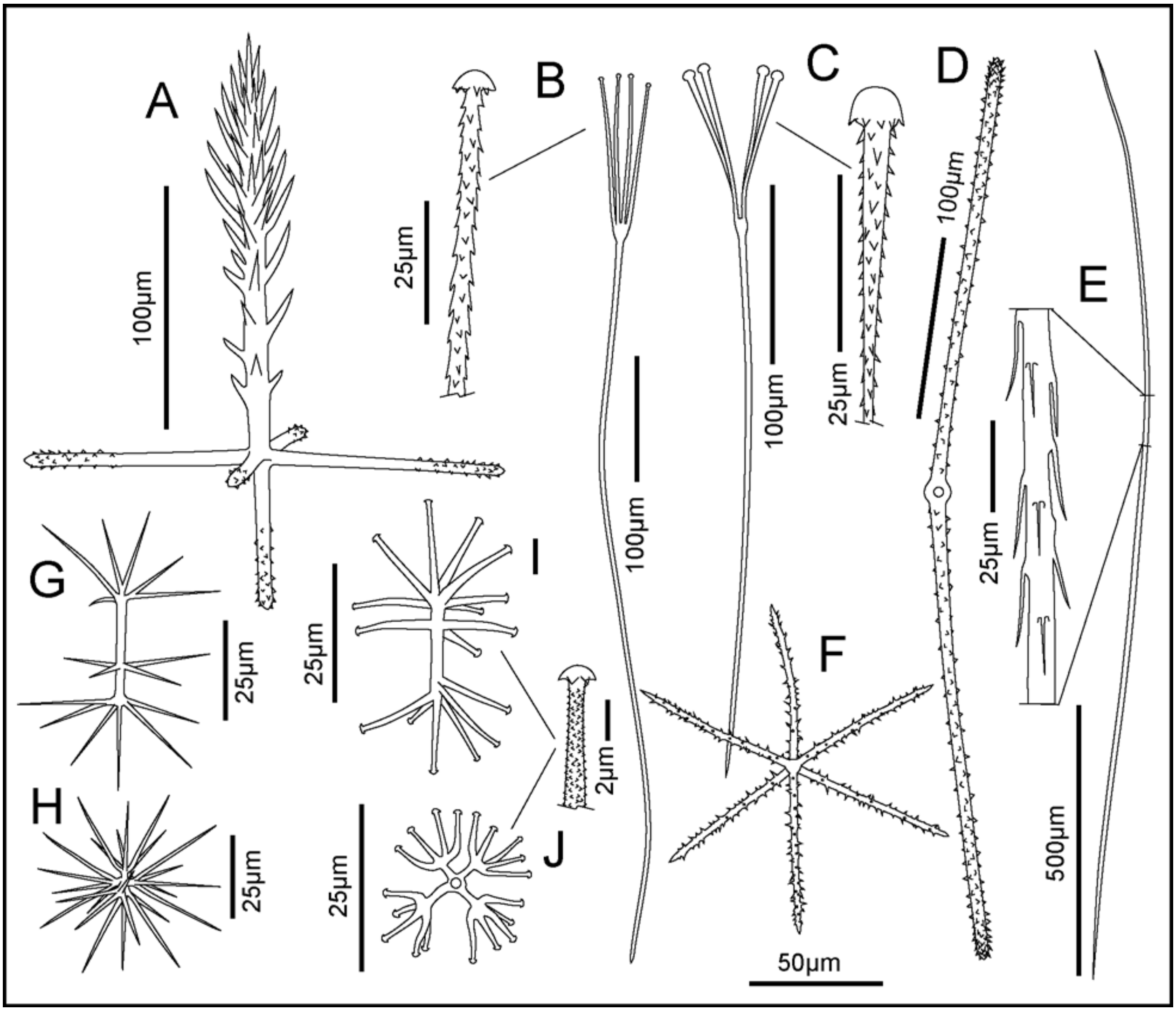


Figure 58. Spicules of *Aphrocallistes beatrix beatrix* Gray, 1858, NMNZ POR.000469. A, dermal pinular hexactin, whole. B, scopule 1, whole and enlargement of upper end of tine. C, scopule 2, whole and enlargement of upper end of tine. D, atrial diactin. E, larger form of uncinate, whole and enlargement of middle segment. F, choanosomal oxyhexactin, NIWA 43418. G, elongate hemioxyhexaster. H, oxyhexaster. I, elongate hemidiscohexaster. J, microdiscohexaster.

Microscleres (Table 29) include hemioxyhexasters, oxyhexasters, hemidiscohexasters and microdiscohexasters. The abundant hemioxyhexasters (Fig. 58G), also called oxydiasters or syngrammous 'roller-stars', have four simple rays and two branched rays bearing 3–6 straight, smooth, acutely pointed secondary rays. Regular oxyhexasters (Fig. 58H) are rare; they are entirely smooth in LM, with short primary rays bearing 2–5 secondary rays. Hemidiscohexasters (Fig. 58I) are similar to hemioxyhexasters in size and form, but have small rough secondary rays bearing small, marginally serrated terminal discs. Some discohexasters with one elongate axis appear similar to hemidiscohexasters in overt form, but all six rays are branched (Fig. 57O). The microdiscohexasters (Figs 57N, 58J) are abundant; their short smooth primary rays each bear 3–7 rough secondary rays ending in small, marginally serrated discs.

REMARKS: The specimens from New Zealand, eastern Australian, and International waters conform to the description of *Aphrocallistes beatrix beatrix* given in Reiswig (2002a). The few differences, such as extended scopule size range and flexion of atrial diactins, are not unexpected in this widely distributed and variable species. The many records and descriptions of *A. beatrix beatrix* allow the numerous washed-out fragments with their distinctive honeycomb frameworks and mitten-like form to be unambiguously assigned to this taxon. This is the first report of a member of the family Aphrocallistidae and the genus *Aphrocallistes* from the southwest Pacific region.

KEY DIAGNOSTIC CHARACTERS:

- Body form is a narrow tube with hollow lateral fistules projecting from its upper part

- Body wall consists of a conspicuous hexagonal honeycomb of straight channels (diarhyses)
- Megascleres include pinular hexactins, two forms of scopules, diactins, and uncinates
- Microscleres consist mainly of 'roller-stars', hemidiscohexasters with branching restricted to one axis

AULOPLACIDAE Schrammen

Auloplacidae Schrammen, 1912:191; Zittel 1915: 74.
Dactylocalycidae Gray (in part), 1867: 505; Reiswig 2002: 1293; Finks *et al*. 2004: 542.
Tretodictyidae Schulze, 1886: 78 (in part), Ijima 1927: 112; Reid 1963: 229; Mehl 1992: 58; Finks *et al*. 2004: 501.

Basiphytous Hexactinosida with rigid erect body on a short tubular stem; upper body consisting of several vertical plates or fans composed of conjoined thin-walled tubes dividing acutely and remaining tightly connected side-by-side. Constituent tubes are open both distally and by lateral oscula which may have margins raised above the plane of tubes. One exposed side of each tube has a very thin dictyonal frame composed of large apertures covered by a rectangular lattice of loose spicules, dominated by very large oxypentactins; margins of these framework apertures may be raised slightly, but longitudinal strands are lacking. The other external surface and the lateral walls shared with adjoining tubes are thicker, have larger lateral apertures not covered by a loose spicule lattice, and usually possess longitudinal strands joined mainly by uniaxial connecting rays, which results in a framework where false nodes outnumber true nodes. Primary framework construction appears not based upon longitudinal strand formation. Scopules are present but not in the usual position as tufts arrayed around radial rays of pentactins; uncinates are small and thin with reduced brackets and barbs; microscleres are mainly or entirely discohexactins. (This diagnosis is new here and applies only to Recent species).

Remarks: Schrammen (1912) erected the family with focus clearly upon the Recent species *Auloplax auricularis* (Schulze, 1904) but defined it to include his new fossil forms, *A. spongiosa* Schrammen, 1912 and three species of *Stereochlamis*. His diagnosis was based mainly on body form. The family is usually treated as a junior synonym of either Tretodictyidae or Dactylocalycidae, depending on where *Auloplax* is assigned by individual authors. It is resurrected here to include the single Recent genus *Auloplax* which, because of its unique framework structure, cannot be included in any of the presently accepted Hexactinosida families.

Auloplax Schulze

Auloplax Schulze, 1904: 47; Schrammen 1912: 191; Ijima 1927: 219; Reid 1963: 228; Mehl 1992: 58; Reiswig 2002h: 1294; Finks *et al*. 2004: 501.
Hexactinella (in part) Reid 1963: 228.

Diagnosis of the genus is the same as that of the family since the latter is monogeneric.

Type species: *Auloplax auricularis* Schulze, 1904.

Remarks: Until now, *Auloplax* contained only two species, *A. auricularis* from off NW Africa and *A. filholi* (Topsent, 1904b) from off NW Spain. The two are very similar and have long been thought to be synonymous, but both of their original descriptions are inadequate to support such a conclusion. Review of both type specimens is required to settle their relationship.

***Auloplax breviscopulata* n. sp.** (Figs 59–61)

Material examined:

Type material: **Holotype** NIWA 31490, NZOI Stn K0832, near Kermadec Islands, 29.832° S, 178.263° W, 1050 m, MV *Tangaroa*, 7 Jul 1974. **Paratypes** NIWA 43412, NIWA Stn KAH0204/40, West Cavalli Seamount, 34.164° S, 173.964° W, 805–820 m, 18 Apr 2002; NIWA 49702, NZOI Stn T0258, Kermadec Islands, 31.068° S, 178.580° W, 785 m, MV *Tangaroa*, 8 Mar 1982.

Non-type material: *Southern end of Norfolk Ridge*: NIWA 69110, 62126, NZOI Stn U581, 31.855° S, 172.147° E, 1170 m, 5 Feb 1988. *Hikurangi Margin*: NIWA 69393, NIWA Stn Z10169, 39.491° S, 178.418° E, 1000 m, 3 Jun 1999 (no spicules).

Comparative material: Paralectotypes of *Auloplax auricularis*, ZMB 5390 and NHMUK 1908.9.24.41, SS *Valdivia*, Stn 33, NW Africa, 24.588° N, 17.078° W, 2500 m, 30 Aug 1898.

Type locality: Kermadec Ridge.

Distribution: Known from Kermadec Islands and Cavalli Seamounts, New Zealand (Fig. 59A).

Habitat: Attached to hard substratum; depth range 785–1050 m.

Description:

Morphology of the least damaged fragment, paratype NIWA 43412, is a rigid, short-stalked, irregular polyfan composed entirely of conjoined thin-wall tubes 4–14 mm in diameter; the vertical stalk, consisting of a single hollow tube arising from the small attachment disc, branches shortly above the base into two conjoined tubes; these branch acutely giving rise to three or more vertical plates made up of branching hollow tubes joined laterally and opening by oscula at their distal tips (Fig. 59E, F). The upper surface is an obliquely concave sieve membrane (Fig. 59E, H). Although the holotype is badly broken into fragments, the form of these is consistent with it having had similar morphology but larger overall size (Fig. 59B–D).

Dimensions of most intact specimen, paratype NIWA 43412, are 9.3 cm in height and 6.5 x 5.8 cm in width, with a small attachment disc 11 x 12 mm. The holotype consists of 15 fragments ranging from 14–112 mm in length, 7–56 mm in width and 5–25 mm in depth. Constituent tubes are 3.9–8.5–14.2 mm in external diameter (n = 19); body wall thickness varies from 1–3 mm.

Texture is hard but very fragile.

Surface is topographically complex, but at the fine level fairly smooth. The upper surface of NIWA 43412 is a sieve of rather coarse, thin framework covered by a lattice of loose spicules dominated by very large but short (nearly flattened) pentactins (Fig. 60K, 61B). The same thin sieve surface is found on the external surfaces of some of the laterally projecting tube arrays. It is also a common feature on almost all of the holotype fragments where it covers about 30% of the exposed surfaces (Fig. 59G). The remaining surfaces are covered by a thicker lattice with longitudinal strands, which is covered by a loose spicule lattice dominated by smaller pentactins with longer proximal rays. There are no spicules or framework elements projecting from the surface.

Colour of live sponge white to light beige.

Choanosomal skeleton of the sieve areas is a very thin, coarse dictyonal framework, 1–2 meshes thick, with large oval apertures outlined by patches of densely packed dictyonalia. Dictyonalia are fused mostly end to end in the thick aperture margins with free rays projecting into the apertures (Fig. 60A). Connecting rays are uniaxial and attach to neighbouring beams forming false nodes. Flagellated chambers are not contained in these thin sieve structures (Fig. 60B); it remains uncertain if they function as inhalant or exhalant surfaces. The main framework of the other tube areas is thicker and contains longitudinal strands and flagellated chambers (Fig. 60C, D). This framework type occupies the external expanded ridges and the surfaces shared with adjacent tubes (Fig. 60E). Very shallow pits are distributed over the outer surface of the ridges, but since the direction of water flow is unknown, these cannot be named as either epirhyses or aporhyses. The longitudinal strands are composed of both uniaxial and biaxial protosiphons (Fig. 60F) which are enclosed in a common silica envelope. This suggests the strands are formed by two processes, by addition of founding dictyonalia alongside one another in longitudinal series to form the original strand and by later addition of dictyonalia in an ‘astride’ manner (two adjacent rays of different axes contribute to the strand) to strengthen and stabilise the strand. Lateral rays of both the founding and secondary dictyonalia project as uniaxial beams and join without special alignment to neighbouring beams; this results in very large numbers of false nodes (74 false nodes vs 68 true nodes in a segment, part shown in Fig. 60G) and a lack of biaxial connectives which characterise both farreoid and euretoid frameworks. Isolated longitudinal strands (Fig. 60H), examined in 85% sucrose to minimise surface refraction, show that strands carry 2–5 axial filaments at any point; mean distance between dictyonal centra on strands is 1.12 mm and individual axial filaments within strands average 2.25 mm in length, definitely not an aulocalycoid pattern. Longitudinal strands, while common, do not seem to be a basic constructional feature of the framework. They are not individually continuous over long distances; they are generally identifiable over only 4–8 mesh lengths; they are absent from the sieve surfaces; they arise from no single dictyonal centre but terminate proximally in a tuft of exposed protosiphons. These features suggest that the longitudinal strands cannot be considered primary framework constituents.

Meshes are primarily triangular but rectangular and polygonal forms are also common. Beams are mostly finely spined (Fig. 60I) but individual beams may be smooth; anaxial synapticula do not constitute a significant part of the framework and, indeed, have not been found here at all. Nodes are not swollen. Spurs on the external surface tend to be short, conical, and blunt-pointed but those within the framework and especially those projecting into the tube cavities are club-shaped and finely rough (Fig. 60J). Small oxyhexactins are not appended to framework beams. Free choanosomal spicules include microscleres, uncinates, and scopules.

Ectosomal skeleton could be interpreted to include the framework of the sieve surface, described above, since flagellated chambers appear to be absent from this structure. More reasonably the ectosomal skeleton consists of the loose spicule lattices associated with surface membranes. On the outer sieve framework, a coarse rectangular lattice is formed by tangential rays of large flat pentactins and smaller hexactins (Fig. 60B); scopules, small uncinates, and microscleres occur distributed in or under this membrane. The cover lattice of the ridge areas is formed mainly by pentactins with long proximal rays and smaller hexactins, but also includes scopules, small uncinates, and microscleres. The internal lining of the ridge areas of the tubes has only thin uncinates as supporting spicules. Distinction between dermalia and atrialia cannot presently be made since direction of water flow remains uncertain.

Megascleres (Table 30) consist of two classes of large pentactins (or subhexactins), a smaller hexactin, two classes of scopules, and small uncinates. The large pentactin forming the major support for large sieve fields has long, tapered, finely-spined tangential rays, often stair-stepped, with blunt-pointed tips (Figs 60K, 61A); the proximal ray is generally much shorter than the tangential rays; the sixth distal ray may be only a swelling (pentactin form) or a very short ray with rounded tip. The second large pentactin (or subhexactin) common on outer ridge surfaces is similar but has proximal rays usually as long as or longer than tangential rays (Figs 60M, 61C); here too the distal ray is most often a small swelling but may extend up

Table 30. Spicule and framework dimensions (µm) of *Auloplax breviscopulata* n. sp.

Parameter	**Holotype NIWA 31490**			
	mean	**s. d.**	**range**	**no.**
Large sieve pentactin or subhexactin:				
tangential ray length	822	188	398–1398	113
tangential ray width	33.0	7.2	18.9–59.6	97
proximal ray length	349	199	105–884	35
proximal ray width	29.0	6.6	15.3–46.0	57
distal ray length	57.4	12.5	28.0–90.1	58
distal ray width	38.8	7.9	23.7–69.3	55
Ridge pentactin or subhexactin:				
tangential ray length	445	110	178–695	50
tangential ray width	21.5	6.5	4.9–33.2	50
proximal ray length	548	150	213–867	50
proximal ray width	21.5	7.8	7.2–41.0	50
distal ray length	42.9	9.2	26.8–73.1	50
distal ray width	23.4	7.1	8.7–37.3	50
Small hexactin tangential ray length	223	57	129–377	56
tangential ray width	10.9	2.9	4.7–18.2	50
proximal ray length	126.3	4.8	49.3–264.5	50
proximal ray width	10.1	2.7	4.0–18.1	50
distal ray length	63	22	21–113	50
distal ray width	11.0	3.0	4.9–20.3	50
Small scopule length	261	29	216–366	97
head length	67.8	6.0	51.1–83.3	97
tine length	56.9	5.6	40.3–70.9	97
shaft width	3.7	1.2	1.7–6.6	97
Large scopule length	519	62	408–670	50
head length	94.0	8.6	74.1–115.1	50
tine length	81.9	8.4	62.7–105.7	50
shaft width	5.1	1.1	3.1–7.8	50
Uncinate length	410	148	122–785	100
width	2.5	0.7	1.3–4.6	100
Discohexactin diameter	65.7	8.5	36.9–85.6	100
Framework beam length	575	262	173–1612	100
beam width	110	50	15–239	100
Spur length in sieve area	449	181	178–1014	50
in internal ridge area	357	153	84–717	50
Frame gaps of sieve area (mm)	1.65	0.51	0.89–3.05	38
of ridge area (mm)	1.30	0.94	0.48–5.20	24

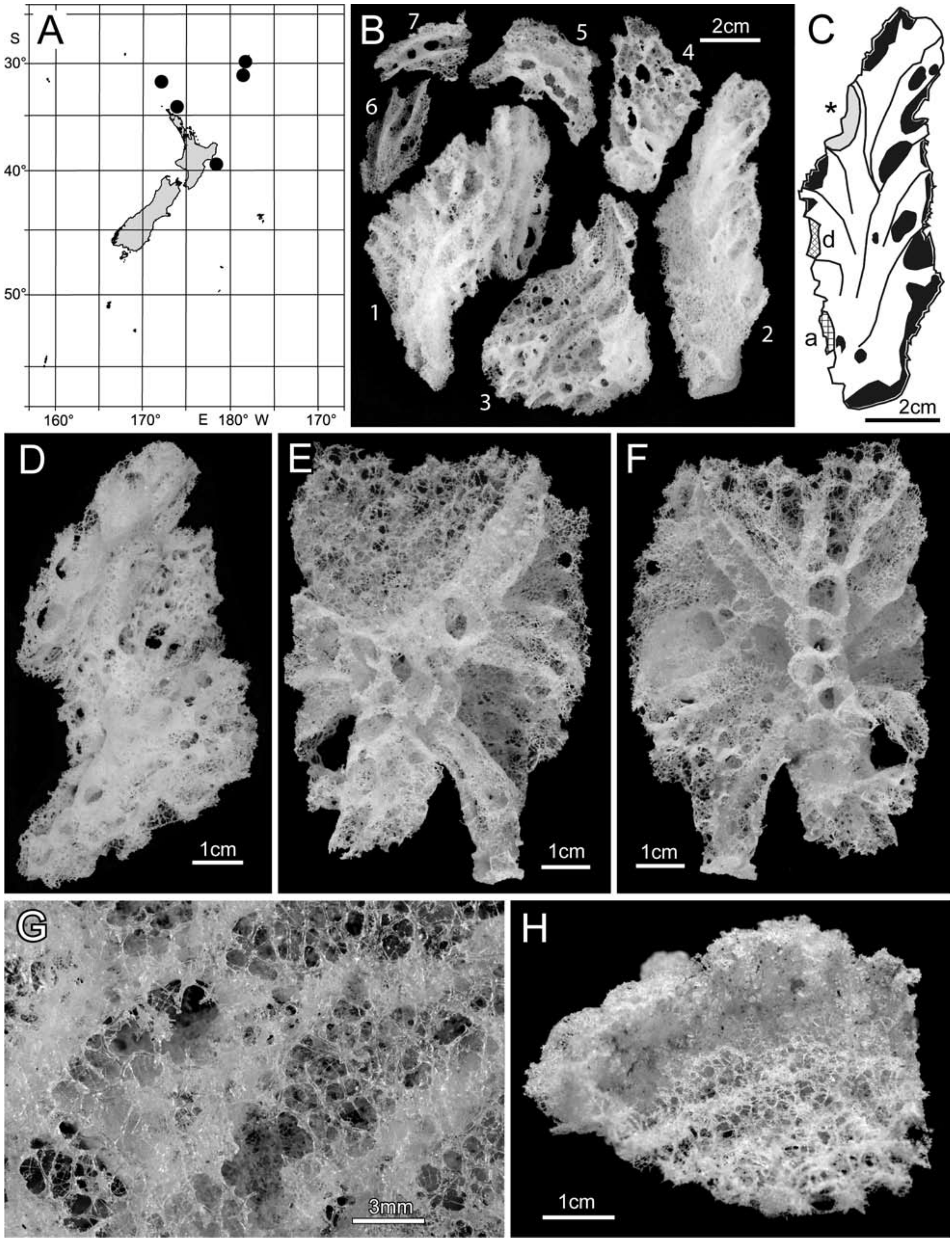
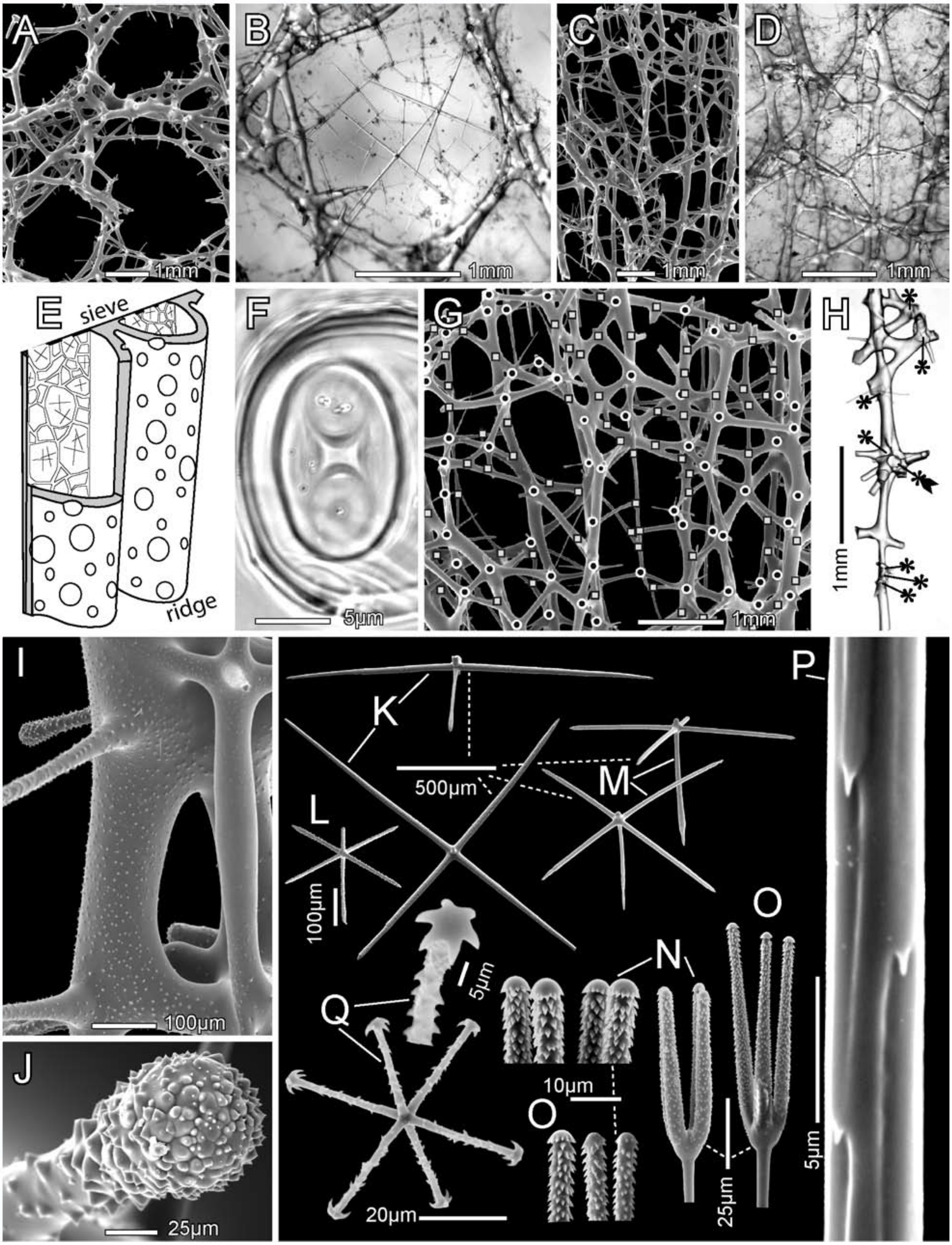


Figure 59. *Auloplax breviscopulata* n. sp. A, distribution in New Zealand waters. B, largest seven fragments of the holotype, NIWA 31490. C, diagram of the tube components of fragment 2; a = an attachment site; d = a dead area; * indicates a terminal osculum opening on the other side. D, other side of fragment 1. E, F, two views of the paratype NIWA 43412. G, a sieve area of the holotype, fragment 2. H, upper sieve area of the paratype NIWA 43412.


A
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G
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100µm
J
25µm
K
500µm
M
L
100µm
5µm
Q
N
O
10µm
O
20µm
25µm
5µm
P

Figure 60 (*opposite*). *Auloplax breviscopulata* n. sp. framework and spicules, holotype NIWA 31490. A, clean framework of sieve area. B, sieve area with spicules in place (LM). C, clean framework of the ridge area. D, ridge area with spicules and tissues in place; flagellated chambers can be seen as oval shadows (LM). E, diagram of tube surface structure showing sieve and ridge walls. F, section of longitudinal strand with two protosiphons bearing one and two axial filaments, enclosed in multilayered silica sheath (LM). G, enlarged part of ridge framework shown in C, with circles indicating true nodes and squares indicating false nodes. H, a longitudinal strand from ridge framework with dictyonal centra indicated by asterisks and an 'astride' dictyonalium indicated by arrow vanes (LM). I, beams and spurs showing ornamentation. J, a spur from the internal framework. K, large pentactin from sieve area. L, small hexactin from sieve area. M, large pentactins from ridge area. N, small scopule with magnified tine tips. O, large scopule with magnified tine tips. P, uncinate segment. Q, discohexactin with magnified ray end.

to 73 µm. The small hexactin (Figs 60L, 61B) is more coarsely spined and has both proximal and distal rays significantly developed but only one-half or less as long as the four equal tangential rays. It occurs in all surface membranes. The two scopule forms differ in size and shape of the heads, but ornamentation and tine tips are similar, with small smooth caps not demarcated sufficiently to be called discs and thus designated as strongyloscopules (Figs 60N, O, 61D, E). The small scopule has generally four parallel tines covered with small, reclined thorns; the neck has few spines and the shaft is smooth except near the tapered, pointed tip. The larger scopule has 3–7 longer tines splayed at about 12°. Both scopules are present in all surface areas but generally below the bounding membranes and associated with the outer dictyonal framework. Both scopule types are present in the two spicule-bearing specimens, but the smaller forms predominate in the holotype, NIWA 31490, while the larger form predominates in the paratype, NIWA 43412. The uncinates (Figs 60P, 61F) are thin finely pointed oxeote spicules with

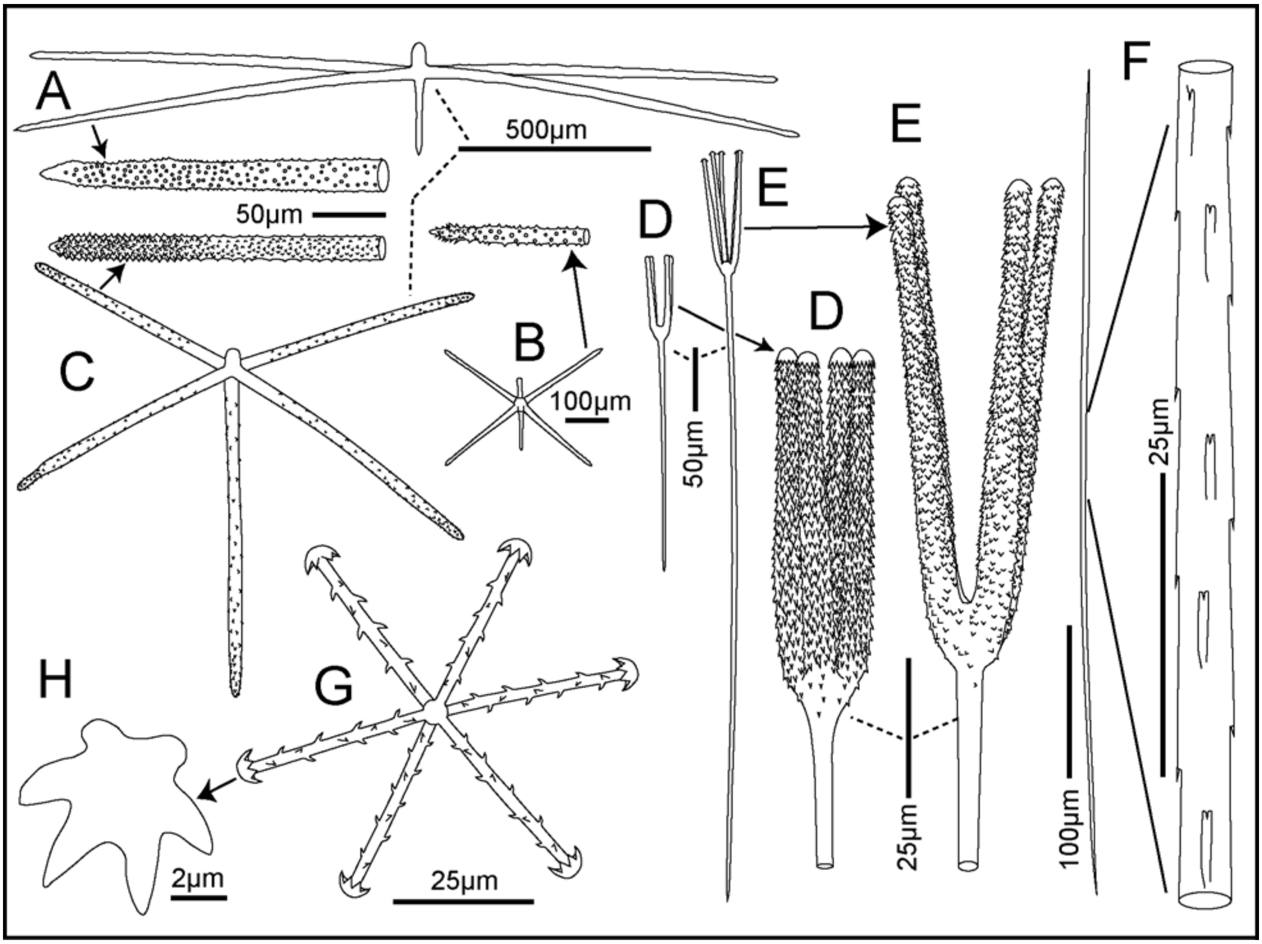


Figure 61. Spicules of *Auloplax breviscopulata* n. sp., holotype NIWA 31490. A, large subpentactin with enlargement of ray end from sieve area. B, small hexactin with enlargement of ray end from sieve area. C, large pentactin with enlargement of ray end from ridge area. D, small scopule, whole and enlargement of head. E, large scopule, whole and enlargement of head. F, uncinate, whole and enlargement of middle segment. G, discohexactin. H, end disc of discohexactin.

brackets barely resolvable at high LM magnification, but the very small barbs can only be seen with SEM. They are distributed throughout the skeleton but not in the outer surface membranes.

Microscleres (Table 30) consist mostly of discohexactins (99%) and a few hemidiscohexactins. The discohexactins (Figs 60Q, 61G, H) and hemidiscohexactins (not shown) have rays ornamented with large reclined thorns and end in large discs with 5–7 marginal teeth. The hemidiscohexactins have only 1–2 primary rays bearing 2–3 terminal rays. Both are distributed throughout the skeleton.

ETYMOLOGY: The species name *breviscopulata* refers to the presence of a small class of scopules occurring only in this New Zealand species.

REMARKS: The specimens from New Zealand waters conform so closely to the limited descriptions of *Auloplax auricularis* and *Hexactinella filholi* (now *Auloplax*) that there is no question that they are members of the same genus. The principal difference between these is the presence of a small class of scopules occurring only in the New Zealand specimens. The presence of the large scopule in *A. auricularis* was confirmed in the NHMUK lectotype slides, but evidence that the two Atlantic species are conspecific as claimed by Tabachnick (2006) remains unpublished. Examination of the dictyonal frameworks of the New Zealand species and the *A. auricularis* lectotype show that the frame of *Auloplax* is neither farreoid, euretoid, nor aulocalycoid (the latter claimed by Tabachnick, 2006), but has a unique construction form in which the connecting rays are primarily uniaxial, synapticula are absent or insignificant, and longitudinal strands are multiaxial and include a significant number of secondary dictyonalia appended in an 'astride' manner (rays from two different axes contribute to the strand). This results in a framework where false nodes outnumber true nodes, as in typical aulocalycoids. Detailed analysis of dictyonal frameworks must still be considered preliminary, and thus the constructional basis of the *Auloplax* framework cannot yet be related in a phylogenetic sense to those of other Hexactinosida. The new Pacific species *A. breviscopulata* described here may be conspecific with the still undescribed form from New Caledonia mentioned by Tabachnick (2006).

KEY DIAGNOSTIC CHARACTERS:

- Body is composed of a system of 4–14 mm diameter, acutely branching, conjoined hollow tubes with open terminal and lateral oscula
- Each tube has two distinct types of surface, a thin-wall sieve surface without flagellated chambers and a thicker-wall surface with flagellated chambers usually on the convex ridge side
- Longitudinal strands are multiaxial and confined to the non-sieve wall
- False nodes outnumber true nodes in the framework
- Megascleres include two size classes of strongylote scopules
- Microscleres are mainly discohexactins, but a few hemidiscohexactins also occur

Auloplax sonnae n. sp. (Figs 62, 63)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** NIWA 32133, Kermadec Ridge, 25.790° S, 177.106° W, RV *Sonne* Stn SO192–2/12, 640 m, 2 May 2007.

DISTRIBUTION: Known only from the type locality, Kermadec Ridge (Fig. 62A).

HABITAT: Attached to coral skeleton, depth 640 m.

DESCRIPTION:

Morphology is a flattened ovoid mitten (Fig. 62B), extending from three substratum attachments; the attachment on a coral skeleton (Fig. 62C) is most likely to be the original. The specimen is somewhat crushed and severely washed out, allowing most of the dictyonal skeleton to be directly viewed. It is composed of small, hollow, thin-wall tubes, 3.7–5.2–7.2 mm in diameter, that branch at acute angles, remain in partial contact along their short courses, and open by large terminal oscula on the outer body surface (Fig. 62D).

Dimensions are 50.8 x 28.9 x 12.3 mm, but the specimen was probably compressed in packaging for shipment; body wall thickness varies from 1–2 mm.

Texture is slightly flexible, brittle, and extremely fragile.

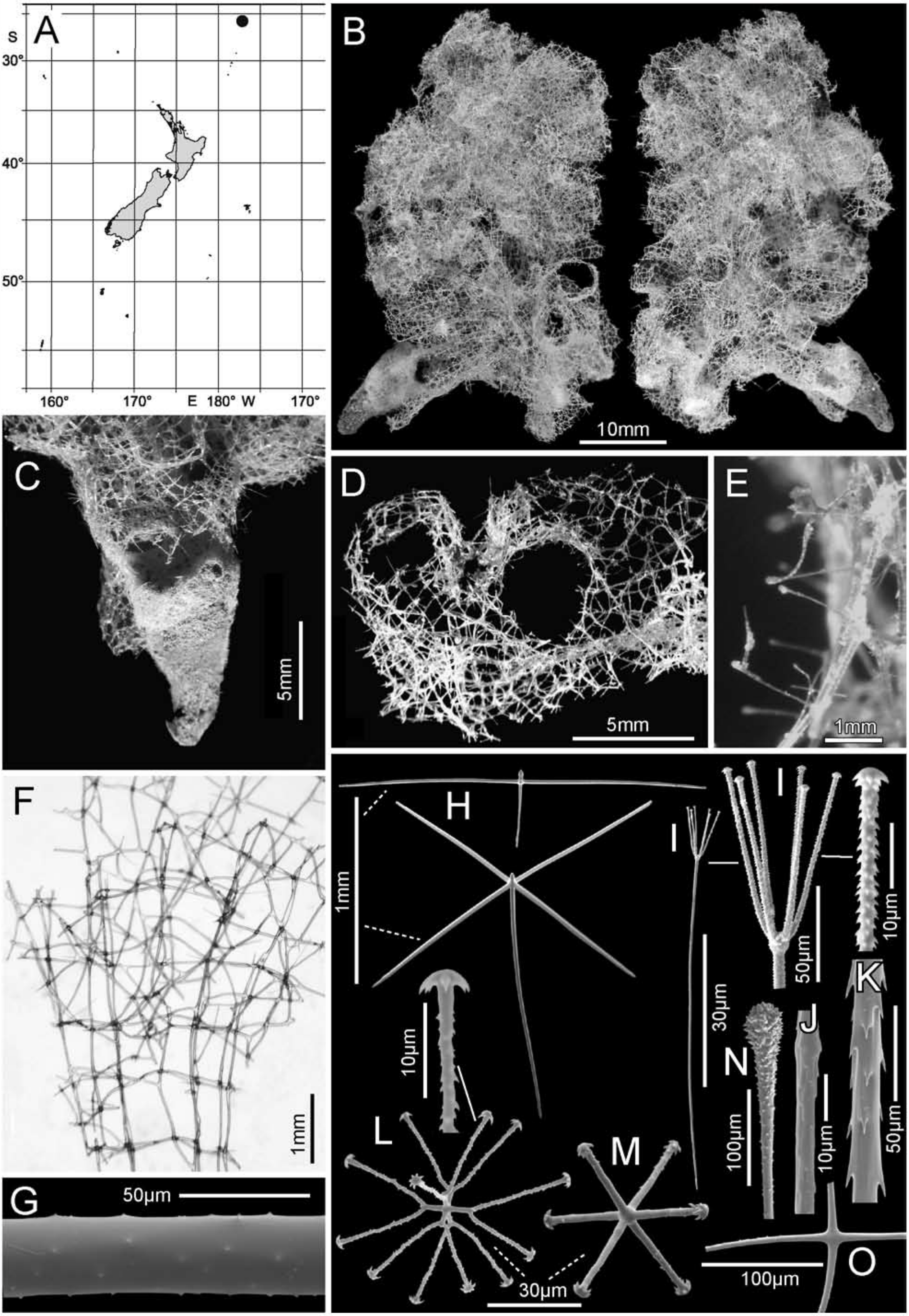
Surface is composed of the exposed dictyonal skeleton of tube walls and terminal apertures. It is thus slightly uneven since tube walls are externally convex, but grooves are present where walls of adjacent tubes join. The beams and strands of tube walls thus form a wiry surface.

Colour rusty brown.

Choanosomal skeleton is entirely composed of the dictyonal walls of the branching tubes (Fig. 62D); the walls are only about 1 mm and 1–2 dictyonal meshes in thickness. In such thin walls, channelisation cannot be developed. The walls are composed of two types of dictyonal networks, a reticular type with distinct longitudinal strands and some (not all) connecting beams joining these at nearly right angles to form large rectangular meshes (Fig. 62F), and a more irregular sieve type network lacking longitudinal strands with beams oriented in all directions and meshes triangular and polygonal but rarely rectangular. The second mesh type is not figured but is similar to the sieve areas in *A. breviscopulata*. These two wall types are irregularly distributed as small areas along tubule walls and are not separately developed on large areas of the outer body surface as in other species of *Auloplax*. Both regions have wall apertures that are distinctly larger than regular meshes, and recorded as wall gaps in Table 31. All connecting beams in the reticular area begin with single axial filaments and have overlapping axial filaments only in their central parts; thus the filaments of these beams do not extend completely from one central cross to the other as typical of euretoid frameworks. Longitudinal strands are constructed of dictyonalia serially joined alongside the terminal ray of the growing strand; the strands carry two axial filaments at any point (80% of length), rarely three (15%), and more rarely only one (5%). Thus overlapping of rays is a basic pattern of strand construction here, but individual rays that contribute to the strands extend only two mesh lengths. True and false node numbers are approximately even (48 and 52% respectively) in the reticulate area. In the terminal aperture margins of the tubes, free rays project into the apertures as thickened club-shaped spurs (Fig. 62E). Ornamentation is very consistent throughout most of the framework with beams and nodes sparsely and lightly spined (Fig. 62G); beams of some basal areas are thickened and more heavily spined. Anaxial synapticula and small attached oxyhexactins are absent. Nodes are not swollen. Spurs on the external surface tend to be short, conical, and sharp-pointed but those within the framework and especially those projecting into the tube cavities are club-shaped and finely rough like those within the terminal tube apertures (Figs 62N, 63I). Three very dense patches up to 8 mm diameter of

Table 31. Spicule and framework dimensions (µm) of *Auloplax sonnae* n. sp.

Parameter	**Holotype NIWA 32133**			
	mean	**s. d.**	**range**	**no.**
Subhexactin and pentactin:				
tangential ray length	1136	229	668–1566	50
tangential ray width	25.0	7.3	10.8–41.3	50
proximal ray length (short)	372	156	147–671	29
proximal ray length (long)	1326	292	802–2014	38
proximal ray width	22.0	6.2	9.6–33.2	50
distal ray length	69	17	24–118	50
distal ray width	28.3	6.7	17.1–46.1	50
Scopule length	714	82	551–879	31
head length	132	30	72–182	37
tine length	115	27	58–158	36
Macrouncinate length (mm)	2.84	0.46	1.89–3.69	50
Width	13.4	2.5	9.0–19.3	50
Microuncinate length	196	37	134–373	50
Width	4.7	0.8	2.5–7.0	50
Discohexaster diameter	83	14	42–106	50
primary ray length	7.2	1.1	4.0–9.3	50
secondary ray length	34.9	6.9	14.3–46.8	50
Discohexactin diameter	77	14	48–107	50
Framework beam length	603	178	222–979	50
beam width	41	17	22–97	50
spine spacing	11.2	3.0	6.2–21.3	127
Spur length, dermal	214	139	93–891	50
Atrial	514	349	155–1697	69
Frame gaps of sieve area (mm)	0.82	0.16	0.55–1.19	18
of reticular area (mm)	1.23	0.43	0.66–2.10	29


A
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30°
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160°
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E 180° W
170°
B
10mm
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D
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I
I
50µm
10µm
30µm
K
J
N
100µm
10µm
50µm
L
10µm
M
30µm
O
100µm

Figure 62 (*opposite*). *Auloplax sonnae* n. sp., holotype NIWA 32133. A, distribution in New Zealand waters. B, both sides of the holotype, NIWA 32133. C, basal attachment on coral skeleton. D, two oscula as terminal tube apertures on outer body surface. E, margin of an osculum showing club-shaped atrial spurs. F, cleaned reticulate wall area with longitudinal strands and perpendicular connecting beams (LM). G, beam of framework with characteristic spine pattern. H, large subhexactins with short (upper) and long (lower) proximal rays. I, discoscopule, whole, head, and single tine. J, segment of a microuncinate with swelling. K, segment of a macrouncinate. L, discohexaster with enlarged terminal ray. M, discohexactin. N, club spur from atrial framework. O, stauractin centrum from a dense network on the framework.

fused stauractins (Fig. 63J) and hexactins occur in lower parts of the specimen; it was not possible to determine whether or not they are fused to the main framework and their nature remains uncertain although they do not appear to be foreign in origin. Because free spicules occur only in residual patches on the dictyonal frame, their original positions cannot be determined and those belonging to the choanosomal and ectosomal regions cannot be distinguished with certainty.

Megascleres (Table 31) consist of two classes of large subhexactins/pentactins, one class of discoscopules, and two classes of uncinates. Large subhexactins/pentactins occur with either short (<700 µm, Figs 62H upper, 63A) or long (>700 µm, Figs 62H lower, 63B) proximal rays; they are otherwise similar and measurements are thus combined in Table 31. They have

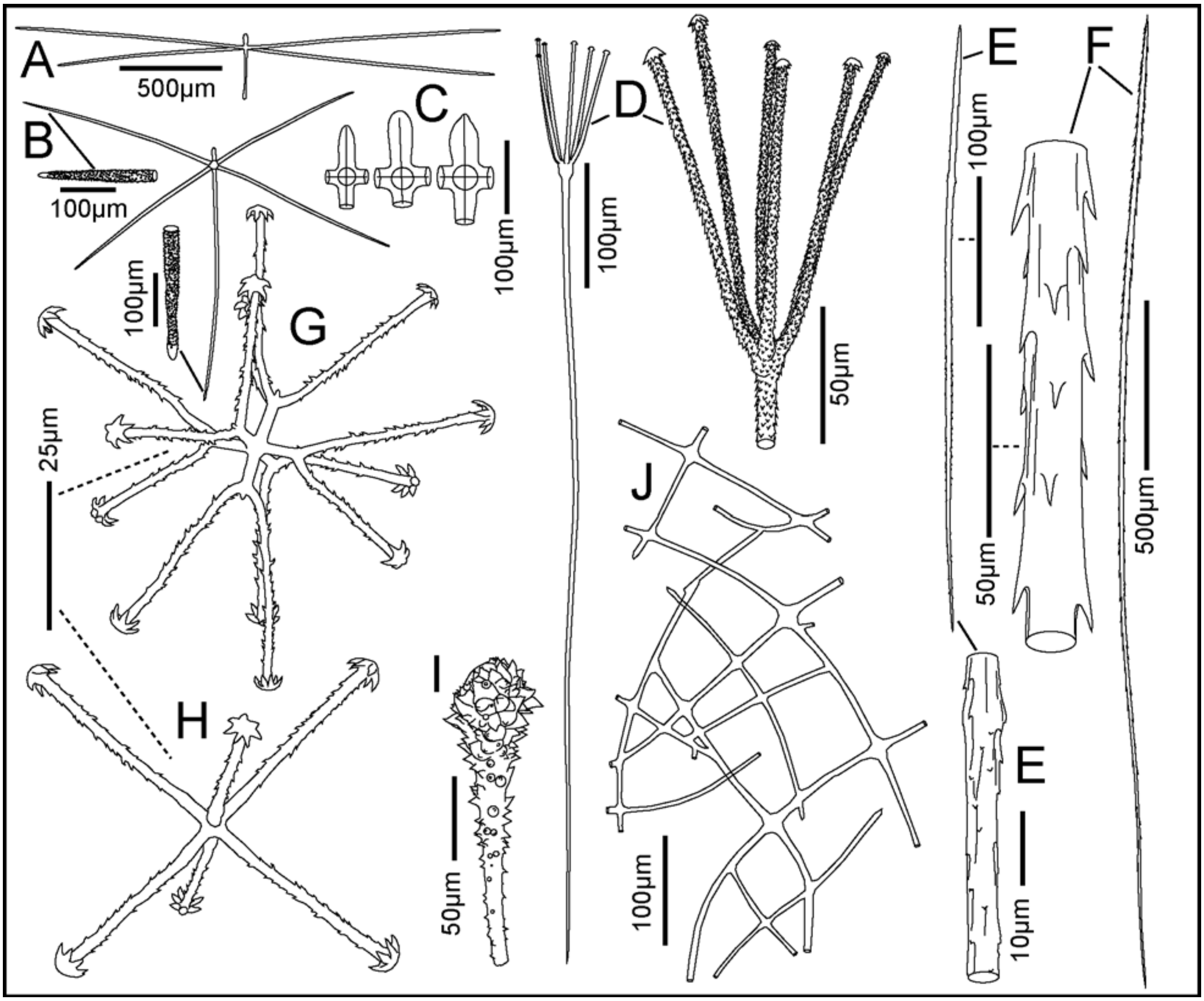


Figure 63. Spicules of *Auloplax sonnae* n. sp., holotype NIWA 32133. A, large subhexactin with short proximal ray. B, large subhexactin with long proximal ray and enlargements of ray ends. C, profiles of distal rays of subhexactins. D, discoscopule, whole and enlargement of head. E, microuncinate, whole and enlargement of upper segment with swelling. F, macrouncinate with enlargement of middle segment. G, discohexaster. H, discohexactin. I, club-shaped spur from atrial surface of framework. J, a small portion of one of the fine networks within the dictyonal framework.

long, tapered, smooth tangential rays that are finely spined and often stair-stepped only near their rounded tips. The sixth distal ray may be only a swelling in the uncommon pentactin form, but most often is a short inflated ray with rounded or bluntly pointed tip (Fig. 63C). Discoscopules are moderate size with 4–10 straight or slightly bent tines spreading in cone from a very small neck (Figs 62I, 63D); each tine ends in a small marginally serrated disc which is distinctly larger in diameter than the supporting tine; tines, neck, and upper shaft are ornamented with small reclined spines but most of the shaft is smooth, tapering to a very fine pointed tip. Uncinates occur in two forms, a large macrouncinate with almost indistinguishable brackets and short, inclined, conical barbs (Figs 62K, 63F), and a very abundant microuncinate which is smooth in LM but is shown to have very small brackets and very reduced barbs in SEM (Figs 62J, 63E); the latter has a distinct swelling near its anterior quarter.

Microscleres (Table 31) consist mostly of discohexasters (98%), a few hemidiscohexsters (1%), and a few discohexactins (<1%). The discohexasters (Figs 62L, 63G) and hemidiscohexasters (not shown) are spherical and have short smooth primary rays, each bearing 1–4 rough secondary rays ending in discs with 5–7 marginal teeth. Mean ratio of primary to secondary ray length is 0.206. The discohexactins are generally slightly smaller and stouter; their ornamentation and terminal discs are similar to those of the discohexasters.

ETYMOLOGY: The species name *sonnae* refers to the German research vessel RV *Sonne*, from which this new species was collected. The RV *Sonne* conducts worldwide operations in marine research disciplines, especially marine geosciences and marine zoology.

REMARKS: The new specimen from Kermadec Ridge has a dictyonal framework similar to the known species of *Auloplax* but it is thinner and lighter in structure. The subhexactins/pentactins are slightly larger than those of *A. breviscopulata* but are of the same two form classes. The new species differs from *A. breviscopulata* in lacking the smaller hexactins, in having one instead of two classes of scopules, in having a macrouncinate, and in having discohexasters instead of discohexactins as dominant microscleres. It is presently best assigned to the genus *Auloplax* within the Auloplacidae, but could eventually form the basis of a distinct genus on the basis of the difference of its microscleres.

KEY DIAGNOSTIC CHARACTERS:

- Body is composed of a system of 3.7–7.2 mm diameter, acutely branching, conjoined hollow tubes with open terminal oscula
- Thin tube walls have two types of structure, reticulate areas with longitudinal strands and sieve areas with beams oriented without order
- False nodes and true nodes are approximately even in abundance
- Megascleres include one size class of discoscopules
- Microscleres are mainly small discohexasters, but a few hemidiscohexasters and discohexactins also occur

Auloplacidae incertae sedis (with spicules)

(Figs 64, 65)

MATERIAL EXAMINED:

Lord Howe seamount chain: NIWA 62100, NZOI Stn Q68, 29.233° S, 159.001° E, 1045 m, 1 Jun 1978.

Bay of Plenty, Rumble V Seamount: NIWA 43424, NIWA Stn TAN0107/225, 36.147° S, 178.204° E, 772–951 m, 23 May 2001.

DISTRIBUTION: Known from the Lord Howe seamount chain and the Bay of Plenty (Fig. 64A).

HABITAT: Presumably attached to hard substratum but base not included; depth range 772–951 m.

DESCRIPTION:

Morphology of both fragments is that of severely damaged fragments with light dictyonal skeletons with broken siliceous fibres on most external surfaces. Both fragments are composed of small, relatively thick-walled tubes that lie apposed, side-by-side, and veer away from each other to end in apertures on the surface (Fig. 64B). The tubes probably branch from a common origin, but the fragments do not contain the branch points. Tubes are 2.7–4.3 mm in diameter, with 1.0–2.2 mm walls and 1.2–2.1 mm apertures. Longitudinal dictyonal strands on the torn surfaces are apparent to the naked eye. The mushroom shape of the larger fragment probably is not reflective of that of the original specimen.

Dimensions are 24.1 x 15.0 x 7.8 mm for the larger fragment; those of the smaller fragment are 9.4 x 6.4 x 4.1 mm.

Texture is slightly flexible, brittle, and fragile.

Surface is composed of the broken edges of the dictyonal skeletons of the constituent tubes and their terminal apertures. Small patches of the original surface remain on the smooth side of the large fragment, where large oval dictyonal meshes are covered with remnants of a spicule lattice (Fig. 64C). The other surfaces have irregular topography ascribed to breakage of the skeletal framework and not indicative of the normal surface.

Colour beige.

Choanosomal skeleton is entirely composed of the dictyonal walls of the branching tubes. The walls on the flat surface are thin, only 1–2 meshes thick, and are sieve-like with large oval meshes (Fig. 64D). The other walls are thicker and reticulate, composed of 4–8 densely packed meshes dominated by longitudinal strands with short connecting beams (Fig. 64E); the strands curve smoothly to the flat sieve-like surface. False nodes outnumber true nodes. Longitudinal strands are limited in length to 5–10 meshes and end in tufts of singly projecting long protosiphons often wound around each other. The two types of framework structure are similar to those of Auloplacidae described above. Both beams and nodes are ornamented with sparse small, evenly distributed spines (Fig. 64F). Anaxial synapticula have not been detected as part of the main framework, but fused networks of small spiny oxyhexactins (Fig. 64E) occur in patches throughout the larger fragment; there appears to be no direct fusion between the main framework and these networks, thus their nature and origin remain unknown. Nodes are not swollen. Spurs on the external surface tend to be short, conical and sharp-pointed, but those within the framework and especially those projecting into the tube cavities include both very long, sharply pointed forms and short rough club-shaped forms.

Determination of free spicules associated with either the choanosome or ectosome could not be made since the spicules occur only as residual patches dispersed through the skeletal framework. Moreover, both fragments are very severely contaminated with spicules of *Farrea occa occa* and slightly with those of *Hexactinella aurea*, both collected from the same station. It was necessary to arrive at probable 'native' spiculation of the fragments by ignoring the spicules of *F. occa occa* (70% of all loose spicules) and *H. aurea* (<5% of same); those spicules that could not be clearly attributed to those species were considered 'native', but still with low confidence because of the condition of the fragments.

Megascleres (Table 32) not attributable to the other species include pentactins and one class of scopules. Pentactins (Figs 64G, 65A) have large spines on the upper surfaces of the tapered tangential rays, which end in rounded or blunt-pointed tips; the proximal rays are generally much longer than tangential rays. Scopules (Figs 64H, 65B) are thin, usually with smoothly tapered neck but sometimes angularly swollen, and 1–5 tines which appear in LM as disco-tipped but in SEM the tip disc is found not to be significantly larger than tine diameter; they are thus strongyloscopules. Fine reclined spines either cover the entire surface or are absent from the upper shaft. All uncinates in spicule preparations are consistent with either the macrouncinates of *Farrea occa occa* (most), or the microuncinates of *Hexactinella aurea* (few), and thus are most likely foreign.

Microscleres in all spicule preparations are dominated by the long-primaried oxyhexasters from

Table 32. Spicule and framework dimensions (µm) of Auloplacidae incertae sedis (with spicules).

Parameter	**NIWA 43424**			
	mean	**s. d.**	**range**	**no.**
Pentactin tangential ray length	286	71	167–483	50
tangential ray width	8.6	2.0	4.3–13.1	50
proximal ray length	341	164	162–726	50
proximal ray width	8.7	2.3	4.4–15.3	50
Scopule length	523	100	368–744	50
head length	68.7	11.1	39.0–91.1	50
tine length	58.2	9.8	31.8–79.1	50
Oxyhexactin diameter	111	18	62–142	50
Hemioxyhexaster diameter	110	10	90–131	25
primary ray length	6.9	1.2	5.1–9.3	25
secondary ray length	49.7	6.0	31.8–57.6	25
Framework beam length	479	188	121–1070	54
beam width	60	24	22–133	50
spine spacing	17.9	6.3	5.5–31.0	118
Spur length	363	193	104–973	44

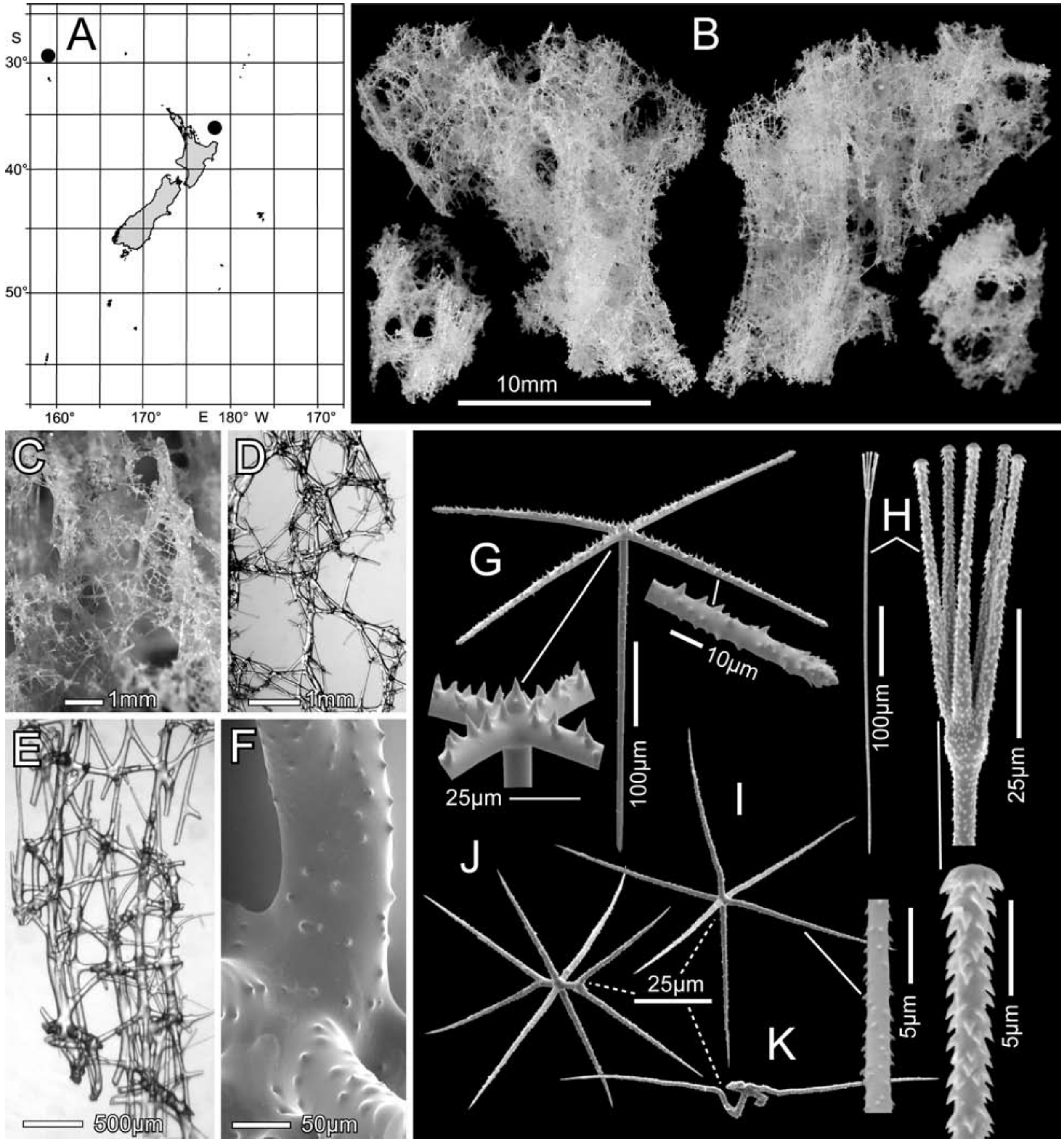


Figure 64. Auloplacidae incertae sedis (with spicules). A, distribution in New Zealand waters. B, both sides of fragments, NIWA 43424. C, flat surface area with remnant spicule lattice. D, sieve wall area of cleaned framework with large oval meshes (LM). E, cleaned reticulate wall area with longitudinal strands and at least some perpendicular connecting beams (LM). F, beam and node with spines. G, surface pentactin with enlargements of central area and tangential ray end. H, scopule, whole with enlarged head and tine end. I, oxyhexactin with enlarged ray segment. J, hemioxyhexaster. K, spiral diactin variant of oxyhexactin.

F. occa occa (70%) and a very few stellate discohexasters from *H. aurea*. Those not considered foreign in origin (Table 32) are oxyhexactins (85%) and short-primaried oxyhexasters (15%). The oxyhexactins (Figs 64I, 65C) have straight tapered rays covered with small, reclined spines. The oxyhexasters (Figs 64J, 65D) have similar rays, 1–3 of which bifurcate close to the centrum; mean ratio of primary to secondary ray lengths is 0.138. Variants with 2–4 spiral primary rays (Fig. 64K) are moderately common.

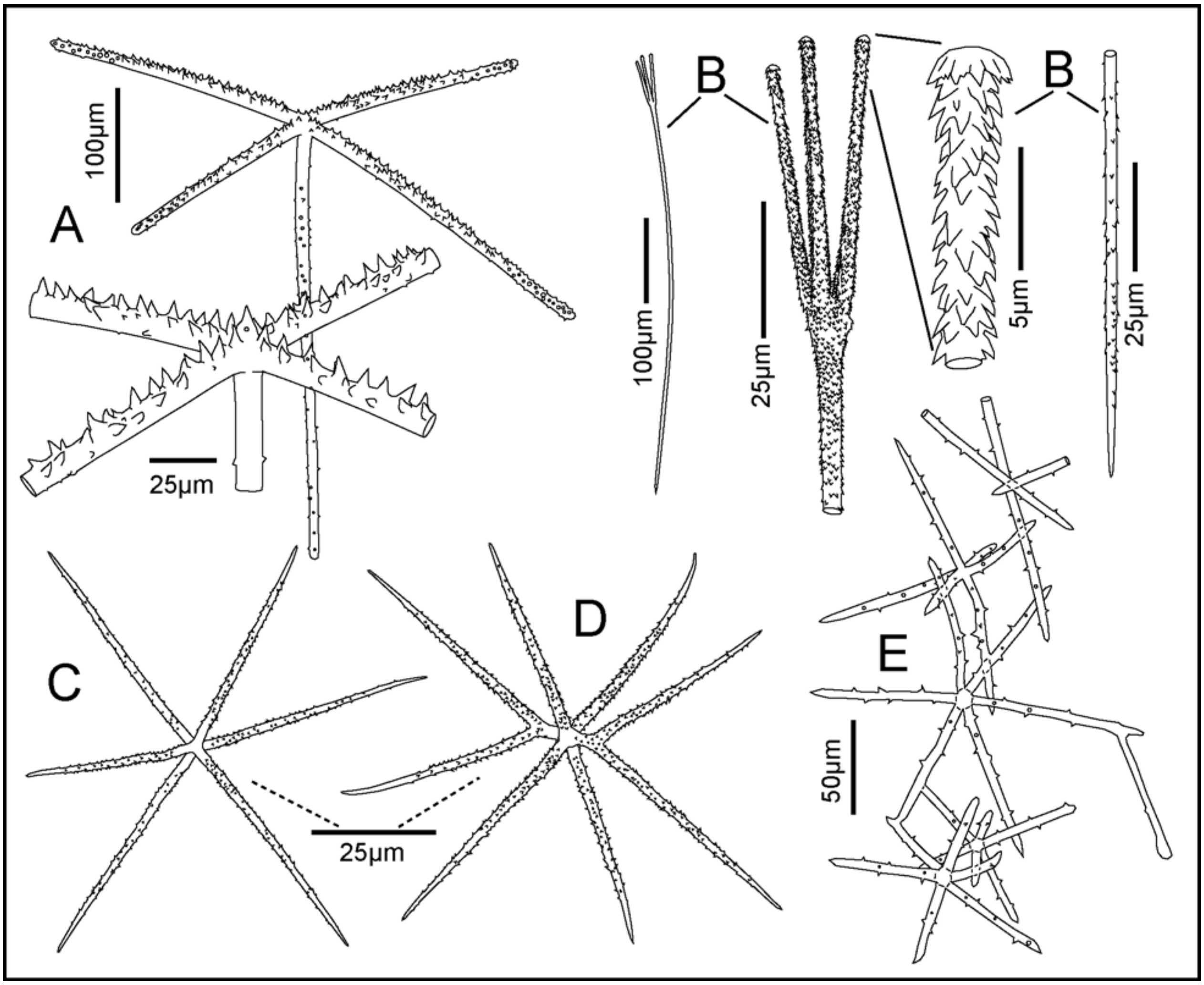


Figure 65. Spicules of Auloplacidae incertae sedis, NIWA 43424. A, surface pentactin with enlargement of central area. B, scopule, whole, enlargement of head, tine, and shaft end. C, oxyhexactin. D, hemioxyhexaster. E, small portion of fused oxyhexactin network.

REMARKS: The two fragments from NE of Bay of Plenty, almost certainly from a single specimen, have dictyonal frameworks similar to the known species of *Auloplax* and are unambiguously assignable to Auloplacidae on this basis. Had all of the spicules from these fragments been consistent with foreign origin, the fragments would have simply been considered as washed-out fragments of an unidentifiable auloplacid. However, Fig. 64C shows that the larger fragment had some proper spicules and some spicules in the preparations cannot be attributed to the other specimens collected at that station. While the pentactins are similar to those of *F. occa occa*, those with long proximal rays are very rare or absent from the specimens taken at that station; in addition, some of the distally spined pentactins are fused onto the framework, supporting their proper nature. The scopules are very similar to those of *H. aurea*, but some preparations with many scopules have no spicules such as dermalia and microscleres from *H. aurea*. The oxyhexactins and short-primaried oxyhexasters cannot be attributed to a foreign source. The most reasonable, if uncomfortable, conclusion from available evidence is that a member of Auloplacidae exists in New Zealand waters with *Farrea*-like dermal pentactins, stronglyloscopules, and only oxy-tipped microscleres. Because of the small size and damaged condition of the fragments, and their contamination with foreign spicules, we do not consider them adequate for erection of a new species, but feel their existence should not be disregarded.

KEY CHARACTERS:

- Body is composed of laterally conjoined hollow tubes 2.7–4.3 mm in diameter with open terminal oscula

- Tube walls have two types of structure, reticulate areas with longitudinal strands and sieve areas with beams oriented without order as in other auloplacids
- Megascleres include distally spined pentactins and strongyloscopules
- Microscleres consist of oxyhexactins and hemioxyhexasters

Auloplacidae incertae sedis (without spicules) (Fig. 66)

MATERIAL EXAMINED:

West Cavalli Seamount: NIWA 43404, 43406, NIWA Stn KAH0204/38, 34.1586685° S, 173.9629974° E, 780–800 m, 18 Apr 2002.

DISTRIBUTION: West Cavalli Seamount (Fig. 66A).

HABITAT: Presumably attached to hard substratum but base not collected; depth range 780–800 m.

DESCRIPTION:

Morphology of all four fragments is similar; they are somewhat flattened plates with the terminal apertures of hollow cylindrical tubes, 4–9 mm in diameter, projecting from the rugose side (Fig. 66B, C, upper). Areas between the tubes are recessed crevices. Some of the tubes branch from a common source tube, but this pattern could not be verified for all tubes because of the damaged condition of the fragments. The other sides of the fragments are smoothly curved with occasional round or oval openings 5–6 mm in diameter in the bounding surface (Fig. 66B, C, lower). All fragments

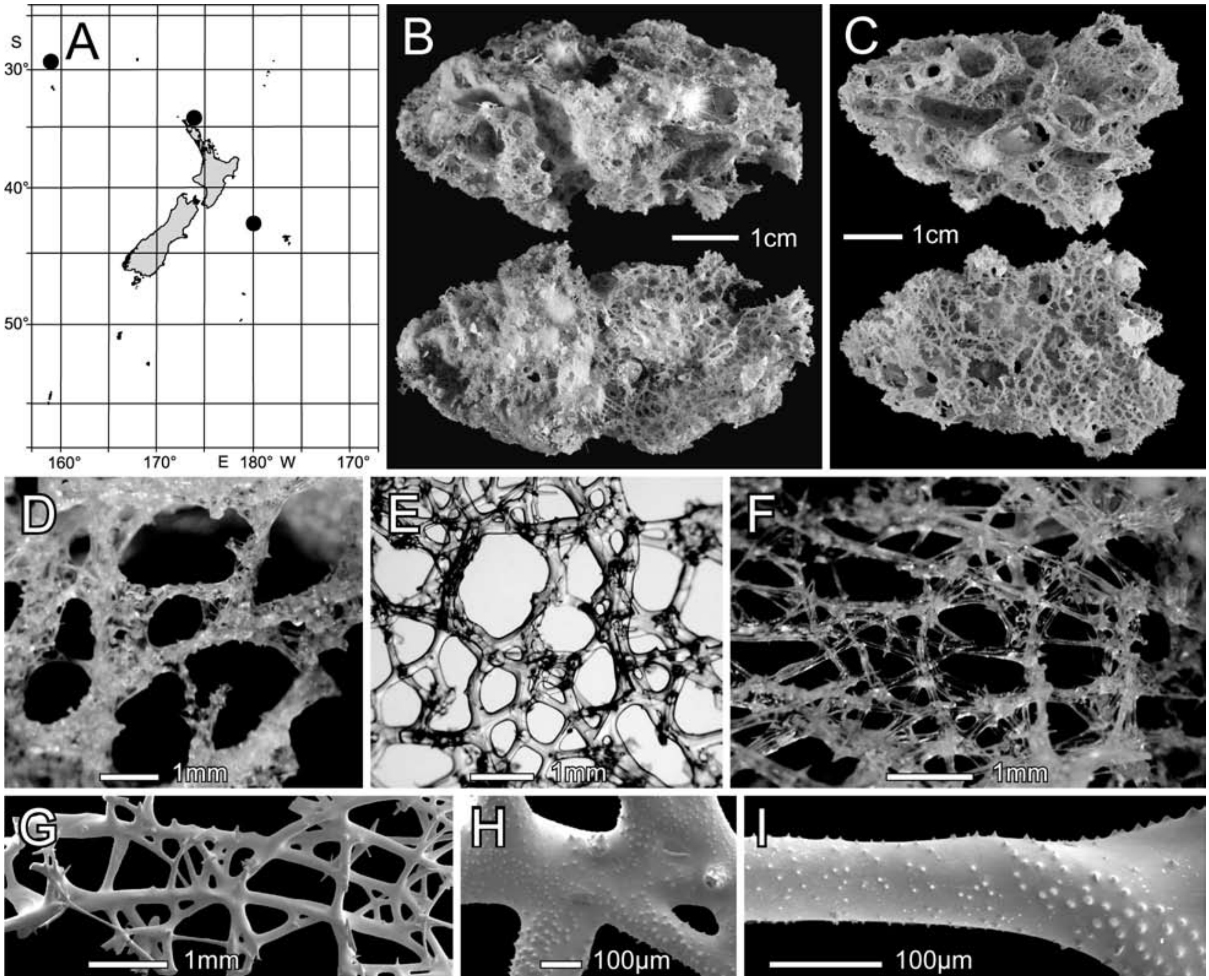


Figure 66. Auloplacidae incertae sedis (without spicules). A, distribution in New Zealand waters. B, both sides of NIWA 43404, nearly enclosed by demosponges. C, both sides of the largest fragment of NIWA 43406. D–I from NIWA 43404. D, cleaned but unmounted sieve-like wall area of framework with large oval meshes (LM). E, cleaned, balsam-mounted sieve-like wall area of framework (LM). F, cleaned reticulate wall area with longitudinal strands and at least some perpendicular connecting beams (LM). G, cleaned reticulate wall area with longitudinal strands. H, framework nodes with ornamentation. I, framework beam showing variation in spine size.

are frameworks of long dead auloplacid hexactinellids that have been colonised by a variety of demosponges and bryozoans.

Dimensions of the fragments vary from 42.3–63.4 mm in length, 28.2–40.3 mm in width, and 18.8–25.0 mm in thickness.

Texture is slightly flexible, brittle, and fragile.

Surface of NIWA 43404 (Fig. 66B) consists mostly of that of invading demosponges, which have completely enclosed the hexactinellid framework. Surfaces of the three fragments of NIWA 43406 (Fig. 66C) have only small epizoans, leaving the hexactinellid framework mostly exposed. The tube-bearing rugose sides have complex topography of projecting tubes and intervening crevices. The smoother sides of all fragments are bounded by thin sieve-like wall with oval openings flush with the general surface.

Colour light to medium brown.

Choanosomal skeleton of all fragments, ignoring the epizoans, is composed of a common sieve-like wall on the smoothly curved surfaces and the lateral walls of the projecting tubes on the rugose surfaces. The sieve-like wall of the smooth side (Fig. 66D, E) is thin, mostly only one mesh in thickness, with circular, oval, and polygonal meshes. Longitudinal strands are absent. Beams are curved, thick [66–213–502 µm (sd = 85; n = 50)], and often knobby in appearance since nodes are closely spaced. The walls of the tubes (Fig. 66F, G) consist of a more reticulate lattice 2–5 meshes in thickness, with detectable longitudinal strands, more angular meshes, thinner beams [66–161–329 µm (s.d. = 65; n = 50)], with nodes more distantly spaced [beam length = 122–448–1,375 µm (sd = 255; n = 50)]. Both beams and nodes are ornamented with sparse small, evenly distributed spines (Fig. 66H, I), with mean spine spacing at three locations of NIWA 43404 being 11.8, 13.3, and 16.1 µm. Anaxial synapticula and fused networks of small oxyhexactins have not been detected as part of the main frameworks. Nodes are not swollen. Shape and size of spurs could not be assessed due to their eroded condition. Loose spicules proper to the fragments are entirely absent.

REMARKS: Skeletal characteristics of the four fragments from ENE of North Cape do not agree completely with those of any of the auloplacids described above, but fit best with *Auloplax breviscopulata*, particularly in constituent tube diameter. *Auloplax breviscopulata* also is known to occur very close to the location of collection of these long-dead fragments. While it is very likely that these are skeletal remnants of *A. breviscopulata*, the lack of proper spicules in these fragments and the presence of other species in the general area prevent the confident assignment of the fragments to that species. It is prudent to designate them as Auloplacidae incertae sedis.

KEY CHARACTERS:

- Body is composed of laterally conjoined hollow tubes 4–9 mm in diameter with open terminal oscula
- Tube walls have two types of structure, reticulate areas with longitudinal strands, and sieve-like areas with beams oriented without order as in other auloplacids
- Proper loose spicules are entirely absent

Hexactinosida incertae sedis (Fig. 67)

MATERIAL EXAMINED:

Southern Kermadec Ridge and volcanic arc, *Volcano D* (*Sonne*): NIWA 43433, NIWA Stn TAN0205/12, 34.091° S, 179.556° E, 1705–1930 m, 13 Apr 2002. *Macauley Volcano*: NIWA 62070, NIWA Stn TAN0205/60, 30.160° S, 178.498° W, 636–751 m, 22 Apr 2002.

Cavalli Seamounts, *West Cavalli Seamount*: NIWA 43394, 43395, 62071, 43396, NIWA Stn KAH0204/29, 34.163° S, 173.963° E, 782–790 m, 17 Apr 2004; NIWA 43400, NIWA Stn KAH0204/32, 34.162° S, 173.962° E, 780–810 m, 17 Apr 2004; NIWA 62066, NIWA Stn KAH0204/38, 34.159° S, 173.963° E, 780–800 m, 18 Apr 2004.

North Chatham Rise, *Graveyard seamount complex*, *Graveyard Seamount*: NIWA 52537, NIWA Stn TAN0604/016, 42.765° S, 179.988° W, 993 m, 29 May 2006. *Ghoul Seamount*: NIWA 25257, NIWA Stn TAN0604/111, 42.797° S, 179.988° W, 970 m, 7 Jun 2006. *Shipley Seamount*: NIWA 25313, NIWA Stn TAN0604/133, 41.801° S, 179.493° W, 1240 m, 9 Jun 2006. *Scroll Seamount*: NIWA 52546, NIWA Stn TAN0604/039, 42.7878 ° S, 179.999° W, 1021 m, 30 May 2006.

Macquarie Ridge, *Seamount 10* (*International waters*): NIWA 41080, NIWA Stn TAN0803/114, 59.065° S, 158.935° E, 1775–1973 m, 19 Apr 2008; NIWA 41092, NIWA Stn TAN0803/117, 59.051° S, 158.922° E, 1596–1781 m, 19 Apr 2008. *Seamount 9* (*Australian EEZ*): QM G331871, QM G331872, NIWA Stn TAN0803/102, 56.242° S, 158.462° E, 790–1025 m, 16 Apr 2008; *Seamount 3*: NIWA 62062, NIWA Stn TAN0803/33, 50.091° S, 163.482° E, 1077–1408 m, 1 Apr 2008.

DISTRIBUTION: Known from Cavalli Seamounts, Kermadec Ridge, Chatham Rise (Fig. 67A), and Macquarie Ridge.

HABITAT: Presumably all were attached to hard substratum; NIWA 43433 and 62070 have attachments to volcanic dacite and NIWA 62062 has attachment to coral; depth range 636–1973 m.

Description:

All specimens are long-dead, washed-out fragments of skeletal frameworks. NIWA 43394 and 43400 are very dense, convoluted ovoids penetrated by large meandering passages opening on external surfaces (Fig. 67B). NIWA 43409 is a small low-density, fibrous chip (Fig. 67C). NIWA 43395 and 43396 are dense, somewhat flattened fragments with angular edges (Fig. 67D). NIWA 43433 and 62070 are small dense hemi-ovoids attached to substratum on the flattened side (Fig. 67E). NIWA 62071 is a moderately dense irregular chip with rounded margins (Fig. 67F). The other fragments are each similar to one of these. Channelisation is absent in all fragments.

Dimensions of NIWA 43394 are 54.1 x 32.2 x 25.3 mm and of NIWA 43400 are 48.2 x 34.8 x 21.0 mm; both were cut in half, the remaining parts not seen and retained at NIWA. NIWA 62066 is 17.1 x 15.2 x 7.8 mm. The two fragments of NIWA 43395 are 65.7 x 33.2 x 13.0 mm and 53.6 x 38.0 x 14.3 mm. NIWA 43396 is 45.3 x 27.3 x 18.0 mm. NIWA 43433 is 5.2 x 6.1 x 7.2 mm. NIWA 62070 is 17.2 x 11.3 x 8.0 mm. NIWA 62071 is 41.0 x 28.5 x 14.7 mm.

Texture of NIWA 62066 is light, fibrous, and fragile; all others are dense, smooth, and stony hard.

Surfaces of NIWA 43394 and 43400 are irregular with pits and internal passages, openings 3.2–5.7 mm diameter, they are otherwise smooth and worn. NIWA 62066 has a coarsely rough surface with broken dictyonal elements projecting. Surfaces of NIWA 43395, 62071, and 43396 are generally smooth, but have irregular small indentations, prominences, ridges and a few scattered holes 0.4–3.9 mm in diameter; the latter are too sparse and irregularly placed to be considered skeletal channels. NIWA 62070 is completely smooth.

Colour of most fragments yellowish-white or cream; NIWA 41092 dark brown; NIWA 25313 white with a black surface mineral deposit.

Choanosomal skeletons of NIWA 43394 and 43400 are dense, isotropal dictyonal networks composed of dictyonalia connected without evidence of regular patterning (Fig. 67G); longitudinal strands are absent. True nodes are unswollen and polyradial, each supporting eight or more beams (Fig. 67H); false nodes are common. Meshes are mostly triangular; beams are smooth, 117–273 µm long, 17–46 µm thick. Remains of attached oxyhexactins are common but they are mostly eroded. The framework of NIWA 62066 is constructed in a water-plume pattern, with longitudinal strands extending apically and curving to one surface, presumably the dermal surface (Fig. 67I). Primary dictyonalia are aligned laterally to form ranks or septa, with axial spacing of 1.68 mm; septal spacing is compacted both at the growth apex and marginally. Main nodes are regular and unswollen. Main meshes are rectangular and elongate; beams are smooth, 473–2171 µm long, 34–133 µm thick. Secondary dictyonalia are intercalated irregularly within the main meshes and small oxyhexactins are sparsely attached to both main and secondary beams (Fig. 67J). The frameworks of NIWA 43395 and 43396 are very dense patterned networks of dictyonalia arranged in radial columns emanating from both sides of a central primary layer (Fig. 67K). Dictyonalia of the massive columns, interpreted as dermal and atrial cortices, are stacked to form radial strands (Fig. 67L); no evidence of channels is present and meshes are mainly rectangular, but triangular and polygonal forms also occur. The primary dictyonal framework consists of 3–4 layers of dictyonalia spaced more widely laterally (Fig. 67M, brackets); no attempt was made to isolate this layer in longitudinal dissection. Beams are smooth, 84–297 µm long, 22–77 µm thick, with attached oxyhexactins abundant. NIWA 43433 and 62070 have isotropic frameworks of regularly arrayed dictyonalia forming short but discontinuous strands arising obliquely from the attachment interface (Fig. 67N). Nodes are unswollen and mostly true and normal, supporting six beams. Meshes are both rectangular and triangular; beams are finely tuberculate, 73–304 µm long and 23–51 µm thick (Fig. 67O). Oxyhexactins are attached to beams and each other in very large numbers, largely occluding mesh openings. The skeleton of NIWA 62071 is extremely unusual. The marginal 1–2 mm thick framework is an array of dictyonalia fused relatively closely without apparent regularity as common in Hexactinosida cortices (Fig. 67P). The entire interior framework consists of a low-density network of beams spot-fused at contact points, resembling a lyssacine scaffold (Fig. 67Q). The beams are not, however, diactins and stauractins, but apparently elongate rays of sparsely distributed hexactins; they are of indeterminate length in this central region. Meshes of the marginal frame are mostly triangular; beams are smooth, 95–272 µm in length, 23–69 µm in width. Nodes are not swollen and attached oxyhexactins are common. Mesh shape and beam lengths cannot be determined for the central region.

Remarks: With the exception of NIWA 62066, all of the other fragments reviewed here are basal or lower stem skeletal remains that are rarely inspected and never described in detail in species descriptions. Since these parts of hexactinellids are subject to beam thickening, filling of skeletal channels and obliteration of the diagnostic details of younger parts that allow taxon discrimination, it is understandable that little attention has been paid to them, except in paleontological studies. All of these samples thus lack criteria, e.g. channelisation, which would allow their placement to family. NIWA 43394 and 43400, without dictyonal strands and with polyradial nodes, are probably Dactylocalycidae but candidate species are unknown. Most

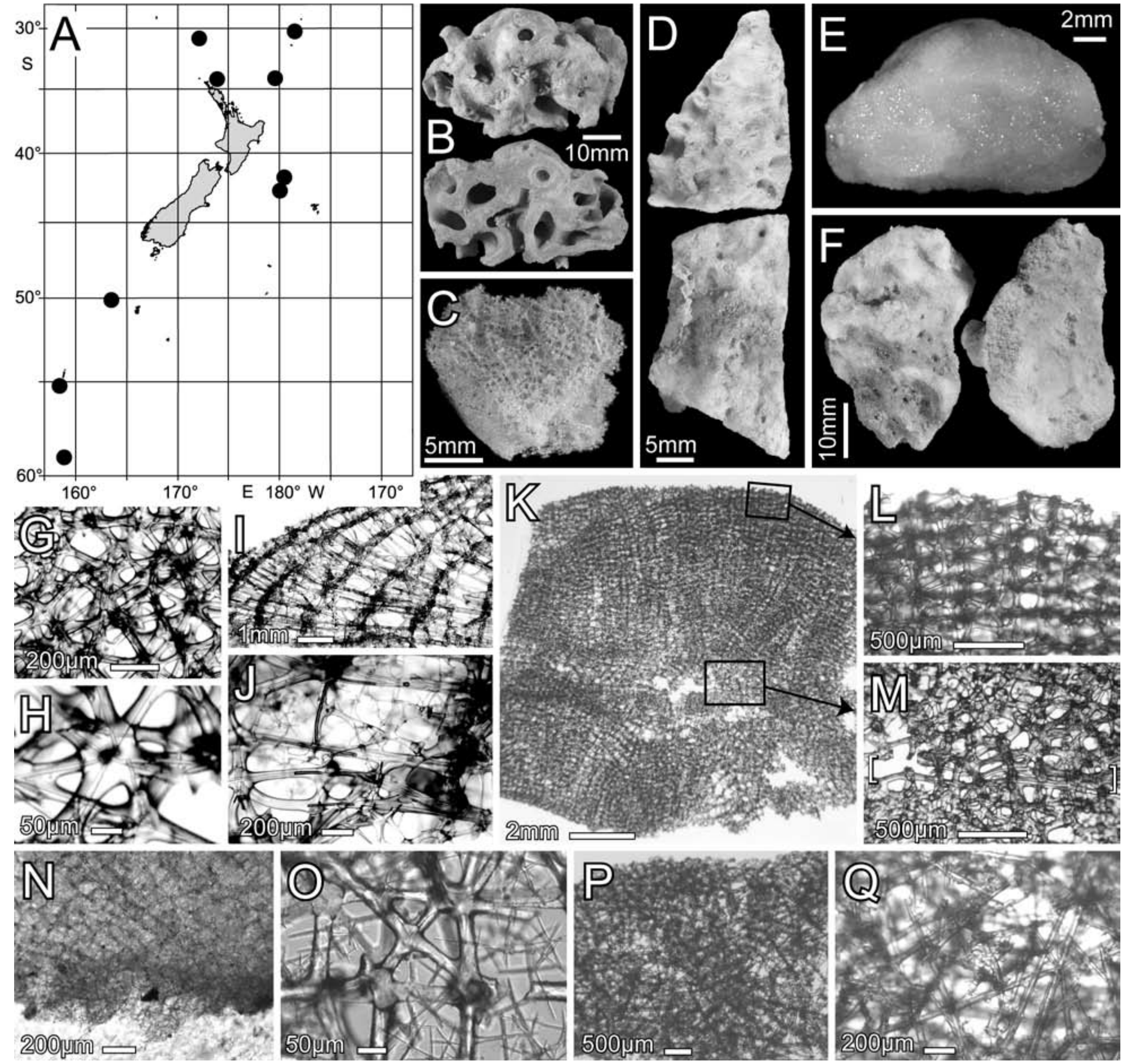


Figure 67. Hexactinosida incertae sedis. A, distributions in New Zealand waters. B, NIWA 43394, surface and section. C, NIWA 43409. D, NIWA 43395. E, NIWA 62070. F, NIWA 62071. G, H, sections of NIWA 43394 showing rotular polyradial nodal structure (LM). I, J, longitudinal section of NIWA 62066 showing pattern of septa in I and intercalated secondary dictyonalia within one septum in J (LM). K–M, cross-section of NIWA 43395 with magnified surface cortex in L and primary layer in M (between brackets) (LM). N, O, cross-section of NIWA 62070 showing attachment interface (lower) and general framework in N and magnified view of beams, nodes, and attached oxyhexactins in O (LM). P, Q, cross-section of NIWA 62071 showing dense marginal frame in upper part of P and magnified view of central part in Q (LM).

specimens (NIWA 25313, 62057, 41080, 41092, 62066, 43395, 43396, 43433, 62070, 52537, 52546, 52557, 62062) are likely Euretidae, but confirming characters for assignment there are absent. NIWA 62071, with internal, long-rayed hexactins with rays fused at contact points, is unprecedented in its structure, but is here assigned to Hexactinosida because all of its dictyonalia are hexactins and it has a typical hexactinosidan peripheral skeleton. There is no evidence that the internal loose skeleton has been overgrown by a different tight-mesh hexactinellid species, but even this would not solve the problem of what kind of hexactinellid formed the original central framework. It provides evidence that patterns of skeletal structure within Hexactinellida remain to be discovered.

KEY CHARACTERS:

- All specimens are dead washed-out dictyonal skeletal frameworks
- The body forms of all specimens are unknown as they are basal or stem fragments
- Channelisation is lacking
- One specimen has longitudinal strands but lacks other criteria for family assignment

AULOCALYCOIDA Tabachnick & Reiswig

Aulocalycoida Tabachnick & Reiswig, 2000: 51; Reiswig 2002d: 1361; Janussen & Reiswig 2003: 2.
Hexactinosa (in part) Schrammen, 1903: 4; 1912: 208; Ijima 1927: 113.

Basiphytous Hexasterophora in which a rigid dictyonal framework is constructed around a series of primary longitudinal strands formed of long extensions of dictyonal rays; strands are either uniaxial, each composed of a single dictyonal ray which is unlimited in length (aulocalycoid pattern) or multiaxial, each composed of overlapping rays of a longitudinal dictyonal series (paraulocalycoid pattern) (from Reiswig 2002d).

REMARKS: Scope and diagnosis of the order must still be considered tentative since details of framework construction of Hexactinosida remains incomplete. The order presently contains two families, Aulocalycidae and Uncinateridae.

AULOCALYCIDAE Ijima

Aulocalycidae Ijima, 1927: 274; Tabachnick & Reiswig 2000: 47; Reiswig 2002e: 1362; Janussen & Reiswig 2003: 2.
Euryplegmatidae de Laubenfels, 1955: E78.

Basiphytous or rhizophytous Aulocalycoida with primary structural elements as conspicuous longitudinal strands of unlimited length which are single rays of hexactine dictyonalia; strands connected and cross-braced by either hexactine dictyonalia or anaxial synapticula or combinations of both; sceptrules absent (from Janussen & Reiswig 2003).

REMARKS: The family presently contains two subfamilies, Aulocalycinae and Cyathellinae.

AULOCALYCINAE Ijima

[Aulocalycinae] Ijima, 1927: 274; Janussen & Reiswig 2003: 2.

Basiphytous Aulocalycidae with primary longitudinal strands connected and braced by either uniaxial rays of hexactine dictyonalia joined to strands by fusion at tips or by anaxial synapticula, not by direct apposition of hexactin centres to strands; strands always contain only a single axial filament; channelisation absent or shallow epirhyses and aporhyses or schizorhyses; dermalia and atrialia always as rough or occasionally smooth pentactins (from Janussen & Reiswig 2003).

REMARKS: The subfamily presently contains six species in five genera, *Aulocalyx*, *Euryplegma*, *Ijimadictyon*, *Leioplegma*, and *Rhabdodictyum*.

Aulocalyx Schulze

Schulze, 1886: 56; 1887: 174; 1904: 179; Dendy 1916:211; Ijima 1927: 276; Reid 1963: 230; Barthel & Tendal 1994: 67; Tabachnick & Reiswig 2000: 48; Reiswig 2002e: 1364.

Aulocalycidae with thin-wall cup or sack-shaped body bearing accessory oscula on short lateral body wall tubes or ridges; attached to hard substratum by small basal disc with stony-hard skeleton; skeletal frame progressively softer and more flexible towards fragile distal end; framework unchannelised. Dermalia and atrialia as rough pentactins; microscleres include large distinctive rhopalasters, discohexasters, and sometimes oxyhexactins; uncinates and sceptrules are absent (modified from Reiswig 2002e)

REMARKS: The genus has previously been known from Marion Island, SE of Cape of Good Hope, Africa, and Saya de Malha Group, W Indian Ocean. It has not been reported from New Zealand waters prior to this work.

TYPE SPECIES: *Aulocalyx irregularis* Schulze, 1886.

Aulocalyx australis n. sp. (Figs 68, 69)

MATERIAL EXAMINED:

TYPE MATERIAL: **Holotype** QM G331850, NIWA Stn TAN0803/82, Seamount 7, Macquarie Ridge (Australian EEZ), 53.729° S, 159.163° E, 1087–1160 m, 12 Apr 2008. **Paratypes** QM G331851, NIWA Stn TAN0803/77, Seamount 7, Macquarie Ridge (Australian EEZ), 53.738° S, 159.114° E, 925–1014 m, 11 Apr 2008; QM G331852, NIWA Stn TAN0803/84, Seamount 7, Macquarie Ridge (Australian EEZ), 53.705° S, 159.115° E, 998–1100 m, 13 Apr 2008; QM G331853, NIWA Stn TAN0803/98, Seamount 9, Macquarie Ridge (Australian EEZ), 56.246° S, 158.506° E, 676–750 m, 16 Apr 2008; QM G331854, NIWA Stn TAN0803/100, Seamount 9, Macquarie Ridge (Australian EEZ), 56.223° S, 158.461° E, 1248–1260 m, 16 Apr 2008; QM G331855, NIWA Stn TAN0803/102, Seamount 9, Macquarie Ridge (Australian EEZ), 56.242° S, 158.462° E, 790–1025 m, 16 Apr

2008; NIWA 41132, 52664, NIWA Stn TAN0803/118, Seamount 10, Macquarie Ridge (International waters), 53.048° S, 158.901° E, 1400–1615 m, 19 Apr 2008.

NON-TYPE MATERIAL: *Bounty Plateau*: NIWA 62098, NZOI Stn I666, 47.792° S, 178.992° W, 1165 m, 13 Mar 1979.

COMPARATIVE MATERIAL: Holotype of *Aulocalyx irregularis* NHMUK 1877.10.20.073, HMS *Challenger*, station 145A, NE of Marion Island, SE of Cape of Good Hope, Africa, 46.683° S, 38.16° E, 567 m, 27 Dec 1873; Holotype of *Aulocalyx serialis* Dendy, 1916 NHMUK 1920.12.9.61, HMS *Sealark*, station C20, Saya de Malha Group, western Indian Ocean, 9.790° S, 60.190° E, 605–915 m, 7 Sep 1905.

DISTRIBUTION: Known only from Macquarie Ridge and Bounty Plateau (Fig. 68A).

TYPE LOCALITY: Macquarie Ridge.

HABITAT: Attached to hard substratum; depth range 676–1615 m.

DESCRIPTION:

Morphology is a thin-walled cup or vase, with extensively folded sides projecting as short tubes (Fig. 68B, C; see Fig. D of Frontispiece for form in life), attached to hard substratum by a stony-hard basal mass (Fig. 68D). While all walls of the specimens, including the radial tubes, are very thin, in alternative interpretation the entire wall of the cup can be considered very thick as it consists of the length of the constituent radial tubes. Radial tubes, sometimes aligned in vertical rows, are commonly connected to adjacent tubes, thereby circumscribing roughly tubular inhalant spaces of about the same dimensions between them. The central atrium is a narrow funnel, which may be entirely open (Fig. 68C) or occasionally traversed by strands of tissues and supporting skeleton. The new specimens, mostly wall fragments but also a few basal cups, are all badly damaged fragments, so the complete body form and original condition of peripheral tissues cannot be determined with great certainty.

Dimensions of the fragments range from 87.8 x 64.3 x 15.3 mm down to small flakes of wall about 10 mm in diameter. The thickest fragments with tissues and spicules remaining (Fig. 68B, C), have radial tubes 16–20 mm long and external diameters (wall centre to wall centre) of 7.8–10.3 mm. External tube apertures of long-dead specimens are 2.2–7.1 mm. Thickness of the radial tube walls with tissue and spicules is 1.6–1.9–2.3 mm (n = 7) but in long-dead or cleaned specimens (Fig. 68E), the remaining framework is only 0.6–0.9–1.1 mm (n = 8) in thickness.

Texture of the long-dead frameworks is hard and brittle; that of the few specimens alive upon collection is very fragile.

Surface is topographically complex due to the projection of radial tubes on the external surface of the cup-shaped body. Specimens with spicules and tissues have a coarse felt-like surface, with occasional prostal spicules projecting from the tube margins; there is no evidence of epirhyses or aporhyses. Surfaces of washed-out, dead frameworks are relatively smooth in close view, but the walls are easily seen by naked eye to consist of coarse networks of compound and simple skeletal strands crossing at widely varying angles, outlining large triangular to polygonal meshes (Fig. 68F).

Colour of live specimens ranges from medium brown to nearly white; dead frameworks range from completely transparent to dark brown.

Choanosomal skeleton is a typical aulocalycoid framework. It is constructed of primary hexactine dictyonalia whose rays are extremely long, curved, and fused either directly in apposition, often in spirals, or by anaxial ladder-like synapticula to similar rays of other primary dictyonalia (Fig. 68F, G). The compound spiral strands cross other such strands at various angles, are fused together at those contact points, and are thickened to over 400 µm by additional silica layering to form a thin network of strong support elements. Additional dictyonalia are added into the large primary meshes by soldering to the sides of the existing beams and strands; occasionally one of their rays may undergo unlimited extension, forming a new primary ray into the network. Nodes are unswollen and most beams are smooth, although small sparse patches of very small spines occur irregularly (Fig. 68H). Obvious features of this framework are that triangular to polygonal meshes are large (to over 2 mm), there is no regular relationship between adjacent dictyonalia (as in farreoid and euretoid frameworks), synapticula are important components, and very few of the nodes are true nodes of dictyonalia centres with axial crosses (estimate less than 5%). A result of this construction pattern is that spurs normally found in abundance on the surface of dictyonal skeletons are extremely rare in this framework. In the normal process of removing projecting foreign macrospicules from trawled specimens for photography, it was found that many of those in the live specimens were firmly attached. Some were nonetheless removed and found to have broken fusions and synapticular bridges attached (Fig. 68I). Closer inspection verified that these were large diactins fused into a longitudinal position of the tubule walls—a radial position relative to the entire cup. Those with relatively early fusions were found to have small axial crosses (Fig. 68J), confirming that they were diactins;

the free ends and axial crosses were identical to those that were projecting freely and removed but which had no traces of fusion to the framework. These diactins must be accepted as proper spicules that contribute a minor component (6–10 per tubule) to the structure of the choanosomal dictyonal framework of this species. Their presence could not be reliably confirmed in long-dead frameworks. They were fairly obvious in recently dead skeletons with little fouling and erosion, but unconfirmed in older skeletons. Loose spicules of the choanosomal skeleton include oxyhexactins and microscleres.

Ectosomal skeleton of both external surfaces and atrial surfaces consists of loose pentactine megascleres; their organisation in a lattice could not be confirmed due to presumed collection damage. Sceptrules and uncinates, although occasionally encountered, are not proper spicules of *A. australis*. Microscleres are scattered in both surface and subsurface tissue layers.

Megascleres (Table 33) are oxypentactins and a very few oxystauractins as dermalia and atrialia and diactins as loose or attached prostalia. Pentactins (Figs 68L, 69A) and rare stauractins are moderately variable in size and shape; rays are straight and entirely rough with occasional sparse large spines on the outer surface; ends are slightly inflated. Most of the pentactins lack any indication of a sixth distal ray, but a slight swelling occurs rarely. Forms with proximal rays shorter, longer or equal to the tangential rays are common; occasional very large spicules encountered outside of the normal random measurement survey had tangential rays to 980 µm long and proximal rays to 2730 µm long. Loose and slightly attached diactins (Fig. 69B) project radially from the outer ends of body tubes. They are very slightly curved with no central swelling. The main spicule is smooth although with grey patches indicating irregular silica deposition; the ends are rounded and finely spined, with the terminal cap remaining smooth. Choanosomal oxyhexactins (Fig. 69F) are generally thin; rays are straight and uniformly densely spined, with acute tips, but some thicker forms with blunt tips occur.

Microscleres (Table 33) include large rhopalasters (<0.1%), large and small stellate discohexasters (0.8% and 91.3% resp.), and oxyhexactins (7.8%). Rhopalasters, the distinctive spicule type of the genus, have very short primary rays supporting 8–10–12 long, club-shaped terminal rays bearing numerous large, reclined, slightly s-shaped or simply curved thorns all around the distal two-thirds (Figs 68K, M, 69C).

Table 33. Spicule and framework dimensions (µm) of *Aulocalyx australis* n. sp.

Parameter	**Holotype QM G331850** **mean**	**s. d.**	**range**	**no.**
Dermal pentactin:				
tangential ray length	442	67	325–673	60
tangential ray width	14.1	3.0	8.5–20.6	50
proximal ray length	619	169	314–1084	62
proximal ray width	14.1	2.7	9.1–19.7	50
Prostal diactin length (mm)	15.5	5.5	6.5–28.1	35
width	89	26	39–155	31
Rhopalaster diameter	391	31	287–441	50
primary ray length	16.1	2.1	11.5–20.8	50
secondary ray length	181	15	126–205	50
Large discohexaster diameter	159	27	103–249	54
primary ray length	12.8	2.0	8.3–16.9	54
secondary ray length	66.9	12.8	38.7–105.7	54
Small discohexaster diameter	59.2	9.7	44.6–88.6	53
primary ray length	10.5	1.7	7.1–14.8	53
secondary ray length	19.2	3.8	14.2–30.5	53
Oxyhexactin diameter	104	21	48–157	50
ray width	2.5	0.6	1.3–4.3	50
Frame large mesh sides (mm)	1.28	0.42	0.60–2.14	58
beam width	77.2	26.4	32.6–154.5	58

At a fine microscopic scale, all surfaces are smooth. Large discohexasters are typically stellate (Fig. 69D) but, when viewed resting on three adjacent terminal plumes, they appear spherical (Fig. 68N); a small number may have straight and widely spread terminals to approach spherical form. Their short primary rays bear 8–12 s-shaped terminal rays spreading in a slightly flaring perianthic cup. All rays are rough and terminal discs bear 10–14 marginal teeth. Small discohexasters are strictly stellate (Figs 68O, 69E). Their short primary rays carry 5–15 s-shaped terminals spreading in a tight perianth plume. All rays are rough and terminal discs bear 7–10 marginal teeth. Oxyhexactins (Fig. 69F) have straight tapered rays entirely and evenly ornamented with short conical spines; tips are bluntly sharp. Because of the damaged condition of the spicule-bearing specimens, it was not possible to determine specific locations of microscleres within the body wall.

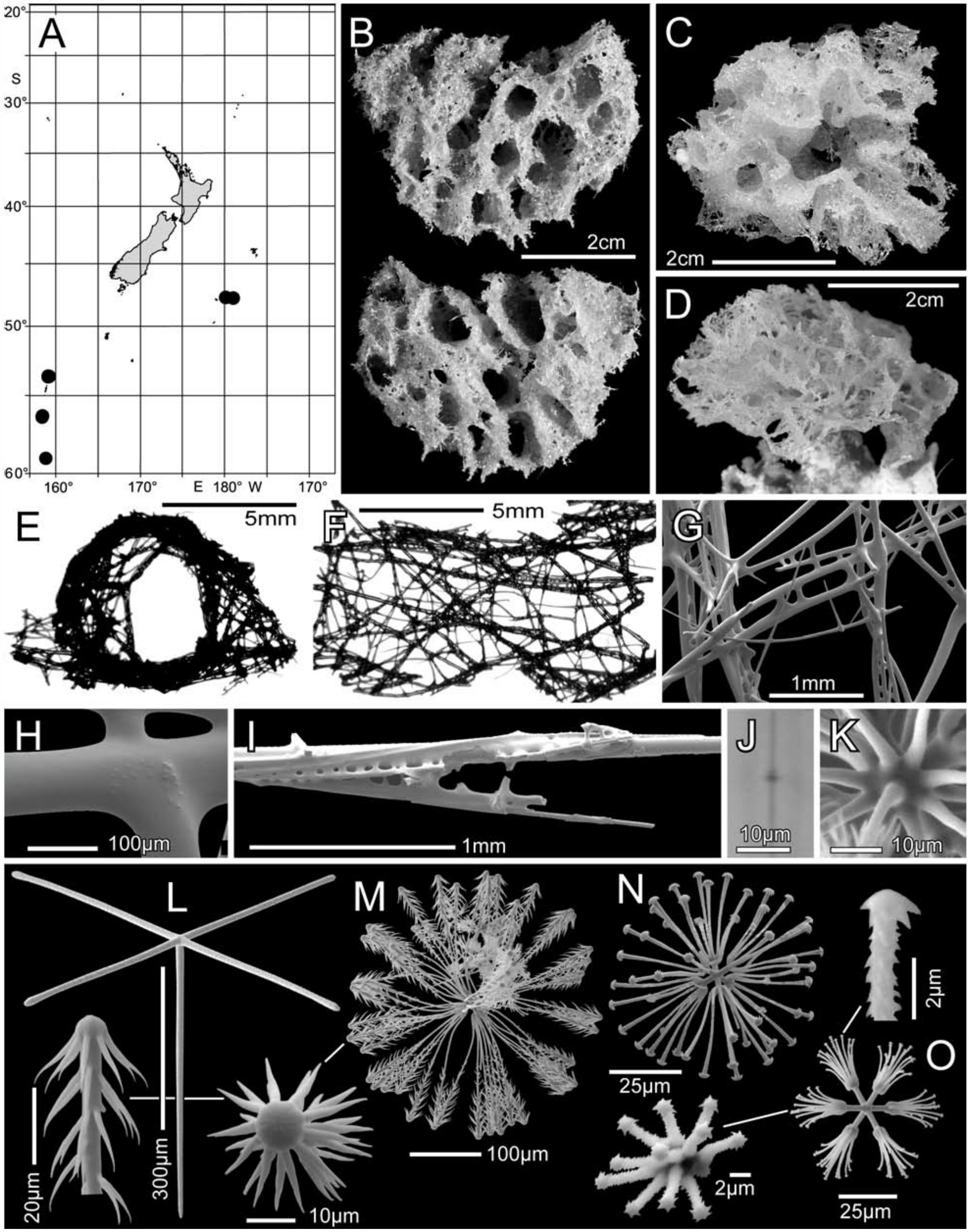
ETYMOLOGY: The species name is derived from Latin *australis* meaning 'southern' and reflects the species distribution.

REMARKS: The washed-out specimens are confidently assigned to *A. australis* since their frameworks are the same as those of the spicule-bearing specimens and there are no other species with similar frameworks known in the Macquarie Ridge area. Comparing the new *A. australis* to the two known species is difficult because of the poor and largely unquantitative original descriptions. Characters of *A. irregularis*, as given by Schulze (1887), include dermal and atrial pentactins entirely rough with blunt tips (not inflated), rhopalasters c. 400 µm diameter with six terminal rays per primary ray, large stellate discohexasters (c. 150 µm diameter from figures), and large numbers of oxyhexactins (47–175 µm diameter from his composite figure). Examination of a poor fragment of the holotype allows confirmation of the presence of rhopalasters and large discohexasters, but is inadequate to provide new information on sizes of those spicules. The fragment allows first measurements of surface pentactins of this species (Table 34, not considered to be an unbiased sample) and confirmation of their uninflated tips, confirmation of the abundance and size of oxyhexactin microscleres, and addition of small size classes of both stellate and spherical discohexasters not mentioned or alluded to by Schulze. Using all of these data, *A. australis* differs from *A. irregularis* in 1) having inflated tangential ray tips on surface pentactins, 2) having usually ten and never six terminal rays on rhopalaster primary ray tips, and 3) having no small (38–94 µm diameter) spherical discohexasters. These two species share most of the other known characters, but some still remain unavailable.

Characters of *A. serialis*, as given by Dendy (1916), include surface pentactins (tangential rays 113–380 µm long from figures) rough only near tips, large parenchymal hexactins (rays 206–780 µm long from figure), rhopalasters c. 240 µm diameter (234 µm diameter and 5–6 terminal rays per primary ray from figure), and medium-sized stellate and spherical discohexasters (116 and 134 µm diameter resp. from figure); he did not mention oxyhexactin microscleres. Examination of a very good fragment from the holotype confirms the general size of the surface pentactins (Table 34) and their restricted spination, presence of large parenchymal hexactins, general size range of and form of rhopalasters (small sample but all with six terminal rays per primary ray), presence of stellate and spherical discohexasters of medium size (means 121 and 118 µm diameter respectively), and absence of oxyhexactins in the microsclere size range. Using Dendy's description and Table 34, *A. australis* differs from *A. serialis* in 1) having surface pentactins entirely rough, 2) lacking parenchymal hexactine megascleres entirely, 3) having larger rhopalasters with more terminal rays (10) per primary ray, 4) having both stellate and spherical discohexasters of entirely different sizes than those of *A. serialis*, and 5) having common oxyhexactine microscleres. Clearly *A. australis* is very distinct from *A. serialis*, but this summary of characters also points up the numerous differences between *A. irregularis* and *A. serialis*, confirming their status as distinct species. Unfortunately there are still only single spicule-bearing specimens known for the two earlier species, thus character variation cannot be assessed. For the new species, *A. australis*, there are two spicule-bearing specimens from different locations and this enables some appreciation of variation in this species. Although not presented in detail here, it can be stated that spicule sizes and shapes and dictyonal skeletons of the two specimens are virtually indistinguishable.

KEY DIAGNOSTIC CHARACTERS:

- Body is a cup with walls composed of thin-wall radial tubes 8–10 mm in diameter and open at both ends
- Body and tube walls are not channelised
- Primary dictyonal framework is aulocalycoid with elongate single rays of dictyonalia forming longitudinal strands
- Synapticula are significant components of the skeletal framework
- Typical rhopalasters are present, each primary ray bearing 8–12 terminal rays
- In spicule-bearing specimens, proper prostal diactins project from terminal ends of radial tubes


A
20°
S
30°
40°
50°
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160°
170°
E 180° W
170°
B
2cm
C
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E
5mm
F
5mm
G
1mm
H
100µm
I
1mm
J
10µm
K
10µm
L
20µm
300µm
10µm
M
100µm
N
25µm
2µm
O
2µm
25µm

Figure 68 (*opposite*). *Aulocalyx australis* n. sp., holotype QM G331850. A, distribution in New Zealand waters. B, both sides of the holotype. C, paratype NIWA 52664, top view. D, paratype QM G331854, side view. E, cleaned framework of a tube unit of NIWA 52664, distal end view (LM). F, cleaned framework of the side of a tube of NIWA 52664 (LM). G, framework of the holotype showing synapticula and coiled longitudinal strands. H, magnified view of G showing smooth beams and patch of small rounded spines at a false node. I, three prostal diactins attached to each other and the general framework by direct silica fusion and ladder synapticula. J, axial cross of an attached prostal diactin (LM). K, rhopalaster, end of a terminal ray with origin of 10 terminal rays. L, surface pentactin. M, rhopalaster, with enlarged end and side view of terminal rays. N, large discohexaster appearing spherical in this orientation but probably stellate in plan view. O, small stellate discohexaster with magnified end view of terminal tuft and side view of one terminal ray end.

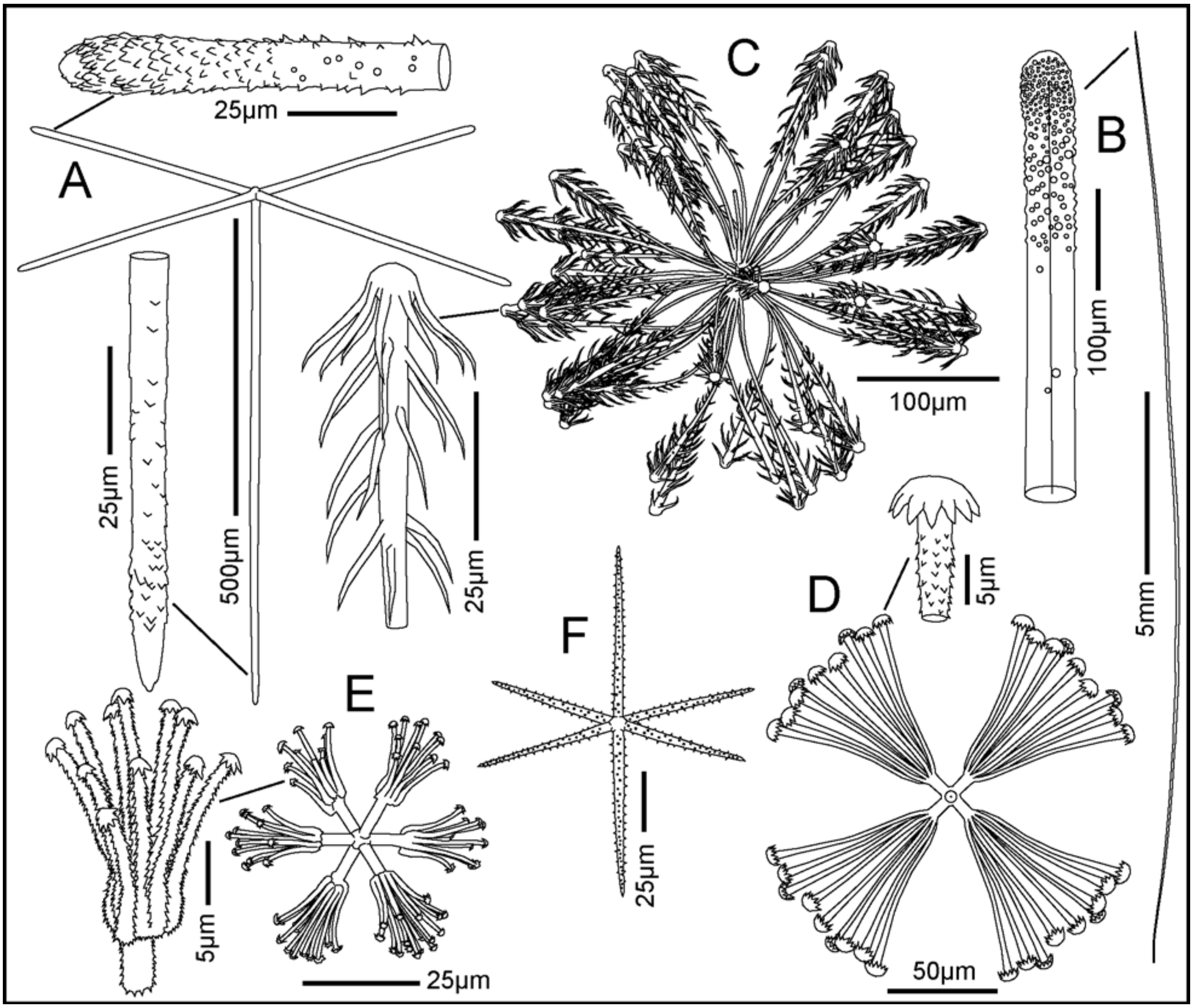

Figure 69. Spicules of *Aulocalyx australis* n. sp., holotype QM G331850. A, surface pentactins with enlargements of tangential and proximal ray ends. B, prostal diactin with enlargement of end. C, rhopalaster with enlargement of terminal ray end. D, large discohexaster in plan view (2 primary rays and secondary tufts omitted), with enlargement of secondary ray end. E, small stellate discohexaster with enlargement of secondary ray tuft. F, oxyhexactin microsclere.

Table 34. New spicule dimensions (µm) from holotype specimens of *Aulocalyx irregularis* Schulze, 1886 and *A. serialis* Dendy, 1916. Dashes indicate absence of those spicule types.

Parameter	***A. irregularis*** **NHMUK 1887.10.20.073**				***A. serialis*** **NHMUK 1920.12.9.61**			
	mean	**s. d.**	**range**	**no.**	**mean**	**s. d.**	**range**	**no.**
Surface pentactin[1]:								
tangential ray length	290	72	179–418	13	357	116	142–706	60
tangential ray width	8.8	2.7	4.7–15.1	10	9.4	2.4	4.5–15.5	54
proximal ray length	447	72	337–553	7	474	115	220–716	54
proximal ray width	8.9	3.1	5.2–15.5	8	9.5	2.3	5.7–15.7	54
Parench. hexactin ray length	–	–	–	–	324	181	124–1048	50
ray width	–	–	–	–	7.2	2.1	3.1–13.7	52
Rhopalaster diameter[1]					282	48	210–312	4
primary ray length					8.9	1.3	7.1–10.0	4
secondary ray length					132	23	98–147	4
Spherical discohexaster diam.	57	19	38–93	8	118	26	48–152	50
primary ray length	7.9	2.1	5.4–10.7	8	8.0	1.5	4.4–10.6	50
secondary ray length	22.0	9.4	9.5–38.9	8	51.0	11.9	19.3–67.2	50
Stellate discohexaster diameter	47	11	31–84	26	121	18	73–157	50
primary ray length	7.5	1.3	5.0–9.7	26	9.8	1.8	6.7–15.6	50
secondary ray length	16.3	4.7	9.5–32.7	26	50.9	8.4	27.2–65.9	50
Oxyhexactin diameter	92	29	32–224	312	–	–	–	–
ray width	2.4	0.7	1.0–4.7	312	–	–	–	–

[1] sample of *A. irregularis* was inadequate for obtaining reasonable samples of megascleres and large microscleres.

Euryplegma Schulze

Schulze, 1886: 80; 1887: 176; Ijima 1903: 25; 1927: 276; Reid 1957: 907; Tabachnick & Reiswig 2000: 40; Reiswig 2002e: 1376.

Semi-involute tongue-shaped body with aulocalycoid framework bearing schizorhyses-like channels; dermalia and atrialia as pentactins; choanosomal hexactins spanning micro- and megasclere size ranges; proper microscleres are mainly perianthic discohexasters (modified from Reiswig 2002e).

Remarks: The genus is monospecific; its only species, *Euryplegma auriculare* Schulze, 1886, was originally reported from New Zealand waters.

Type species: *Euryplegma auriculare* Schulze, 1886.

Euryplegma auriculare Schulze, 1886 (Figs 70, 71)

Euryplegma auriculare Schulze, 1886: 80; 1887: 176; Ijima 1927: Reid 1957: 907; Mehl 1992: 97; Tabachnick & Reiswig 2000: 40; Reiswig 2002e: 1365.

Material examined:

South Fiji Basin: NIWA 62112, NIWA Stn Z9899, 28.100° S, 175.470° E, depth unknown, 20 Oct 1999.

Three Kings Ridge: NIWA 49268, NZOI Stn U582, 31.862° S, 172.453° E, 790 m, RV *Rapuhia*, 5 Feb 1988; NIWA 70636, NZOI Stn U584, 31.438° S, 172.593° E, 1137 m, 6 Feb 1988.

Cavalli Seamounts, Seamount 441: NIWA 43416, NIWA Stn KAH0204/47, 34.042° S, 174.817° E, 792–880 m, 19 Apr 2002; NIWA 62068, 43421, NIWA Stn KAH0204/52, 34.055° S, 174.808° E, 820–910 m, 19 Apr 2002.

NE Northland: NIWA 52828, NZOI Stn Z9152 (SMT9801/40), 36.506° S, 176.514° E, 899 m, 24 Jun 1998.

Southern Kermadec Ridge and volcanic arc, Volcano K (Cupcake): NIWA 43439, NIWA Stn TAN0205/49, 31.098° S, 179.106° W, 1248–1272 m, 20 Apr 2002.

Bay of Plenty, Rungapapa Seamount: NIWA 62086, NIWA Stn TAN0413/118, 37.554° S, 176.969° E, 154–190 m, 13 Nov 2004.

Hikurangi Plateau: NIWA 31194, 43457, 43458, NIWA Stn TAN0413/184, 39.042° S, 179.341° E, 2595–2700 m, 17 Nov 2004; NIWA 43459, NIWA Stn TAN0413/188, 39.019° S, 179.343° E, 2446–2675 m, 18 Nov 2004; NIWA 70642, NZOI Stn E745, 38.067° S, 179.108° E, 1441 m, 28 Mar 1967.

Hawke Bay: NIWA 70643, NZOI Stn R435, 39.431° S, 178.422° E, 985–1190 m, 15 Jun 1990.

North Chatham Rise, Graveyard seamount complex, Zombie Seamount: NIWA 52531, TAN0604/021, 42.766° S, 179.926° W, 906 m, 29 May 2006. *Pyre Seamount*: NIWA 25179, TAN0604/053, 42.717° S, 179.906° W, 1050 m, 31 May 2006.

North of Auckland Island, Campbell Plateau: NIWA 70619, NIWA Stn Z9364, 50.067° S, 165.901° E, 989 m, 19 Sep 1998.

COMPARATIVE MATERIAL: Lectotype NHMUK 1877.10.20.075, HMS *Challenger* Stn 170A, off Raoul Island, Kermadec Islands, 29.750° S, 178.183° W, 1152 m, 14 Jul 1874.

DISTRIBUTION: Known from the South Fiji Basin, and around New Zealand, from Three Kings Ridge to Kermadec Islands to E of Table Cape and Chatham Rise (Fig. 70A); known also from 19 locations near New Caledonia, Loyalty Islands, Fiji, and Wallace and Futuna Islands (Tabachnick and Reiswig 2000).

HABITAT: Attached to hard substratum. Depth range within New Zealand area 154–2700 m; outside New Zealand 540–3680 m.

DESCRIPTION:

Morphology of the lectotype is a semi-involute ear-shaped plate with slightly spreading base at the narrow end (Fig. 70B). The convex external surface is fairly smooth while the inner surface has variable ornamentation from longitudinal grooves and furrows distally to low cushion-like knobs in the lower area parts. Fragments of young live specimens damaged during collection are plate-like with a fibrous appearance, as a woven straw mat (Fig. 70C). Fragments of mature specimens, often consisting only of long-dead frameworks, exhibit the general body form of the lectotype, with or without a short stalk (Fig. 70D). Of the 31 new fragments, 16, all young stages, were alive at the time of collection as evidenced by retention of normal spiculation; but all were rather severely damaged and lacked retention of skeletal organisation seen in the lectotype. While there is still no histological evidence for distinguishing dermal and atrial sides of *E. auriculare*, the likelihood of the convex surface being dermal, as in most other hexactinellids, seems acceptable as a working hypothesis.

Dimensions of the lectotype were originally 17 cm in length, 6–7 cm in breadth and 3–5 mm in thickness. The new fragments range from 7.5–2.2 cm in length, 4.3–1.3 cm in breadth, and 1.8–7.5 mm in wall thickness; due to convolution of the wall, some reach a total thickness of 27 mm.

Texture of young fragments is wiry and flexible but very fragile; the mature fragments are stony hard.

Surface of the convex outer side of the lectotype is topologically smooth, with longitudinally elongate holes entering into a complex internal canal system; distally these are covered by a lattice of dermal megascleres. The concave inner atrial surface is highly variable. Distally the surface consists of alternating longitudinal ridges and furrows, each about 2 mm in width; mostly covered by a loose lattice of atrial megascleres. More proximally the furrows are partially covered by transverse bands of fused skeletal beams and most proximally the bands are thickened to form low cushions which project up to 3 mm into the atrial concavity (Fig. 70B, right); the cushions each bear a small central 0.5–1.0 mm diameter aperture opening to internal canals. In the new fragments, remnants of the dermal apertures (Fig. 70C, right) and the longitudinal groove-furrow system of the atrial side (Fig. 70C, left) are recognisable, but surface megasclere lattices cannot be detected. The very thickened dead skeletons of mature fragments (Fig. 70D) have elongate schizorhysial apertures on the concave surface, often in longitudinal rows; these are presumably equivalent to the canal apertures on tissue-bearing younger specimens. On the concave surface, the older skeletons have oval apertures without detectable organisation; no structures comparable to the regular surface cushions of the lectotype occur.

Colour of all young fragments dark brown; that of the dense old fragments light tan to white.

Choanosomal skeleton is constructed of primary longitudinal strands occurring in fairly compact bundles forming the macroscopically obvious 1–2 mm wide longitudinal ridges. All strands, often several millimetres in length, originate as single elongate rays of hexactine dictyonalia distributed irregularly throughout the bundles. The five other rays of those dictyonalia are usually short, curved, and fuse tip-to-ray to neighbouring strands, providing stabilisation within bundles. Occasional single rays cross the furrows between bundles, providing some lateral stabilisation between the ridges. Superficial cortical layers of dictyonalia also span the furrows on both surfaces, providing greater lateral support to the ridges and circumscribing the schizorhysial apertures (Fig. 70E). Cortical transverse bands added to the atrial surface further stabilise the entire skeleton (Fig. 70F). Anaxial synapticula are common support components of all parts of the choanosomal skeleton forming ladder-like structures between adjacent strands (Fig. 70E, F). Beams are either smooth or moderately spined (Fig. 70G). False nodes far outnumber true nodes, which are unswollen and remain strictly hexactin. Meshes are irregular in shape and size; attached oxyhexactins are never encountered. In very mature specimens beams are heavily thickened and synapticula become very significant strengthening components of the stony framework (Fig. 70H). Loose spicules of the choanosomal skeleton include oxyhexactins and microscleres; surface pentactins also line internal canals but are not here considered to be choanosomal.

Ectosomal skeleton of both external surfaces and major internal canals consists of a lattice of loose pentactine megascleres with overlapping tangential rays. Sceptrules and uncinates, although occasionally encountered, are not proper spicules of *E. auriculare*. Microscleres are scattered in both surface and subsurface tissue layers.

Megascleres (Table 35) are oxypentactins as surface and canal spicules and oxyhexactins as choanosomal spicules. Pentactins (Figs 70I, 71A, B) are highly variable in size and shape; rays are straight and usually sparsely fine-spined with acute or blunt-pointed tips; most lack any indication of a sixth distal ray but a slight swelling occurs very rarely. Both long and short proximal ray forms are common. Choanosomal oxyhexactins (Figs 70J, 71C, D) are generally thin and range across megasclere and microsclere sizes; rays tend to be straight and uniformly densely spined, with acute tips, but some thicker forms with blunt tips occur. They are very rare in NIWA 43457.

Microscleres (Table 35) include stellate discohexasters, spherical discohexasters, hemidiscohexaster varieties of both forms, onychohexasters, discohexactins, discodiasters, and a variety of variant spicules that cannot be categorised. Stellate discohexasters (Figs 70M, N, 71H, I) are the most common microscleres in all specimens examined (78% in lectotype). The short nearly smooth primary rays each bear 1(hemi)–6–18 s-shaped rough terminal rays that are capped by discs with 6–12 marginal teeth; mean primary to secondary ray lengths are 0.285 in the lectotype and 0.333 in

Table 35. Spicule and framework dimensions (μm) of *Euryplegma auriculare* Schulze, 1886.

Parameter	**NHMUK 1887.10.20.075**				**NIWA 43457**			
	mean	**s. d.**	**range**	**no.**	**mean**	**s. d.**	**range**	**no.**
Surface pentactin:								
tangential ray length	163	44	65–313	100	281	69	101–492	50
tangential ray width	8.2	2.3	3.5–14.8	50	12.8	5.2	5.6–27.8	50
proximal ray length	257	132	59–605	100	464	262	74–1140	50
proximal ray width	8.0	2.6	3.1–13.9	50	15.3	5.5	5.3–27.8	50
Hexactin ray length	101	40	55–276	50	97	n.a.	84–109	2
ray width	4.4	1.5	1.8–8.2	50	6.7	n.a.	6.5–6.9	2
Stellate discohexaster diam.	45.7	4.9	36.5–59.1	50	52	14	33–101	50
primary ray length	5.1	0.9	3.1–7.2	50	6.6	2.0	3.7–13.3	50
secondary ray length	17.9	2.1	14.4–24.9	50	19.8	5.3	10.5–37.8	50
Spheric discohexaster diam.	37.6	4.7	27.6–50.0	50	43.1	5.9	32.8–58.7	50
primary ray length	4.0	0.8	2.3–6.1	50	4.4	0.9	2.3–7.0	50
secondary ray length	15.1	2.1	10.7–20.7	50	17.3	2.8	11.8–23.0	50
Hemidiscohexaster diam.	42.0	7.1	29.9–56.3	15	38.6	4.6	29.9–45.9	15
primary ray length	4.1	0.9	2.6–5.6	15	4.8	1.0	3.3–7.0	15
secondary ray length	16.9	3.4	11.9–23.8	15	14.7	2.5	11.0–19.2	15
Onychohexaster diam.	91	16	37–116	51	55.0	5.8	45.3–62.8	19
primary ray length	5.5	1.0	2.9–7.9	51	7.0	1.2	5.1–9.2	19
secondary ray length	40.2	7.8	15.6–58.9	51	21.2	2.4	17.0–24.7	19
Discohexactin diameter	39.3	4.0	35.9–43.8	3	40.2	5.0	29.9–46.6	15
Framework dimensions:								
true ray beam length	492	375	113–1660	50	1638	1468	292–6758	50
all beam length	287	179	64–795	50	722	670	53–3319	50
beam width	34.3	6.7	18.0–52.5	50	56	16	27–107	50

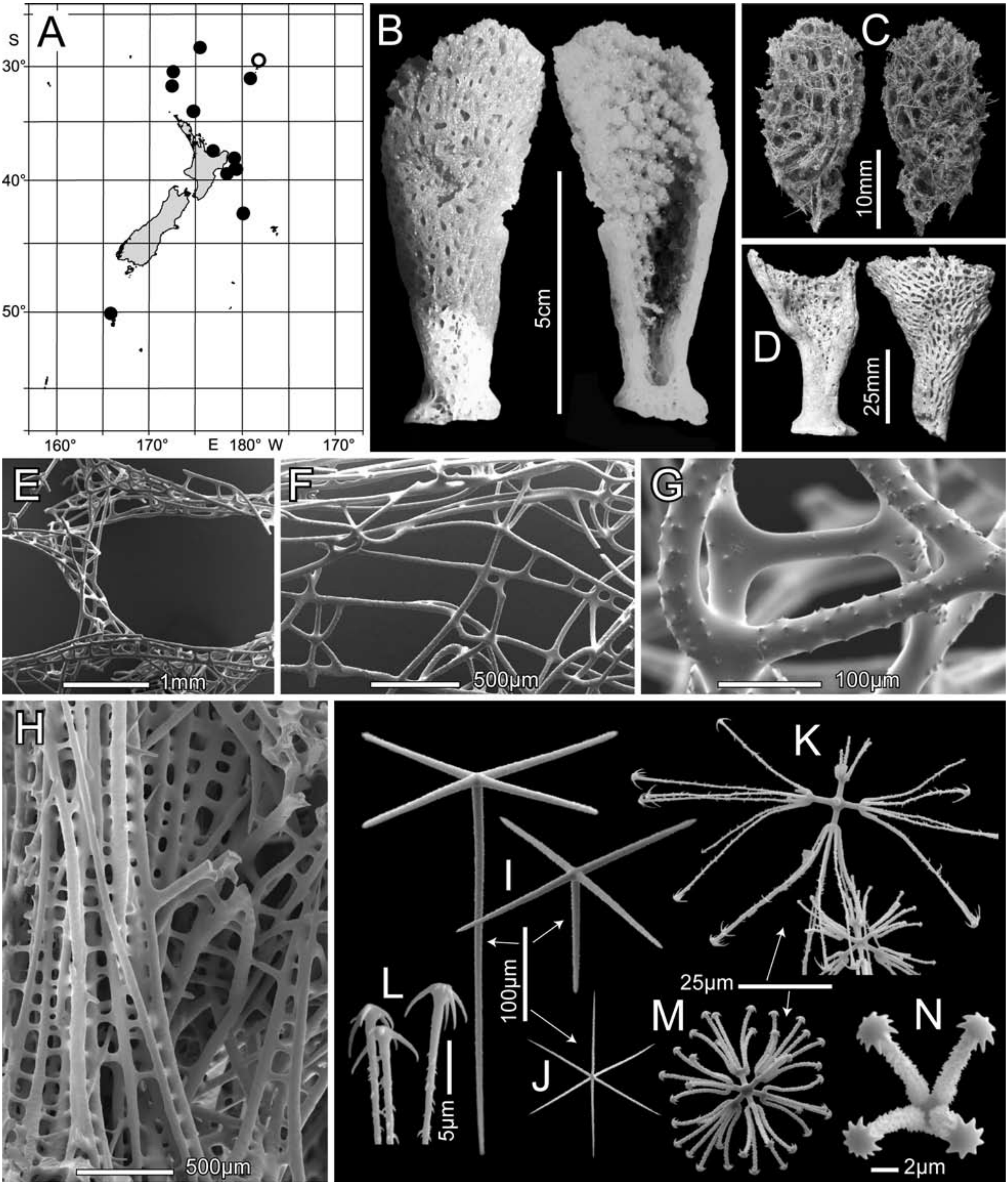

Figure 70. *Euryplegma auriculare* Schulze, 1886, E–G and all spicules from lectotype NHMUK 1887.10.20.075. A, distribution in New Zealand waters, lectotype location indicated by unfilled circle. B, both sides of the lectotype NHMUK 1887.10.20.075 photographed 1988. C, both sides of the young live fragment NIWA 62068. D, two old basal fragments of NIWA 49268. E, cleaned skeleton of convex surface with two longitudinal bundles and a transverse crossbridge. F, cortex of concave side showing long curved beams emanating from the few dictyonalia, short curved rays, and ladder synapticula. G, ornamentation of beams and synapticula. H, dense skeleton of older specimen NIWA 49268 showing bundle of thickened longitudinal strands joined by synapticula. I, two pentactins with long and short proximal rays. J, choanosomal hexactin. K, large onychohexaster and small stellate discohexaster. L, magnified terminal ray tips of onychohexaster with recurved marginal claws. M, stellate discohexaster. N, terminal discs of a stellate discohexaster tuft.

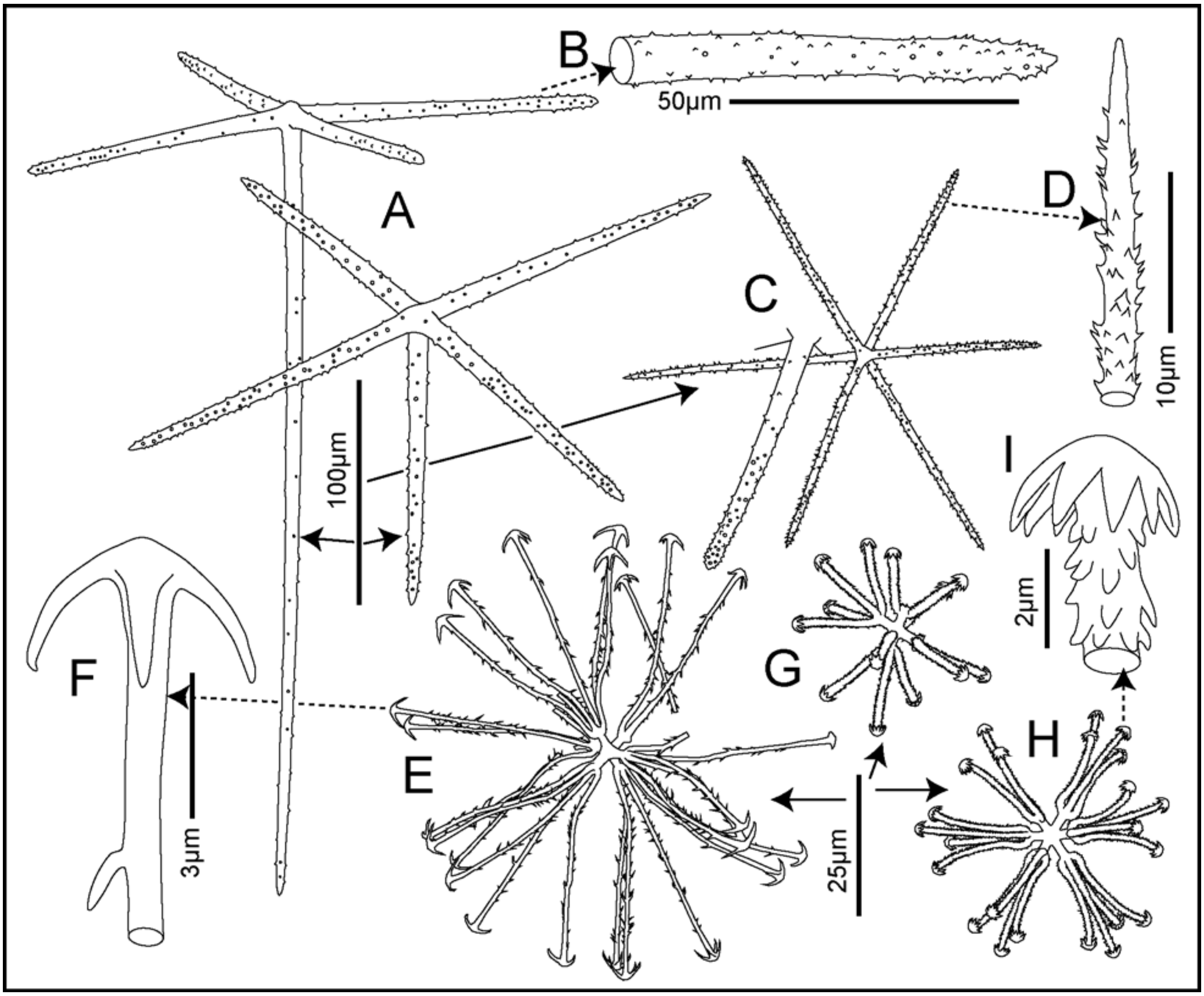

Figure 71. Spicules of *Euryplegma auriculare* Schulze, 1886 from lectotype NHMUK 1887.10.20.075**.** A, surface pentactins with long and short proximal rays. B, enlargement of tangential ray end of pentactin. C, choanosomal hexactin with thin and thick rays. D, enlargement of hexactin ray end. E, onychohexaster. F, enlargement of onychohexaster terminal ray end. G, spherical discohexaster. H, stellate discohexaster. I, enlargement of terminal ray end of discohexaster.

NIWA 43457. Large robust forms over 60 µm in diameter were only encountered in NIWA 43457. There is considerable variation in the curvature and angular spread of the terminal rays so there is complete continuity between stellate and spherical varieties of the discohexasters. Spherical discohexasters (Fig. 71G) are generally similar to, but less common (13% in lectotype) than the stellate form; terminal rays tend to be fewer in number (1–5), straight and widely spread; mean 1° /2° ray lengths are 0.265 in the lectotype and 0.254 in NIWA 43457. Onychohexasters (Figs 70K, L, 71E, F) are a new addition to the *E. auriculare* spicule complement; they were discovered here through use of filter methodology. They are rare (3% in the lectotype), with short smooth primary rays each supporting 4–12 long thin terminals covered with reclined thorns (not visible in LM) capped with a whorl of 2–10 recurved claws; mean primary to secondary ray lengths are 0.137 in the lectotype and 0.330 in NIWA 43457 where only the smaller forms are present. One spicule had secondary branching of the terminal rays near their distal ends. Discohexactins are present but relatively rare (<1%) in both specimens analysed in detail.

Remarks: The range of fragments reviewed here agrees in all respects with previous descriptions of *Euryplegma auriculare*, with the exception of the addition of the new but rare onychohexaster microsclere type, somewhat reminiscent of the rhopalaster of *Aulocalyx*. Preliminary examination of any proper specimen of this species will still reveal the distinctive skeletal framework constructed primarily of bundles of longitudinal strands joined by synapticula, pentactin megascleres with long and short proximal rays, and stellate discohexasters as the main microscleres. Even without retained spicules, long-dead washed-out specimens can be confidently assigned to this species on the basis of its distinctive skeletal framework. The species has thus been recognised as a probable component of the fossil fauna of the Tutuiri Greensand deposits of Chatham Island (Kelly & Buckeridge 2005).

Key diagnostic characters:

- Body is a semi-involute ear-shaped plate attached to hard substratum by the narrow end
- Primary dictyonal framework consists of bundles of longitudinal strands of indefinite length
- A schizorhysial channel system pervades the 3–7 mm thick body wall
- Synapticula are significant components of the skeletal framework
- Spiculation consists mainly of pentactine megascleres and stellate discohexasters

LYCHNISCOSIDA Schrammen

Lychniscosa Schrammen, 1903: 7; 1912: 264; Ijima 1927: 299; Reid 1958: xliv.
Lychniscosida Reiswig 2002f: 1377.

Hexasterophora in which a rigid dictyonal framework is formed of fused lychniscid dictyonal hexactins.

AULOCYSTIDAE Sollas

Aulocystidae Sollas, 1887: 423; Schulze 1904: 180; Ijima 1927: 301; Reiswig 2002g: 1378.
Maeandrospongidae (in part): Schulze, 1886: 84.

Recent Lychniscosida with dictyonal framework composed of unchannelised pillars, plates or tubules, the components of which (pillars, tubule walls) are several lantern-shaped lychniscs in thickness; primary meshes are square or rectangular with tendency for arrangement of nodes in ranks parallel to growth margin.

Neoaulocystis Zhuravleva

Cystispongia (in part) Roemer, 1864: 7.
Iphiteon (in part) Bowerbank, 1869a: 76.
Myliusia Bowerbank 1869b: 335 (not Gray, 1859: 439); Schmidt 1880: 51.
[*Aulocystis*] Schulze, 1885: 451 (nomen nudum).
Aulocystis Schulze, 1886: 87; 1887: 356; Ijima 1927: 302.
Neoaulocystis Zhuravleva in Rezvoy *et al*. 1962: 44; Reiswig 2002g: 1380.

Aulocystidae constructed of thin-wall branching and anastomosing tubules 2–15 mm diameter, circumscribing a system of similar-size intercanals; primary dictyonalia arrayed in ranks parallel to growing tube margins; with graphiocomes and lophohexasters and/or only spherical discohexasters with normally serrated discs bearing 5–25 short marginal teeth.

Remarks: The genus *Neoaulocystis* contains three species occurring only in relatively low latitudes, *N. grayi* (Bowerbank, 1869), distributed in the Caribbean, *N. polae* (Ijima, 1927) in the Red Sea, and *N. zitteli* (Marshall & Meyer, 1875) spread across the central Indo-Pacific.

Type species: *Myliusia grayi* Bowerbank, 1869b

***Neoaulocystis cristata* n. sp.** (Figs 72, 73)

Material examined:

Type material: **Holotype** NIWA 32124, Kermadec Ridge, W of the Kingdom of Tonga, 21.143° S, 175.743° W, RV *Sonne* Stn SO 192–2/62, 259 m, 12 May 2007.

Type locality: Pule ʻanga Fakatu ʻi ʻo Tonga (Kingdom of Tonga).

Distribution: Known only from the Kermadec Ridge, west of Pule ʻanga Fakatu ʻi ʻo Tonga (Kingdom of Tonga) (Fig. 72A).

Habitat: Attached to hard substratum; depth range 259 m.

Description:

Morphology is a flattened ovoid composed of sheets of thin, foliose, crested, meandering walls (Fig. 72B), alternately interpreted as branching and anastomosing tubes; a central tube can be distinguished as the original atrial element but its walls extend laterally in many directions and fuse with other extensions, creating intercanal valleys and obscuring the original atrial funnel.

Dimensions are 42.6 x 43.8 x 25.0 mm. Canal and intercanal diameters are 2.2–3.5–5.1 mm; wall thickness is 0.4–0.9–1.7 mm.

Texture is slightly flexible and brittle.

Surface is composed of the growing edge of the continuous wall. Remnants of a very delicate, transparent cover layer persist over the outer openings of only a few marginal intercanals (Fig. 72C), with small circular holes near the centres. No projecting prostalia are present.

Colour yellowish grey.

Choanosomal skeleton consists of the rigid dictyonal framework of the walls of the tube elements. The framework is composed of 2–3 layers of fused lychniscid dictyonalia, forming lantern-shaped nodes, in fairly regular longitudinal and lateral series (Fig.

72D–H). The layers are also in register or in ranks, with lychnisc centres directly aligned radially (Fig. 72E, G). In some areas, the buttresses of the lychniscs are clearly fasciculate, with numerous synapticular bridges forming a perforate structure (Fig. 72E) while in most of the framework, the buttresses are sharp and compact, without holes (Fig. 72G). In peripheral areas, many of the lychniscs are irregular and often consist only of compact synapticular lattices. The buttresses are moderate in size, leaving a decidedly circular opening in the centre of each mesh (Fig. 72E–G). Buttresses, connecting beams, and free spurs are ornamented with large knobs, either occurring singly or in small joined groups of 2–3 forming short transverse ridges (Fig. 72H). The beams inside the lychnisc nodes are smooth. There is no channelisation of the walls. Free spicules in the choanosomal region include oxyhexactin megascleres and microscleres.

Ectosomal skeleton consists of a continuous cover of pentactin megascleres and microscleres on both dermal and atrial surfaces of the dictyonal framework.

Megascleres (Table 36) exceedingly thin, consisting of surface-related pentactins, choanosomal oxyhexactins, and a few oxystauractins. The pentactins (Figs 72I, 73A, B) are abundant in the surface tissues of both inhalant (dermal) and exhalant (atrial) sides of the tube walls. Their rays are mainly smooth and cylindrical, bearing small spines only near the tips where they abruptly taper to a sharp point. The proximal rays vary widely in length, some to over 1.5 mm; longer ones may occur but extensive breakage of these delicate spicules prevented their verification. The choanosomal oxyhexactins (Figs 72J, 73C) are smaller and most are otherwise similar to the pentactins; some are entirely ornamented with abundant small conical spines. A few have one or two short extra rays emanating from the spicule centre. Stauractins are present in small numbers, but they are not sufficiently abundant to include in the table. Diactins may be present but intact spicules cannot be positively distinguished from the broken long proximal rays of pentactins.

Microscleres (Table 36) consist mostly of intact discohexasters, broken onychohexasters of two forms, stylohexasters, and broken graphiocomes. The discohexasters, occasionally in hemidiscohexaster form (Figs 72K, 73D), are relatively robust, with short smooth

Table 36. Spicule and framework dimensions (µm) of *Neoaulocystis cristata* n. sp.

Parameter	**Holotype NIWA 32124**			
	mean	**s. d.**	**range**	**no.**
Pentactin tangential ray length	251	55	112–372	50
tangential ray width	3.1	0.9	1.5–4.8	50
proximal ray length	662	497	90–1503	50
proximal ray width	3.1	0.7	1.7–4.9	50
Hexactin ray length	111	22	59–173	50
ray width	2.1	0.5	1.2–3.2	50
Discohexaster diameter	67.5	8.5	50.7–83.5	50
primary ray length	8.4	1.9	5.5–14.0	50
secondary ray length	25.4	3.7	17.7–31.1	50
Onychohexaster diameter	56	12	31–86	50
primary ray length	6.3	2.0	2.3–14.3	50
secondary ray length	21.3	5.0	10.8–34.4	50
Onychohexactin diameter	63	23	45–115	8
Stylohexaster diameter	27.7	2.0	25.0–29.6	7
primary ray length	5.9	1.0	3.8–6.9	7
secondary ray length	7.9	2.1	5.2–10.7	7
Graphiocome centrum diameter	13.2	2.2	10.5–15.9	4
raphide length	56.8	7.1	44.3–71.8	50
raphide width	0.54	0.08	0.30–0.68	22
Framework longitudinal beam length	238	35	135–297	61
lateral beam length	207	57	50–352	57
beam width (*between lanterns*)	21.8	5.6	11.6–40.6	65
lantern diameter, *oblique*	110	21	64–153	67
spur length (*dermal and atrial*)	213	42	149–268	24

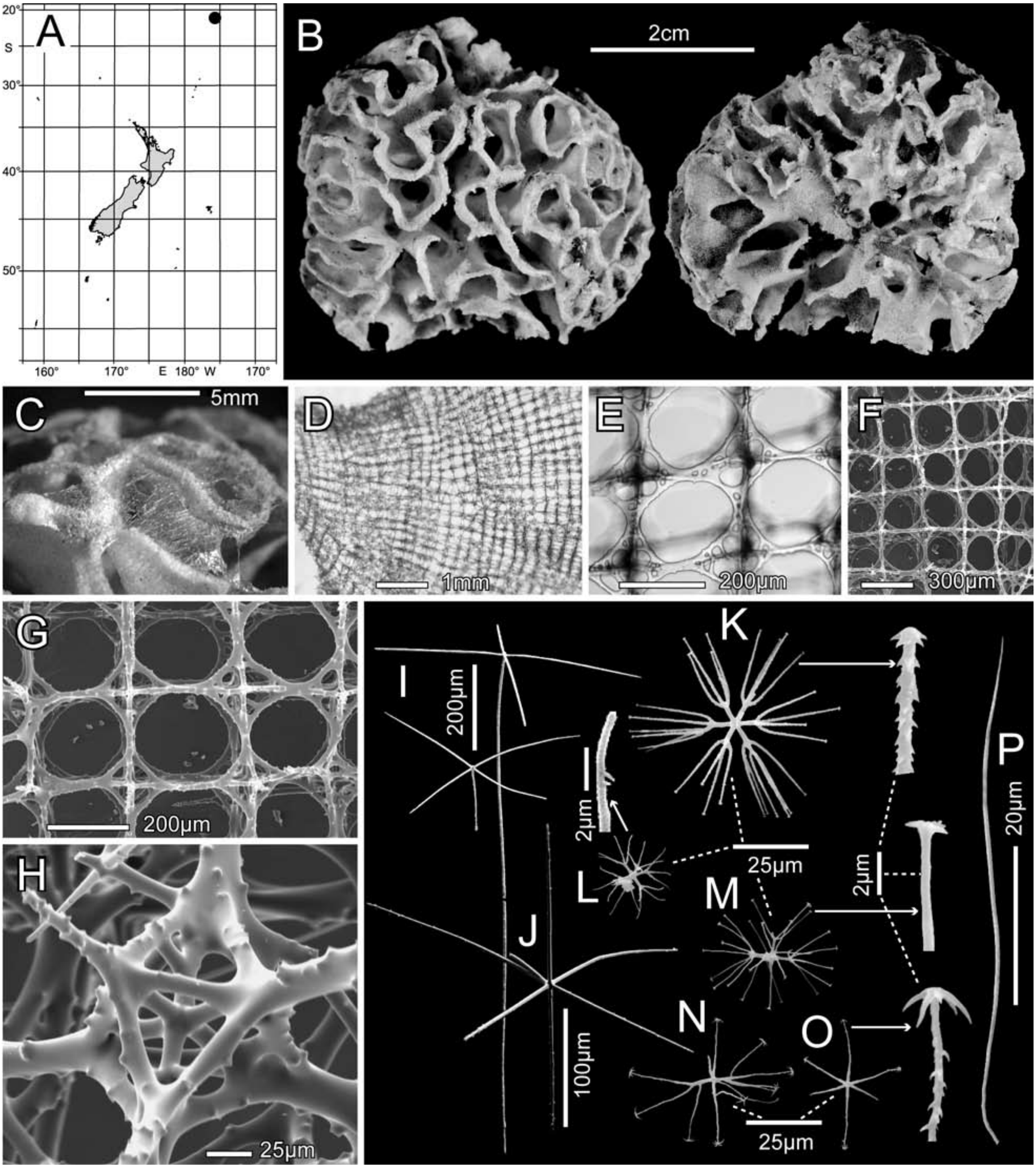

Figure 72. *Neoaulocystis cristata* n. sp., holotype NIWA 32124. A, distribution in Tongan waters. B, top (left) and bottom (right) of the holotype, NIWA 32124. C, transparent cover layer over a few intercanals. D, lateral view of wall structure, growth direction to right. E, fenestrate structure of marginal lantern-shaped lychniscs (LM). F, regular lychnisc arrangement in deeper parts of wall. G, closer view of wall showing lychniscs of two layers aligned. H, oblique view of surface lychnisc node showing ornamentation of beams and buttresses and thinner unornamented beams within the node. I, surface pentactins. J, choanosomal oxyhexactin with short extra ray. K, discohexaster and magnified terminal ray end. L, stylohexaster and magnified terminal ray end. M, onychohexaster with magnified smooth terminal ray end. N, clawed onychohexaster, broken. O, clawed onychohexactin with magnified thorned ray end. P, raphidial terminal ray of graphiocome.

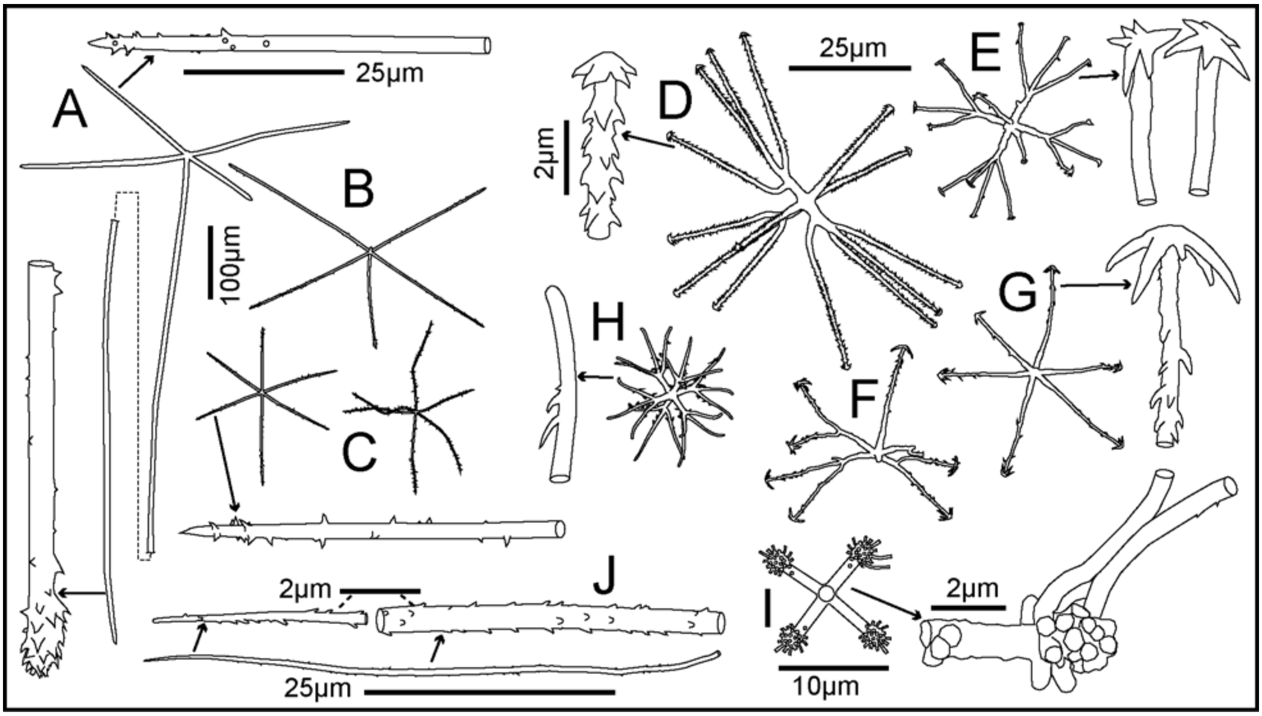

Figure 73. Spicules from *Neoaulocystis cristata* n. sp., holotype NIWA 32124. A, surface pentactin with long proximal ray and enlargements of tangential and proximal ray ends (all whole megascleres to same scale; all megasclere ray ends to same scale). B, surface pentactin with short proximal ray. C, two choanosomal oxyhexactins with enlargement of ray end. D, hemidiscohexaster, common irregular form, with enlargement of terminal ray end (all whole microscleres to same scale; all microsclere terminal ray ends to same scale). E, hemionychohexaster with enlargement of two ray ends. F, broken clawed hemionychohexaster. G, clawed onychohexactin with enlargement of terminal ray end. H, stylohexaster with enlargement of terminal ray end. I, graphiocome centrum with enlargement of one primary ray with basal parts and facets of terminal rays. J, raphidial terminal ray of graphiocome with enlargements of distal end and central segment.

primary rays each bearing 1–7 long straight, profusely-spined, secondary rays terminating in discs with 4–7 marginal spines. Terminal rays often originate at irregular positions on the primary ray rather than from a single branching point. The mean ratio of primary to secondary ray lengths is 0.340. Onychohexasters and their hemihexaster and hexactin forms are almost always broken in spicule preparations. They have either short smooth terminal rays with 3–10 short perpendicular claws (Figs 72M, 73E) or long retro-spined terminal rays with 4–7 long reclined terminal claws (Figs 72N, O, 73F, G). Because spines and terminal claw detail cannot be clearly distinguished in LM, measurements for both forms are combined in Table 36. Stylohexasters (Figs 72L, 73H) are small, rare, but intact microscleres. Their primary rays, mostly smooth but occasionally bearing 1–2 reclined thorns, each carry 3–5 outwardly curved thorned terminals, which end in simple rounded tips. Graphiocome centra (Fig. 72I) are very rare, small, simple, hexactin structures with slightly swollen ends bearing c. 20 facets on which terminal rays connect; several small round-ended protrusions appear to be incipient, but uncompleted, terminal ray bases. They are extremely fragile and prone to breakage; only one fragment was found in SEM preparations. The terminal rays (Figs 72P, 73J) are extremely abundant in all preparations; they are slightly sinuous in shape and sparsely covered with small reclined spines. While some of them were found connected to typical graphiocome hexactine centra in both LM and SEM preparations, many were seen connected to irregular siliceous structures (not shown here), suggesting graphiocome form is not predominantly regularly hexactine in this specimen. Many microsclere types reported here were encountered as broken forms, possibly due to the dry condition of the specimen. Better comprehension of the full complement of microsclere forms may be gained when a wet specimen is obtained and analysed.

Etymology: The species name *cristata* reflects the general tufted or crested nature of the sponge surface, and refers specifically to the covering on the open tubule ends.

Remarks: The new species from Pule ʻanga Fakatu ʻi ʻo Tonga, the Kingdom of Tonga, is closely related to its nearby congener, *Neoaulocystis zitteli*, distributed throughout the central Indo-Pacific region, from NW Australia to the Philippine Islands, to Great Kei Island as its eastern known limit. While the Tongan species is indistinguishable in details of its body form, tubule diameter, and framework measurements from the subspecies *N. zitteli sibogae* (Ijima, 1927). as described by Ijima (1927), it differs from both forms of *N. zitteli* in lacking the distinctive lophodiscohexaster common to all descriptions of that species.

The typical subspecies, *N. z. zitteli* (Marshall & Meyer, 1877), also has two discohexaster forms. The stellate lophodiscohexaster has long primary rays, straight secondary rays, a diameter of 100–153 µm, and a shape reflected in the ratio of primary to secondary ray lengths as 0.93–1.00 determined from data and figures in Schulze (1887, 1901), Ijima (1927), and Tabachnick *et al*. (2008). The second discohexaster is typically spherical with a diameter of 50–106 µm, and primary to secondary length ratio of 0.10–0.15. The subspecies *N. z. sibogae* has the same two discohexaster forms, the lophodiscohexaster with out-curved terminals, a diameter of only 35–57 µm, and primary to secondary length ratio of 0.05–1.00, while the spherical form is 54–70 µm in diameter, and has a similar shape to that of the type subspecies.

The Tongan species has neither of these distinct discohexaster forms, but a stellate calycocome-like form 51–84 µm in diameter with a mean primary to secondary length ratio of 0.34. Accepting the fact that SEM technology was unavailable to describers of *N. zitteli*, it is considered extremely unlikely that onychohexaster spicules prevalent in the new Tongan species would have been mistaken by those workers for discohexasters.

In summary, *N. cristata* differs from *N. zitteli* in lack of lophodiscohexasters and lack of typical spherical discohexasters, but has instead an intermediate stellate discohexaster and a variety of onychohexasters unknown in the latter species. Since the two existing subspecies of *N. zitteli* differ mainly in size ranges of their microscleres, and the Tongan species differs from those in the types of its microscleres, and its geographic collection site is 5900 km from the nearest *N. zitteli* record, it seems inappropriate to consider the Tongan specimen simply an additional subspecies of *N. zitteli*. It is here considered the first and only known member of a new species, *N. cristata*.

KEY DIAGNOSTIC CHARACTERS:

- Body is composed of a foliose system of ridges, crests, and gutters or branched tubes of 2.2–5.1 mm diameter
- Thin walls are constructed of 2–3 layers of lychniscid dictyonalia aligned in all three directions
- Megascleres are predominately extremely thin pentactins with proximal rays of highly variable length
- Microscleres are stellate discohexasters, a variety of onychohexasters, and graphiocomes

DISCUSSION

After preliminary surveys had been made of the NZOI and NMNZ collections at the beginning of this project, it was estimated that perhaps 40 species of hexactinellid sponges would be the final tally for the New Zealand region. After detailed analysis of the specimens here, we have documented 29 named species and subspecies of dictyonal hexactinellids alone. We estimate that an additional 10 species or subspecies of dictyonal hexactinellids will eventually be found, based upon the washed-out and otherwise damaged specimens not assignable to any of the known taxa. Now, with better knowledge of the yet to be documented groups of Amphidiscophora and Lyssacinosida, we estimate that slightly over 100 species of Hexactinellida will be found in the New Zealand area, making it one of the highest, if not the highest, area of hexactinellid diversity in the world.

The proportion of new species found in the present survey is quite astonishing. Of the 29 determinable species-level taxa, 20 (or 69%) are new to science and only 9 (or 31%) have previously been known either within or outside the New Zealand area. These results are clearly attributable to the long lack of availability of taxonomic expertise on Hexactinellida in New Zealand. The fact that 22 of the 29 species-level taxa (76%) are presently considered endemic to this area may also be evidence that the lack of expertise availability extends beyond New Zealand. Many of the species-level taxa now considered endemic to New Zealand may well extend into eastern Australian and Indonesian areas, but with the low level of taxonomic work on dictyonal Hexactinellida in adjacent regions, it may be many years before the present pattern of endemism can be either refuted or confirmed. Newly described species are almost always endemic to the type locality, for a while.

The biogeographic affinities of the New Zealand dictyonal hexactinellid fauna are very clear. At the species level, only seven species are shared with other regions. All seven are shared with the Indo-West-Pacific region as defined in Tabachnick's (1994) bathyal faunal regions; three of seven are shared with the North Pacific region (specifically, Japan), and two are shared with what could be more reasonably defined as an expanded Australian region (north and south). None of the dictyonal species within the New Zealand region are shared with the Kerguelen or South American regions, the strongest similarity linkages found in Tabachnick's analysis of all known Hexactinellida at the genus level. When comparing shared genera between regions, the greatest affinity of the New Zealand region is again with the Indo-West-Pacific region. Of the 15 genera shared by New Zealand and at least one other faunal region, 10 are shared with the Indo-West-Pacific, five with Japan, and four each with the greater Australian and Kerguelen regions. No genera are shared between the New Zealand and South American regions.

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A large number of specimens were also collected on the NORFANZ voyage, TAN0306, a survey of the mid-Tasman Sea on RV *Tangaroa* during May and June 2003, funded by Australia's National Oceans Office (NOO), CSIRO Marine and Atmospheric Research (CMAR), NIWA, and New Zealand's Ministry of Fisheries (MFish) (Project ZBD2002–16). We are grateful to the Queensland Museum, particularly to Dr John N. A. Hooper, for the collection, accession, and provision of specimens for identification and inclusion in this Memoir. We also thank Dorte Janussen, Senckenberg Museum, for her interim care of the Queensland Museum collections.

Several specimens representing new species were collected from within Australian EEZ waters around Macquarie Island on the TAN0803 voyage of RV *Tangaroa*. These specimens have been donated to the Queensland Museum and accessioned into their biodiversity collection, and we thank Dr John Hooper for facilitating this. The MacRidge 2 voyage (TAN0803) represented a collaboration between New Zealand and Australian scientists from NIWA and GNS Science in New Zealand, and CSIRO Division of Marine and Atmospheric Research, the Antarctic Climate and Ecosystems Cooperative Research Centre, and the Research School of Earth Sciences, Australian National University in Australia.

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