ISSN 0083-7903, 66 (Print)
ISSN 2538-1016; 66 (Online)

The Marine Fauna of New Zealand: Isididae (Octocorallia : Gorgonacea) from New Zealand and the Antarctic

by

RALPH GRANT

New Zealand Oceanographic Institute Memoir 66

1976

NEW ZEALAND

DEPARTMENT OF SCIENTIFIC AND

INDUSTRIAL RESEARCH

The Marine Fauna of New Zealand: Isididae (Octocorallia : Gorgonacea) from New Zealand and the Antarctic

RALPH GRANT

Geology Department, University of Auckland

New Zealand Oceanographic Institute Memoir No. 66

1976

Edited by Q. W. Ruscoe, Science Information Division, DSIR,

and Mrs R. J. Wanoa, N.Z. Oceanographic Institute, DSIR

Citation according to
World List of Scientific Periodicals, 4th edn.:
Mem. N.Z. oceanogr. Inst. 66
ISSN 0083-7903

Received for publication October 1973

A. R. SHEARER, GOVERNMENT PRINTER, WELLINGTON, NEW ZEALAND—1976

CONTENTS

FIGURES

The Marine Fauna of New Zealand: Isididae (Octocorallia : Gorgonacea) from New Zealand and the Antarctic

by

RALPH GRANT*
Geology Department, University of Auckland

New Zealand Oceanographic Institute Memoir No. 66, 1976, 56 pp.

ISSN 0083-7903

ABSTRACT

A systematic study of the Isididae held in the collections of the New Zealand Oceanographic Institute is presented. After brief introductory remarks on morphology, 19 species belonging to 10 genera are described. These include three new monotypic genera, *Circinisis, Minuisis,* and *Chathamisis;* five new species of *Keratoisis;* one new species of *Lepidisis;* and one new species of *Peltastisis. Circinisis* is placed in a new subfamily Circinisidinae, and *Minuisis, Chathamisis,* and *Peltastisis* in a new subfamily Peltastisidinae. Already-described species are *Acanella sibogae, A. japonica, A. eburnea, Mopsea elongata, Primnoisis antarctica, P. ambigua, P. formosa, Echinisis spicata,* and *Keratoisis flexibilis.* Other genera of Gorgonacea belonging to the suborder Holaxonia identified in the collections are listed in an appendix.

* Current address: c/- Corpus Christi College, Cambridge, England.

INTRODUCTION

Although fossil Isididae have been investigated by various authors, particularly Squires (1958), the Recent Isididae of the New Zealand region have not been dealt with previously. In fact, the Octocorallia generally have been paid very little attention, the Scleractinia being the only coral group to have received comprehensive study (Squires and Keyes 1967).

The study of Recent Isididae by the present author is based on material held in the collections of the New Zealand Oceanographic Institute of the Department of Scientific and Industrial Research.

Genera of the families Primnoidae, Acanthogorgiidae, Chrysogorgiidae, and Ainigmaptilidae of the suborder Holaxonia were also identified in the collections (*Appendix 1*).

ACKNOWLEDGMENTS

The co-operation of the Director of the New Zealand Oceanographic Institute, Mr J. W. Brodie, in making the Institute's isidid collections available for study, is gratefully acknowledged. Additional material was kindly made available by the National Museum in Wellington, Dr P. M. Ralph of the Zoology Department, Victoria University of Wellington, and Mr B. Richards of Houhora. Thanks also go to Dr J. A. Grant-Mackie, Geology Department, University of Auckland, for assistance during the study and for reading the manuscript; to Mr J. Whalan, Information Service, DSIR, for preparing the photographs; and to Mr W. S. Bertaud and Mrs L. Donaldson of the Physics and Engineering Laboratory, DSIR, for the electronscan micrographs.

STATION DETAILS

All NZOI stations

Stations in the New Zealand region

C632 39°14.0′S, 172°01.0′E, 406 m, inner end of Challenger Plateau. Pebbles, coral, two rocks.
Keratoisis tangentis n.sp.
Keratoisis glaesa n.sp.

C645 39°18.0′S, 172°00.0′E, 442 m, inner end of Challenger Plateau. Shell, coral, small rock chips.
Keratoisis tangentis n.sp.

D90 43°50.0′S, 179°00.0′W, 399 m, Chatham Rise. Fine muddy sand. *Chathamisis bayeri* n.gen et sp.

D224 40°47.0′S, 169°41.0′E, 903 m, Challenger Plateau.
Acanella sibogae Nutting
Acanella eburnea (Pourtalès)

E148 40°30.0′S, 177°45.0′W to 44°30.2′S, 177°45.2′W, 880 m, Chatham Rise. Fine green glauconite ooze.
Primnoisis ambigua Wright & Studer

E246 34°39.0′S, 172°50.0′E, 33 m, south-east of Three Kings Islands. Fine shell sand. *Echinisis spicata* (Hickson)

E323 34°00.0′S, 172°15.0′E, 165 m, east of Three Kings Islands. Bryozoan shell debris, algal/bryozoan accretions, and probably glauconite.
Circinisis circinata n.gen. et sp.

E707 40°10.3′S, 177°18.3′E, 951–834 m, south-east of Cape Kidnappers, on edge of Hikurangi Trench. Soft gritty grey mud. *Keratoisis hikurangiensis* n.sp.

E724 37°23.3′S, 178°00.5′E, 695–631 m, Bay of Plenty. Brownish sloppy mud. *Keratoisis projecta* n.sp.

E736 37°08.2′S, 176°48.0′E, 1 033–1 116 m, Bay of Plenty. Sloppy grey-brown gritty mud.
Keratoisis flexibilis (Pourtalès)

E776 42°43.0′S, 169°15.5′E, 978–1 067 m, west coast, South Island. Grey ooze. *Peltastisis nuttingi* n.sp.

E784 43°23.0′S, 168°05.0′E, 1 221–1 213 m, west coast, South Island. Brownish sloppy mud.
Keratoisis hikurangiensis n.sp.

E800 45°20.5′S, 166°41.5′E, 1 003–913 m, off Fiordland. Pebbles. *Keratoisis zelandica* n.sp.

E841 33°53.0′S, 172°17.0′E, 479–428 m, north-east of Three Kings Islands. Pebbles and small angular boulders.
Minuisis pseudoplanum n.gen. et sp.

E856 32°11.0′S, 168°18.0′E, 1 171–1 159 m, Norfolk Ridge. Rock, solidified bryozoan debris.
Lepidisis solitaria n.sp.

E859 32°01.0′S, 168°03.0′E, 500 m, Norfolk Ridge. Rock.
Minuisis pseudoplanum n.gen. et sp.

E868 33°51.0′S, 167°20.0′E, 751–672 m, Norfolk Ridge.
Minuisis pseudoplanum n.gen. et sp.

E879 35°19.0′S, 172°25.0′E. 768–786 m, west of North Island. Fine sandy mud. *Keratoisis projecta* n.sp.

E880 35°20.0′S, 172°20.0′E, 1 029–1 074 m, west of North Island. Globigerina ooze. *Acanella sibogae* Nutting

E884 35°59.0′S, 173°10.0′E, 701–659 m, west of North Island. Globigerina ooze. *Keratoisis projecta* n.sp.

E890 36°40.0′S, 173°34.0′E, 1 014 m, west of North Island. Soft grey sloppy ooze.
Keratoisis hikurangiensis n.sp.

E892 37°20.0′S, 173°35.0′E, 1 234–1 224 m, west of North Island. Sloppy brown mud.
Keratoisis hikurangiensis n.sp.

E901 38°00.0′S, 173°19.0′E, 1 247–1 250 m, west of North Island. Grey ooze. *Keratoisis hikurangiensis* n.sp.

F873 37°19.5′S, 178°11.0′E, 1 050–1 053 m, Bay of Plenty. Soft grey-brown mud. *Acanella sibogae* Nutting
Acanella eburnea (Pourtalès)

F878 37°28.5′S, 177°31.5′E, 997–942 m, Bay of Plenty. Brown sloppy ooze. *Acanella sibogae* Nutting

F892 36°58.6′S, 176°41.0′E, 1 278–1 144 m, Bay of Plenty. Brown ooze. *Keratoisis hikurangiensis* n.sp.

F897 36°40.5′S, 176°24.0′E, 1 306–1 231 m, Bay of Plenty. Soft grey-brown ooze, pumice, rock.
Acanella japonica Kükenthal
Acanella sibogae Nutting

F913 34°43.5′S, 174°31.5′E, 743 m, north-east of Bay of Islands. Globigerina slop, pumice.
Keratoisis projecta n.sp.

G259a 43°33.0′S, 179°22.0′E, 410 m, Chatham Rise.
Chathamisis bayeri n.gen. et sp.

G279 43°39.0′S, 179°07.0′E, 426 m, Chatham Rise. Phosphorite nodules from 3–7 in.
Chathamisis bayeri n.gen. et sp.

G284a 43°26.0′S, 179°01.0′E, 421 m, Chatham Rise.
Chathamisis bayeri n.gen. et sp.

Stations in the Antarctic region

Ross Sea stations

E171 76°01.0′S, 168°20.0′E, 101 m, off Franklin Island. Medium sandy mud, bryozoa, and small pebbles.
Mopsea elongata Roule

E172 76°02.0′S, 168°21.0′E, 280 m, off Franklin Island.
Mopsea elongata Roule

E175 75°56.0′S, 168°00.0′E, 512 m, off Franklin Island.
Primnoisis antarctica (Studer)

E177 75°59.0′S, 168°11.0′E, 190 m, off Franklin Island.
Mopsea elongata Roule

E186 72°17.1′S, 170°13.0′E, 59 m, Moubray Bay.
Primnoisis antarctica (Studer)

E188 72°10.4′S, 170°48.4′E, 353 m, Moubray Bay.
Primnoisis antarctica (Studer)

E189 72°01.2′S, 170°57.5′E, 307–298 m, Moubray Bay.
Primnoisis antarctica (Studer)

E193c 71°18.0′S, 170°02.0′E, 59 m, off Ridley Beach, Cape Adare. *Echinisis spicata* (Hickson)

Balleny Islands stations

E197a 67°21.8′S, 164°46.0′E, 185 m, north-east of Sturge Island. Rough fractured rocks and fine sandy mud.
Mopsea elongata Roule

E200 67°33.0′S, 165°14.0′E, 646 m, east of Sturge Island.
Echinisis spicata (Hickson)

E209b 66°41.0′S, 162°57.0′E, 190 m, north-west of Buckle Island. *Mopsea elongata* Roule
Primnoisis antarctica (Studer)
Primnoisis formosa Gravier
Echinisis spicata (Hickson)

E212 66°57.0′S, 163°14.0′E, 91 m, south of Buckle Island. Angular rocks and pebbles. *Echinisis spicata* (Hickson)

E215a 66°30.2′S, 162°25.0′E, 209 m, south of Young Island. Sandy mud with angular and rounded pebbles. *Primnoisis formosa* Gravier

E215b 66°31.7′S, 162°28.6′E, 190 m, south of Young Island. *Primnoisis formosa* Gravier

E220b 66°28.2′S, 162°45.5′E, 371 m, east of Row Island. Large boulders. *Primnoisis antarctica* (Studer)
Echinisis spicata (Hickson)

E223 66°57.8′S, 163°13.4′E, 199 m, south of Buckle Island. *Mopsea elongata* Roule

E224 66°31.2′S, 162°27.0′E, 199 m, west of Young Island. *Primnoisis formosa* Gravier

E225 66°31.0′S, 162°26.0′E, 209–218 m, west of Young Island. Pebbles. *Mopsea elongata* Roule

GLOSSARY OF MORPHOLOGICAL TERMS FOR THE ISIDIDAE

anthocodia: upper, tentacular part of the polyp

axis: central supporting structure for the colony, consisting of alternating nodes and internodes

calicles: polyps

coelenteron: the body cavity of the polyp

coenenchyme: the complex, spiculiferous mesogloea uniting the polyps of the colony

condyle: the articulating surface of the internode

cycloid (scale): circular scale, with central nucleus

internode: the calcareous segment of the axis

lamella: a discrete portion of horny material building up the axis

mesentery: a vertical, fleshy partition of the coelenteron

mesogloea: the gelatinous substance between the ectoderm and endoderm

needle: a monaxial spicule pointed at one end, rounded at the other

node: the horny portion of the axis

operculum: the anthocodial spicular apparatus that more or less closes the polyp, and protects the tentacles in contraction

polyp: an individual of the colony

rod: a short monaxial spicule rounded at each end

scale: a thin, flat, platy spicule

sclerite: calcareous skeletal element of the mesogloea, irrespective of form

siphonoglyph: a ciliated tract along one of the sides of the pharynx

spicule: sclerite

spindle: a monaxial spicule pointed at each end

tubercle: rod-like projection formed by fine skeletal elements, which are usually disposed vertically.

GENERAL ACCOUNT OF THE OCTOCORALLIA AND GORGONACEA

The Isididae is a family of the Order Gorgonacea, subclass Octocorallia (Alcyonaria). Octocorals are sedentary, colonial Anthozoa with polyps bearing eight pinnate tentacles, and with the polyp coelenteron subdivided by eight complete, single mesenteries. The pharynx has along one of its sides a ciliated tract, the siphonoglyph, which superimposes a bilateral aspect on to the superficial radial symmetry which is thus radiobilateral. The nature of the skeletal support varies, and more or less characterises the recognised orders.

Gorgonacea are typically aborescent, with a central axis covered by a coenenchyme containing calcareous spicules and bearing the polyps. In the suborder Scleraxonia the axis is formed by an inner zone of calcareous spicules which are more or less solidly bound together by horny or calcareous material. Colonies of the suborder Holaxonia are supported by a central axis made purely of horny material (four families) or of horny material more or less impregnated with calcareous

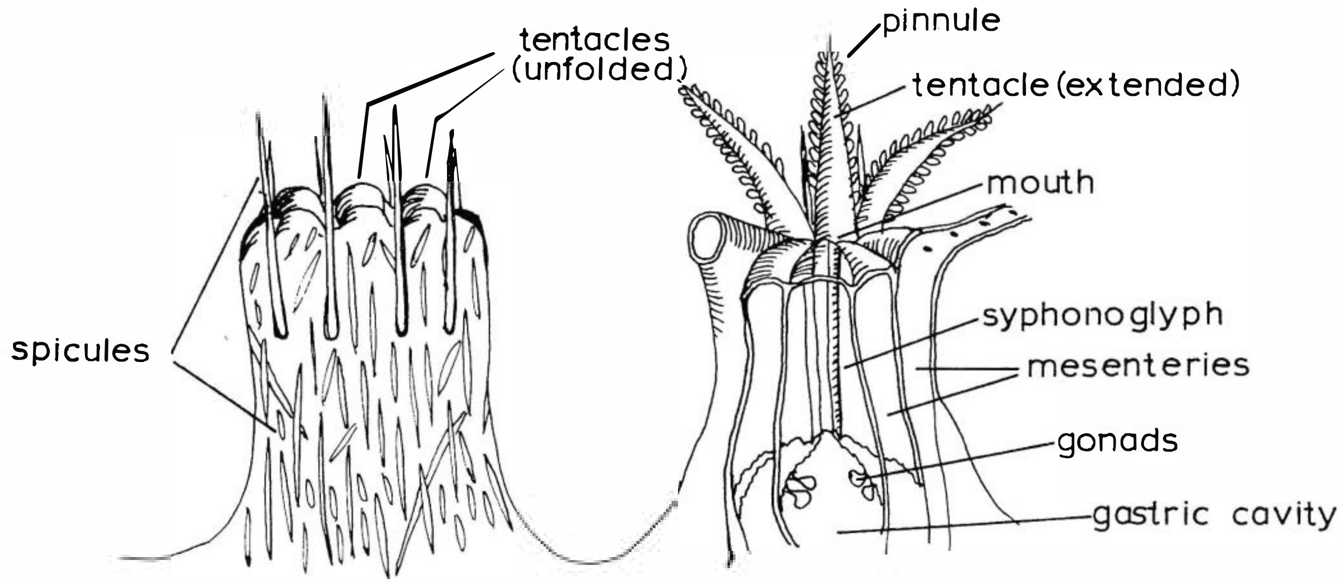


Figure 1 Generalised isidid polyps– whole polyp and longitudinal section (after Bayer 1956, figure 134).

matter (seven families). The axes of this suborder contain no spicules, which are confined to the coenenchyme and polyps (Fig. 1).

In three families of the Gorgonacea, the axis is composed of alternating calcareous portions (internodes) and horny portions (nodes). Two of these, the Melithaeidae and the Parisididae, belong to the Scleraxonia. The other, belonging to the Holaxonia, is the Isididae.

CLASSIFICATION OF THE ISIDIDAE

HISTORY OF THE FAMILY

The genus *Isis* was established by Linnaeus in 1758. It subsequently came to include a diversity of jointed forms, including the species later made type-species of the holaxonians, *Mopsea* Lamouroux, 1816, *Isidella* Gray, 1857, and *Primnoisis* Studer, 1887; and the scleraxonians *Melithaea* Lamouroux, 1812, *Mopsella* Gray, 1857, and *Wrightella* Gray, 1870.

Lamouroux (1812) placed the genera *Isis* and *Melithaea* in a family Isideae, and in 1816 added the genus *Mopsea* (Lamouroux 1816). His definition of the family was: "Colony dendroid, formed of a rind analogous to that of the Gorgoniees*, and of an articulated axis, with articulations alternatively corneous or suberous and calcareous."

In Lamarck's "Histoire Naturelle des Animaux sans Vertèbres" (2nd ed. 1836, revised by Deshayes and Milne Edwards), the genera are classified as follows:

" 'Second class', the Polyps
Order, Polyps with a Polypary
Second Division, Polyparies of two very distinct separate substances
Section, With cortuiferous polyparies
Isis, Melithaea."

The species referred by Lamouroux to *Mopsea* were here included in the genus *Isis*.

Milne Edwards and Haime (1857) recognised a family Gorgonidae, with a subfamily Isidinae, including the genera *Isis, Mopsea,* and *Melithaea*. Gray (1857) recognised a suborder Lithophyta, containing two families: the Isidae included *Isis, Mopsea,* and a new genus, *Isidella;* and the Melitaeadae included *Melithaea* and new genera *Mopsella* and *Solanderia*. Later (Gray 1859) this same classification was used, being included in an Order Rupicolae. Gray distinguished the Isidae and the Melithaeadae, respectively, as follows: "axis calcareous, solid, divided by narrowed horny joints", and "axis spongy, permeated by flexuous tubular canals interrupted by harder, swollen, calcareous joints."

*Family Gorgoniidae

Kölliker (1865) retained a Family Gorgonidae, containing six subfamilies including Isidinae and Melithaeaceae. His descriptions included reference to the basic difference in axial structure between the forms now called holaxonian and scleraxonian. Isidinae: "axis jointed, composed of horny and calcareous portions; of these the latter possessed a lamellose structure, and maintains its form after it has been placed in alkali;" and Melithaeaceae: "axis jointed; the flexible (soft) joints consisting of calcareous spicules surrounded by horny substance and connective tissue, the hard joints of coalesced calcareous spicules." The Isidinae included *Isis*, but unfortunately Kölliker had only one species of *Mopsea*, *M. erythraea*, and this was in fact an erroneously placed scleraxonian, so that he placed *Mopsea* along with *Melithaea* in the Melithaeaceae (see p. 33).

Wright (1869) placed his new genus *Keratoisis* in the subfamily Isidinae along with *Isis*, but separated *Mopsea*, placing it in a subfamily Mopseadinae.

Gray (1870) recognised four families within an unnamed division of his suborder Lithophyta : Mopseadae (*Mopsea*), Acanelladae (*Acanella* Gray, 1870; *Isidella* Gray, 1857), Keratoisidinae (*Keratoisis* Wright, 1869) and Isidae (*Isis*). Studer (1878) recognised the one family Isidae. Verrill (1883) placed the genera *Keratoisis, Acanella, Isidella, Callisis* n.gen., and *Lepidisis* n.gen. in a family Keratoisidae. This left the one genus *Isis* in the family Isidae. Studer (1887) persisted in the recognition of the one family Isidae, dividing it into the subfamilies Ceratoisidinae and Primnoisidinae, based on *Primnoisis* n.gen., and Isidinae.

Wright and Studer (1889) followed Studer (1887) apart from substituting the name Mopseinae for Primnoisidinae. This classification and terminology has been followed to the present day except by Hickson (1907) who regarded division into subfamilies as unnecessary and inconvenient because the characters of the spicules, which Wright and Studer had used in defining the subfamilies, were too variable for taxonomic use at this level. The issue was centred on Hickson's new form *Ceratoisis spicata*, and this is discussed later in the section on *Echinisis* (p. 47). Other subsequent writers have merely altered to varying extents their familial and subfamilial diagnoses. Kükenthal (1915) corrected the family name to Isididae and added the subfamily Muricellisidinae to accommodate a new form *Muricellisis echinata*.

Kükenthal's (1919, 1924) monographs on the Gorgonacea include the last comprehensive studies of the Isididae. Aurivillius (1931), Deichmann (1936), Bayer (1955), and Utinomi (1958) are among the relatively few zoologists who have been concerned with the family since that time. A modern account of the group, based upon contemporary taxonomic concepts and using newer techniques, is lacking, making study of the group more than usually difficult.

TAXONOMIC CHARACTERS

All holaxonian octocorals with jointed axes belong to the Family Isididae. The only taxonomic problem at family level is to distinguish jointed Holaxonia (Isididae) from jointed Scleraxonia (Melithaeidae and Parisididae). This can be done on the basis of (a) the internal structure of the axis — thin sections reveal the spicular or non-spicular nature of the axis—and (b) spiculation. (The former character is especially important for fossil specimens.)

The family can be divided into four subfamilies on the basis firstly of the retractile or non-retractile nature of the polyps, and secondly of the characteristic spicular type.

The usual factors in generic differentiation are mode of branching, and form and spiculation of the polyps. An isidid colony may be unbranched (simple) or branched from the nodes or internodes; it may be branched in one plane, either pinnately or dichotomously, or branched on all sides.

Individual species are recognised from their mode of branching, and the form of the spicules and their arrangement in the polyps and coenenchyme. Many early specific descriptions were illustrated only by the isolated spicules, the assumption being that details of spicule form were the characteristic specific feature. That this is very unsatisfactory becomes obvious when one attempts to use these descriptions; the overall character of the spiculation and the gross form of the polyps is very important.

CLASSIFICATION USED IN THE PRESENT WORK

During the present study, species of seven established genera within two isidid subfamilies have been recognised : *Keratoisis*, *Lepidisis*, and *Acanella* (Keratoisidinae); *Primnoisis*, *Mopsea*, *Peltastisis*, and *Echinisis* (Mopseinae). In addition, three new monotypic genera are described. These genera, however, are not readily placed in any of the recognised subfamilies, and they complicate the issue with respect to assignment of the previously described genera noted above.

Circinisis n.gen. can be distinguished from *Chathamisis* and *Minuisis* in an analogous way to the distinction between *Primnoeides* (Primnoeidinae) and the Primnoinae within the primnoidae, a family whose close relationship with the Isididae, at least in terms of spiculation, has been often noted. *Circinisis* and *Primnoeides* both have irregularly placed cycloid scales with no differentiation between the scales of the polyps and the coenenchyme, and no operculum. The Primnoinae have the more typical primnoid scale arrangement with a clearly differentiated operculum. The spiculation of *Chathamisis* and *Minuisis*, including the possession of an operculum, is closer to this type. On this basis

Chathamisis and *Minuisis* can be assigned to a different subfamily from *Circinisis*.

The major problem is whether they can be assigned to existing subfamilies. In each case the only candidate is the Mopseinae, considering the non-retractile polyps and the scale-like spicules. Specifically then, the question is whether either *Circinisis*, or *Chathamisis* and *Minuisis* can be assigned to the Mopseinae.

Circinisis is clearly distinct with respect to its spiculation, and should on this basis be assigned to a different subfamily.

The most important characteristic of *Chathamisis* and *Minuisis* is the clearly differentiated operculum. The Mopseinae already includes one genus with an operculum, *Peltastisis* Nutting (1910), assigned to the subfamily by its author, this placing having since been accepted, for example, by Kükenthal (1919) and Bayer (1956). As noted above, genera of the Primnoidae with an operculum are separated, on a subfamilial basis, from the one genus without. By analogy, a case could be made for excluding operculate genera such as *Peltastisis*, from the Mopseinae based as it was originally on *Primnoisis* and *Mopsea*, both genera without an operculum.

In *Primnoisis antarctica* and *P. formosa* the most distal of the polyp wall scales are variously expanded, often into a roughly triangular shape, thus covering the base and proximal portion at least of the tentacles. In addition, the external surface of the tentacles is covered with small serrated scales. Species with such an arrangement of spicules have in the past been described as having a "pseudo-operculum". This terminology is reasonable as long as it does not blur the distinction between this spiculation and the possession of a fully differentiated operculum. The difference is here taken to be of subfamilial importance, and *Chathamisis* and *Minuisis*, and *Peltastisis*, are removed from the Mopseinae and placed in the new subfamily Peltastisidinae.

KEYS TO SUBFAMILIES AND GENERA OF THE ISIDIDAE

Subfamilies

1. Polyps retractile 2
   Polyps non-retractile 3
2. Polyp sclerites spindles with many spines .... Muricellisidinae
   Polyp sclerites small rods with tubercles .... Isidinae
3. Polyp sclerites include needles, spindles, or rods .... Keratoisidinae
   Polyp sclerites scales only 4
4. Polyp operculate .... Peltastisidinae
   Polyp non-operculate 5
5. Scales cycloid, irregularly arranged, overlapping, free edge smooth .... Circinisidinae
   Scales transversely arranged, overlapping, free edge dentate .... Mopseinae

Genera

1. Polyps retractile 2
   Polyps non-retractile 4
2. Polyp sclerites spindles with many spines .... *Muricellisis*
   Polyp sclerites small rods with tubercles 3
3. Branching from the internodes, coenenchyme thick .... *Isis*
   Branching from the nodes, coenenchyme thin .... *Chelidonisis*
4. Polyp sclerites include needles, spindles, or rods 5
   Polyp sclerites scales only 8
5. Polyps and coenenchyme with complete external layering of scales .... *Lepidisis*
   Polyps and coenenchyme without complete external layering of scales 6
6. Branching from the internodes, or unbranched .... *Keratoisis*
   Branching from the nodes 7
7. Branching in one plane .... *Isidella*
   Branching in whorls .... *Acanella*
8. Operculum present 9
   No operculum 12
9. Unbranched .... *Peltastisis*
   Branching 10
10. Opercular sclerites tri-radiate 11
    Opercular sclerites triangular .... *Minuisis*
11. Polyp scales oval, transversely placed *Chathamisis*
    Polyp scales irregular, distal ones bearing projecting spine .... *Echinisis*
12. Branching on all sides .... *Primnoisis*
    Branching in one plane .... *Mopsea*

Subfamilial Distribution of Genera

Keratoisidinae
- *Keratoisis*
- *Acanella*
- *Lepidisis*
- *Isidella*

Mopseinae
- *Mopsea*
- *Primnoisis*

Peltastisidinae
- *Peltastisis*
- *Chathamisis*
- *Minuisis*

Circinisidinae
- *Circinisis*

Isidinae
- *Isis*
- *Chelidonisis*

Subfamily uncertain
- *Echinisis*

TAXONOMIC IMPORTANCE OF THE ISIDID AXIS

As has been mentioned, the internal structure of the axis provides an important criterion for distinguishing the suborders Scleraxonia and Holaxonia. Although most taxonomic work on the isidids (and octocorals generally) in the past has been based on gross morphology of the colony or detailed morphology of the polyps and spicules, indications are that the axis itself is of taxonomic importance. Comments about the axis have been confined usually to noting the external ornamentation, and whether the internodes are hollow or solid. Little systematic investigation of the internal microstructure of the axis was done before Bayer (1955, 1956) demonstrated structural variation among various Holaxonia families. He noted that the Isididae are characterised by radial patterns of calcification, and gave brief indications of the variation within the family.

Further investigation during the present study suggested that variations in axial structure can be correlated at least to some extent with subfamilial generic and specific categories as defined by traditional taxonomic criteria. Variations between and within subfamilies of the Isididae are shown in the accompanying photomicrographs of thin sections of the axes (Fig. 2, p 12; Fig. 3 a-d p. 13) and are described below.

KERATOISIDINAE

Figs 2, 3 a-d

In *Keratoisis tangentis*, *K. zelandica*, *K. flexibilis*, and *K. projecta* the axis is made up of variously shaped horny lamellae, all more or less concentrically disposed, and appearing in longitudinal section to extend the length of the internode. In cross section the lamellae of *K. tangentis* are tangential, and alternate to give a zig-zag effect. Those of *K. zelandica* are more truly concentric, and those of *K. projecta* are wider, curving around the circumference of the axis.

The above is one aspect of the axial structure. In cross section, shown clearly in Fig. 2a, there is a fine, even, radial structure apparent. This is the calcareous material, and this pattern of calcification seems to be characteristic of many of the Isididae.

In *Acanella japonica* the calcification is obscured (Figs 3e, 4a), although in other species it is seen to be radial.

MOPSEINAE

Fig. 4 b-d, p. 14

The pattern of calcification for this subfamily is the same as for Keratoisidinae. The concentrically disposed axial substance is much less in evidence, however. Instead there is a marked radial differentiation, with discrete sectors appearing much darker in transverse and longitudinal sections.

Bayer (1955) did not treat the Mopseinae in detail, but claimed that the structure of *Primnoisis* at least, was the same as in the Ellisellidae, which he did treat fully. He described the calcareous fibres of the Ellisellidae as being differentiated into radial sectors, the sclerodermites, each with component fibres of different optical orientation. This seems not to be the case for the Mopseinae, however. When very thin sections of *Primnoisis* are examined, they show an evenly pervading pattern of calcification with uniform extinction. The rays are not sclerodermites in the sense that Bayer otherwise used the term, that is, they are not structurally homologous with the sclerodermites of *Isis*, for example. In fact, these rays are not really definite structures at all, and seem rather to be sectors darkened by inclusions, possibly of horny material.

CIRCINISIDINAE

Fig. 5a b, p. 15

The basic pattern of calcification for this subfamily is the same as for the above two subfamilies. The distinctive feature is the markedly undulating appearance of the concentric lamellae (Fig. 5a and b). This is similar to the structure of the Primnoinae as illustrated by Bayer (1955). Note, however, that the calcareous material in this latter subfamily is not radially deposited, although it is in the Calyptrophorinae, another subfamily of the Primnoidae (*see* Kükenthal 1919: Pl. 53, figures 117, 118). The most interesting comparison would be with the Primnoeidinae but figures of the axis of *Primnoeides* have not been published.

ISIDINAE

The internal structure of *Isis hippuris* has been fully described and illustrated by Bayer. It is characterised by well-formed axial sclerodermites which form a distinct radial structure along the centre of the internode (Bayer 1955: Pl. 6a--d, 8c). The calcification of this genus thus contrasts with those described above.

The internal structures of *Muricellisis*, *Peltastisis*, and *Minuisis* are unknown. The structure of *Chathamisis* is similar to that of *Primnoisis*.

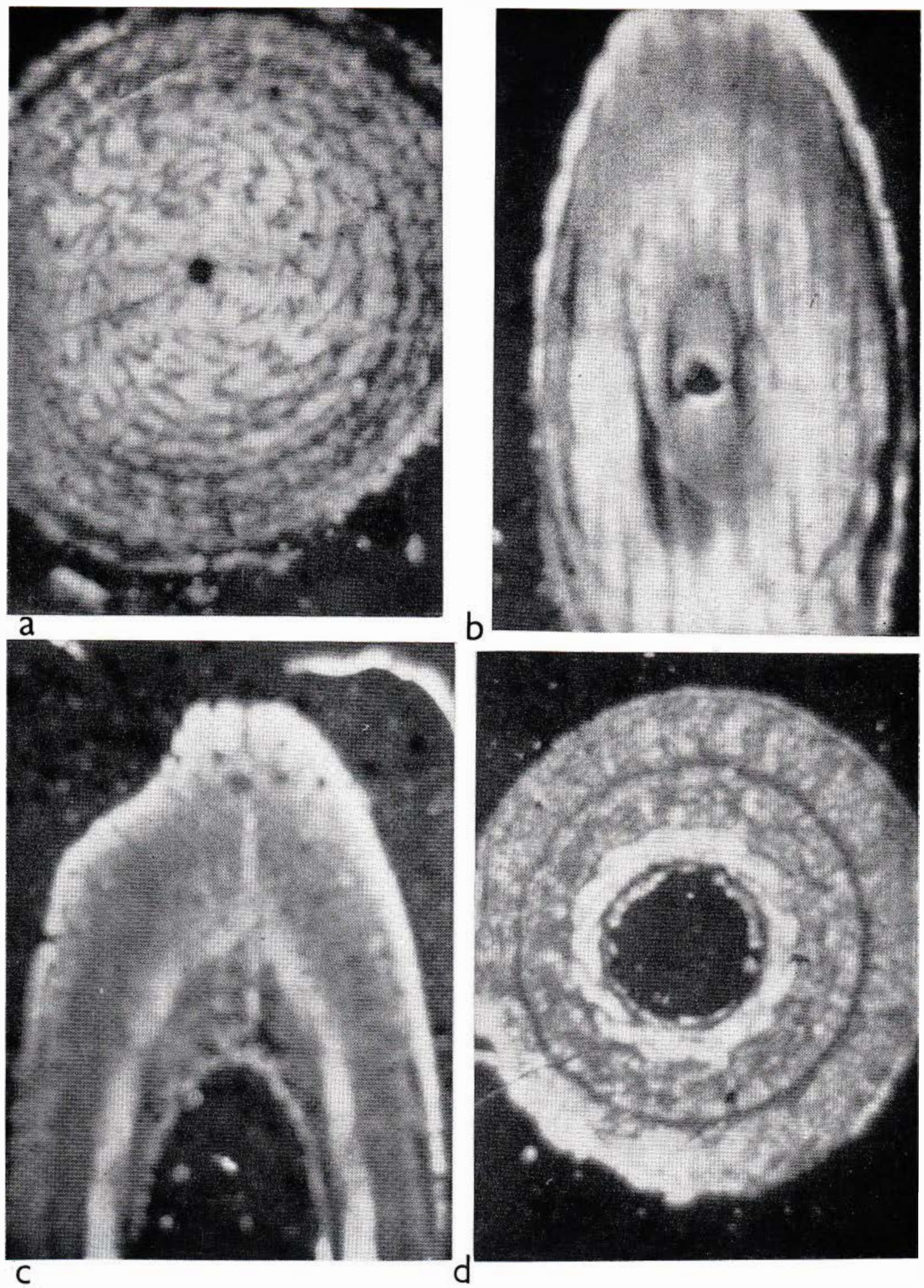


Figure 2 a, *Keratoisis tangentis,* NZOI Stn C632, transverse section of axis; b, oblique section of axis; c, *Keratoisis zelandica,* NZOI Stn E800, oblique section of axis; d, transverse section of axis. (× 45).

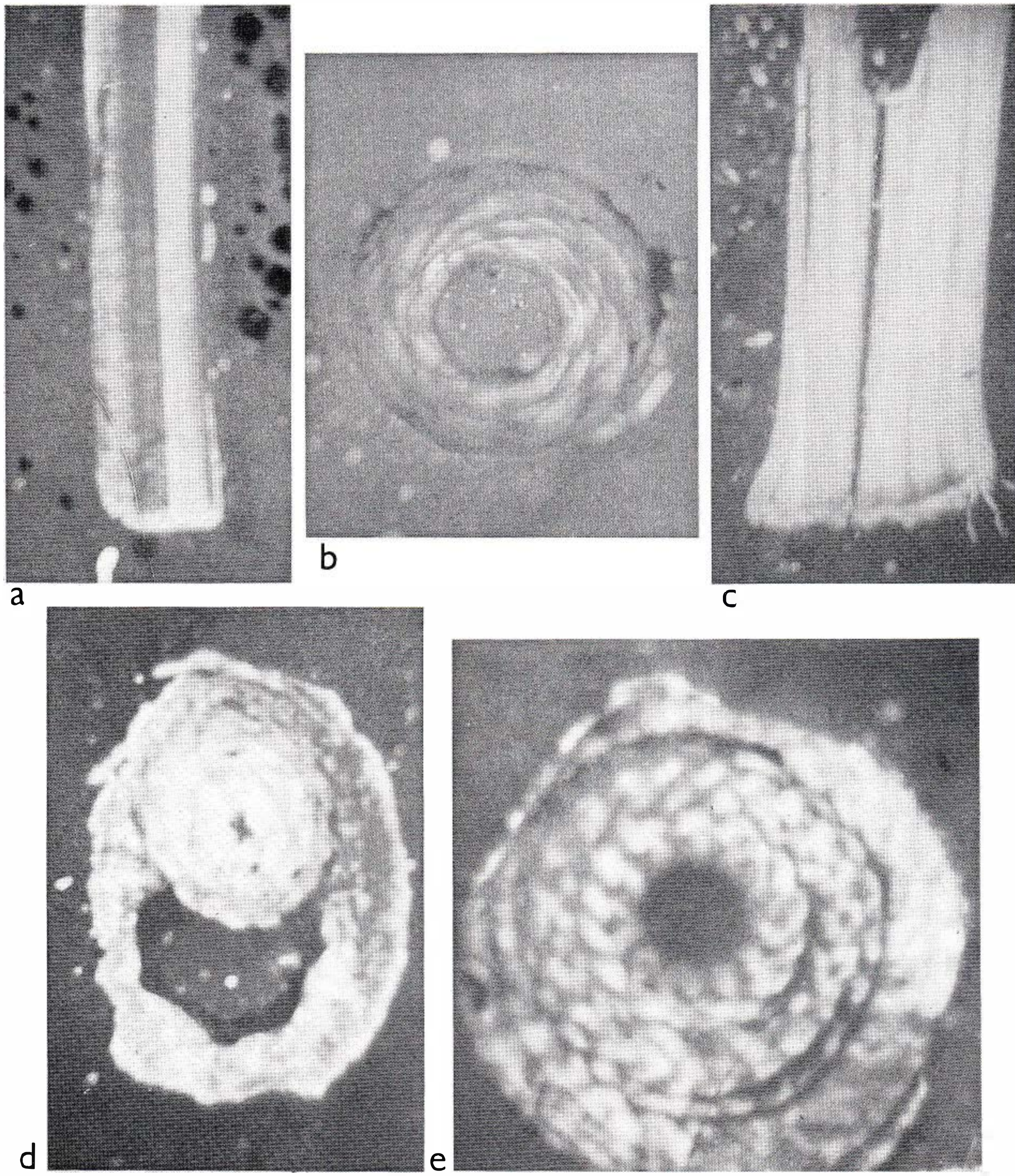


Figure 3 a, *Keratoisis zelandica,* NZOI Stn E800, longitudinal section of axis (× 45); b, *Keratoisis projecta,* NZOI Stn F913, transverse section of axis (× 70); c, longitudinal section of axis (× 45); d, *Keratoisis flexibilis,* NZOI Stn E736, transverse section of axis (×45); e, *Acanella japonica,* NZOI Stn E897, transverse section of axis (×45).

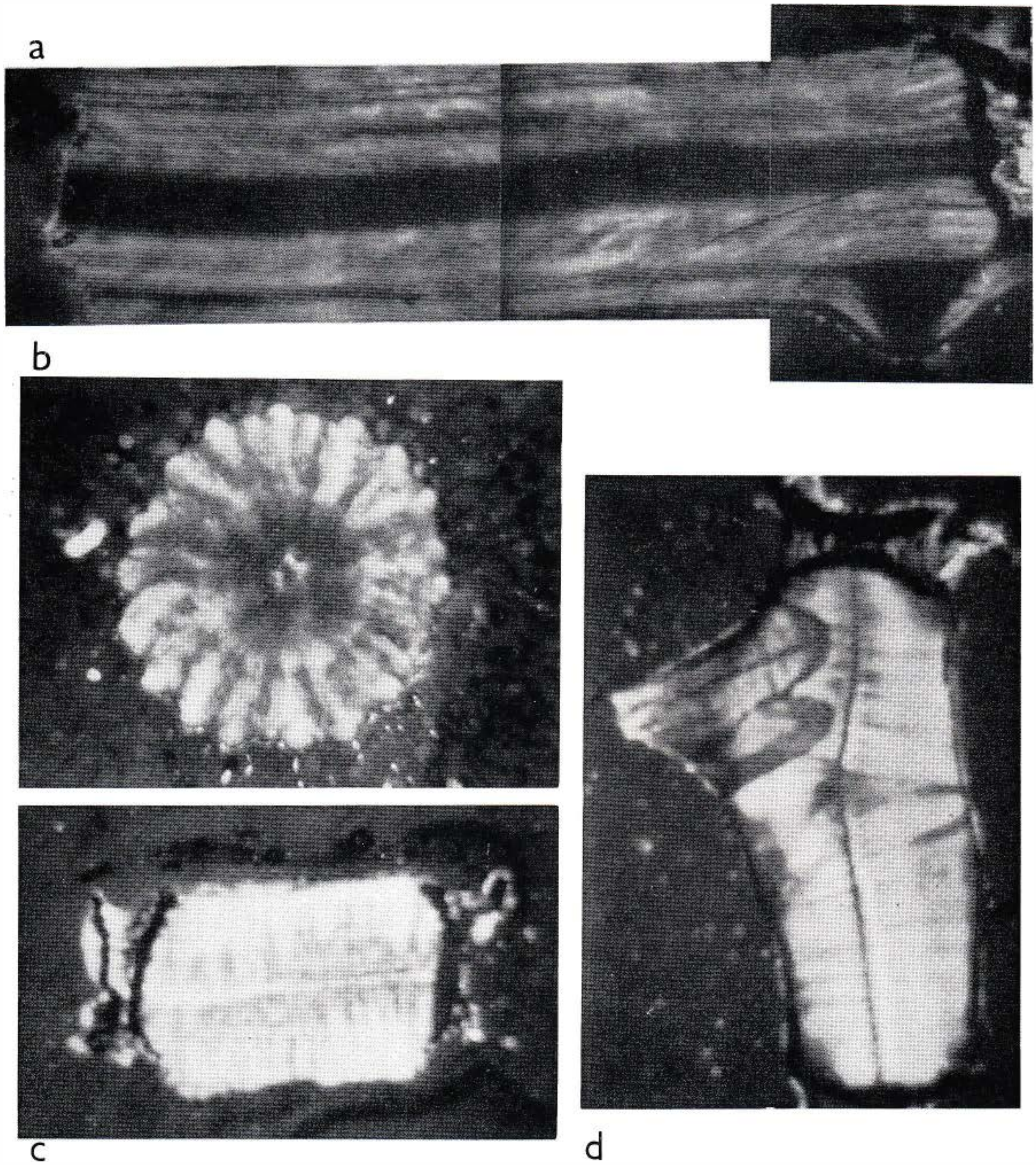


Figure 4 a, *Acanella japonica,* NZOI Stn E897, longitudinal section of axis (× 30); b, *Mopsea elongata,* NZOI Stn E223, transverse section of axis (× 70); c, longitudinal section of axis (× 45); d, *Primnoisis ambigua,* NZOI Stn E148, longitudinal section of axis (× 45).

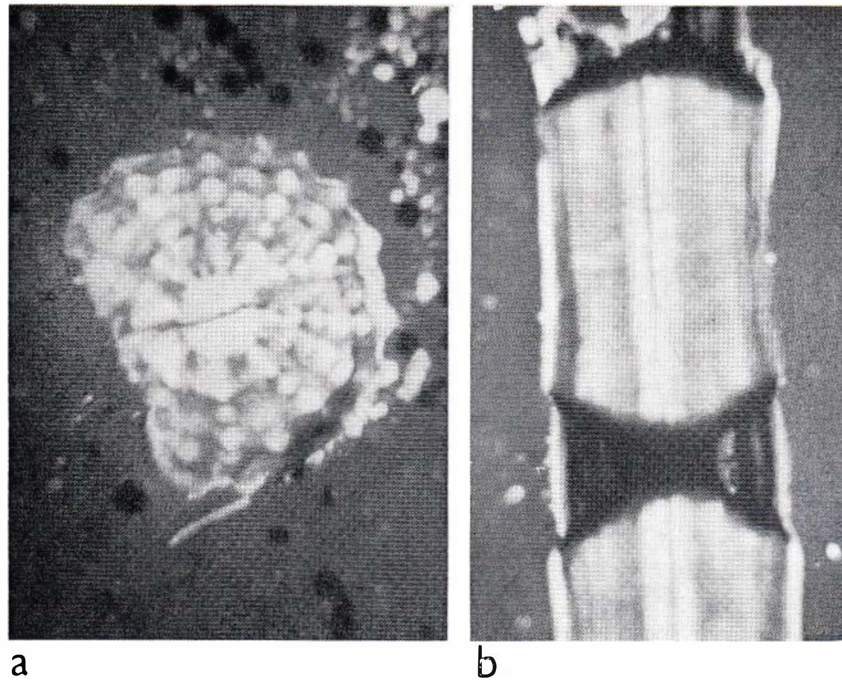


Figure 5 a. *Circinisis circinata*, NZOI Stn E323, transverse section of axis: b, longitudinal section of axis (× 45).

SYSTEMATIC DESCRIPTIONS

FAMILY ISIDIDAE Lamouroux, 1812 [nom. correct. Kükenthal, 1915 (pro Isidae Lamouroux, 1812)]

DEFINITION Holaxonians with axis of alternating purely horny nodes and non-spicular calcareous internodes.

DESCRIPTION The colony may be simple or branched. If branched, the branches may arise from the nodes or internodes, in one plane or on all sides. The polyps may be retractile or non-retractile, the coenenchyme thick or thin. The sclerites of the polyps and coenenchyme are needles, rods, spindles, scales, or stellate forms. The base may be either a roof-like calcareous structure for anchoring the colony in a soft bottom, or a basal disc for attachment to a solid substrate. Calcareous material of the axis radially deposited.

SUBFAMILY KERATOISIDINAE Gray, 1870 [nom. transl. and correct. Bayer, 1955 (ex Keratoisidae Gray, 1870) (=Ceratoisidinae Studer, 1887)]

DEFINITION Isididae with non-retractile polyps, with sclerites in form of spindles, needles, or rods placed along the septa.

DESCRIPTION Colonies unbranched or branching from nodes or internodes; internodes are smooth or longitudinally grooved, hollow or solid, and made up of concentrically or tangentially arranged horny lamellae impregnated with fine radially deposited calcareous material. Coenenchyme is thin, with the polyps non-retractile, both with spindles, needles, or rods; the polyps sometimes with scales in the tentacles.

Genus **Keratoisis** Wright, 1869

1869 *Keratoisis* Wright, *Ann. Mag. nat. Hist. 4(3):* 23.

TYPE-SPECIES *K. grayi* Wright, 1869 (o.d.)

DEFINITION Keratoisidinae which branch from the internodes, or are unbranched and lack a covering of scales over polyps and coenenchyme.

DESCRIPTION Colony branches from the internodes, or is unbranched. Internodes are hollow and smooth or longitudinally grooved. Polyps are often irregularly disposed but sometimes biserial, erect, or inclined to the axis. Polyps possess longitudinally placed rods, needles, or spindles, some projecting; sometimes polyps have scattered scales. Tentacles possess rods or scales; in some species stellate pharyngeal sclerites are present. Coenenchyme is thin, containing spindles, rods, or scales.

HISTORY *Keratoisis* was erected as a monotypic genus by Wright (1869). Studer (1878) added three new species, *K. siemensii, K. japonica,* and *K. grandiflora.* Verrill (1878) in describing *K. ornata* unjustifiably spelled the genus "*Ceratoisis*", and started a usage which continued through subsequent literature until Bayer (1956 : 222) returned to the original spelling.

Wright and Studer (1889) described *K. philippinensis, K. palmae, K. paucispinosa,* and *K. nuda.* Roule (1896) placed *Isis flexibilis* Pourtalès, 1868, a species for which Verrill (1883) had erected a new genus *Callisis,* in *Keratoisis,* and Thomson and Henderson (1906) described *K. gracilis.* Hickson (1907) described *K. spicata* and *K. delicatula,* and recommended synonymising the genus *Primnoisis* with *Keratoisis,* but this was not followed by later workers, and the above two species were subsequently transferred to *Echinisis* and *Primnoisis* (see discussions of these two genera). Nutting (1908) described *K. flabellum* and *K. grandis,* and later (Nutting 1910) named *K. wrighti.* Kükenthal (1915) described *K. chuni, K. squatiosa,* and *K. macrospiculata.* Later (Kükenthal 1919) he described *K. rigida,* placed *Bathygorgia profunda* Wright, 1885, and *Acanella simplex* Verrill, 1883, in the genus, and noted *K. nuda* and *K. grandis* as "incompletely described and uncertain species". Molander (1929) described *K. microspiculata.*

DISCUSSION See Discussion of *Lepidisis* (p. 30).

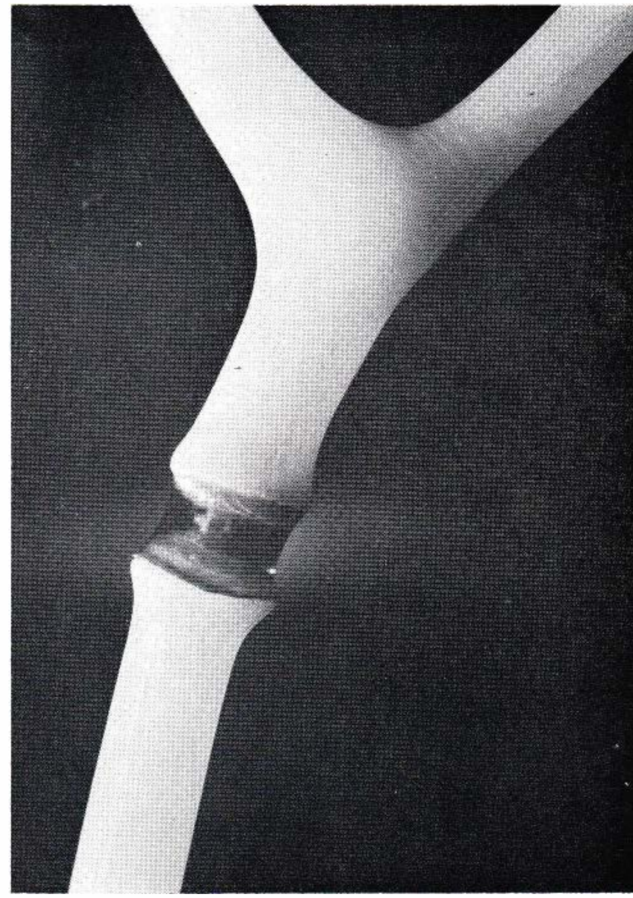


Figure 6 *Keratoisis tangentis,* NZOI Stn C632. Node. For scale, see Fig. 8; this is an enlargement of the lower node of the top left specimen.

Keratoisis tangentis n.sp.

Figs 6–8

DESCRIPTION Species represented by a number of fragments. Branched mainly in one plane, or in two planes at right angles. Internodes long e.g., 28 mm × 3 mm (medially), 32 × 1 mm, 52 × 2 mm, 81 × 1.5 mm; distally slightly dilated; sides with regular, close, longitudinal grooves, some running slightly obliquely; hollow, a typical proportion being diameter of internode 2 mm, width of canal 0.6 mm, canal stopping short of the condyle; condyles raised, pointed, with irregular concentric grooves, and with points of adjacent condyles meeting through nodes (Fig. 6).

Polyps irregularly placed all round the axis, sometimes opposite, sometimes alternating, mostly bent subparallel to the axis. Up to 2 mm long, 1 mm across at base, expanding to 1.5 mm at summit. Along the distal two-thirds of the polyp are eight spinose needles, 1.93 × 0.11 mm, up to 2.37 × 0.15 mm. Each polyp arises from a rounded base, sometimes with the margin indented, which is thicker than the surrounding coenenchyme. The tentacles bear relatively few small rods,

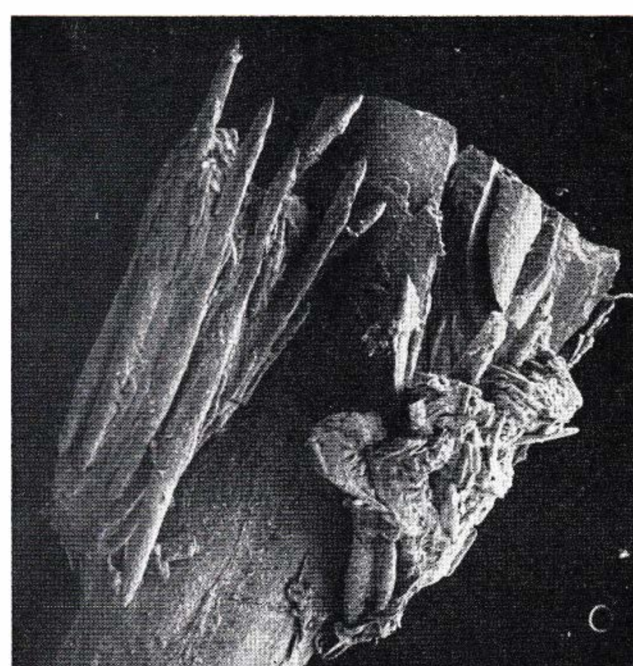


Figure 7 *Keratoisis tangentis,* NZOI Stn C632. Polyps. (×20)

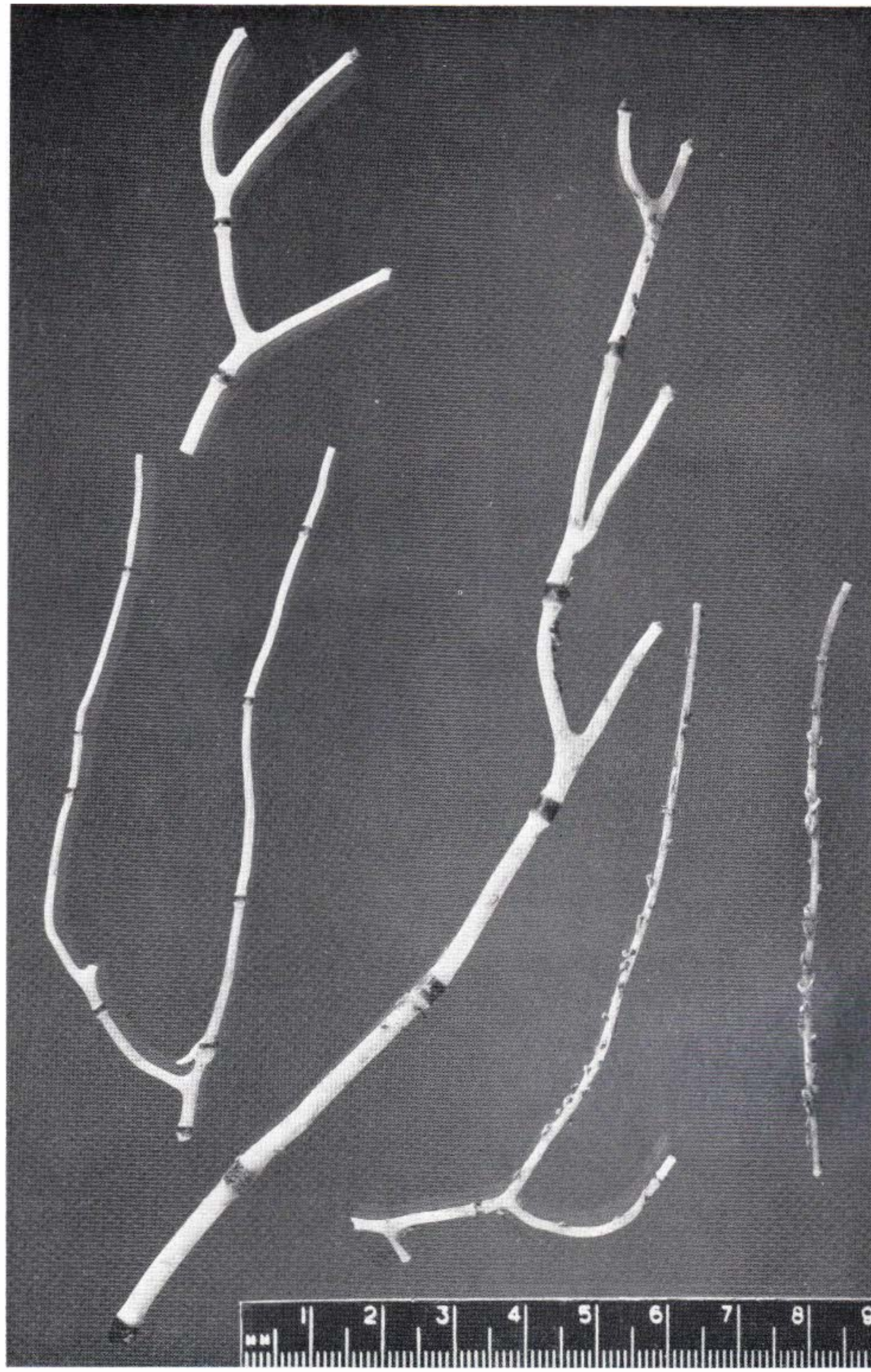


Figure 8 *Keratoisis tangentis,* NZOI Stn C632. Large centre specimen is holotype, others are paratypes.

typical size 0.22 × 0.03 mm. The projecting spicules are aligned along the surface of the polyp wall; within the body wall are a number of small rods, always much smaller than those on the surface.

Coenenchyme very thin distally, and seems non-spicular. Proximally, there are rods scattered on the surface, and others thickly fill the coenenchyme. Some short and thick, 0.12 × 0.06 mm, others longer and narrowed medially, 0.18 × 0.06 mm. The axis is made up of tangential-concentric lamellae (Figs 2a and b), pervaded by radially deposited calcareous material.

MATERIAL EXAMINED NZOI Stn C632, a large number of fragments, including type specimens; C645, 3 decorticated internodes.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute, No. 122, NZOI Stn C632.

PARATYPES Deposited in the New Zealand Oceanographic Institute No. P188, NZOI Stn C632.

TYPE LOCALITY The New Zealand end of Challenger Plateau, 406 m.

DISCUSSION On the basis of internal axis structure, this species has been recognised from the lower Miocene of New Zealand (N.Z. Fossil Record File N2/f 591, grid reference 507526, 200–250 m north of Tokatoka Point, North Cape; S136/f826, grid ref. 479546, north end of All Day Bay, Kakanui; N41/f520 (GS 7616), grid ref. 955620, Maori Bay, about 1 km south of Muriwai Beach).

The specific name is taken from the Latin *tangens, tangentis,* from which is derived the English 'tangent', reference being to the disposition of the horny elements of the axis.

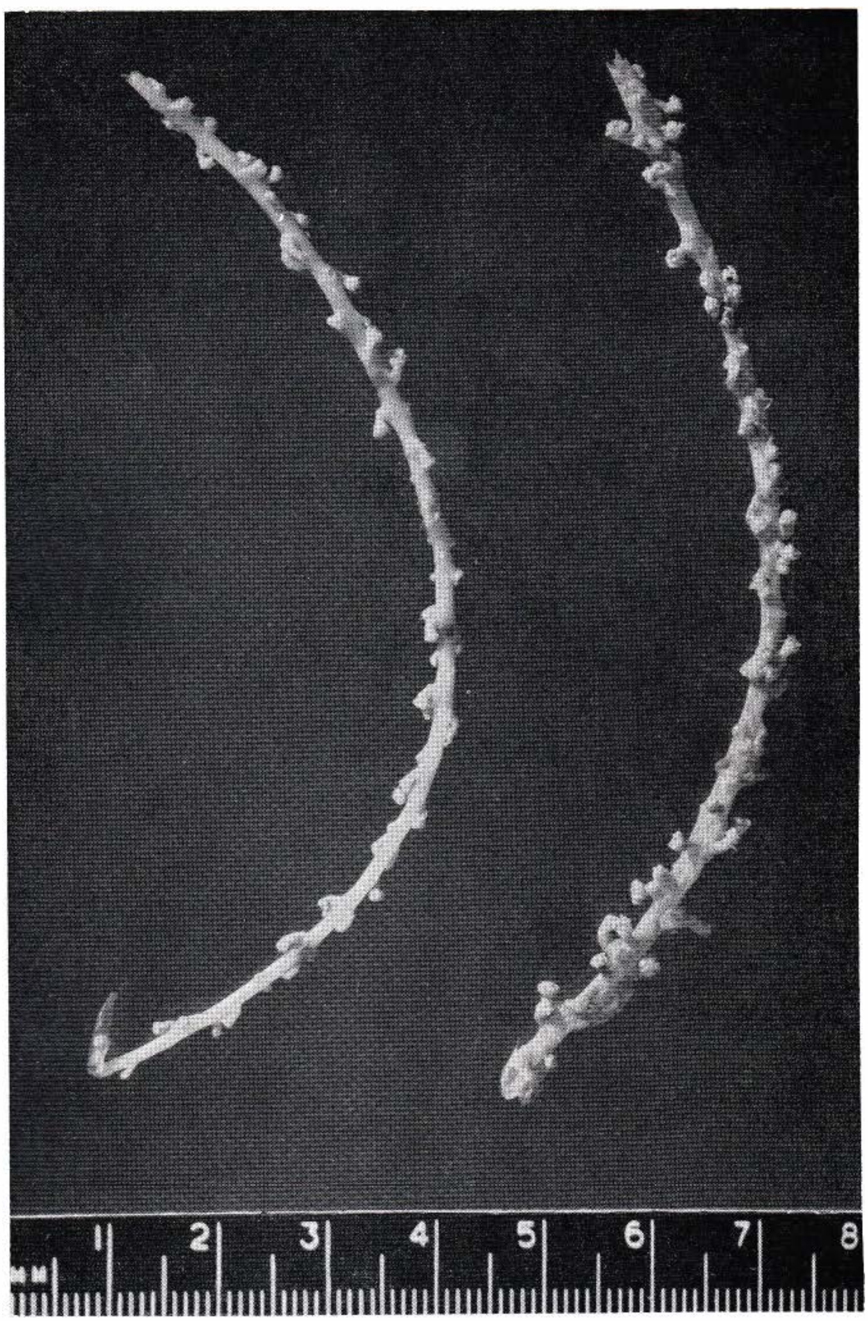


Figure 9 *Keratoisis glaesa,* right hand specimen is holotype, other is paratype, both from NZOI Stn C632.

Keratoisis glaesa n.sp.

Figs 9, 10

DESCRIPTION Species represented by a number of fragments. Colony unbranched. Axis hollow, with a large central canal, the substance of the axis being reduced to a thin, fragile tube; longitudinally grooved, this showing clearly through the coenenchyme when dried. Internodes long, e.g., 86 × 1.5 mm, 51 × 2.2 mm, 32 × 2.0 mm.

Polyps 2–3 mm in height, some almost perpendicular to the axis, most bent over to varying degrees, arising from a clearly demarcated base as in *K. tangentis*. Lower part of polyp narrow, expanding a short way up into a trumpet shape, this upper part bearing the majority of the spicules. The spiculation is quite variable. Along the upper half to two-thirds of the polyp are at least eight large, slightly projecting needles, up to 1.65 mm long by 0.05 mm diameter. Sometimes there are two such needles sitting one alongside the other. The intervening polyp wall may be bare, or have various numbers of smaller needles, most about 0.7 mm in length; similar needles are present to varying degrees in the lower part of the polyp. The tentacles are filled with longitudinally placed rods, typical sizes 0.13 × 0.01 mm, 0.21 × 0.02 mm. Spicules smooth, glossy. Coenenchyme thin, with very few scattered spindles.

MATERIAL EXAMINED NZOI Stn C632. A large number of fragments, mixed with those of *K. tangentis*, from which it is quite distinct in being unbranched, in the size of the canal, and in the polyp spiculation.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 123, NZOI Stn C632.

PARATYPES Deposited in the New Zealand Oceanographic Institute No. P189, NZOI Stn C632.

DISCUSSION Verrill (1883 : 20) described a new species *Lepidisis vitrea* (from Blake Expedition Stn 222, 422 fathoms, off St Lucia) which had a large central tube and smooth spicules; it is not figured, but the description indicates that the polyps are longer than those of *K. glaesa* and that spicules extend their whole length.

The specific name is taken from the Old English word *glaes*, from which is derived "glass", reference being to the appearance of the spicules.

Keratoisis hikurangiensis n.sp.

Figs 11, 12

DESCRIPTION Colony unbranched. The type specimen is *c.*600 mm high, with a 4-rayed root system at the base, The basal internode is 10 mm long × 2.6 mm diameter, with the lengths of successive internodes being 4, 2, 21, 50, 50, 30, 45, 20, 4, 30, 35, and 40 mm. Length of nodes about 2 mm shorter in most distal portion. Another specimen has a 3-rayed root system and a total height of 1 100 mm; first internode 5 mm long × 3 mm diameter, next internode 25 mm long, then 81, 64.5, 74, 75 mm; the longest 83 mm. The internodes are slightly dilated distally, with prominent, regular, longitudinal grooves. Hollow, e.g., width of internode 2.9 mm, width of canal 1 mm; width of internode 2.5 mm, canal 0.5 mm; width of internode 1.25 mm, width of canal 0.8 mm.

The polyps mostly project more or less straight out from the axis, maximum length *c.*9 mm. A typical polyp

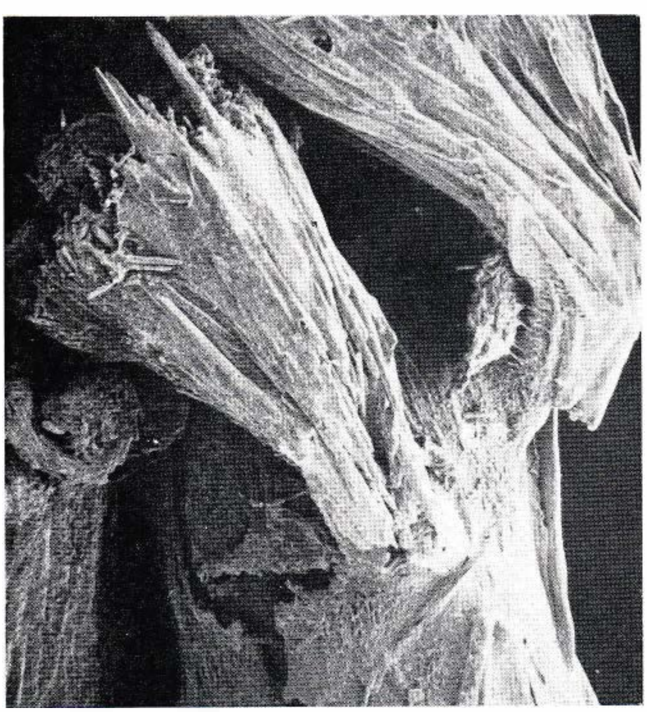


Figure 10 *Keratosis glaesa*, NZOI Stn C632. Polyps. (×20)

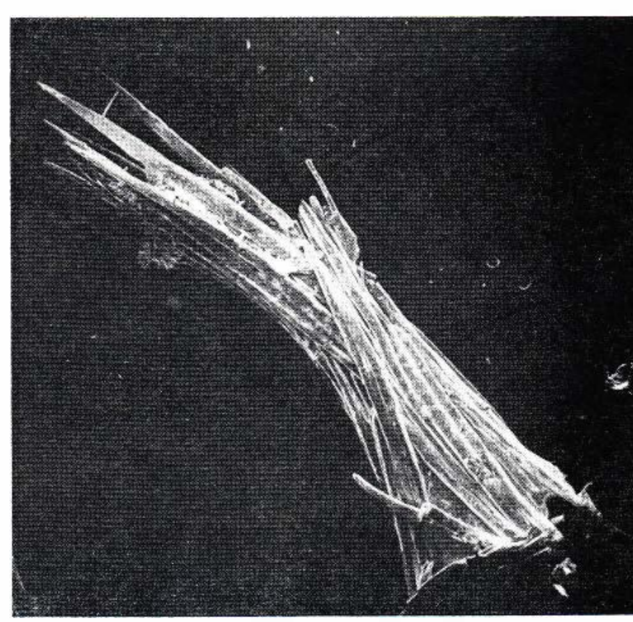


Figure 11 *Keratoisis hikurangiensis*, NZOI Stn E707. Polyp. (×20)

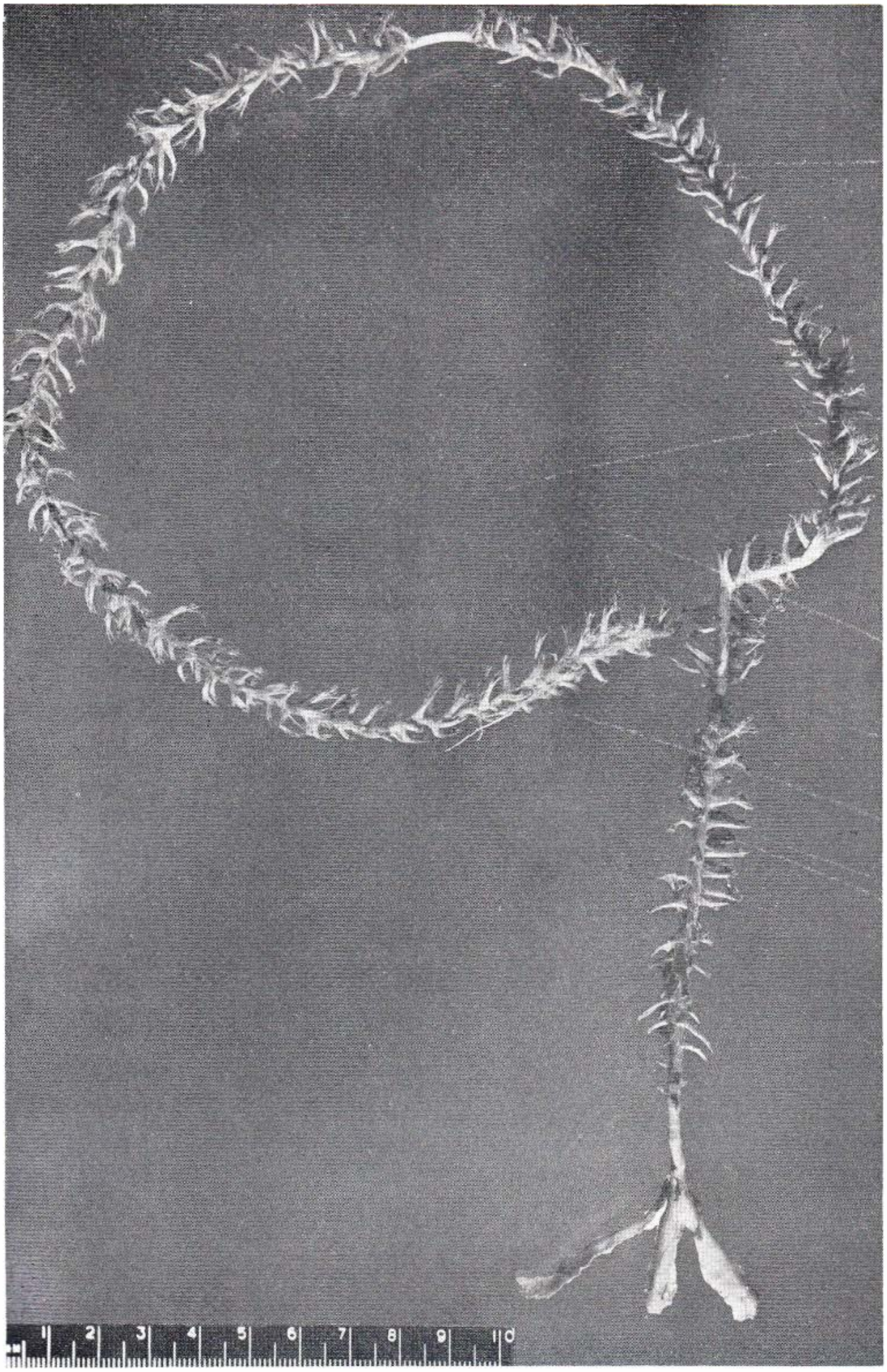


Figure 12 *Keratoisis hikurangiensis*, NZOI Stn E707. Holotype.

from the type specimen is 8.1 mm long, with a crown of needles up to 5.25 mm in length projecting 2.75 mm beyond the mouth; these needles may be curved. The walls of the polyps are otherwise heavily covered with spindles; the surfaces of all the spicules of the polyp walls are spiny or roughly ridged. The tentacles bear elongated scales with rounded and slightly dilated ends, typical size 0.17 mm long, 0.036 mm wide.

The needles of the crown seem to be placed precariously on the sides of the polyp, and are easily dislodged by rough handling.

Coenenchyme thin, with fairly heavy covering of irregularly placed rods up to *c*.1.2 mm long, with surfaces roughened but not truly spinose. Near the polyps the coenenchyme is covered with large rods similar to those of the polyps.

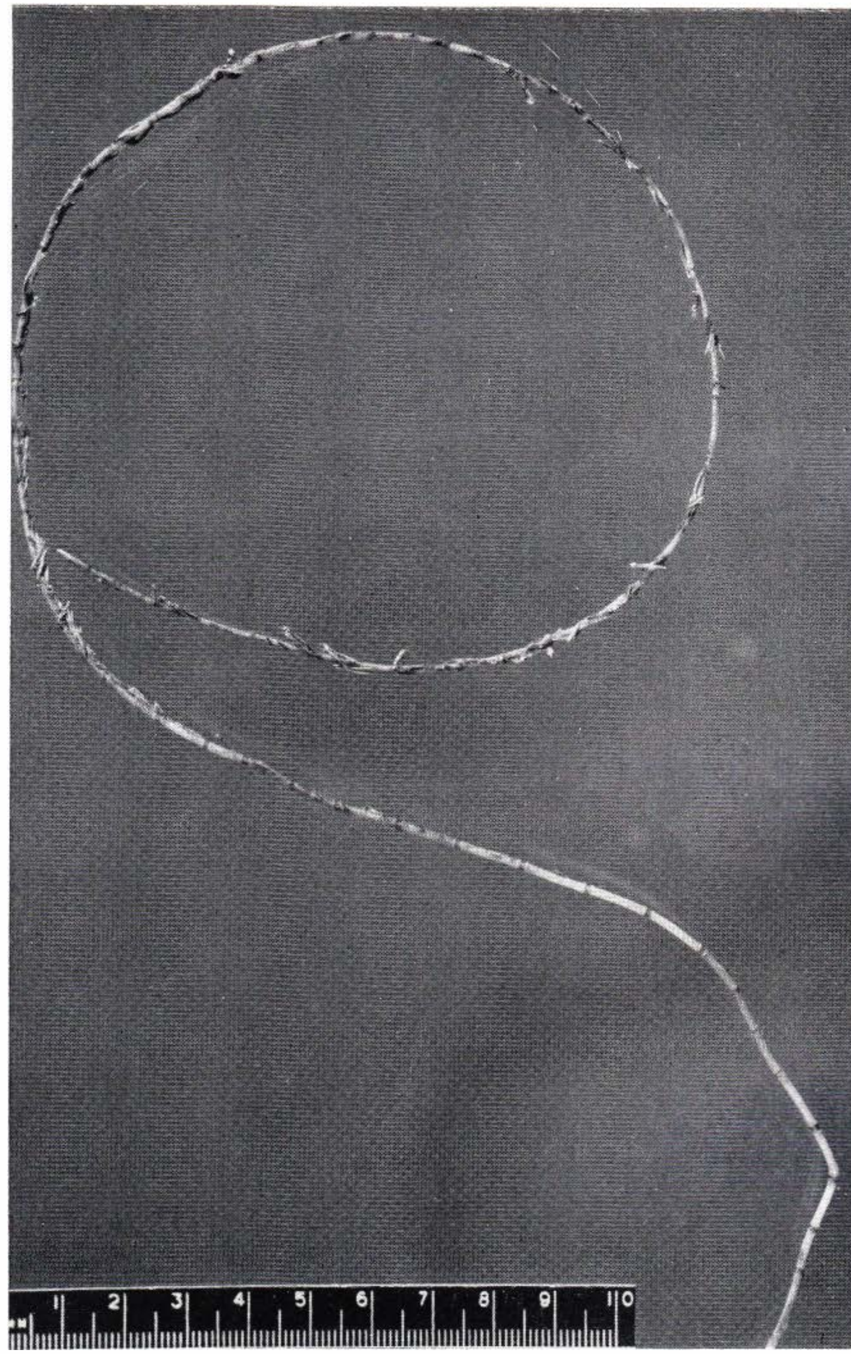


Figure 13 *Keratoisis projecta*. NZOI Stn F913. Holotype.

MATERIAL EXAMINED NZOI Stn E707, 1 complete specimen (the type), 3 decorticated internodes; E784, 1 specimen; E890, fragments of at least 3 specimens; E892, fragments; E901, 1 specimen; F892, 2 broken internodes.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 124, NZOI Stn E707.

TYPE LOCALITY South-east of Cape Kidnappers, on the edge of the Hikurangi Trench, 834–951 m.

DISCUSSION The name is taken from Hikurangi Trench, the location of the type-species.

Keratoisis projecta n.sp.

Figs 13, 14

DESCRIPTION Unbranched; basal root system. Hollow, width of internode 1.3 mm, width of canal 0.55 mm. Internodes mostly *c*.10 mm long, with well spaced longitudinal grooves, though these are sometimes not apparent.

Polyps 4–7 mm long to the tip of the projecting needles, very narrow and tapering towards the base, diameter up to 1 mm distally, flattened against the axis, directed distally. Eight needles projecting beyond the base of the tentacles, with one, sometimes two, abaxial

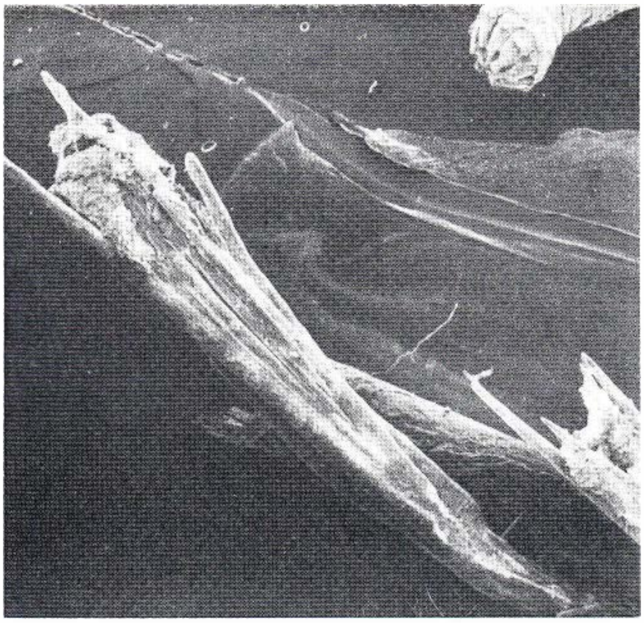


Figure 14 *Keratoisis projecta,* NZOI Stn F913. Polyps. (×20)

needle up to 6 mm long reaching almost to the base of the polyp and being larger than, and clearly differentiated from, the rest; surface of needles rough and spiny; sometimes with smaller needles interspersed. Tentacles crowded, with transversely and obliquely placed flat scales with rounded ends and tapering medially, 0.2 × 0.03 mm.

Small flattened rods are present on the axis close to the polyps, the thin coenenchyme otherwise bearing few spicules.

MATERIAL EXAMINED NZOI Stn E724, 1 decorticated stem, 280 mm long; 1 basal portion of stem with root system; E879, 1 incomplete specimen; E884, 1 incomplete specimen; F913, 1 specimen (the type), 2 smaller specimens.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 125, NZOI Stn F913.

TYPE LOCALITY North-east of Bay of Islands, 743 m.

DISCUSSION Two already described species have a differentiated abaxial needle. *K. wrighti* Nutting (1910, p. 12) can be distinguished in that the needle does not usually project, the tentacles bear no spicules, and the coenenchyme is thick. *K. macrospiculata* Kükenthal (1919, p. 600) seems to be distinct from the present species mainly in that the polyp needles are smooth, and the internodes are much larger, up to 94 mm long.

Keratoisis zelandica n.sp.

Figs 15, 16

DESCRIPTION Unbranched; hollow, width of internode 3.75 mm, width of canal 1.1 mm. Most basal internodes 9 mm long, diameter 5 mm medially, slightly dilated at the ends; next 10 × 4 mm, 3rd 28 × 4 mm, next 50 × 4 mm, longest up to 88 × 2 mm. Nodes up to 3 mm long. Fine longitudinal striations along the axis.

Polyps up to 10 mm long, dilating from less than 1 mm at the base to 2 mm across the mouth. Orientation variable, sometimes almost perpendicular, often curved around or along the axis, though not in contact with it. Polyp bases not in contact but polyps quite abundantly distributed all round the axis. Covered with closely packed smooth needles, longitudinally placed, from 0.73 × 0.03 mm up to the most distal needles which project as much as 1.5 mm beyond the edge of the calyx, 4.0 × 0.26 mm; also rounded scales 0.23 × 0.03 mm, mostly at the distal end placed longitudinally along the tentacles. Some are present on the general body of the polyp, especially near the base, but they are generally sparse and isolated.

Coenenchyme thin, filled with oval scales, 0.2 × 0.05 mm, often with a medial constriction.

MATERIAL EXAMINED NZOI Stn E800, a large number of fragments, including the basal portion of a young specimen with an attachment disc.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 126, NZOI Stn E800.

TYPE LOCALITY Off Fiordland, 913–1 003 m.

Figure 15 *Keratoisis zelandica,* NZOI Stn E800. Polyp. (×20)

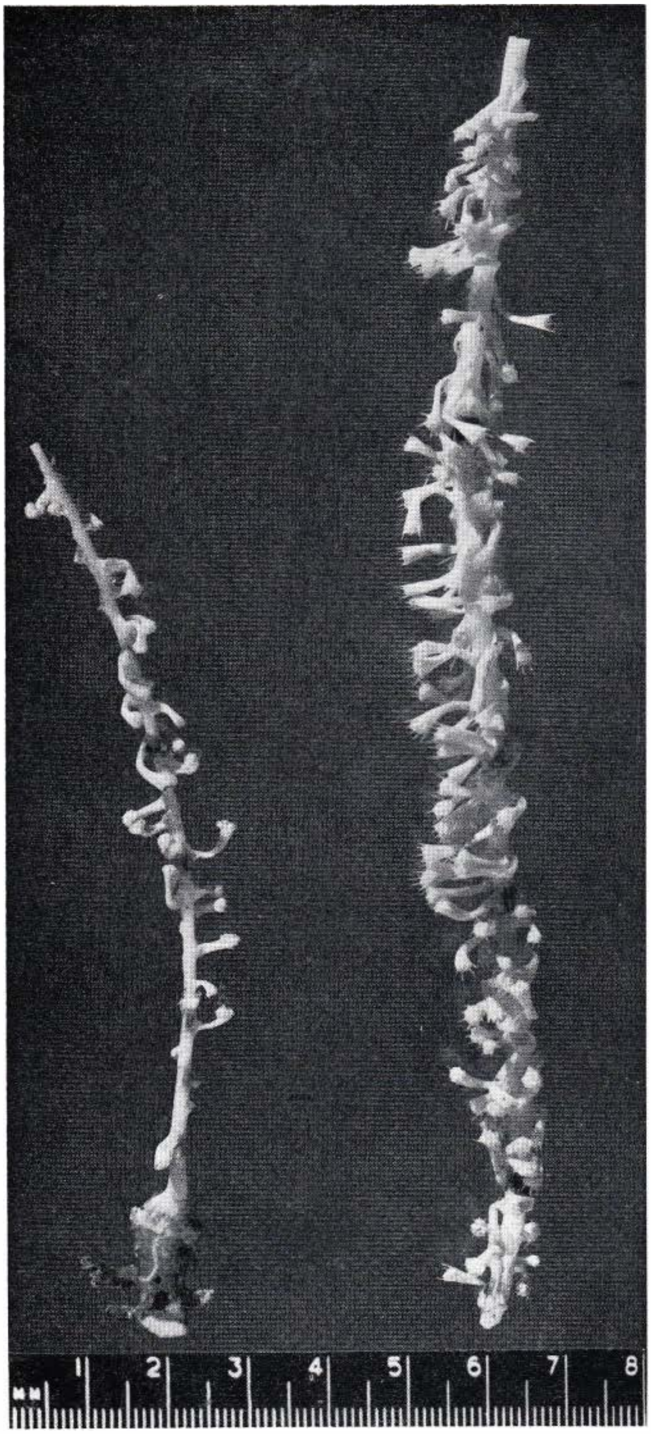


Figure 16 *Keratoisis zelandica*, NZOI Stn E800. Largest specimen is holotype.

Keratoisis flexibilis (Pourtalès, 1868)

Figs 17–19

1868 *Isis flexibilis* Pourtalès, *Bull. Mus. comp. Zool. Harv. 1(7)*: 132.

1870 *Isis flexibilis;* Gray, *Cat. Lith. Br. Mus.*: 21.

1883 *Callisis flexibilis;* Verrill, *Bull. Mus. comp. Zool. Harv. 11(1)*: 9.

1896 *Ceratoisis flexibilis;* Roule, *Annls Univ. Lyon, 26*: 305.

1919 *Ceratoisis flexibilis;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2)*: 590.

DESCRIPTION There is one specimen in the collection which is referable to this species. The branching is in one plane, but as the branches are quite long and flexible, they tend to curl, giving the colony a very irregular appearance. It arises from a basal calcareous disc, with the lengths of the internodes successively up from the base being 7, 8, 8, 10, 12, and 13 mm; longest internode 17 mm. Internodes coarsely and regularly grooved in the medial and distal parts of the colony; hollow.

The branching always takes place from the end of the internodes, such that there is a common node for the base of the branch and the base of the next internode along the stem (Fig. 19).

The polyps are generally well spaced, rarely opposite. They are squat, e.g., height 1.6 mm, width 1.3 mm, and bear longitudinally placed, thorny rods (Fig. 17), up to 1.75 mm in length, most *c*.1 mm. The coenenchyme bears small flattened rods.

MATERIAL EXAMINED NZOI Stn E736, 1 specimen.

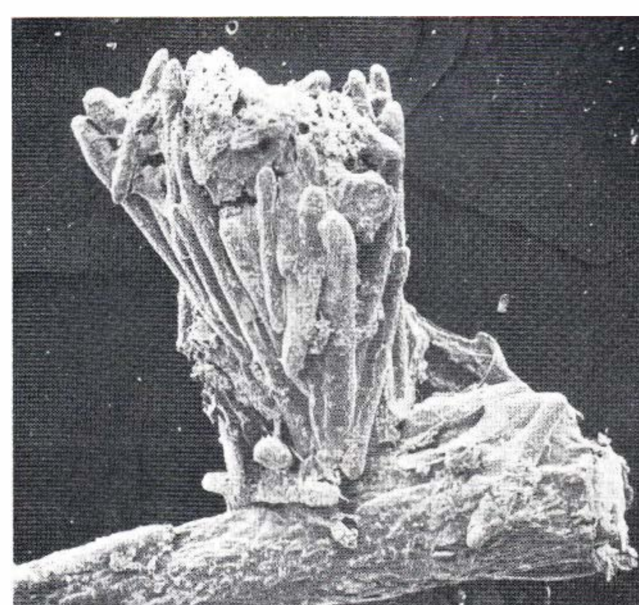


Figure 17 *Keratoisis flexibilis*, NZOI Stn E736. Polyp. (×40)

Figure 18 *Keratoisis flexibilis*, NZOI Stn E736.

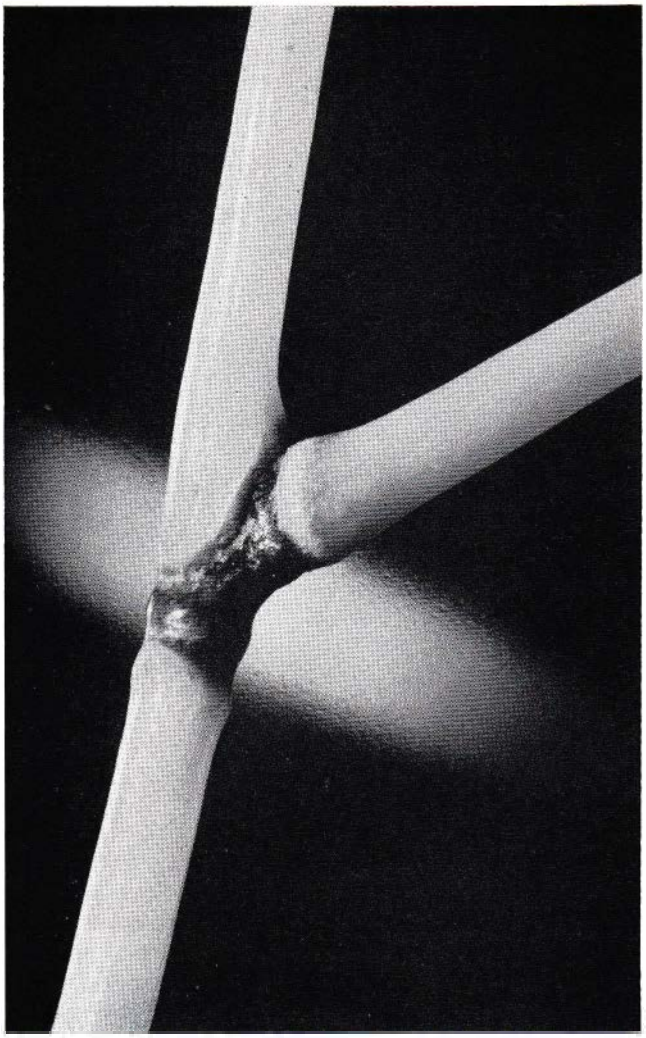


Figure 19 *Keratoisis flexibilis,* NZOI Stn E736, showing origin of branching.
For scale, see Fig. 18; this is an enlargement of the branch two-thirds up the right-hand stem.

DISCUSSION Kükenthal (1919, p. 587) discussed the history of this species. He gave the fullest description of this species so far (1919, p. 590), but made no mention of the mode of branching noted above. However, Pourtalès (1868, p. 132) noted that, "In a few instances the branches appear to arise from the corneous joints"; and Verrill (1883, p. 9) stated, "The branches arise from near the proximal end of the calcareous joints, in the specimen examined." This form of branching is seen in *Primnoisis ambigua* and in *Mopsea elongata,* and it is perhaps arguable that the branches arise from the nodes rather than the internodes. At any rate, it does blur any sharp distinction between branching from the internodes, and branching from the nodes.

Genus **Acanella** Gray, 1870

1870 *Acanella* Gray, *Cat. Lith. Br. Mus.:* 16

TYPE-SPECIES *Mopsea arbusculum* Johnson, 1862

DEFINITION Keratoisidinae in which branching takes place in whorls from the nodes.

DESCRIPTION Colony bushy, sometimes with distinct main stem, from one to about six branches per node. Internodes solid, smooth or longitudinally striated. Polyps covered with finely thorned or warted spindles, sometimes with rods in the tentacles. Coenenchyme thin, with irregularly distributed spindles.

HISTORY Gray established the genus *Acanella* for *Mopsea arbusculum* Johnson. As described by Gray, the genus had as one of its characters the verticillate arrangement of the branches. Verrill (1883, p. 13) preferred to regard this as a specific feature, and extended the genus to include unbranched forms. He included here *Mopsea eburnea* Pourtalès, 1868, *A. spiculosa* n.sp., and *A. simplex* n.sp., this last being an unbranched form.

Wright and Studer (1889) described *A. chilensis* and *A. rigida,* Thomson and Henderson (1906) described *A. robusta,* and Nutting (1910) described *A. sibogae* and *A. weberi*. These authors accepted Verrill's definition, although all the species that they described were branched.

Kükenthal (1915) described *A. africana, A. japonica,* and *A. verticillata* and (Kükenthal 1919) synonymised *A. normani* with *A. arbuscula* and *A. spiculosa* with *A. eburnea.* He also transferred the unbranched species *A. simplex* Verrill to the genus *Keratoisis,* thus reverting to Gray's original definition of *Acanella.* Thomson (1929) described *A. furcata* and Aurivillius (1931) described *A. microspiculata.*

Acanella japonica Kükenthal, 1915
Figs 20, 21

1915 *A. japonica* Kükenthal, *Zool. Anz. 46:* 120.
1919 *A. japonica;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 582, pl. 44, figure 76; text-figures 254–7.

Kükenthal (1919, p. 582) gave the following diagnosis for the species.

"The colony branches regularly on all sides. The main branches originate from the nodes of the stem singly, in pairs, or in whorls of five and at an angle of 45°, and curve slowly inwards adaxially. The internodes are longest in the middle of the colony, and are only very finely longitudinally grooved and almost smooth. The side branches mostly originate singly from the nodes towards the outer edge of the colony; and from them originate single, long, tapering end branches. The polyps stand obliquely, distally directed, fairly well spaced on the side and end branches, often alternate, but on the end

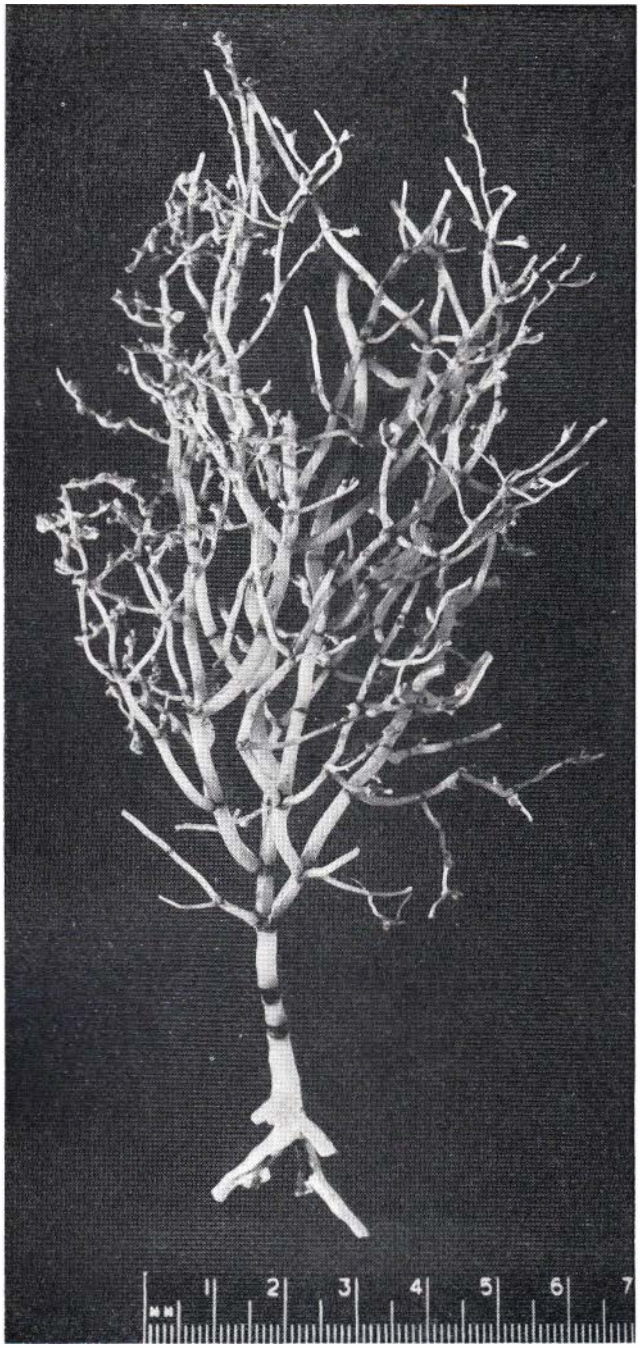


Figure 20 *Acanella japonica,* NZOI Stn F897.

branches also in pairs. They are 2–4 mm long, roller-like, not distally expanded, and relatively thickly armoured with thick spindles 1.2 mm in length, of which eight septal ones project slightly. The spindles are covered with flat, rounded warts; besides these are smaller but not flattened rods with rounded ends, average 0.3 mm long, and thickly covered with flat warts. The tentacles are filled with similar small spicules. The coenenchyme contains some rods up to 0.9 mm in length, as well as numerous smaller, warty, ones."

There is one specimen in the present collection which can be referred to this species.

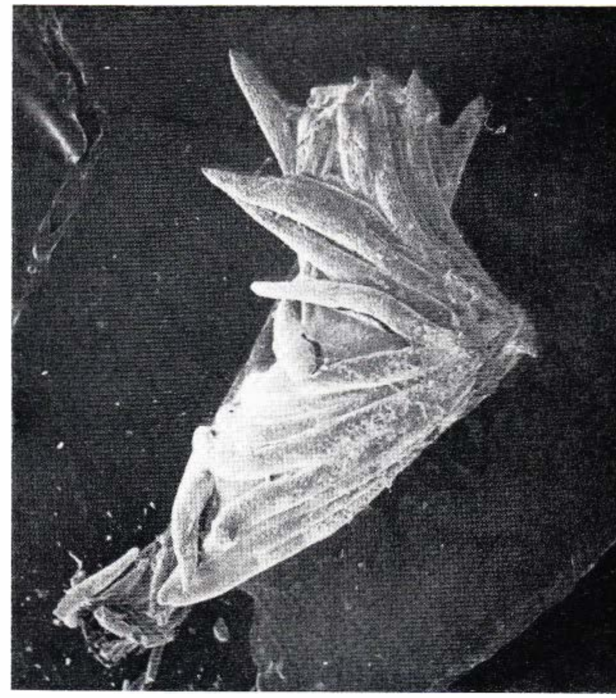


Figure 21 *Acanella japonica,* NZOI Stn F897. Polyp. (×20)

DESCRIPTION The colony is 160 mm high, with gross morphology more or less as above. The polyps (Fig. 21) are present on the third and fourth order branches, being most concentrated distally. They possess large curved body sclerites, up to 1.8 mm long measured around the curve which may be quite strong; other flattened sclerites range from 0.27 to 0.75 mm long.

Coenenchyme rods up to 0.3 mm long.

MATERIAL EXAMINED NZOI Stn F897, 1 specimen.

Acanella sibogae Nutting, 1910

Figs 22–24

1910 *A. sibogae* Nutting, *Siboga Exped. 8:* 14, pl. 3, figures 2, 2a; pl. 4, figure 4.

1919 *A. sibogae;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 575.

DESCRIPTION Three specimens, two of them complete, are referable to this species. Nutting described the species from fragmentary material, so the general description can now be extended. One specimen (Fig. 23) is 90 mm high from the base of the stem, with a basal root system of four processes, each subdividing. A node 1 mm long articulates the root system and the stem. The first internode is bent, 18 mm long × 15 mm diameter, the second 5 mm long, third and fourth 4 mm. Above the fourth internode there is a whorl of four branches, with the first internode of each bent so that the whole

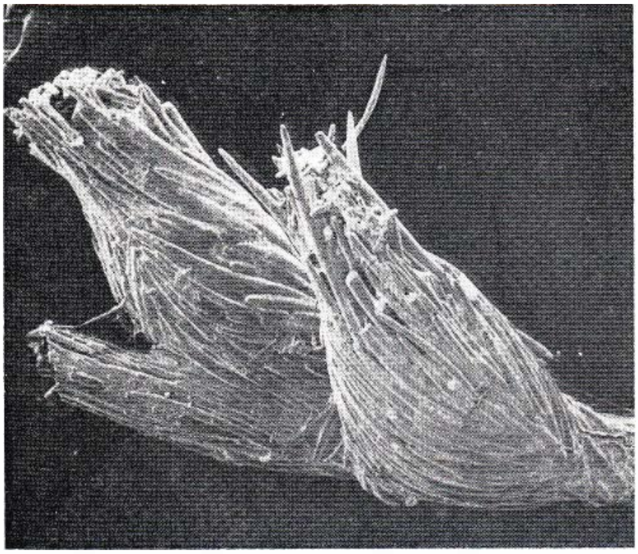


Figure 22 *Acanella sibogae*, NZOI Stn E880. Polyps. (×110)

branch is directed distally. The fifth stem internode is 14 mm long, the sixth 18 mm, the seventh 17 mm; the nodes above the fifth and seventh internodes each bear two branches. Of the four main branches, one is unbranched, one bears a first whorl of three branches, and two bear first whorls of four branches. The other two colonies have initial whorls of four branches; all have distal branching composed of one, two, or three branches per node. Internodes are longitudinally striated.

Another specimen (Fig. 24) has a long (20 mm) "internode" continuous with the root system, that is, there is no node articulating the root system with the stem. It has a first pair of branches, then a whorl of four; all other branches are in pairs. The bearing of the colony is more upright and compact than the above specimens, otherwise the branching and form of the polyps are very similar.

Polyps (Fig. 22) up to 3 mm long, some perpendicular, many bent distally. Some of the polyps, if well preserved, show an arrangement of spicules which agrees well with Nutting's description (1910, p. 15): "Their walls are filled with curved spindles arranged horizontally in the basal parts and obliquely in the distal parts of the walls, those on the abaxial side being larger than those on the adaxial side of the polyp, and extend from the abaxial mid-line upward and obliquely around the calyx walls, somewhat resembling a reversed chevron. The adaxial side is filled with smaller spicules disposed horizontally, in the main. There is usually a crown of eight well marked points around the margin, each point consisting of the distal end of a single spicule. The tentacles bear numerous stout, bar-like forms, without any very definite arrangement." These features, however, are rather distorted in polyps which are bent along the axis.

MATERIAL EXAMINED NZOI Stn D224, 1 fragment; E880, 1 fragment; F873, 2 specimens; F878, 1 specimen; F897, 1 specimen.

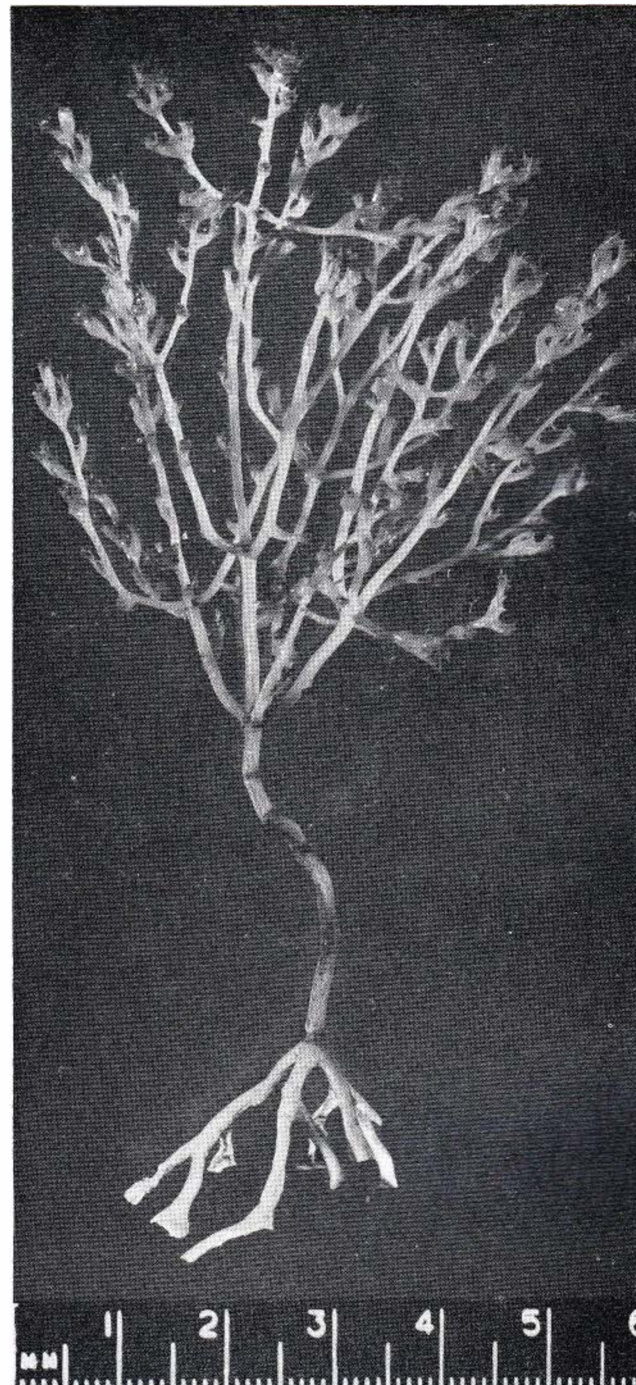


Figure 23 *Acanella sibogae*, NZOI Stn F878.

DISCUSSION Nutting (1910, p. 15) compared this species with *A. rigida* Wright and Studer, saying that: "while the two agree well in form of calyces and maximum size of spicules, they differ in comparative uniformity in size of spicules in the calyx walls. The walls

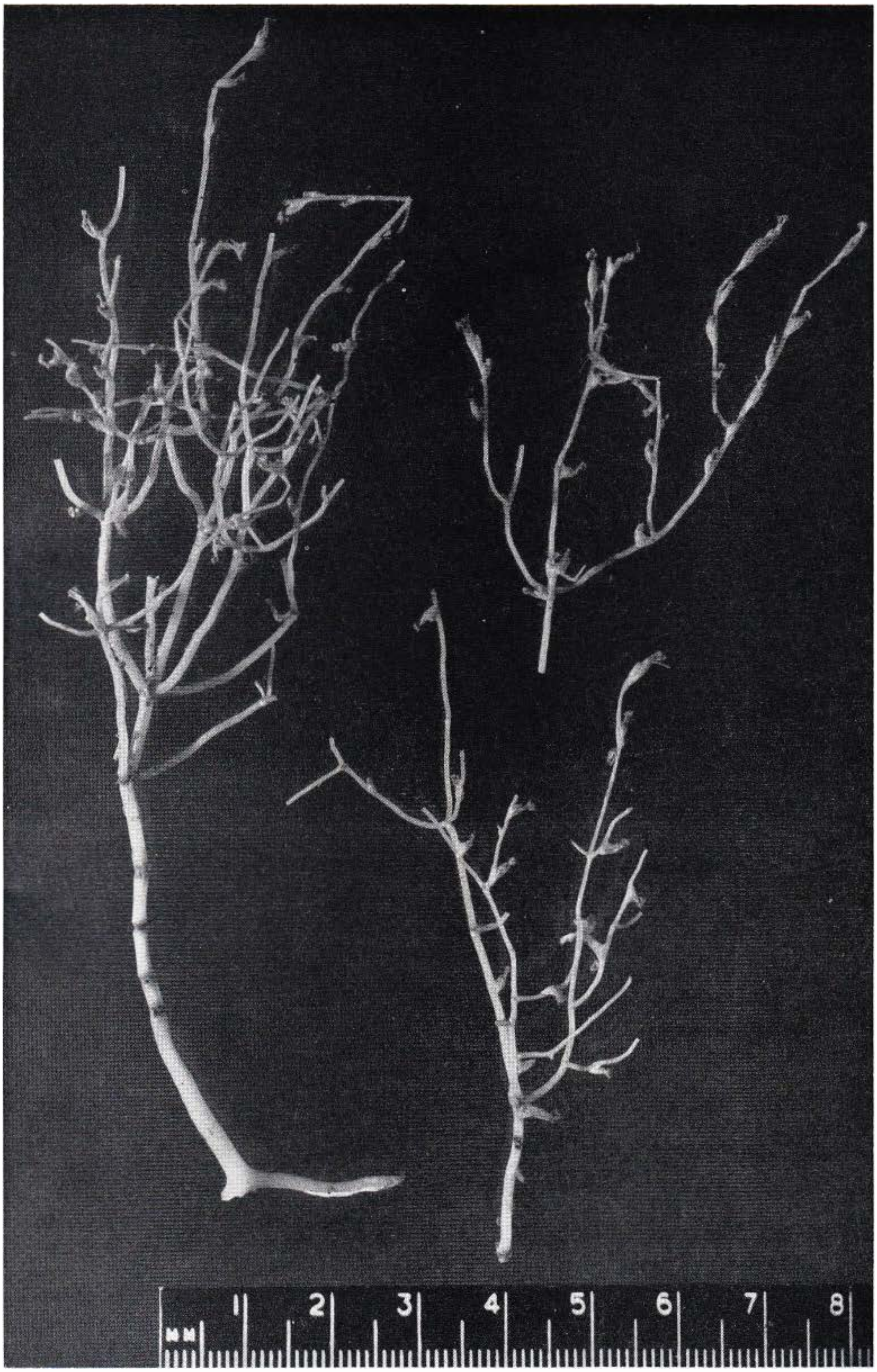


Figure 24 *Acanella sibogae,* NZOI Stn F897.

of *A. rigida* contain a few comparatively large spicules on the abaxial side, interspersed with others much smaller. In *A. sibogae* the abaxial wall is filled with a compact series of more slender spindles of comparatively uniform size, without a noticeable admixture of large and small." The specimens in the present collection indicate that this distinction cannot always be readily made. Some polyps are definitely the *sibogae* type as described above, others do contain varying numbers of admixed smaller spicules. However, *A. rigida* has relatively short internodes near the base, and this contrasts with the present specimens.

Acanella eburnea (Pourtalès, 1868)
Figs 25, 26

1868 *Mopsea eburnea* Pourtalès, *Bull. Mus. comp. Zool. Harv. 1(7):* 132.
1870 *Isidella eburnea;* Gray, *Cat. Lith. Br. Mus.:* 15.
1883 *Acanella eburnea;* Verrill, *Bull. Mus. comp. Zool. Harv. 11(1):* pl. 4, figure 5.
1883 *A. spiculosa* Verrill, *Bull. Mus. comp. Zool. Harv. 11(1):* 17.
1889 *A. eburnea;* Wright & Studer, *Rep. scient. Results explor. Voyage Challenger 31(1):* 30.
1890 *A. arbuscula* Studer, *Mem. Soc. zool. Fr. 5:* 86.
1890 *A. eburnea;* Studer, *Mem. Soc. zool. Fr. 5:* 86.
1901 *A. eburnea;* Studer, *Résult Camp. scient. Prince Albert I 20:* 38.
1908 *?A. eburnea;* Nutting, *Proc. U.S. natn. Mus. 34:* 572.
1919 *A. eburnea;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 575.
1936 *A. eburnea;* Deichmann, *Mem. Mus. comp. Zool. Harv. 53:* 245.

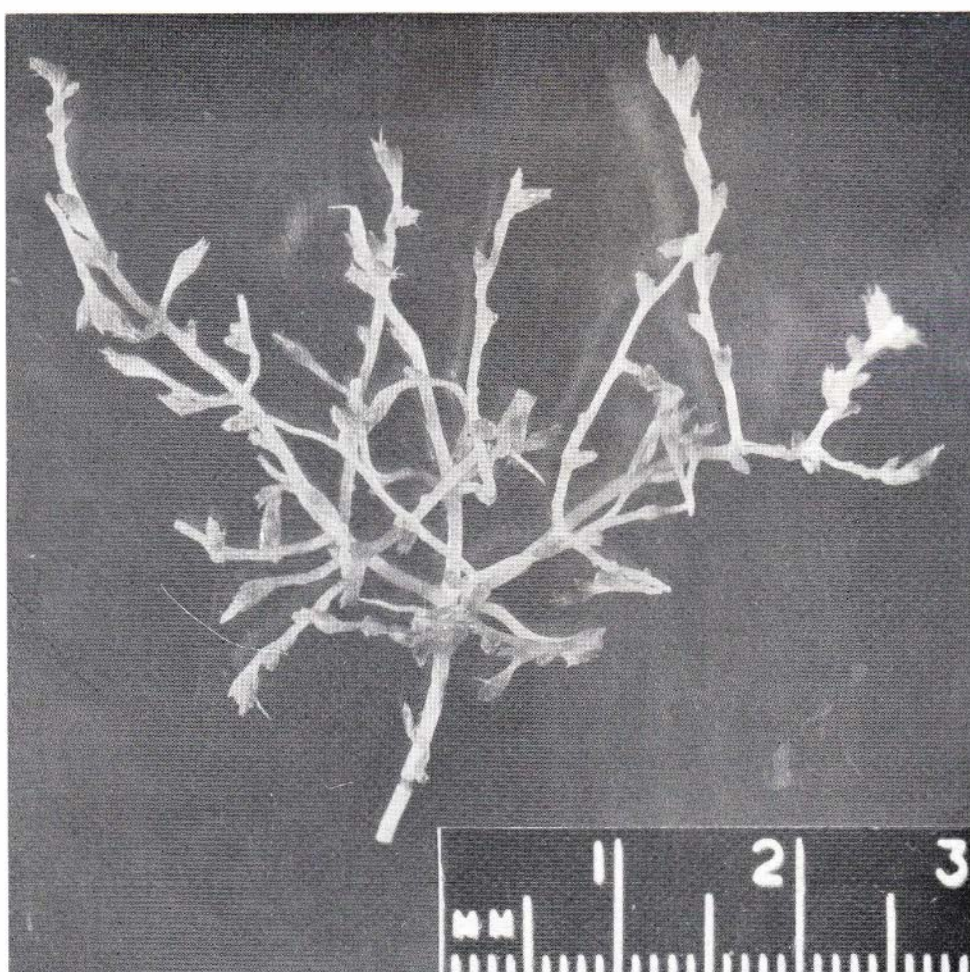
DESCRIPTION One fragment bears a whorl of six variously developed branches; another a whorl of four; otherwise branches are single or in twos or threes. The internodes are mostly quite long, 10–15 mm, minimum 3 mm, longitudinally striated.

The polyps are squat, oblique, tapering distally (Fig. 26), with a typical basal width of 2 mm, and height at the front of 2 mm. The top of the polyp bears, in many cases, a number of spinose spicules somewhat larger than those of the sides and base, in other cases this differentiation is not apparent. Polyps placed on the ends of branches are the largest, and are narrowly cup-shaped.

MATERIAL EXAMINED NZOI Stn D224, 1 specimen; F873, fragments.

DISCUSSION Both Verrill (1883, p. 16) and Deichmann (1936, p. 245) noted that there are no more than three branches per node in this species, Deichmann saying there are two, rarely three, and using this as one of the characters distinguishing it from *A. arbuscula* which normally has four. The exceptions to this among the present specimens are not taken to be of specific import: the species is identifiable from characters other than this. Further, both authors noted the differences in size between the marginal and more basal spicules. The fact is that spiculation is quite variable, and the species cannot be typified with such a rigid description of the polyp. Verrill (1883, p. 17) described, from one fragment, a new species *A. spiculosa*, saying: "It closely resembles *A. eburnea*, but is distinguished by the very much larger size of the spicules in the basal part of the

Figure 25 *Acanella eburnea*, NZOI Stn F873.



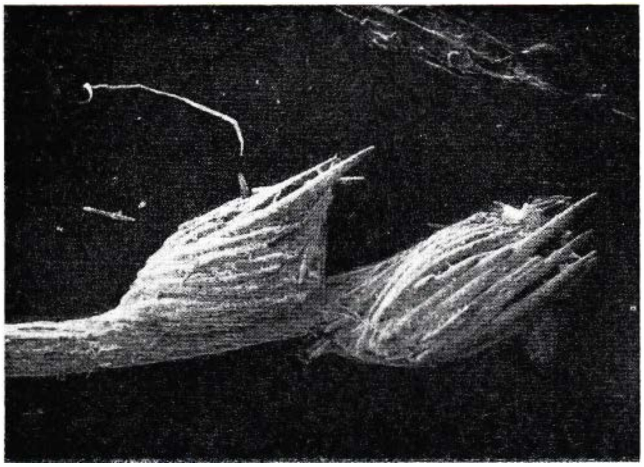


Figure 26 *Acanella eburnea*, NZOI Stn F873. Polyps. (×20)

calicles, and in the coenenchyme". Kükenthal (1919, p. 576) combined this species with *A. eburnea;* the extension of the species to include this variation in spiculation is here taken to be reasonable, and it does not detract from the validity of this species.

Genus **Lepidisis** Verrill, 1883

1883 *Lepidisis* Verrill, *Bull. Mus. comp. Zool. Harv. 11(1):* 18.

TYPE-SPECIES Designated as *L. caryophyllia* by Kükenthal (1915).

DEFINITION Keratoisidinae in which polyps and coenenchyme have an external covering of scales.

DESCRIPTION Branched from the nodes or the internodes; internodes hollow. Polyps erect, walls containing spindles and needles, eight of which project beyond the margin, surface covered with small scales; tentacles with scales. Coenenchyme filled with scales similar to those of the polyps.

HISTORY AND DISCUSSION Verrill (1883, p. 18) introduced the genus *Lepidisis,* ascribing to it three new species, *L. caryophyllia, L. longiflora,* and *L. vitrea* but not designating a genotype. In his generic description, Verrill noted that the coenenchyme has "an external layer of small oblong, scale-like spicula, sometimes with a few fusiform spicula beneath them . . . "; and that the polyps are "filled with large fusiform spicula, which are more or less covered externally by small, oblong, scale-like ones, like those of the coenenchyme". He noted similarity of the genus with *Acanella,* from which it differs "only in having the external layer of small scale-like spicula, both on the coenenchyme and on the calicles".

Wright and Studer (1889) soon pointed out, however, that such scales also occur in various species of *Keratoisis,* including the genotype, and were greatly developed in the coenenchyme of *K. grandiflora.* They claimed that it would thus be difficult to identify a new unbranched species as belonging to *Keratoisis* or to *Lepidisis* (the type species of *Keratoisis* branches from the internodes, with subsequently described species being branched in this way, or unbranched; Verrill had described one unbranched species of *Lepidisis,* one species branched from the nodes, and one of unknown habit). They suggested emending the characters of the genus *Keratoisis* to admit all unbranched species. This effectively left *Lepidisis* with one species, *L. longiflora.* Nutting (1910) concurred in this judgment, and despite the inclusion of *Lepidisis* in his key to genera, seemed to recognise but one genus, *Keratoisis.*

Kükenthal (1919) dismissed Nutting's comments by pointing out the contradictions in the report, and he suggested criteria for distinguishing the two genera, viz, the position in the colony of the longest internodes (medial in *Keratoisis* and distal in *Lepidisis*), and the disposition of the polyps (at right angles to the stem in *Lepidisis* and incurved adaxially in *Keratoisis*).

Bayer (1956, p. 222), in his modern and comprehensive but necessarily brief survey of the octocorals, recognised both genera. He characterised *Lepidisis* as having both needles and scales, but made no mention of scales in his definition of *Keratoisis.*

These last two authors do not take account of the issue as raised by Wright and Studer. Kükenthal's criteria appear as *ad hoc* measures to save the genus *Lepidisis.* They are not readily applicable criteria in many cases and not really suited to generic definition; furthermore the disposition of the polyps is used by Kükenthal at the specific level in *Acanella, Primnoisis,* and *Mopsea.*

Of the three species of *Lepidisis* described by Verrill, one, *L. longiflora,* seems to be rather different from the other two, judged from the descriptions and illustrations given by Verrill (1883). Kükenthal (1919, p. 245) gave an illustration of *L. longiflora* which was not at all similar to that given by Verrill. Deichmann (1936), who was using Verrill's material and making constant reference to Kükenthal, made no comment on this. In the absence of the relevant material, there is no alternative to ignoring Kükenthal's figure and basing the following discussion on Verrill alone. Further, it is the species which seems to best exhibit the features claimed by Verrill for the genus (1883, p. 18 for generic description; pl. 4, figure 4 for *L. longiflora*). However, Verill had named no genotype, and this was subsequently designated by Kükenthal (1915) as being *L. caryophyllia* and this has been accepted by subsequent authors. Following Wright and Studer, however, it is hard to see why this species, and also *L. vitrea,* should be separated from the genus *Keratoisis.*

The problem can be best approached by isolating the most crucial factor concerned and concentrating on this. This factor must be the presence of a layer of scale-like spicules in the coenenchyme and polyps as originally emphasised by Verrill in his description as being the character by which one could distinguish *Lepidisis* from *Acanella* (1883, p. 18). In his synoptic arrangement of the genera of the "Keratoisidae" (pp. 9–10), however, Verrill placed a more specific emphasis on the presence of a layer of such scales in the coenenchyme. His diagnoses read:

"A. Branches arise from the calcareous joints

Ceratoisis Coenenchyme and calicles filled with large fusiform spicula. Calicles armed.

(*Callisis*)

AA. Branches, if present, arise from the horny joints.

Acanella Coenenchyme and calicles filled with large fusiform spicula. Calicles armed.

Lepidisis Calicles filled with large fusiform spicula. Coenenchyme with a layer of small oblong scales, Calicles armed.

(*Isidella*)"

At the time Verrill drew up this key (1883), five species of *Keratoisis* had been described, four branched forms and the unbranched *K. grandiflora*. Thus, there was a precedent for including unbranched species in the genus, and that this was accepted by Verrill is implied in his description of *Keratoisis* (Verrill 1883: 10). (Many more unbranched species have since been admitted to the genus.) *Keratoisis* and *Lepidisis* are separated in Verrill's key on the basis of branching, but this is obviously insufficient in that it does not enable a decision to be made regarding unbranched species. The fact that Verrill separated *Keratoisis* and *Lepidisis* in this way, and the fact that he chose to make a distinction in terms of spiculation between *Lepidisis* and *Acanella* rather than *Keratoisis* in his description, may mean that he took branching from the internodes to define *Keratoisis*, despite the implication to the contrary noted above. In any case, the argument must continue taking due account of the fact that *Keratoisis* cannot be so defined. One must look, therefore, at the respective definitions of the genera. There are two factors: that *Keratoisis* has fusiform spicules in the coenenchyme and polyps (and scales in neither); and that *Lepidisis* has fusiform spicules in the polyps and scales in the coenenchyme. These definitions are too brief to be strictly accurate. Taken literally, they exclude the species *grayi*, *grandiflora*, and *siemensii* from the genus *Keratoisis* because they possess scales; and *caryophyllia* and *vitrea* from *Lepidisis* because fusiform spicules are scattered in the coenenchyme. The most positive and applicable point that is made is that the coenenchyme of *Lepidisis* should have a layer of scales—the genus would then include *L. caryophyllia* and *L. longiflora* and also *K. grandiflora*. If the description (Verrill 1883, p. 18) as opposed to the synoptic definition (Verrill 1883, p. 10) is followed, then the major point is that the polyps and coenenchyme should possess a covering of scales—this would seem to admit only *L. longiflora*.

In the present collection of isidids, six species are referable to the genus *Keratoisis*, five of these being new. A further species, of which there is only one specimen, is distinct from all others in that both polyps and coenenchyme are filled with scales, apparently rather similar to *L. longiflora*. The important point is that very few spindles are present in the polyp wall—virtually all the support for the polyp comes from the filling of the polyp wall with scales, these layers of scales being continuous with those filling the coenenchyme. This species possessed both scales and needles, including a projecting crown, and would thus be placed in the Keratoisidinae rather than the Mopseinae. It is branched from the internodes, thus being placed close, in this respect, to *Keratoisis*. The nature of the spiculation is, however, sufficient to warrant distinction from this genus. It is here included in the genus *Lepidisis*, recognised on the basis of Verrill's original full description (Verrill 1883, p. 18) and illustration of *L. longiflora* (Verrill 1883, pl. 4, figure 4). *"L." caryophyllia* and *"L." vitrea* are not considered to belong to this genus and are transferred to *Keratoisis*.

It should be noted that the description of the genus makes provision for colonies branching from either the nodes or the internodes, and it is thus an emendation of the original description by Verrill.

Lepidisis solitaria n.sp.

Figs 27, 28; p. 32.

DESCRIPTION There is only one specimen (the holotype).

The colony is irregularly branched in one plane, spread out to a height of 170 mm, maximum span 120 mm. Diameter of irregular basal portion 6 mm, soon reduced to *c*.3 mm, distally 1 mm. Length of internodes 10–20 mm. Narrow central canal, e.g., width of internode 1.75 mm, width of canal 0.05 mm.

Polyps standing perpendicular to the axis, height about 5 mm, slightly flared distally to 2 mm. Distribution irregular, although many are placed along two opposite sides in the plane of the colony. Eight slightly projecting needles, 2 × 0.015 mm, with few, sometimes two or three only, other needles in the polyp wall, which is otherwise filled with many small scales, mostly with evenly rounded ends and a medial constriction, 0.18 × 0.06 mm. Scales tightly packed, those of the external layer overlapping; irregularly oriented, except distally where they become arranged longitudinally along the tentacles.

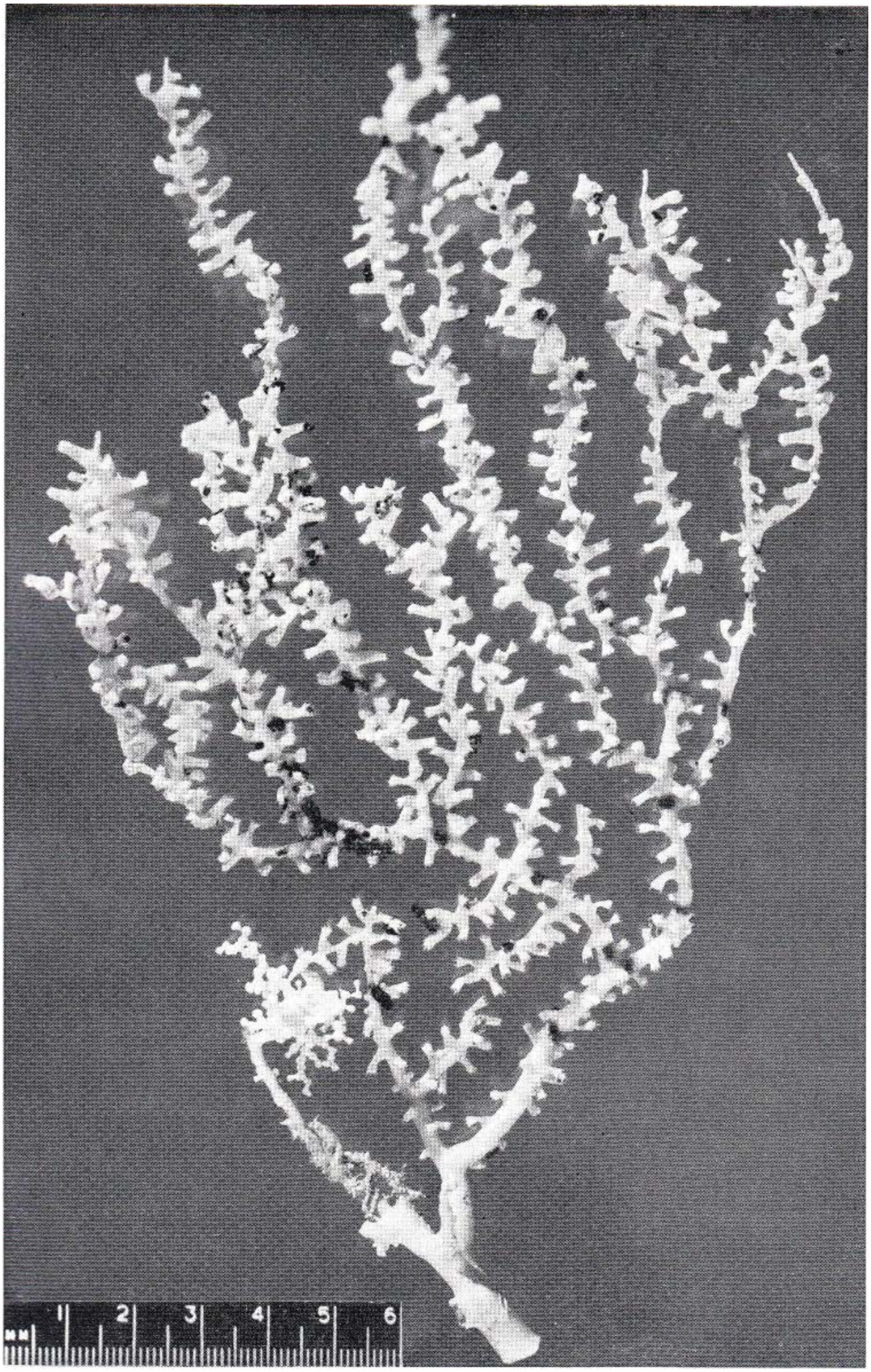


Figure 27 *Lepidisis solitaria*, NZOI Stn E856.

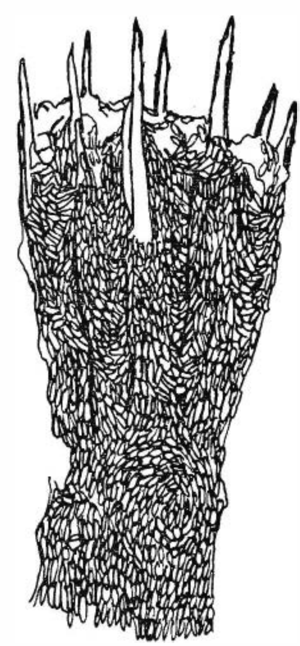


Figure 28 *Lepidisis solitaria*, NZOI Stn E856. Polyp. (× 23)

The mass of scales of the lower part of the polyp is continuous with that covering the axis, so that the coenenchyme is quite thick.

MATERIAL EXAMINED NZOI Stn E856, 1 specimen.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 127, NZOI Stn E856.

SUBFAMILY MOPSEINAE Gray, 1870 [nom. transl. and correct. Wright and Studer, 1889 (Pro Mopseadae Gray, 1870)]

DEFINITION Isididae with non-retractile polyps transversely placed, scale-like sclerites only and no operculum.

DESCRIPTION Colony unbranched, or branching from the internodes. Internodes smooth or longitudinally grooved, solid, consisting of uniformly, radially deposited, calcareous material. Coenenchyme thin, polyps non-retractile; both covered with scales, more or less rectangular, subcircular, or of irregular shape; those of the mouth of the polyp variously developed to give a pseudo-opercular covering.

Genus **Mopsea** Lamouroux, 1816

1816 *Mopsea* Lamouroux, *Hist. Polyp. Corall. flex.*: 465

TYPE-SPECIES *Isis dichotoma* Linnaeus, 1758.

DEFINITION Mopseinae branching in one plane.

DESCRIPTION Colony branched pinnately or dichotomously in one plane; branches arise sometimes from the proximal end of the internodes so that the node at the base of the branch coalesces with that of the stem. Internodes may be smooth, usually with serrated longitudinal ribs, or longitudinal rows of spines. Polyps usually appressed to the stem, irregularly distributed, covered with transverse scales which have spinose surfaces and are quite strongly toothed marginally; tentacles may fold in repose across the mouth, with external covering of scales. Similar scales fit closely together across the surface of the axis.

HISTORY The genus *Mopsea* was erected by Lamouroux in 1816 for *Isis dichotoma* Linnaeus, and a new species *M. verticillata;* Ehrenberg (1834) placed *Isis encrinula* Lamarck, 1816, in the genus and described *M. erythraea* now known to be scleraxonian (placed in the genus *Acabaria*). Gray (1857) wrongly identified a scleraxonian with *Mopsea dichotoma,* and for it created a new genus *Mopsella,* recognising only one species of *Mopsea, M. encrinula.* Kölliker (1865) examined Gray's *Mopsella dichotoma* and Ehrenberg's *Mopsea erythraea,* both scleraxonians, and he placed these, together with a new species *M. bicolor,* in the genus *Mopsea* which he referred to the Melithaeidae. Wright and Studer (1889) were able to clear up the situation, and they recognised *M. dichotoma* (Linnaeus) and *M. encrinula* (Lamarck) as the only genuine species of the isidid genus *Mopsea.* They synonymised *M. verticillata* with *M. encrinula,* and recognised *M. erythraea* as a scleraxonian. *Mopsea* was placed, along with *Primnoisis* Studer and a new form *Acanthoisis flabellum* in the subfamily Mopseinae.

Roule (1908) described a new species *M. elongata,* and Nutting (1910) added *alba* and *flava.* Thomson and MacKinnon (1911) described four new species, *elegans, whiteleggei, flabellum,* and *australis.* Another species, *M. gracilis,* was described by Gravier (1913). Kükenthal (1919) placed *Acanthoisis flabellum* Wright and Studer in the genus *Mopsea* and renamed *M. flabellum* Thomson and MacKinnon as *M. squamosa.* The latest species to be referred to the genus is *M. tenuis* Thomson and Rennet (1928). No reference to the allocation of *M. bicolor* has been made since its erection.

Mopsea elongata Roule, 1908

Figs 29, 30: pp. 34, 35

1908 *M. elongata* Roule, *Exped. Antarct. Fr.*: 31, Pl. 1, figures 1–4.

1913 *M. elongata;* Gravier, *Bull. Mus. natn. Hist. nat. Paris* 7: 454.

1914 *M. elongata;* Gravier, *Deuxieme Exped. Antarct. Fr.*: 34, pl. 4, figures 17–19, text-figures 27–38.

1919 *M. elongata;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2)*: 625.

1929 *M. elongata;* Molander, *Further Zool. Results Swed. Antarct. Exped. 2(2)*: 79.

DESCRIPTION Colony branched dichotomously or pseudo-dichotomously in one plane; branching occurs from internodes, sometimes close to the distal end of the internode so that the node at the base of the branch coalesces with that of the stem; branches may anastomose. The ornamentation of the internodes is variable: more basal internodes often bear serrated longitudinal ridges whilst in more distal parts of the colony the ridges may be less distinct and rows of spines may be interposed. The cross-section of the internode is usually circular, but some distal internodes may be quadrate.

Polyps are irregularly distributed all around the axis; they often have swollen bases, and are distally directed; they bear overlapping transverse scales with serrated edges and warty surfaces. A number of scales cover each tentacle, effectively forming an operculum; they are closely interlocked and may appear to be a single plate. The coenenchyme has a covering of closely packed warty scales.

DISCUSSION There were two recognised species of *Mopsea, M. dichotoma* and *M. encrinula,* in 1908 when Roule described *M. elongata.* He noted (1908, p. 5) that: "This species is very close to *M. dichotoma*", but claimed that it could be distinguished on two counts:

1. there were fewer, longer, and less crowded branches in *M. elongata,* and
2. the polyps of *M. elongata* were smaller and more widely spaced.

Thomson and MacKinnon (1911, pp. 675–6), in commenting on one of their new species *M. australis,* said: "It must be admitted that *M. dichotoma* (Linne), *M. elongata* Roule, and the species at present under

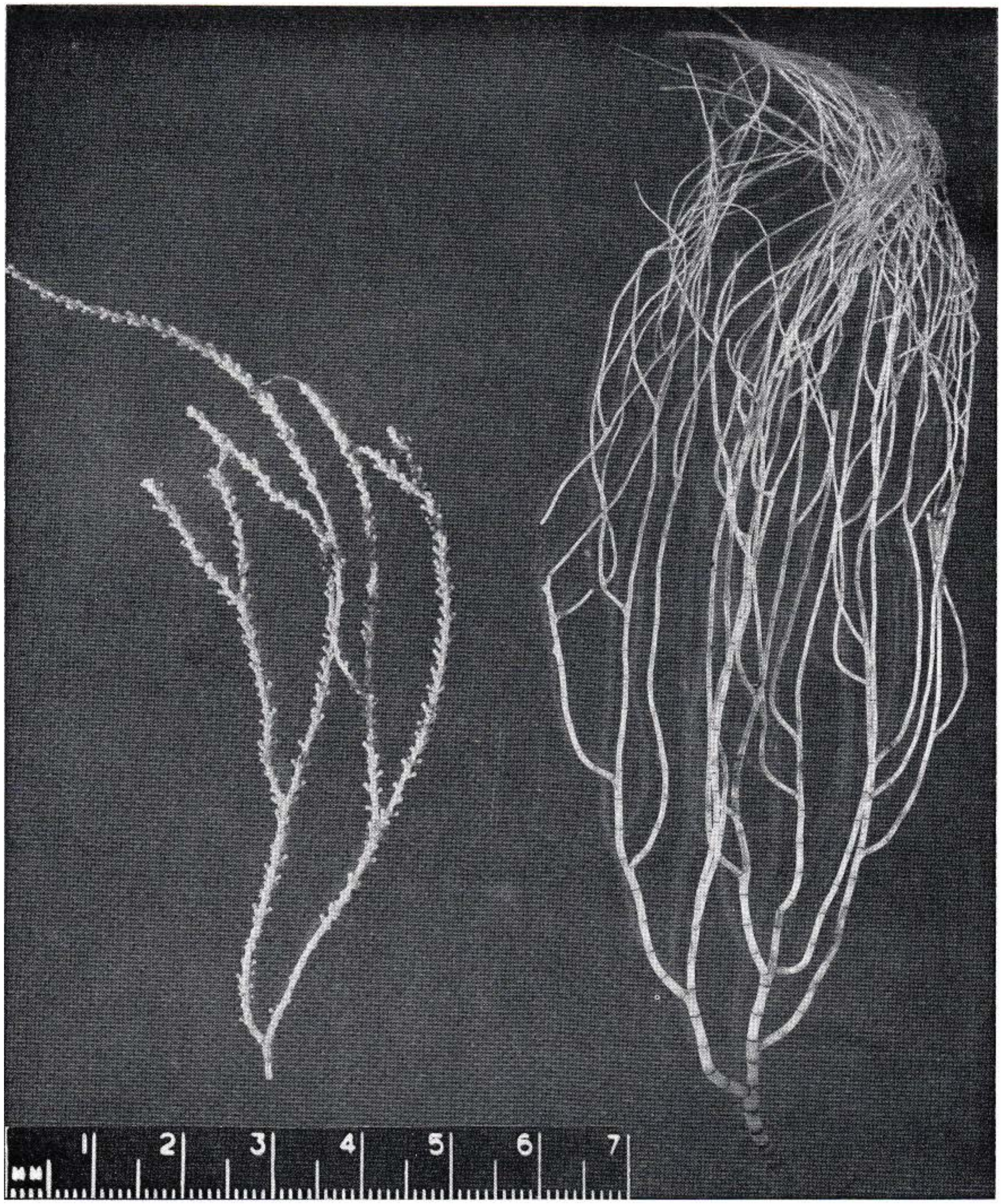


Figure 29 *Mopsea elongata*, left hand specimen from NZOI Stn E225, right hand specimen from NZOI Stn E197a.

discussion, are very closely related. The only noteworthy difference, as it seems to us, lies in the character of the spicules." They noted Roule's criteria, and that the branching of *M. australis* is similar to that of both *M. dichotoma* and *M. elongata*. "We do not think that the mode of branching can here be safely used as a specific distinction. Perhaps the same is true in regard to the details of spicule-form" (1911, p. 676).

Gravier (1914) gave a full redescription of *M. elongata*, using Roule's and his own material, and seemed (Gravier 1914, p. 37) to accept Roule's criteria for the distinction of *M. elongata* and *M. dichotoma*.

Kükenthal (1919, p. 625) included *M. elongata* and *M. australis* under his list of "Incompletely described

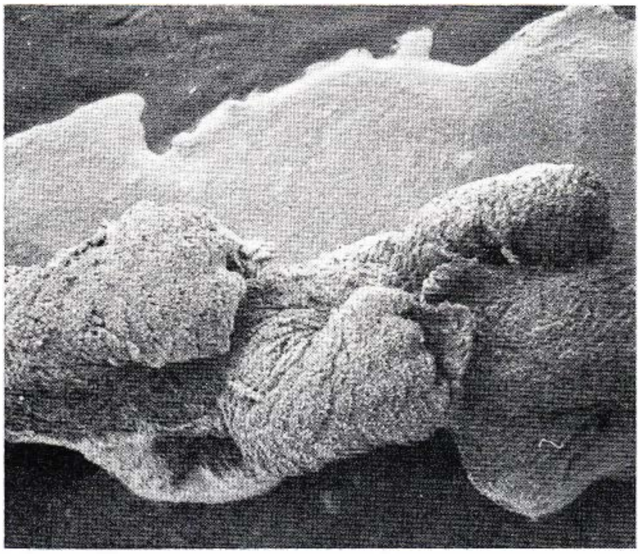


Figure 30 *Mopsea elongata,* NZOI Stn E171. Polyps. (×35)

and uncertain species", and noted their similarity to, and possible identity with, *M. dichotoma.* It should be noted, however, that Kükenthal seems not to have seen Gravier's description of *M. elongata.*

Of the species of *Mopsea* so far mentioned in the discussion, *M. dichotoma, M. elongata,* and *M. australis* have roughly dichotomous branching, and that of *M. encrinula* is pinnate. Thomson and MacKinnon (1911) described two other dichotomous species: *M. elegans* and *M. flabellum* (*M. squamosa* Kükenthal, 1919). The closely wound polyps of *M. squamosa,* and the spiculation of *M. elegans* (Thomson and MacKinnon 1911, p. 667, pl. 68, figure 6), seem sufficient to distinguish these two species from all others. But, as should be evident from the foregoing discussion, there remains considerable doubt as to whether *M. elongata* and *M. australis* can be regarded as species distinct from *M. dichotoma.* The criteria as given by Roule are not definitive. As Wright and Studer (1889, pp. 41–2) emphasised, the concentration of the polyps in *M. dichotoma* depends on their relative position in the colony, and the criterion of spacing of the polyps would be difficult to use.

Furthermore, Roule stated that the polyps are "a little smaller, on the average, that those of *M. dichotoma*", yet Wright and Studer's figures for *M. dichotoma* are 0.6–0.7 mm in height, and for *M. elongata* Roule gave the contracted height as 1.0–1.2 mm.

Gravier (1914) gave good discriptions and illustrations of the form he called *M. elongata,* and it is with this species that the forms in the present collection can be identified, but it must be emphasised that the distinction between this species and the genotype *dichotoma* is not clear. However, synonymy of these species would be a decision to be made only after comparative study of the relevant material.

MATERIAL EXAMINED NZOI Stn E171, fragments; E172, 1 specimen; E177, fragments; E197a, 1 specimen; E209b, fragments; E223, 2 specimens; E225, 3 specimens.

Primnoisis Studer, 1887

1887 *Primnoisis* Studer, *Arch. Naturgesch. 53(1):* 1.

TYPE-SPECIES *Isis antarctica* Studer, 1878

DEFINITION Mopseinae in which colony branches on all sides.

DESCRIPTION Colony usually with distinct main stem, giving off irregularly placed branches on all sides, "bottle-brush" fashion, up to fourth order. Internodes may be smooth but usually with longitudinal ribs. Attachment by basal disc. Polyps erect or inclined to the axis, distally directed, irregularly distributed, covered with transversely arranged scales with toothed edges and warty surfaces. Coenenchyme thin with covering of variously shaped scales with toothed edges. Tentacles bear small transverse scales; base of tentacles may be covered by slightly expanded distal polyp scales.

HISTORY The genus *Primnoisis* was established by Studer for a form he had previously included in *Isis.* Wright and Studer (1889) gave a full description of the genus and of *P. antarctica,* and added three new species, *P. ambigua, P. sparsa,* and *P. rigida.* Hickson (1904) described *Ceratoisis ramosa,* and this was placed in *Primnoisis* by Kükenthal (1919, p. 616), and a species *P. ramosa* was also described by Thomson and Ritchie (1906). Hickson (1907) described *Ceratoisis spicata* and *C. delicatula,* having decided that his two species *ramosa* and *spicata* offered sufficient evidence of the arbitrary nature of the division between *Ceratoisis* and *Primnoisis,* and that the name *Ceratoisis* only should be retained. Nutting (1910) recommended the retention of *Primnoisis* and the placing of *spicata* (and, by implication, *delicatula*) in this genus (*see* discussion of the genus *Echinisis*).

Kükenthal (1912) described new species *P. armata* and *P. fragilis,* and Gravier (1913) described *P. formosa.* Kükenthal (1919) in his review placed *P. ramosa* (Hickson), *P. ramosa* Thomson and Ritchie, and *P. formosa* in his list of "incompletely described and uncertain species", noting the possible identity of *P. ramosa* Thomson and Ritchie with *P. antarctica.*

Thomson and Rennet (1928) established a new genus *Echinisis* for *P. spicata* and *P. armata,* and noted the closeness between *P. antarctica* and *P. sparsa.*

A new species from Florida, *P. humilis,* was described by Deichmann (1936), this being the first record of the genus from the Northern Hemisphere. She stated (p. 251) that the species seemed close to *P. rigida* Wright and Studer, and that it could be a shallow water form of the latter.

Primnoisis antarctica (Studer, 1878)

Figs 31, 32

1878 *Isis antarctica* Studer, *Mber. preuss. Akad. Wiss. Berl.*: 661, pl. 5, figure 32.

1887 *Primnoisis antarctica;* Studer, *Arch. Naturgesch. 53(1)*: 1.

1889 *P. antarctica;* Wright & Studer, *Rep. scient. Results explor. Voyage Challenger 31(1)*: 35, pl. 8, figures 2, 2a, 2b, pl. 9, figure 6.

1907 *Ceratoisis antarctica;* Hickson, *Natn. Antarct. Exped. 3*: 6, pl. 2, figures 13–15.

1912 *P. antarctica;* Kükenthal, *Dt. Sudpol.-Exped. 13, Zool. 5(3)*: 340, pl. 23, figures 18, 19.

1913 *P. antarctica;* Gravier, *Bull. Mus. natn. Hist. nat. Paris 7*: 425.

1914 *P. antarctica;* Gravier, *Deuxieme Exped. Antarct. Fr.*: 28, pl. 3, figure 7, text-figures 14–20.

1919 *P. antarctica;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2)*: 614.

1928 *P. antarctica;* Thomson & Rennet, *Scient. Rep. Australas. Antarct. Exped. 9(3)*: 11.

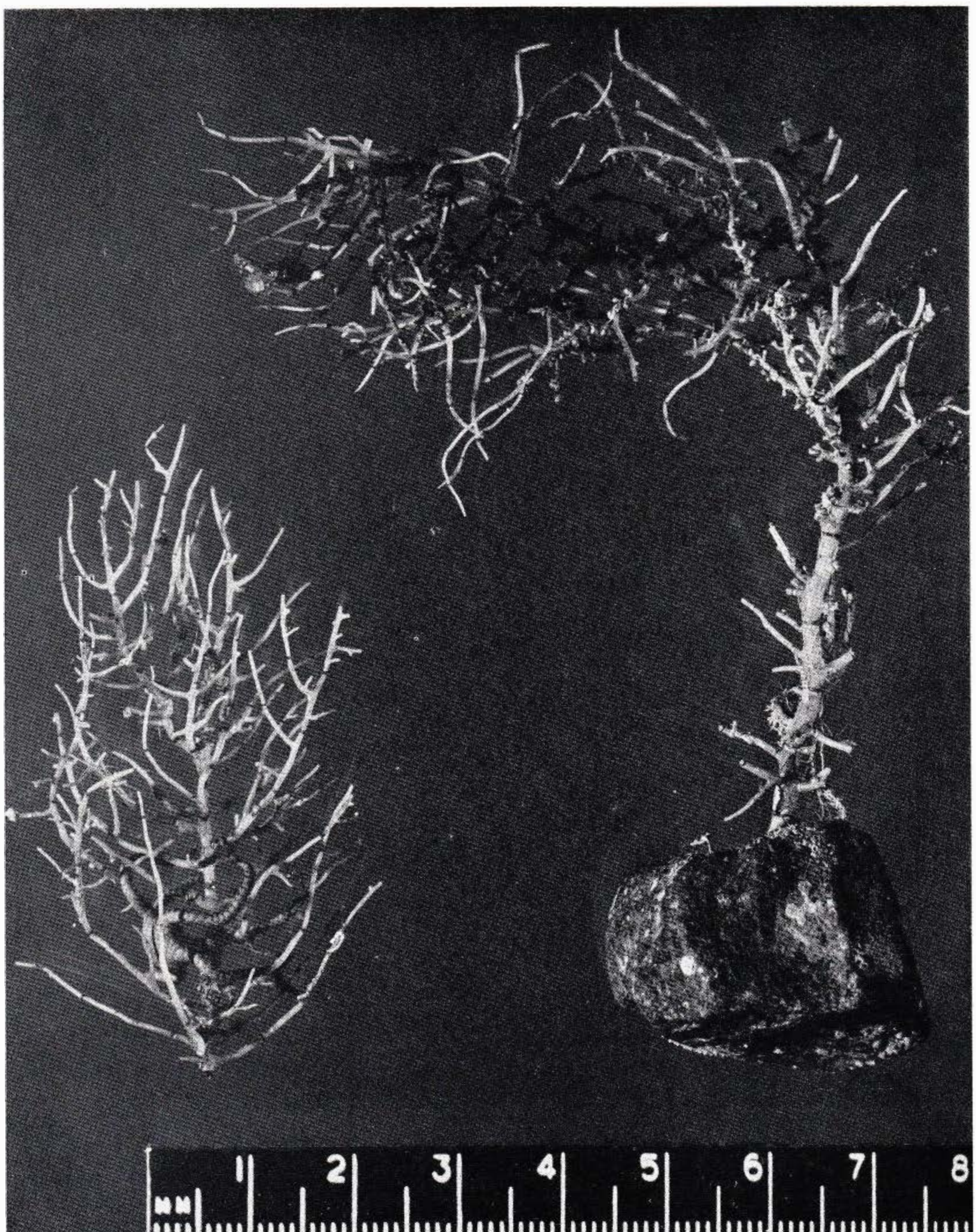
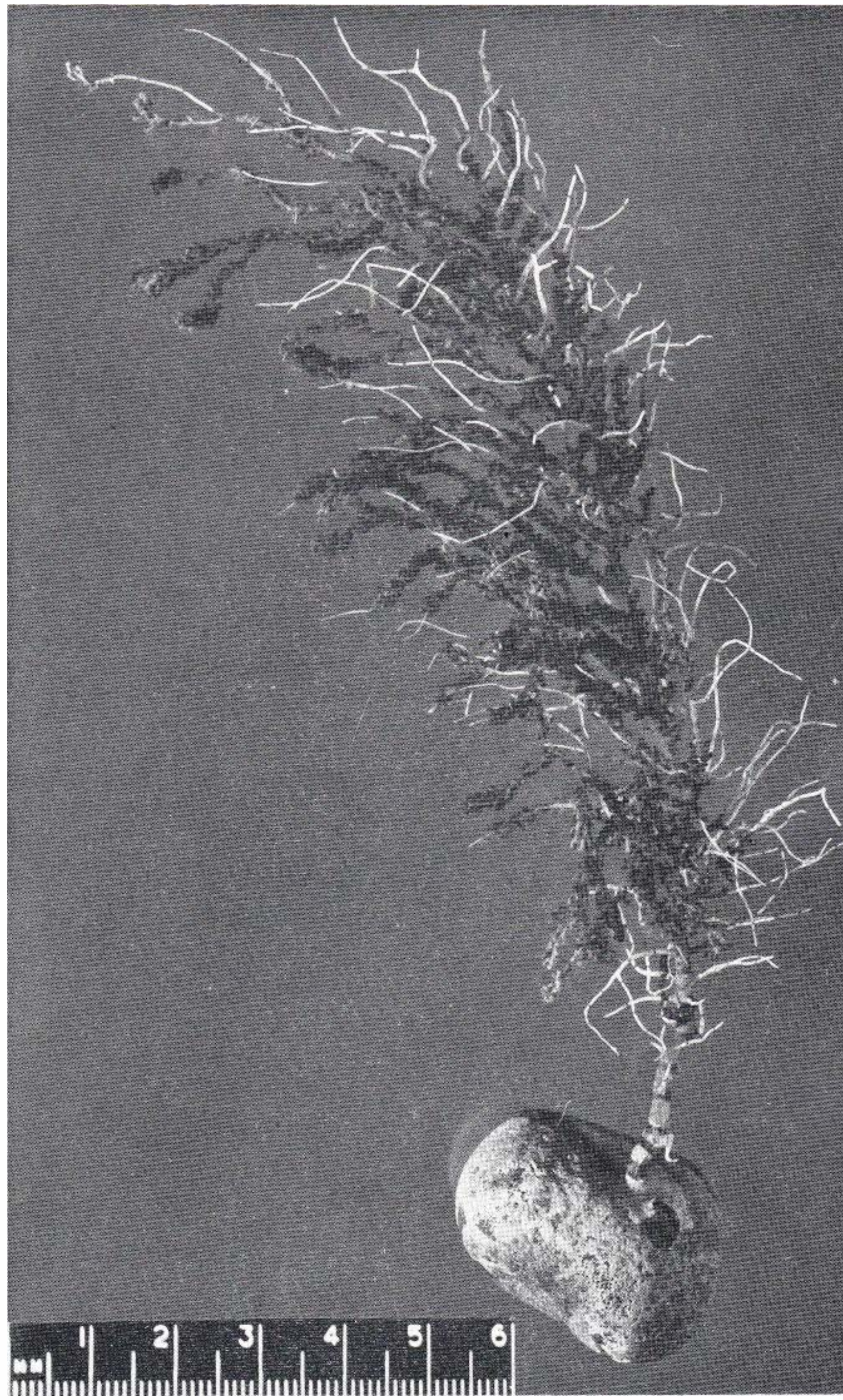


Figure 31 *Primnoisis antarctica*. NZOI Stn E 188.

Figure 32 *Primnoisis antarctica*, NZOI Stn E186.



DESCRIPTION Main stem bearing branches up to fourth order. Internodes distinctly longitudinally grooved. Polyps often standing erect from the axis, although this is not invariable and some are inclined especially toward the distal end of the branches, up to about 1.5 mm in height. Walls covered with scales, edges moderately serrated, surface with small thorny warts. Tentacles with covering of small closely fitting scales, forming a pseudo-operculum.

MATERIAL EXAMINED NZOI Stn E175, 1 specimen; E188, 1 whole specimen, also fragments; E189, 1 specimen; E209b, a number of specimens; E220b, 2 specimens.

Another specimen (Stn E186, Fig. 32) may belong to this species also, but its size (height *c*.230 mm) and the correspondingly large and distally very thickly clustered polyps make it distinct to some degree.

DISCUSSION This is the often recorded genotype. Various other species of *Primnoisis* may be synonymous with it as has been suggested by Kükenthal (1919) for *P. ramosa* Thomson and Ritchie, and by Thomson and Rennet (1928) for *P. sparsa*.

Primnoisis formosa Gravier, 1913

Figs 33–35

1913 *P. formosa* Gravier, *Bull. Mus. natn. Hist. nat. Paris* *7:* 453.
1914 *P. formosa;* Gravier, *Deuxieme Exped. Antarct. Fr.:* 31, pl. 1, figures 3–5, text-figures 21–5.
1919 *P. formosa;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 617.
1929 *P. formosa;* Molander, *Further Zool. Results Swed. Antarct. Exped. 2(2):* 79.

DESCRIPTION Colony branched on all sides of main stem, up to third order. Most second order branches up to 20–30 mm long, although one or two distally directed branches may be rather longer, about 60 mm; branches mostly delicate. The internodes of the main stem are up to about 7 mm long, most less than this; these internodes and those of the basal branches are longitudinally grooved.

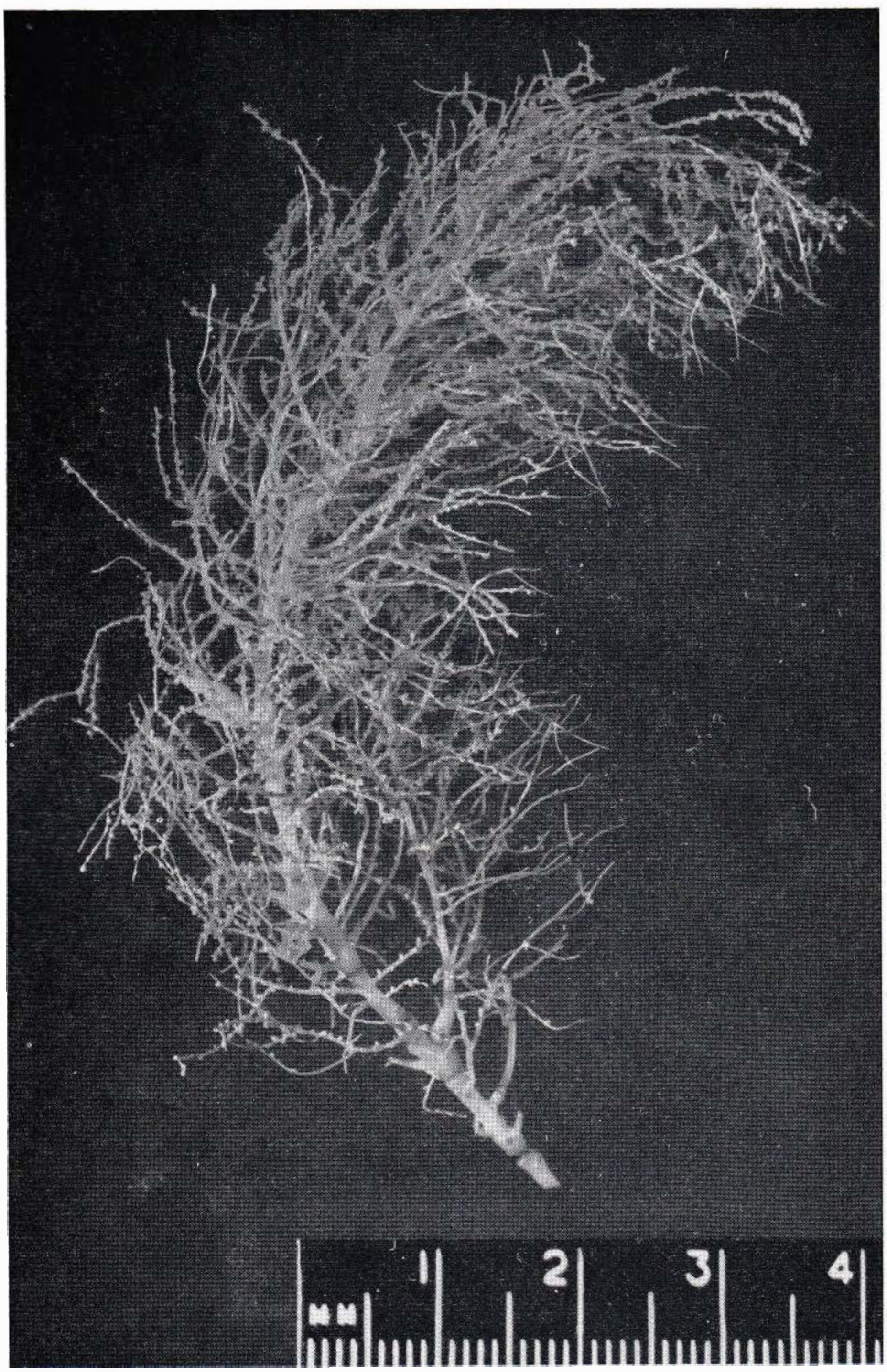


Figure 33 *Primnoisis formosa,* NZOI Stn E209b.

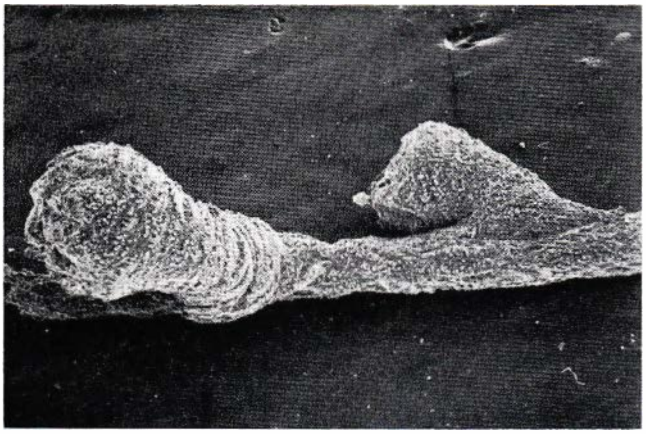


Figure 34 *Primnoisis formosa*, NZOI Stn E209b. Polyps. ($\times 50$)

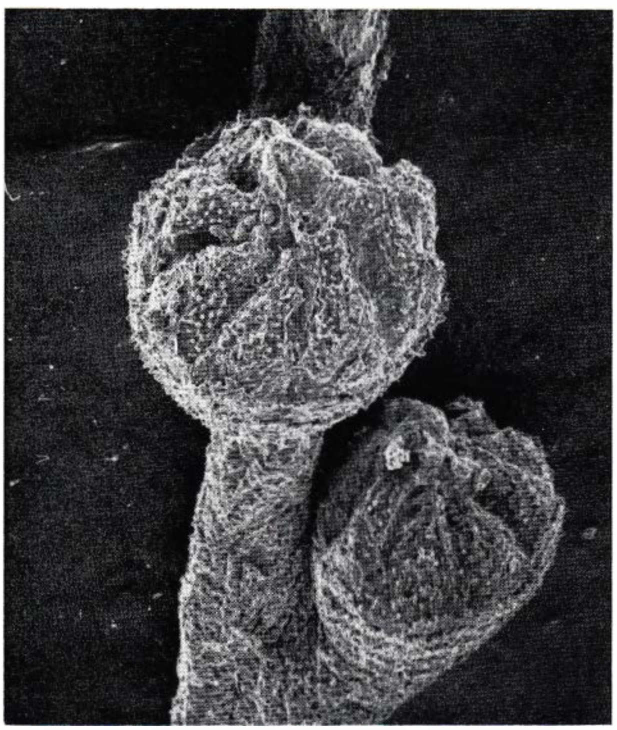


Figure 35 *Primnoisis formosa*, NZOI Stn E209b Polyps. ($\times 90$)

The polyps are small, *c*.0.5 mm high, distributed irregularly around the branches, incurved towards the axis, distally directed. They are covered with transverse scales, strongly marginally sculptured, and bearing warts. Distally these scales form a pseudo-opercular covering over the tentacles.

MATERIAL EXAMINED NZOI Stn E209b, 5 specimens; E215a, 1 specimen: E215b, 1 specimen; E224, 1 specimen.

DISCUSSION At the end of his fuller description of the species, Gravier (1914, p. 34) stated: "The *Primnoisis* described above . . . is clearly distinguished from all those which have been thus far described by Wright and Studer, Hickson, Thomson and Ritchie, and Kükenthal." However, the differences were not systematically enumerated. *P. formosa* is distinct from *P. antarctica* with respect to the size and disposition of the polyps, the relatively deep sculpturing of the margins of the scales, and the delicate branching. But the fragmentary material from which Hickson (1907, p. 5) described *P. delicatula* seems to stand close to *P. formosa* in size of internodes and polyps, and the gracility of the branches. It should be borne in mind that the difference between these two species, at least, has not been fully demonstrated.

Primnoisis ambigua Wright & Studer, 1889

Fig. 36

1889 *P. ambigua* Wright and Studer, *Rep. scient. Results explor. Voyage Challenger 31(1)*: 39, pl. 9, figure 9.

1899 ?*P. ambigua;* Hiles, *Willey's Zool. Results, Pt 2*: 196.

1919 *P. ambigua;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2)*: 615.

1928 *P. ambigua;* Thomson and Rennet, *Scient. Rep. Australas. Antarct. Exped. 9(3)*: 12.

DESCRIPTION One fragmented and decorticated specimen may represent this species. The main stem is bent in various directions along its length. Near the base branches are given off quite acutely, and these may extend for some distance up the colony, their diameter may be equal to that of the main stem. More distally the branches are relatively small. The internodes are short, and distinctly longitudinally grooved. The branches may arise from near the end of the internode so that the node at the base of the branch coalesces with that of the stem. This feature, particularly near the base, gives very irregular branching and mis-shapen internodes.

MATERIAL EXAMINED NZOI Stn E148, 1 specimen.

DISCUSSION The shape of the internodes and the mode of branching agree well with the description given by Wright and Studer, but their type is sparingly illustrated, and identification is not certain.

By comparison with the internodes of the above specimen, both internal and external morphology, internodes of the lower Miocene of New Zealand have been referred to this species (N.Z. Foss. Rec. localities S136/f511 (GS 3947), grid reference 493578, Gees Point, Kakanui; S136/f490 (GS 1211), Campbells Beach, Kakanui; S136/f446 (GS 2103), All Day Bay, Kakanui; S136/f557 (GS 3875), grid ref. 493578, Gees Point. Kakanui; S136/f826, grid ref. 479546, north end of All Day Bay, Kakanui; S136/f854, grid ref. 480545, north end of All Day Bay, Kakanui; S136/f1061 (GS 9688), grid ref. 480545, north end of All Day Bay, Kakanui; S136/f1077 (GS 9626), grid ref. 509655, Deborah Road Cutting, Oamaru).

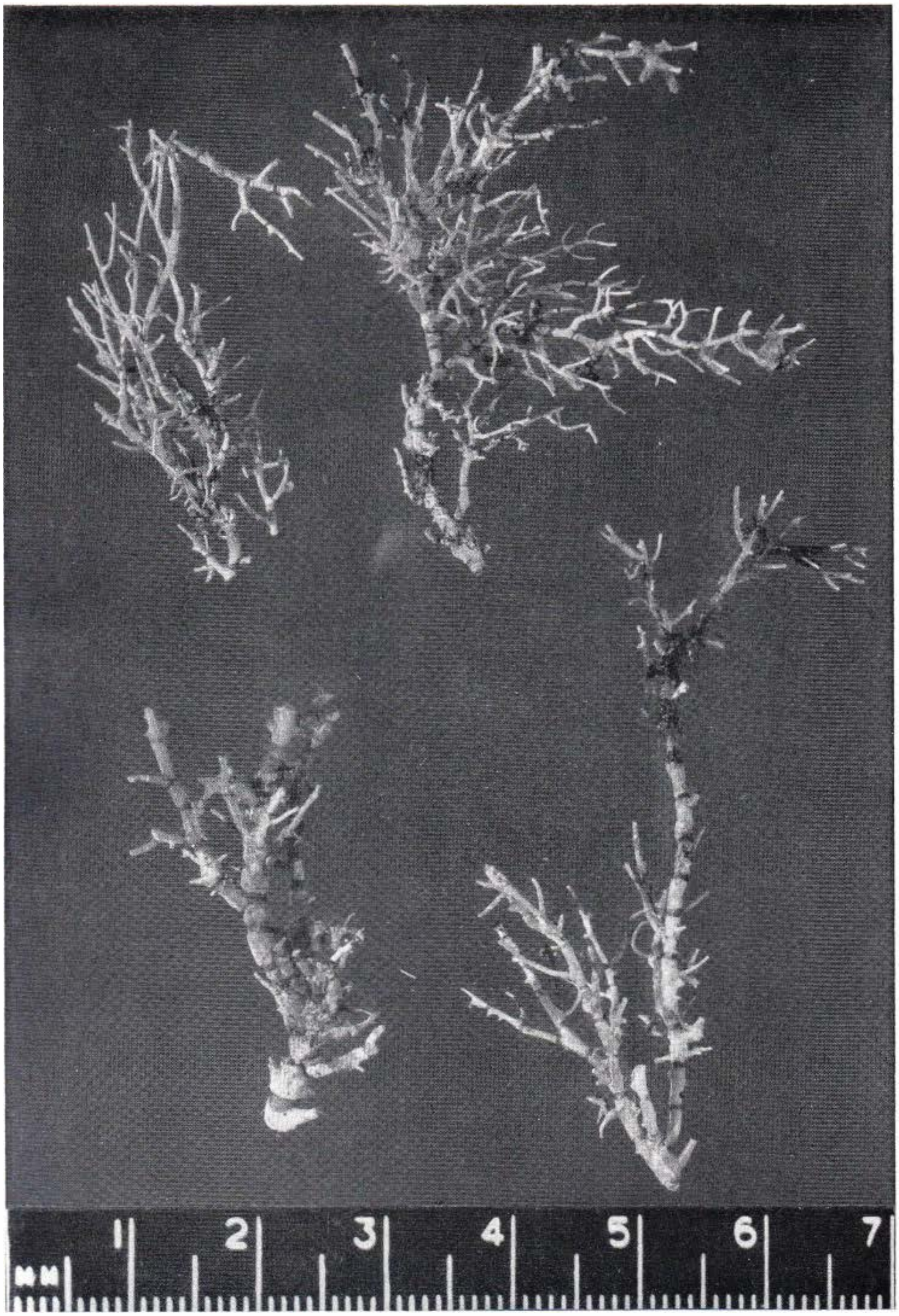


Figure 36 *Primnoisis ambigua*. NZOI Stn E148.

CIRCINISIDINAE n.subfam.

DEFINITION Isididae with scale-like, cycloid or semicycloid spicules which are irregularly distributed, with no differentiation between those of the polyp wall, the tentacular region, or the axial coenenchyme; axis made up of undulating concentric horny lamellae, with fine, evenly pervading, calcareous material.

DISCUSSION The scales of the herein described new genus *Circinisis* are sufficiently distinct from those of all other Isididae to warrant its placing in a separate subfamily. This is reasonable with respect both to the spicular variation between already existing subfamilies, and to the subfamilial separation of *Primnoeides*, a form with spiculation very close to that of *Circinisis*, within the Primnoidae.

Circinisis n.gen.

TYPE-SPECIES *Circinisis circinata* n.sp.

DEFINITION Unbranched Circinisidinae.

DESCRIPTION Unbranched; polyps and coenenchyme with irregularly arranged, overlapping, cycloid or semi-cycloid scales.

Circinisis circinata n.sp.

Figs 37–39

DESCRIPTION Type specimen incomplete, 160 mm long, other specimens (incomplete) up to 250 mm. Internodes shortest at base, 0.5 mm long × 1.5 mm diameter increasing to *c*.3.5 mm × 0.75 mm more distally in the stem; basal nodes may be as long as the internodes or longer, distally relatively much shorter. All internodes with deep longitudinal grooves, sometimes oblique, internodes slightly dilated at each end.

Polyps arise separately, well spaced, narrow base, expanding towards mouth; bent over so that abaxial side parallel to axis, mouth can be closely appressed to the axis; typical length *c*.1.5 mm. Covered with overlapping scales, each typically with projecting edge convex and smooth, with the projecting surface smooth, the covered edge having a spinose surface, dimensions *c*.0.11 × 0.08 mm. This covering of scales is continuous with that of the coenenchyme.

MATERIAL EXAMINED NZOI Stn E323, 4 specimens (incomplete).

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 128, NZOI Stn E323.

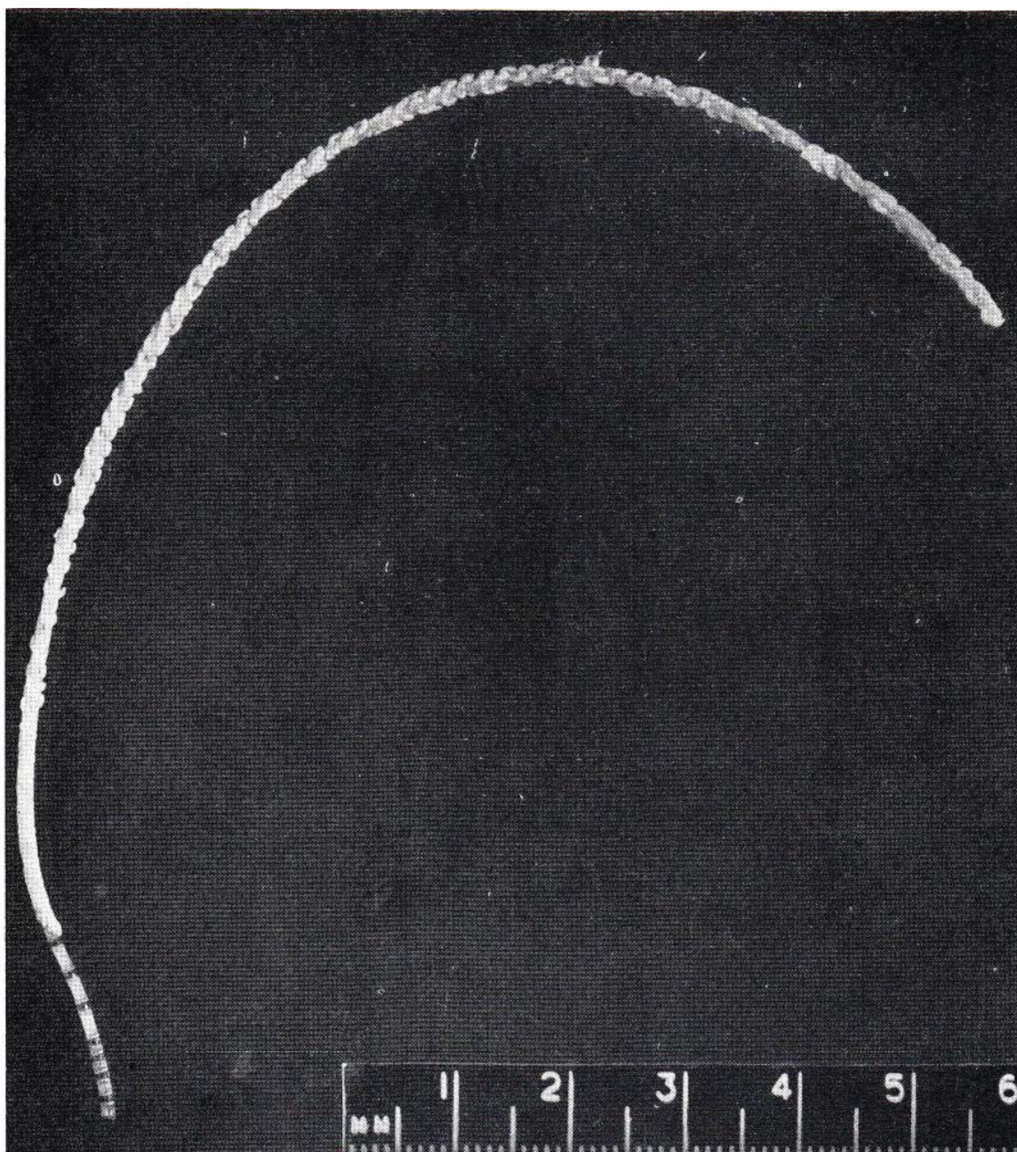


Figure 37 *Circinisis circinata*, NZOI Stn E323.

TYPE LOCALITY East of the Three Kings Islands, 165 m.

DISCUSSION The generic and specific names are taken from the Latin *circinare*, to make round, reference being to the rounded scales.

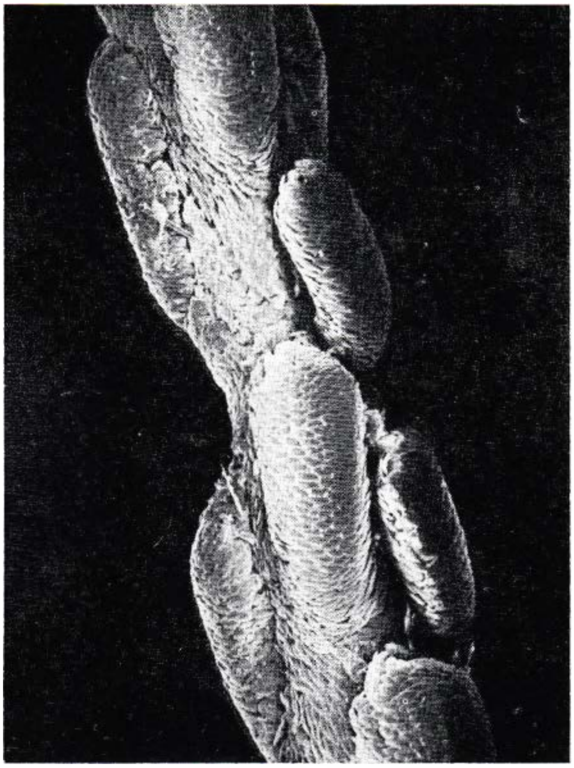


Figure 38 *Circinisis circinata*, NZOI Stn E323. Polyps (×80)

Figure 39 *Circinisis circinata*, NZOI Stn E323. Polyps. (×170)

PELTASTISIDINAE n.subfam.

DEFINITION Isididae having polyps with scale-like spicules, eight of these forming a fully differentiated operculum.

DESCRIPTION Colony branched in one plane or on all sides, or unbranched. Polyps non-retractile, covered with variously shaped scale-like spicules. Eight spicules form a distinct operculum.

DISCUSSION The possession of a fully differentiated operculum distinguishes the genera of this subfamily from all others. By analogy with the accepted subfamilial classification of the Primnoidae, these are taken to be sufficiently distinct to warrant separation as a new subfamily.

Peltastisis Nutting, 1910, emend

1910 *Peltastisis* Nutting, *Siboga Exped.* 8: 19.

TYPE-SPECIES *Peltastisis uniserialis* Nutting, 1910.

DEFINITION Unbranched Peltastisidinae, operculum of eight triangular scales.

DESCRIPTION Colony unbranched. Polyps uniserial (two species) or irregularly placed (one species), with true opercula consisting of eight triangular scales, sides covered with ctenate scales, rectangular, semi-rectangular, triangular, some irregular. Coenenchyme with variously shaped spiny scales.

HISTORY AND DISCUSSION Nutting erected the genus for two new species, *P. uniserialis* and *P. cornuta*. In both, polyps are uniserially disposed and he made this a generic character. The new species below has irregularly arranged polyps, but with its unbranched axis and characteristic polyp spiculation is sufficiently close to the type species to warrant inclusion in the genus, the characters of which are therefore extended.

Peltastisis nuttingi n.sp.

Figs 40, 41

DESCRIPTION The description is based on the unique holotype. Length of colony 335 mm, basal diameter 0.5 mm, first two internodes 4 mm long, thereafter 2–3 mm. The first polyps occur 55 mm up from the base, and are irregularly placed on all sides of the remainder of the stem, being most concentrated along the second quarter of its length. They are 1–2 mm long, mostly incurved so that the adaxial side is close to the stem. The walls of the upper part are covered with regular imbricating series of rectangular, ctenate scales, up to 0.1 × 0.04 mm, less regular around the narrow stalk of the polyp. Covering the mouth of the polyp are triangular, ctenate, opercular scales, length 0.35 mm, width across base 0.1 mm.

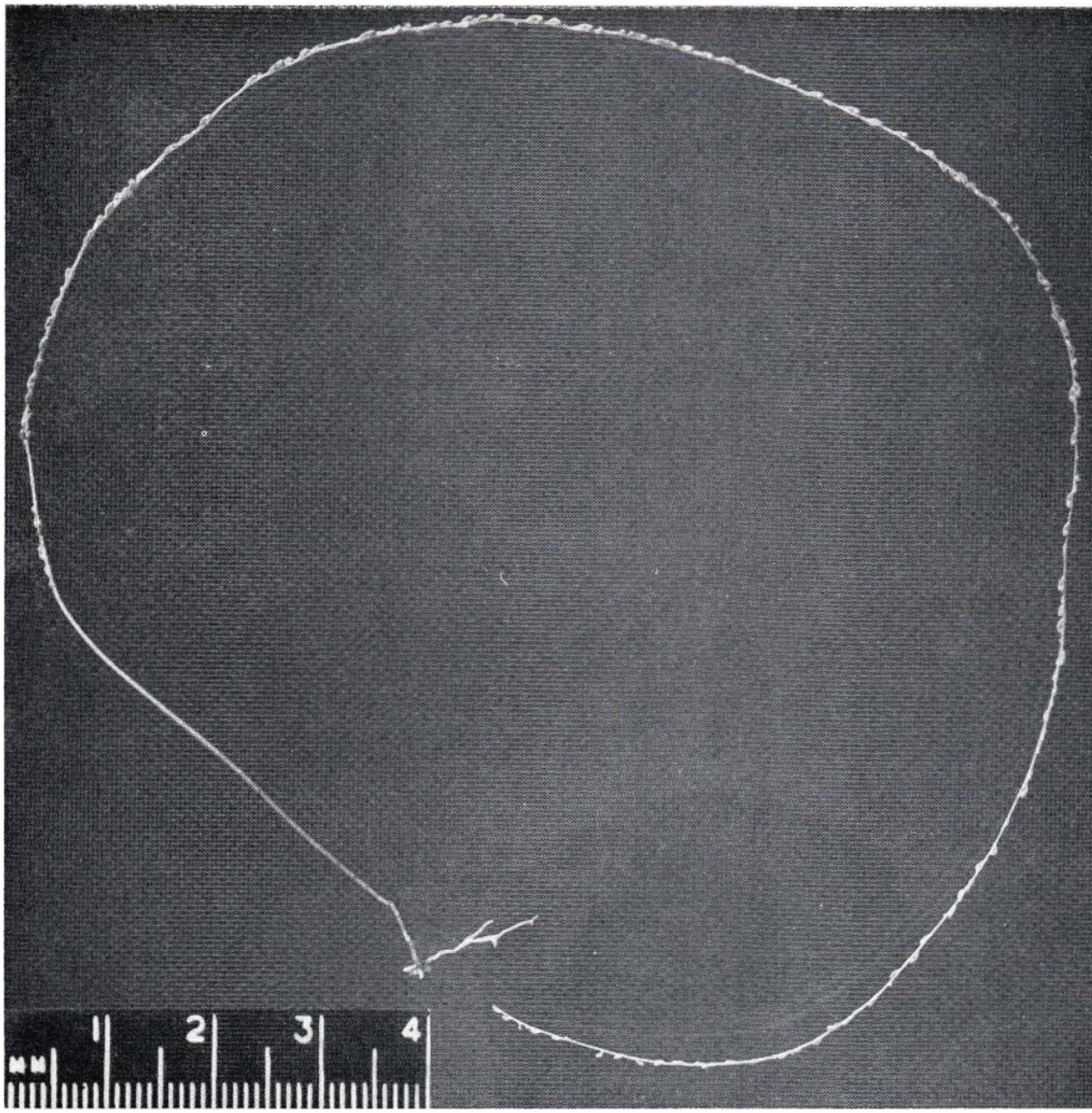


Figure 40 *Peltastisis nuttingi*, NZOI Stn E776.

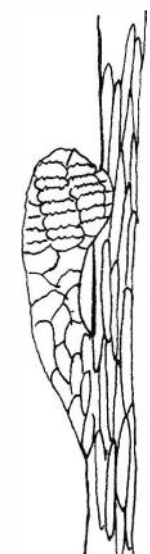


Figure 41 *Peltastisis nuttingi*, NZOI Stn E776. Polyp. (×20)

The lower part of the axis is covered with variously shaped scales with dentate edges locked together. In the polypate portion of the stem the scales become long, narrow, and regularly spaced.

The base of the stem is articulated with a root system, one long rootlet of which is segmented, that is, contains "nodes" along its length.

MATERIAL EXAMINED NZOI Stn E776, 1 specimen.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 129, NZOI Stn E776.

TYPE LOCALITY Off the west coast, South Island, 187–1 067 m.

DISCUSSION *P. nuttingi* can be readily contrasted with Nutting's two species as follows. *P. uniserialis* has uniserial polyps, and *P. cornuta* has uniserial polyps and a differentiated abaxial stay supporting the polyps (Nutting 1910, pl. 6, figures 2, 5); *P. nuttingi* has irregular polyps, and no abaxial stay.

This new species constitutes the first record of the genus since Nutting's original description and is named after him.

Chathamisis n.gen.

TYPE-SPECIES *Chathamisis bayeri* n.sp.

DEFINITION Peltastisidinae which branch irregularly on all sides, operculum of eight triradiate sclerites.

DISCUSSION This genus stands apart from *Peltastisis* and *Minuisis* in the Peltastisidinae, but is grouped with them on the basis of the operculum.

The generic name is taken from the Chatham Rise, the locality of all known specimens of the genus.

Chathamisis bayeri n.sp.

Figs 42–44

DESCRIPTION The type specimen is a small, compact colony 60 mm high, initial main stem which soon breaks up into irregular branches; branching in all directions, but with an overall flattening of the colony in one plane; internodes up to 6 mm long, diameter at base 1 mm, thereafter less than 1 mm, terminal branches tapering to 0.1 mm.

Polyps well spaced, irregularly distributed, squat, *c.* 0.5 mm high to base of tentacles. Walls covered with transversely placed oval scales, curved to fit the contour of the polyp wall, margins lightly serrated. Covering the mouth of the polyp are eight triradiate spicules forming an operculum. The forked base which rests on the upper margin of the polyps may have small projections on the margins, but the internal and external surfaces are smooth; the projecting spine is heavily thorned externally and marginally. The whole spicule is externally convex.

Coenenchyme with variously shaped elongate and thorny scales.

Size of spicules:

1. Operculum spicule 0.32 × 0.20 mm (across base), length of spine 0.18 mm.
2. Polyp wall scale 0.23 × 0.045 mm, 0.28 × 0.045 mm.

Other specimens show the development of the main stem to be variable, and that the overall flattening of the colony is not necessarily characteristic. Attachment by basal disc to pebble (one colony).

MATERIAL EXAMINED NZOI Stn D90, 1 specimen (the type); G259a, 2 specimens; G279, 1 specimen; G284a, 1 specimen.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 130, NZOI Stn D90.

TYPE LOCALITY Chatham Rise, 399 m.

DISCUSSION The species is named after Frederick Bayer, a foremost contributor to the modern studies of Octocorallia.

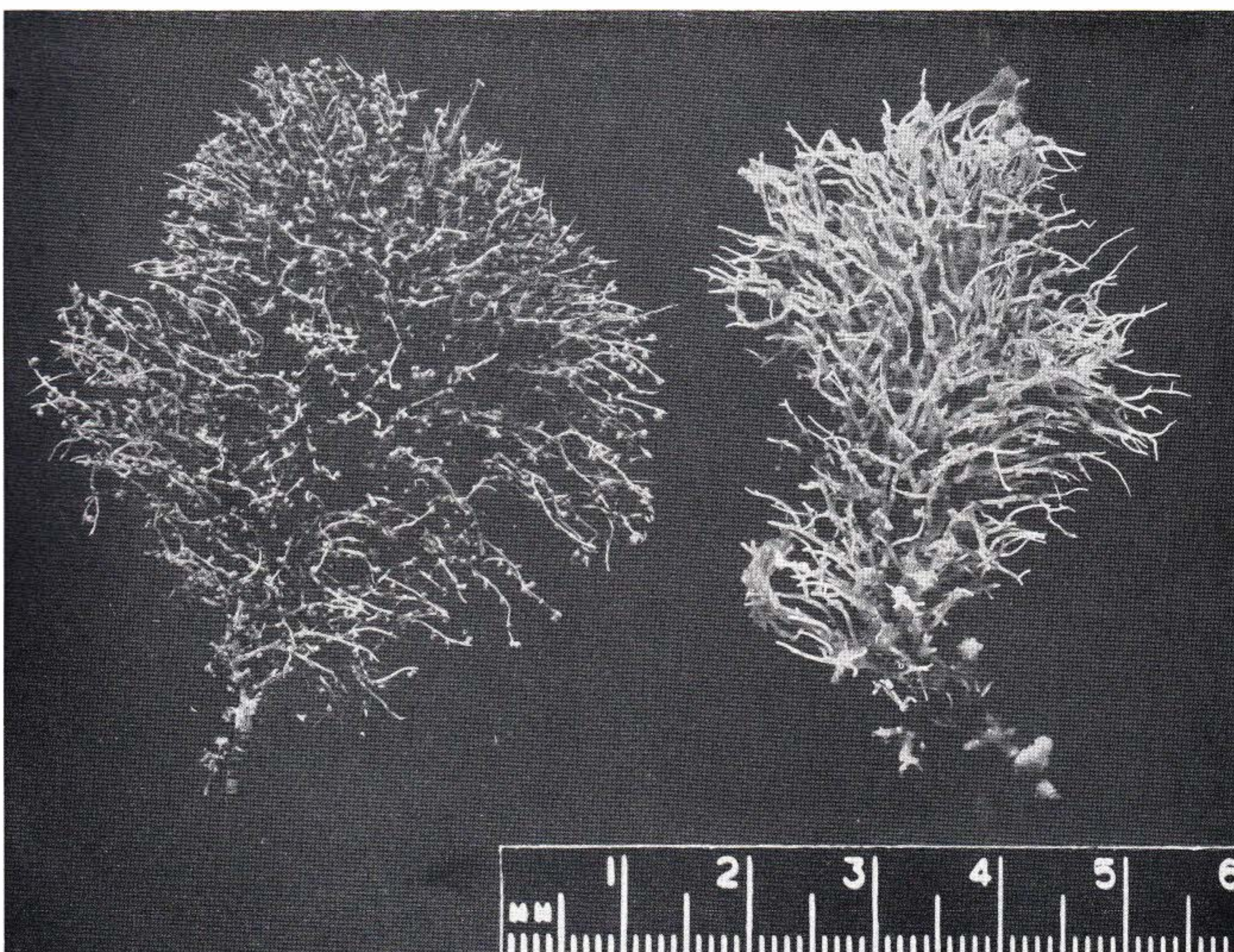


Figure 42 *Chathamisis bayeri*, right hand specimen from NZOI Stn D90, left hand specimen from NZOI Stn G259a.

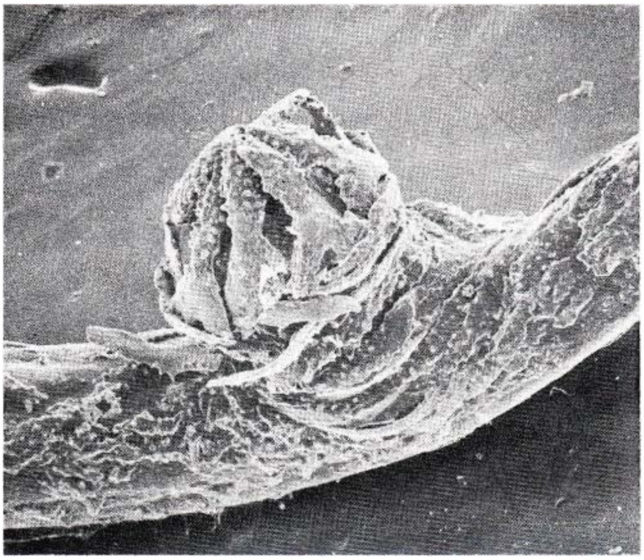


Figure 43 *Chathamisis bayeri*, NZOI Stn D90. Polyp. (×50)

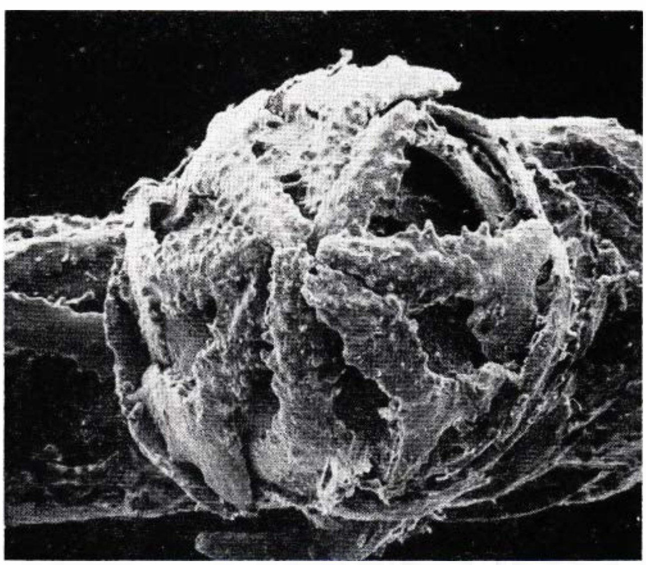


Figure 44 *Chathamisis bayeri*, NZOI Stn D90. Operculum (×190)

Minuisis n.gen.

TYPE-SPECIES *Minuisis pseudoplanum* n.sp.

DEFINITION Peltastisidinae with branches originating in one plane; polyps possess operculum of eight triangular scales.

DISCUSSION With respect to spiculation, this genus stands close to *Peltastisis* within the Peltastisidinae.

The name is derived from the Latin *minuere*, to lessen, reference being to the small size of the colony.

Minuisis pseudoplanum n.sp.

Figs 45–47

DESCRIPTION Type specimen 60 mm high, span 27 mm, branching mainly from two opposite sides, with branches curved to give bushy appearance on three sides, flat fourth side; branches mostly simple, up to 15 mm long. Calcareous disc at base, basal internodes shortest.

Polyps well spaced, erect, *c*.1 mm high, on some branches regularly alternating along opposite sides. Covered with overlapping scales, some semirectangular, some quite irregular, with serrated edges and warty surfaces, typical size 0.27 mm × 0.09 mm. Operculum of eight triangular scales, base 0.18 mm wide, 0.27 mm long.

Coenenchyme with tiny spinose scales, 0.09 × 0.03 mm.

MATERIAL EXAMINED NZOI Stn E859, 2 specimens, including type; E841, 1 specimen; E868, 1 decorticated internode.

HOLOTYPE Deposited in the New Zealand Oceanographic Institute No. 131, NZOI Stn E859.

TYPE LOCALITY Norfolk Ridge, 672–751 m.

DISCUSSION The specific name alludes to the mode of branching.

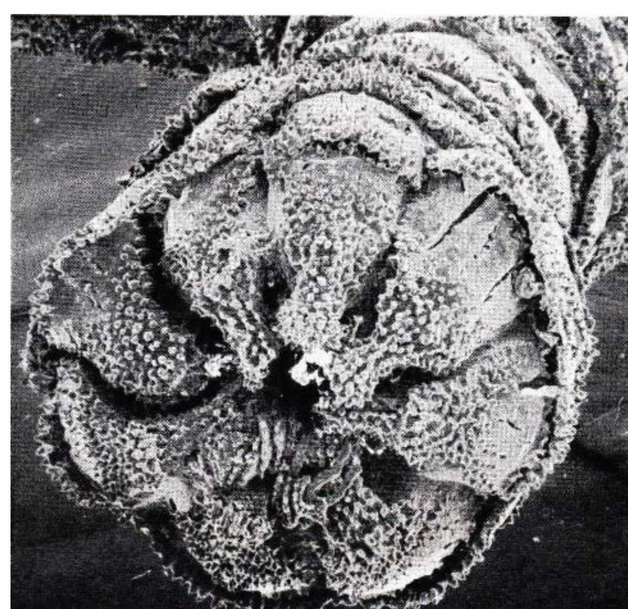


Figure 45 *Minuisis pseudoplanum*, NZOI Stn E859. Operculum. (×190)

Figure 46 *Minuisis pseudo-planum*, NZOI Stn E859. Polyps. (× 20)

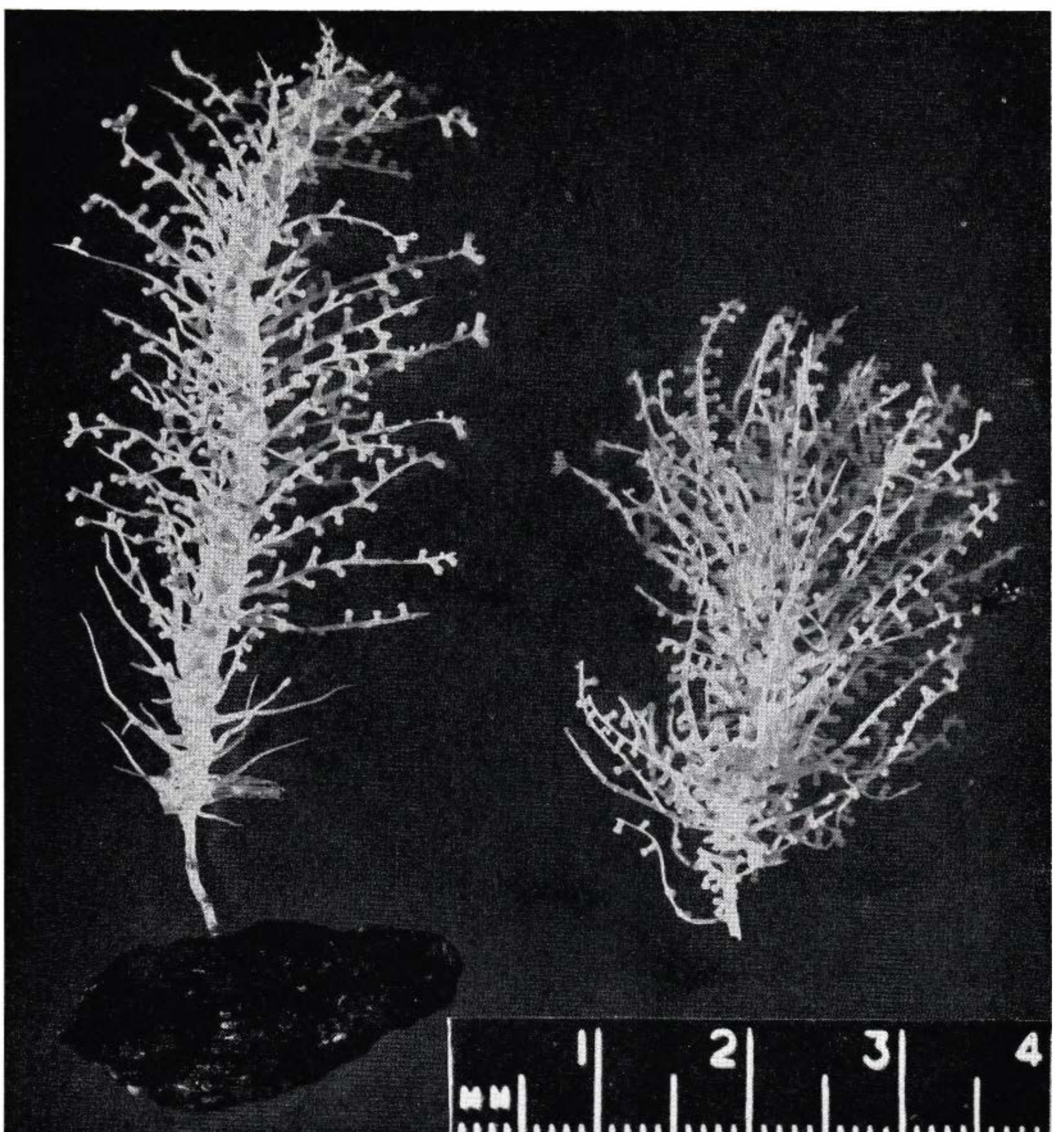


Figure 47 *Minuisis pseudoplanum*, NZOI Stn E859.

SUBFAMILY UNCERTAIN

Echinisis Thomson & Rennet, 1928

1928 *Echinisis* Thomson and Rennet, *Scient. Rep. Australas. Antarct. Exped. 9(3):* 15.

TYPE-SPECIES *Ceratoisis spicata* Hickson, 1907 (here designated).

DEFINITION Isididae with irregularly sculptured and arranged scales, the most distal bearing a projecting spine.

DESCRIPTION Colony bushy with main stem giving off branches irregularly on all sides. Polyps irregularly scattered, covered with overlapping scales some of which are triradiate, others very irregular in form. Surrounding the mouth of the polyp are triradiate sclerites with transversely expanded divaricate bases and with a prolonged medial spine which projects above the rim of the polyp*. The thin coenenchyme has a covering of irregular scales similar to those of the polyps.

HISTORY Hickson (1907 : 7) described a new species *Ceratoisis spicata,* which was placed in the genus *Primnoisis* by Nutting (1910, p. 3). This placing was followed by Kükenthal (1915) who described another similar species *P. armata.* Both species were included in *Echinisis* by Thomson and Rennet (1928) when erecting the genus.

DISCUSSION The polyps of the species described by Hickson are covered by very irregular scales, some spined, as described above. *Primnoisis* and *Mopsea* (Mopseinae) have more regular scales, none of which have a projecting spine. *Keratoisis* and *Acanella* (Keratoisidinae) have a covering of longitudinally placed needles or spindles which, in a number of species, project beyond the mouth of the polyp. Some species of *Keratoisis* have small scales as well. Hickson saw the spiculation of *spicata* as being intermediate between that of *Primnoisis* and *Keratoisis,* and as demonstrating the arbitrariness of their distinction, and thus of the distinction between Mopseinae and Keratoisidinae. He therefore recommended the retention of the one genus only, *Keratoisis,* and disputed the necessity of the subdivision into subfamilies.

However, the similarity between the projecting scales of *spicata* and *Keratoisis* is only superficial, as was pointed out by Nutting (1910, p. 3). Both may have analogous protective roles, in providing a projecting armature for the polyps, but their structure is very different, and this applies to the remainder of the sclerites also. Nutting accordingly retained the subfamilies of Wright and Studer (1889), and placed Hickson's (1907) species in the genus *Primnoisis* on the basis of the scale-like sclerites and the nature of the axis.

*Similar small sclerites form an operculum.

A different approach was taken by Thomson and Rennet (1928, p. 15): ". . . it seems to us impossible to keep it in the genus *Primnoisis* because of the entirely divergent type of spicules, which are not of the close-fitting scale type, but are either very irregular-toothed plates or long-spined forms with divaricate bases. We suggest that Hickson's *C. spicata* and Kükenthal's *P. armata* should be referred to a new genus *Echinisis.*"

The distinction between the subfamilies of the Isididae can be sustained on grounds other than that of the form of the sclerites. Although Hickson (1907, p. 5) claimed that there were no criteria for distinguishing the axes of *Primnoisis* and *Keratoisis* these are in fact available. The general mode of branching is quite distinct, and examination of the internal structure shows clear distinction. The internal structure of *spicata* is very similar to that of *Primnoisis.* However the importance of the difference in spiculation must be acknowledged, and it is here decided to follow Thomson and Rennet in recognising a separate genus *Echinisis.*

The subfamilial placing of this genus still presents a problem. In mode of branching, and internal structure, this genus is similar to *Primnoisis.* But the spiculation is so distinct that inclusion in the subfamily Mopseinae must be doubtful. Further, this form possesses a definite, although reduced, operculum of triradiate sclerites. This brings it close, in this respect to *Chathamisis,* but the spiculation of the two is otherwise very different. The placing of the genus is here left open, with recognition of the possibility that a separate subfamily may be required.

Echinisis spicata (Hickson, 1907)

Figs 48, 49

1907 *Ceratoisis spicata* Hickson, *Natn. Antarct. Exped. 1901–1904 3:* 7, pl. 2, figures 16–18.

1910 *Primnoisis spicata;* Nutting, *Siboga Exped. 8:* 3.

1919 *Primnoisis spicata;* Kükenthal, *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 613.

1928 *Echinisis spicata;* Thomson and Rennet, *Scient. Rep. Australas. Antarct. Exped. 9(3):* 15.

DESCRIPTION Main stem often irregular, branching variable, sometimes with long branches bending upwards, sometimes with apparent development of larger branches in one plane, always fairly irregular. Internodes of stem quite long in some specimens, 10–20 mm, with up to ten branches per internode; other specimens with relatively short internodes. The axis and polyps are covered with irregularly sculptured scales (Fig. 49). The spicules situated distally in the polyps are triradiate with a spine projecting above the mouth of the polyp. Apart from the prominent circlets of spines, smaller spined sclerites lie inside these, flat on the tentacles; the spines of the innermost circlet may also be bent inwards across the mouth.

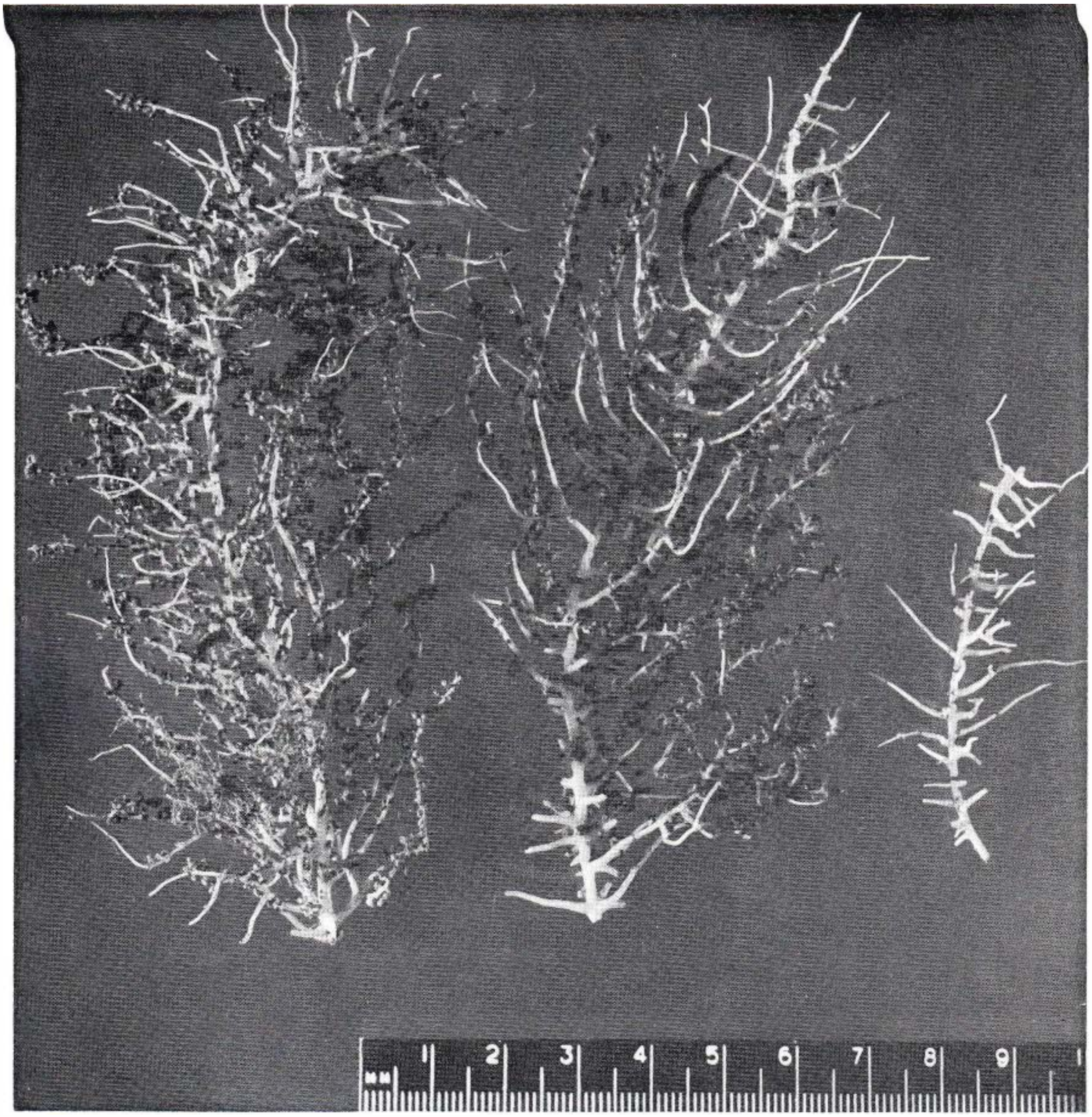


Figure 48 *Echinisis spicata* NZOI Stn E246.

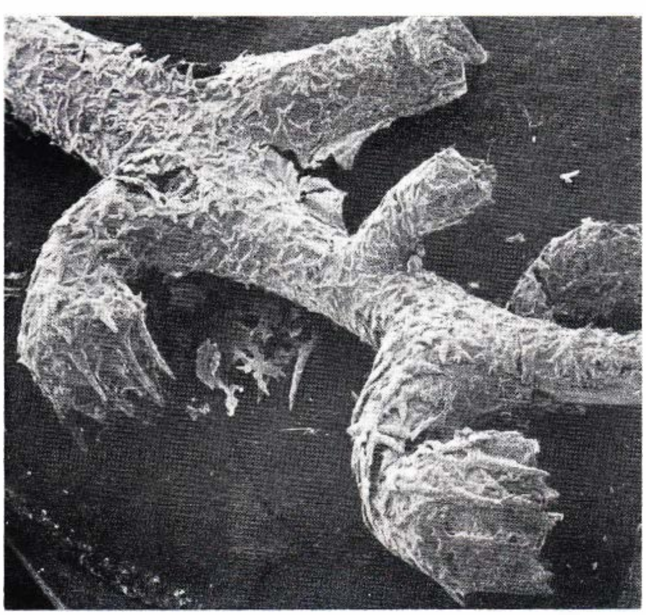


Figure 49 *Echinisis spicata*, NZOI Stn E246. Polyps. (×25)

MATERIAL EXAMINED NZOI Stn E193c, 1 specimen; E200, many fragments and almost complete colonies; E209b, 2 colonies, many fragments; E212, fragments; E220b, 1 specimen; E246, 2 specimens.

DISCUSSION Hickson (1907) described his species as having three circlets of spined sclerites around the distal end of the polyp. Kükenthal (1912, p. 344) noted the close similarity and possible identity of *spicata* with his new species *armata*, but he distinguished *P. armata* as having only one circlet of spined spicules. Of the same species Thomson and Rennet (1928, p. 15) said: "The [sclerites] of the uppermost or distal row (sub-opercular) have transversely expanded divaricate bases, and are prolonged into prominent spines. Those of the next also show protruding spines, but not so long. In some polyps there were short spines even on a third row, although in nine out of ten cases the long spines were restricted to the uppermost of row. This links Hickson's *Ceratoisis spicata* to Kükenthal's *Primnoisis armata*, although we are inclined to retain two species."

A similar variability of specimens, including variable spiculation, noted during examination of the present collection, casts doubt on the necessity for two separate species, and all specimens have been referred to *E. spicata*.

GEOGRAPHIC AND BATHYMETRIC DISTRIBUTION

GEOGRAPHIC

The present study has considerably extended the geographic range of several known species and genera. *Keratoisis flexibilis* and *Acanella eburnea* were described from the West Indies, *Acanella japonica* from Japan and *Acanella sibogae* from the Malay Archipelago.

Apart from equatorial species described by Nutting, the genus *Acanella* has had only one record from the Southern Hemisphere, *A. chilensis* from Patagonia. *Lepidisis* is known only from the West Indies (but note that the taxonomic status of the forms herein called *Lepidisis* is equivocal). *Peltastisis* has not been otherwise recorded since its description by Nutting from the Malay Archipelago. Most species of *Keratoisis* have been recorded from the Northern Hemisphere only. *K. chuni* and *K. rigida* were described from the southern Indian Ocean, and *K. microspiculata* from Antarctica.

Nutting described two species of *Mopsea* from the Malay Archipelago; all others have been described from Australia or Antarctica. *Primnoisis* is a mainly Antarctic or Subantarctic genus, and apart from *P. humilis* from Florida, is unknown north of about 35°S. These two are the southernmost genera in the present collection, all except *P. ambigua* being from stations at latitudes greater than 66°S. Similarly, there is only one record of *Echinisis* north of this latitude.

Various comments should attend the above records before any interpretation of the New Zealand fauna is made: (a) taxonomic subjectivity, (b) the limited comprehensiveness of past international surveys and the accordingly incomplete knowledge of actual distributions, (c) ignorance of dispersal capacity of octocorals. For deep-water forms, such as many of the isidids, latitudinal temperature variations do not necessarily limit distribution, and the central consideration is the mechanical possibility of widespread distribution of species. There may be no reason why a given species should not be recorded a long distance from its previously known localities, particularly if the benthos of the intervening area is poorly known.

The local ranges of distribution can be seen from the accompanying charts (Figs 50 and 51).

BATHYMETRIC

The Isididae have been recorded over a wide bathymetric range, from *Isis reticulata* at 13 m, to *Keratoisis profunda* at 4 209 m. Genera and species have widely varying depth ranges, up to *Keratoisis* with a range of 150 to 4 209 m, and *K. philippinensis* from 150 to 1 264 m. Occurrences of known species and genera in the present survey are generally consistent with former records, as seen below.

Species	*Former known distribution*	*New Zealand distribution*
Keratoisis flexibilis	593–1 410 m	1 033–1 116 m
Acanella eburnea	288– 455	903–1 053
A. sibogae	724–1 570	903–1 366
A. japonica	700	1 231–1 306
Primnoisis antarctica	36– 560	190– 512
P. formosa	254– 460	190– 209
P. ambigua	18– 354	880
Mopsea elongata	150	101– 280
Echinisis spicata	175– 385	33– 646
Genera:		
Keratoisis	150–4 209 m	406–1 278 m
Acanella	320–2 272	903–1 366
Lepidisis	459–1 473	1 159–1 171
Primnoisis	37– 460	190– 880
(*P. rigida*)	(1 090)	
Mopsea	55– 469	101– 280
Peltastisis	411– 918	978–1 067
Echinisis	175– 385	33– 646
New species and genera:		
Circinisis circinata		165 m
Chathamisis bayeri		399– 421
Minuisis pseudoplanum		428– 751
Peltastisis nuttingi		978–1 067
Lepidisis solitaria		1 159–1 171
Keratoisis tangentis		406– 442
K. glaesa		406
K. projecta		602– 786
K. zelandica		993–1 003
K. hikurangiensis		834–1 278

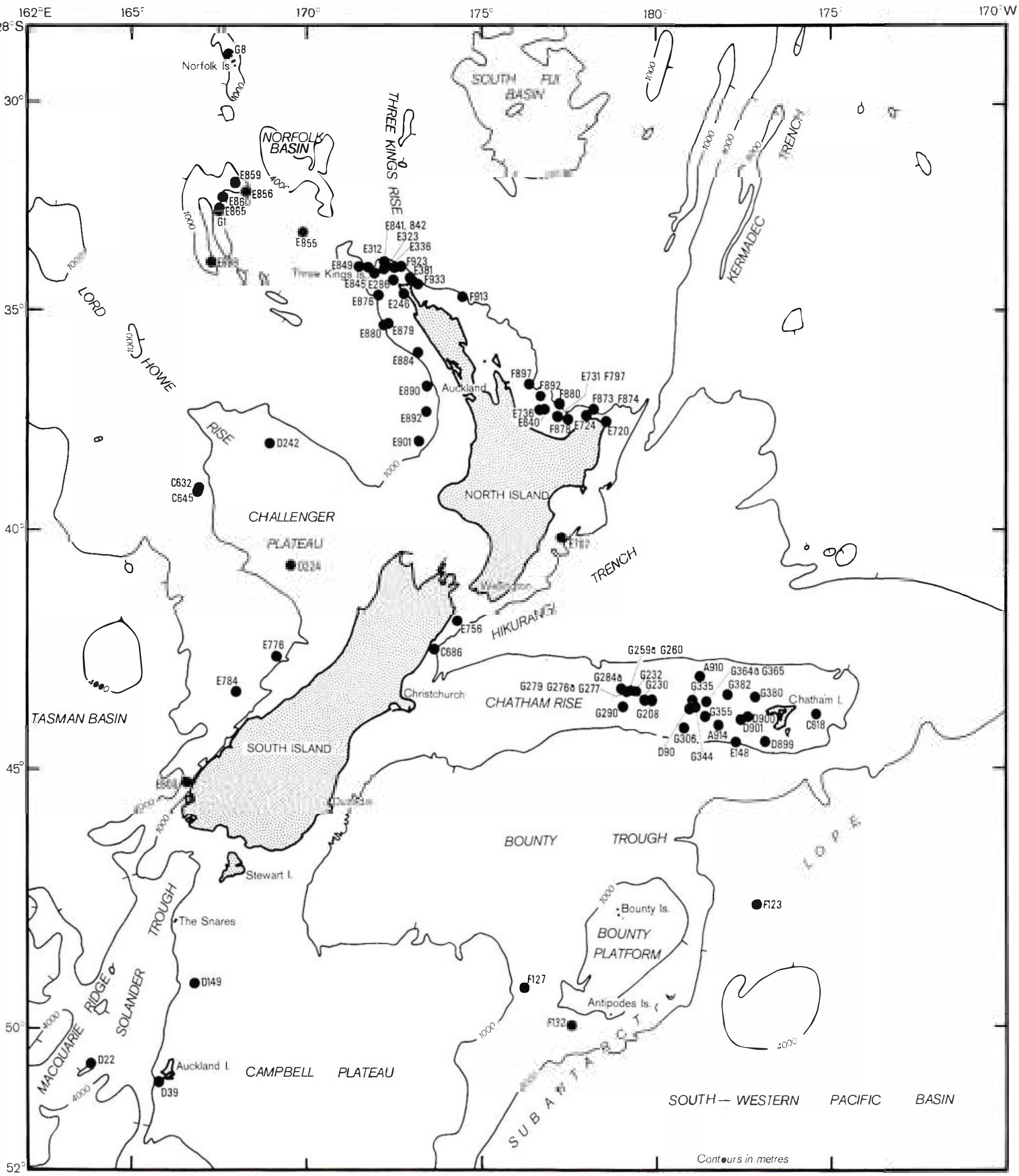


Figure 50 Map showing localities of stations in the New Zealand region.

(Name reading diagonally upwards from bottom middle is **Subantarctic Slope.**)

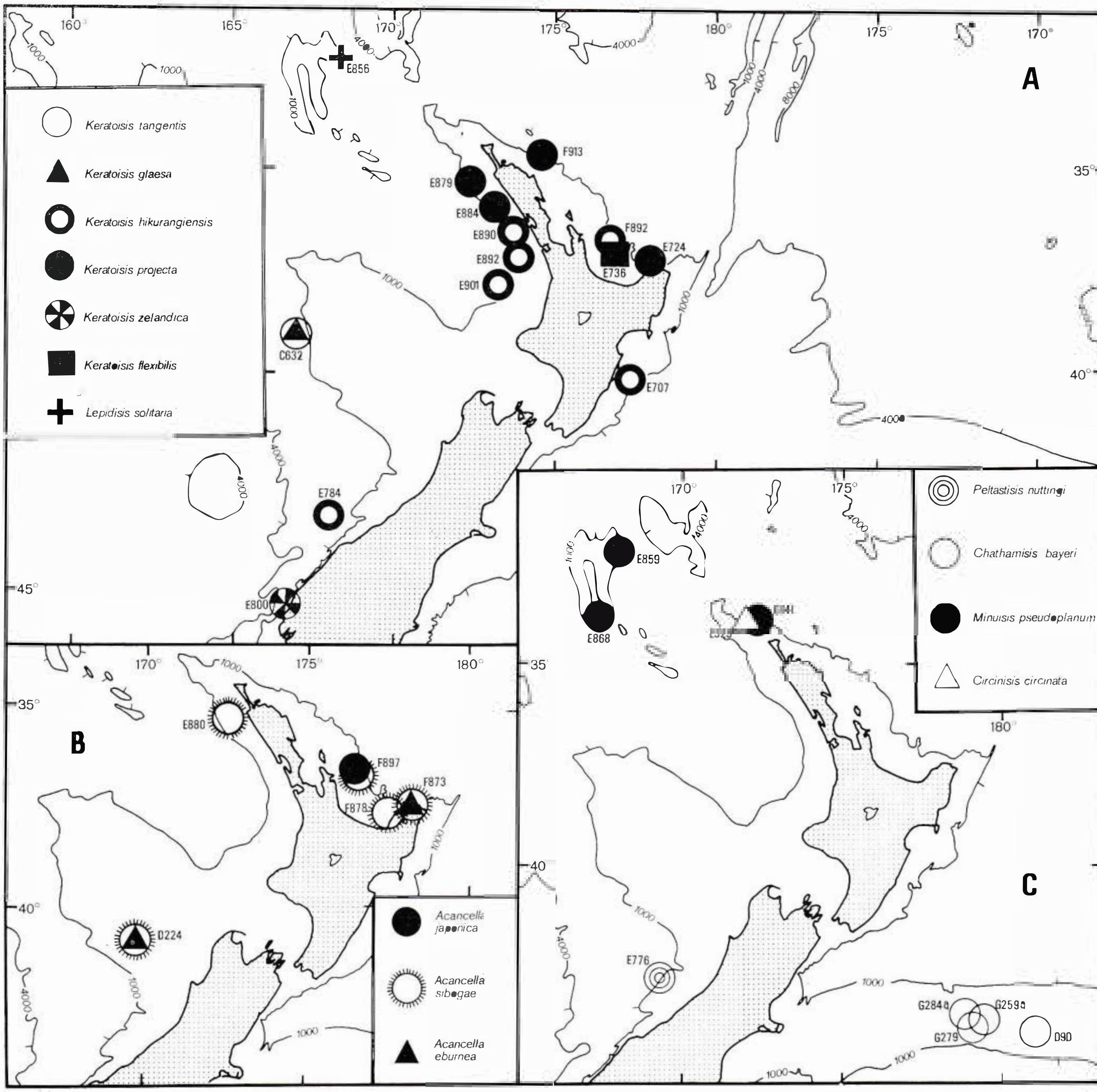


Figure 51 Distribution of species in the New Zealand region.

A–*Keratoisis tangentis, K. glaesa, K. hikurangiensis, K. projecta, K. zelandica, K. flexibilis,* and *Lepidisis solitaria.* B–*Acanella japonica, A. sibogae,* and *A. eburnea.* C–*Peltastisis nuttingi, Chathamisis bayeri, Minuisis pseudoplanum,* and *Circinisis circinata.*

APPENDIX 1

Genera of the Families Primnoidae, Acanthogorgiidae, Chrysogorgiidae, and Ainigmaptilidae of the Suborder Holaxonia Identified in the Collections

(R. Grant and J. A. Grant-Mackie, 1969)

Family Primnoidae

Subfamily Primnoinae

Genus *Callogorgia*

D22, D39, D149, D242,
E171, E179, E188, E189, E209b, E312, E323, E381, E841, E849, E865, E876
F123, F923
G1

Genus *Primnoella*

D213,
E172, E177, E188, E189, E209b, E220b, E286, E323, E336, E842, E845, E849, E856, E860
F123, F127, F132
G8

Genus *Plumarella*

A910, A914
C618, C632, C686
D899, D900, D901
E148, E640, E720, E756
F797
G208, G230, G232, G259a, G260, G276a, G277, G284a, G290, G306, G335, G344, G355, G364a, G365, G380, G382

Genus *Thouarella*

Thouarella (*Thouarella*)
D213, D214, D215, D216, D217,
E171, E172, E175, E177, E185, E186, E188, E189, E197, E198a, E199, E212, E219a, E219b, E220b, E221b, E224, E246
F132

Thouarella (*Euthouarella*)
E175, E188, E189, E212, E220b, E224

Thouarella (s.l.)
E188, E223

Family Chrysogorgiidae

Subfamily Chrysogorgiinae

Genus *Chrysogorgia*

E731, E855, E879, E880
F873, F874, F880, F933

Genus *Iridogorgia*

E859
G1

Family Acanthogorgiidae

Genus *Acanthogorgia*

D214
E209b

Family Ainigmaptilidae

Genus *Ainigmaptilon*

E220b

APPENDIX 2

Station List

NZOI Stn No.	Latitude ° ′	Longitude ° ′	Depth m
A910	43 04.0 S	178 39.0 W	549
A914	44 04.0 S	178 11.5 W	455
C618	43 52.0 S	175 20.0 W	623– 688
C632	39 14.0 S	172 01.0 E	406
C686	42 32.5 S	173 45.1 E	820
D22	50 38.0 S	163 57.0 E	755
D39	50 58.0 S	165 45.0 E	569
D149	49 10.5 S	166 51.0 E	454– 236
D213	66 57.5 S	163 12.0 E	236– 126
D214	66 41.5 S	163 14.0 E	426– 554
D215	66 39.9 S	162 58.0 E	192– 218
D216	67 14.6 S	164 94.5 E	371
D217	66 26.5 S	162 40.0 E	371
D242	38 00.0 S	169 03.0 E	337
D899	44 23.0 S	176 49.0 W	345
D900	43 55.0 S	177 20.0 W	235
D901	43 55.0 S	177 30.0 W	366
E148	40 30.0 S	177 45.0 W	880
	44 30.2 S	177 45.2 W	
E171	76 01.0 S	168 20.0 E	101
E172	76 02 0 S	168 21.0 E	280
E175	75 56.0 S	168 00.0 E	512
E177	75 59.0 S	168 11.0 E	190
E179	73 37.0 S	170 00.0 E	280
E185	72 21.04 S	170 27.5 E	218
E186	72 17.12 S	170 13.02 E	59
E188	72 10 4 S	170 48.4 E	353
E189	72 01.2 S	170 57.5 E	298
E197b	67 21.8 S	164 46.0 E	187
E198a	67 26.0 S	164 55.0 E	371
E199	67 34.8 S	164 53.0 E	278
E209b	66 41.0 S	162 57.0 E	190
E212	66 57.0 S	163 14.0 E	91
E219a	66 30.8 S	162 49.6 E	280
E219b	66 30.8 S	162 49.6 E	280
E220b	66 28.2 S	162 45.5 E	371
E221b	66 30.8 S	162 46.0 E	199
E223	66 57.8 S	163 13.4 E	199
E224	66 31.2 S	162 27.0 E	199
E246	34 39.0 S	172 50.0 E	33
E286	34 20.0 S	172 30.0 E	102
E312	34 00.0 S	171 47.5 E	119
E323	34 00.0 S	172 15.0 E	165
E336	34 00.0 S	172 30.0 E	157
E381	30 15.0 S	172 59.0 E	150
E640	37 15.2 S	176 51.2 E	130
E720	37 33.0 S	178 35.0 E	256– 252
E731	37 23.5 S	177 12.0 E	503–1 033
E756	42 01.8 S	174 24.5 E	885– 967
E841	33 53 0 S	172 17.0 E	479– 428
E842	33 54.0 S	172 17.0 E	224– 187
E845	34 07.5 S	172 01.0 E	277– 179
E849	33 55.0 S	171 32.0 E	216
E855	33 10.0 S	169 56.0 E	742– 716
E856	32 11.0 S	168 18.0 E	1 171–1 159
E859	32 01.0 S	168 03.0 E	500
E860	32 21.0 S	167 41.0 E	1 246–1 258
E865	32 41.0 S	167 36 0 E	168
E876	34 39.0 S	172 07.0 E	489– 492
E879	35 19.0 S	172 25.0 E	768– 786
E880	35 20.0 S	172 20.0 E	1 029–1 074
F123	47 38.0 S	178 57.0 W	1 280
F127	49 22.0 S	176 16.0 E	1 280
F132	49 59.0 S	177 32.0 E	1 335
F797	37 25.7 S	177 11.0 E	348
F873	37 19.5 S	178 11.0 E	1 050–1 053
F874	37 18 0 S	178 11.0 E	1 357
F880	37 06.0 S	177 15.5 E	842– 909
F923	34 07.5 S	172 46.7 E	143– 216
F933	34 24.0 S	173 10.3 E	212– 249
G1	32 35 0 S	167 32.0 E	183
G8	28 50.0 S	167 47.0 E	83
G208	43 38.0 S	179 36.0 E	314
G230	43 33.0 S	179 43.0 E	410
G232	43 31.0 S	179 36 0 E	410
G259a	43 33.0 S	179 22.0 E	410
G260	43 32.0 S	179 22.0 E	395
G276a	43 36.0 S	179 15.0 E	410
G277	43 38.0 S	179 15.0 E	395
G284a	43 26.0 S	179 01.0 E	421
G290	43 40.0 S	179 01.0 E	327
G306	44 11 0 S	179 13.0 W	402
G335	43 39.0 S	178 56.0 W	399
G344	43 44 0 S	178 52.0 W	402
G355	44 00.5 S	178 38 0 W	439
G364a	43 38.0 S	178 32.0 W	424
G365	43 33.0 S	178 32.0 W	417
G380	43 33.0 S	177 19.0 W	366
G382	43 27.0 S	177 57.0 W	402

REFERENCES

AURIVILLIUS, M. 1931: The gorgonarians from Dr Sixten Bock's Expedition to Japan and Bonin Island, 1914. *K. svenska Vetensk-Akad. Handl. Ser. 3. 9(4):* 1–337

BAYER, F. M. 1955: Contributions to the nomenclature, systematics, and morphology of the Octocorallia. *Proc. U.S. natn. Mus. 105:* 207–20, pls 1–8

—— 1956: Octocorallia. Pp. 166–231 *in*, MOORE, R. C. (Ed.) "Treaties on Invertebrate Paleontology. Part F, Coelenterata". University of Kansas Press, Lawrence

DEICHMANN, E. 1936: The Alcyonaria of the western part of the Atlantic Ocean. *Mem. Mus. comp. Zool. Harv. 53:* 1–317

*EHRENBERG, C. G. 1834: Beitrage zur physiologischen Kenntniss der Korallenthiere allgemeinen, und besonders des rothen Meeres, nebst einem versuche zur physiologischen systematik derselhen. *Abh. K. Akad. Wiss. Berl. 1834:* 225–380

GRAVIER, C. 1913: Seconde Expedition Antarctique Francaise (1908–1910). Alcyonaires (Note preliminaire). *Bull. Mus. natn. Hist. nat., Paris 7:* 451–5

—— 1914: Alcyonaires. *Deuxieme Exped. Antarct. Fr.* 116 pp.

GRAY, J. E. 1857: Synopsis of the families and genera of axiferous zoophytes or barked corals. *Proc. zool. Soc. Lond. 25:* 278–94

—— 1859: On the arrangement of zoophytes with pinnated tentacles. *Ann. Mag. nat. Hist. 3(4):* 439–44

—— 1870: "Catalogue of lithophytes or stony corals in the collection of the British Museum". British Museum, London. 51 pp.

HICKSON, S. J. 1904: The Alcyonaria of the Cape of Good Hope. Part 2. *Mar. Invest. S. Afr. 3:* 211–39

—— 1907: Coelenterata: I, Alcyonaria. *Natn. Antarct. Exped. 1901–1904, 3:* 1–15

*KÖLLIKER, R. A. 1865: "Die Bindesubstanz der Coelenteraten". Pp. 87–181 *in*, "Icones Histiologiacae, Vol. 2". Leipzig.

KÜKENTHAL, W. 1912: Die Alcyonaria der Deutschen Sudpolar-Expedition, 1901–1903. *Dt. Sudpol.-Exped. 13 Zool. 5(3):* 287–349

—— 1915: System und Stammesgeschichte der Isididae. *Zool. Anz. 46:* 118–58

—— 1919: Gorgonaria. *Wiss. Ergebn. dt. Tiefsee-Exped. "Valdivia" 13(2):* 1–946

—— 1924: Gorgonaria. *Das Tierreich 47:* 1–470

LAMARCK, J. B. P. 1836: "Histoire Naturelle des Animaux sans Vertebres". 2nd ed., revised by Deshayes and Milne Edwards. Paris.

*LAMOUROUX, J. V. F. 1812: Sur la classification des Polypiers corraligenes non entierement pierreux. *Nouv. Bull. Soc. Philomath. Paris 3:* 181–8

*—— 1816: "Histoire des Polypiers Coralligenes Flexibles, Vulgairement Nommes Zoophytes". Caen. 559 pp.

*MILNE EDWARDS H.; HAIME, J. 1857: "Histoire Naturelle des Corraliaires, ou Polypes Progrement Dits". Paris. 3 vols.

MOLANDER, A. 1929: Die Octactiniarien. *Further Zoological Results Swed. Antarct. Exped. 2(2):* 1–86

NUTTING, C. C. 1908: Descriptions of the Alcyonaria collected by the "Albatross" 1902. *Proc. U.S. natn. Mus. 34:* 543–601

—— 1910: The Gorgonacea of the Siboga Expedition. V. The Isidae. *Siboga Exped. 8:* 1–24

POURTALÈS, L. F. DE 1868: Contributions to the Fauna of the Gulf Stream at great depths. *Bull. Mus. comp. Zool. Harv. 1(7):* 121–42

*ROULE, L. 1896: Resultats scientifiques de la Compagne de "Coudan" dans le Gulf de Gascogne, Coelenteres. *Annls. Univ. Lyon, 26:* 293–323, 439–74

—— 1908: Alcyonaires. *Exped. Antarct. Fr.* 6 pp.

SQUIRES, D. F. 1958: The Cretaceous and Tertiary corals of New Zealand. *Paleont. Bull N.Z. geol. Surv. 29:* 1–107

SQUIRES, D. F.; KEYES, I. W. 1967: The marine fauna of New Zealand: Scleractinian Corals. *Bull. N.Z. Dep. scient. ind. Res. 185. (Mem. N.Z. oceanogr. Inst. 43).* 46 pp.

STUDER, TH. 1878: Ubersicht de Anthozoa alcyonaria, Welche Wahrend der Reise S.M.S. "Gazelle" um die Erde gesammelt wurden. *Mber. preuss. Akad. Wiss. Berl. 1878:* 632–88

*—— 1887: Versuch eines Systems der Alcyonaria. *Arch. Naturgesch. 53(1):* 1–74

*THOMSON, J. A. 1929: Alcyonaires des environs de Monaco et des localites diverses. *Bull. Inst. oceanogr. Monaco 534:* 1–10

THOMSON, J. A.; HENDERSON, W. D. 1906: "An account of the Alyconarians collected by the Royal Indian Marine Survey Ship "Investigator". Pt 1. The Alcyonarians of the Deep Sea." Calcutta. 132 pp.

THOMSON, J. A.; MACKINNON, D. 1911: The Alcyonarians of the "Thetis" Expedition. *Mem. Aust. Mus. 4(13):* 659–96

THOMSON, J. A.; RENNET, N. 1928: Alcyonaria, Madreporaria, and Antipatharia. *Scient. Rep. Australas. Antarct. Exped. 9(3):* 1–46

THOMSON, J. A.; RITCHIE, J. 1906: The Alcyonarians of the Scottish National Antarctic Expedition. *Trans R. Soc. Edinb. 41(6):* 851–60

UTINOMI, H. 1958: A revision of the genera *Nidalia* and *Bellonella*, with an emendation of nomenclature and taxonomic definitions for the family Nidaliidae. *Bull. Br. Mus. nat. Hist., Zool. 5(5):* 99–121, 6 figures.

VERRILL, A. G. 1878: Notice of a recent addition to the fauna of the eastern coast of North America. *Am. J. Sci. 16(3):* 207–15

—— 1883: Report on the Anthozoa, and on some additional species dredged by the "Blake" in 1877–1879, and by the U.S. Fish Commission Steamer "Fish Hawk" in 1880–1882. *Bull. Mus. comp. Zool. Harv. 11(1):* 1–72

WRIGHT, E. P. 1869: On a new genus of Gorgonidae from Portugal. *Ann. Mag. nat. Hist. 4(3):* 23–6

WRIGHT, E. P.; STUDER, TH. 1889: Report on the Alcyonaria. *Rep. scient. Results explor. Voyage Challenger 31(1):* 1–314

*Works not seen.

INDEX

Entries in **bold** indicate a major description: in *italic*, an illustration.